Kaikohe Wastewater Treatment Plant – Revised Application for Resource Consents

Supporting Information

Prepared for Far North District Council
Prepared by Beca Limited

3 April 2025

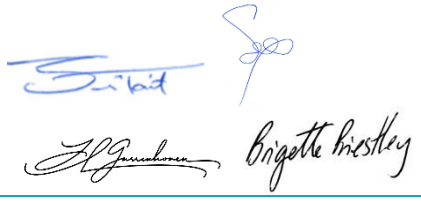
Contents

Appendices

Revision History

Revision N°	Prepared By	Description	Date
1	Ben Tait Stuart Caird Brigette Priestley Jolanta Gussenhoven	Draft for Client review	27 March 2025
2	Ben Tait Stuart Caird Brigette Priestley Jolanta Gussenhoven	Final	3 April 2025

Document Acceptance

Action	Name	Signed	Date
Prepared by	Ben Tait Stuart Caird Brigette Priestley Jolanta Gussenhoven		3 April 2025
Reviewed by	Garrett Hall		3 April 2025
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on behalf of	Beca Limited		

Executive Summary

The Kaikohe Wastewater Treatment Plant (WWTP) treats municipal wastewater from Kaikohe, waste activated sludge from Russell, and sewage and sludge from septic tanks across the Far North District. The WWTP has experienced a range of performance issues and over time the quality of the wastewater discharged has declined causing seasonal non-compliances with existing consented discharge standards. The existing resource consent (consent number CON20100241701) expired on 30 November 2021 however it is still being used because Far North District Council (FNDC) applied for a new resource consent before its expiry.

In August 2021, FNDC lodged its application with Northland Regional Council (NRC) for a new resource consent to discharge treated wastewater from the WWTP. The application notes that the proposal was for a staged consent with a 15-year duration that would allow the WWTP to continue to operate until upgrades or alternative disposal methods can be developed. Timeframes for processing the application were then extended by NRC under section 37 of the Resource Management Act 1991 to allow FNDC to further assess alternative options for treating and discharging wastewater from Kaikohe.

To determine the best practicable option for treating and discharging wastewater, and subsequently determine the nature of the resource consent required, a Working Group[1] consisting of senior representatives from Te Uri o Hua, Te Takotoke, Ngati Kura, Ngāti Whakaeke, Ngāti Tautahi, Matarahurahu and FNDC was formed. Working Group led the investigation into upgrading the WWTP and discharging treated wastewater to land.

This work has largely been completed and the preferred option is a new Membrane Bioreactor (MBR) plant with a discharge to the existing constructed wetlands and improvements made to the final treatment wetlands, and continued investigations into a discharge to land scheme.

The upgraded WWTP will provide for increased growth within Kaikohe, achieve a much higher level of treatment and better environmental outcomes. The upgrades are currently going through design stages, and they are expected to be implemented within several years.

The purpose of this document is to update FNDC's application to reflect the proposed upgrades to the WWTP. It presents an overview of the upgrades and what they are likely to achieve in terms of better outcomes for the Wairoro Stream and people that use and value it. In doing so, it provides further information about the effects of FNDC's proposal on the environment and how the amended proposal is consistent overall with policy direction on managing wastewater discharges and freshwater quality under the Resource Management Act 1991.

The upgraded WWTP will achieve significantly greater total nitrogen and ammonia removal capacity than the existing system and total phosphorus will also reduce. The *E. coli* concentration, an indicator of the presence of faecal pathogens, will reduce significantly due to the membrane process and ultra-violet light disinfection process. The significantly improved discharge is likely to result in the quality of water in the Wairoro Stream improving.

[1] Kaikohe Wastewater Treatment Plant Consent Renewal Working Group.

1 Introduction

1.1 Purpose

In August 2021, Far North District Council (FNDC) lodged its application with Northland Regional Council (NRC) for resource consent to continue discharging treated wastewater from the Kaikohe Wastewater Treatment Plant (Kaikohe WWTP). Timeframes for processing the application were then extended by NRC under section 37 of the Resource Management Act 1991 (RMA) to allow FNDC to further assess alternative options for treating and discharging wastewater from Kaikohe. The work has been done and the preferred option is upgrading the WWTP with a new membrane bioreactor (MBR) plant that will continue to discharge to the existing constructed wetlands, improvements made to the final treatment wetlands, and continual investigations into a discharge to land scheme.

The upgraded WWTP will provide for increased growth within Kaikohe, achieve a much higher level of treatment and better environmental outcomes.

The purpose of this document is to update FNDC's application to NRC. It presents an overview of the proposed upgrades to the Kaikohe WWTP and what they are likely to achieve in terms of better outcomes for the Wairoro Stream and people that use and value it. In doing so, it provides further information about the effects of FNDC's proposal on the environment and how the amended proposal aligns with policy direction on managing wastewater discharges and freshwater quality under the RMA.

It is important to note that the information contained in the document is not exhaustive and some aspects of the proposed upgrades and final discharge quality have yet to be confirmed. That is because the upgrades are still the subject of conceptual design. More detailed information is expected to become available as design progresses.

1.2 Structure

This document is set out as follows:

- Section 2 provides a summary of the process for deciding on the proposed upgrades to the WWTP.
- Section 3 provides an overview of the proposed WWTP upgrades, the reason for the upgrades, and the expected timeframe for them happening.
- Section 4 presents an assessment of the effects of the proposed upgrades on the environment.
- Section 5 provides an updated assessment of the proposed discharges against relevant objectives and policies in the National Policy Statement for Freshwater Management, Regional Policy Statement and the Proposed Regional Plan for Northland, as well as an updated assessment of the proposal against the purpose and principles of the RMA.
- Section 6 sets out proposed conditions of consent.
- Section 7 concludes the amended application.

The information in this report is intended to complement the original application and should be read in conjunction with the following report:

- Beca Ltd. 27 August 2021. Kaikohe Wastewater Treatment Plant Discharge Consent Application – Assessment of Environmental Effects on the Environment Report. Prepared for Far North District Council.

2 Best Practicable Option Decision Making Process

Following the lodgement of FNDC's resource consent application in August 2021, a Terms of Reference to establish the Kaikohe Wastewater Treatment Plant Consent Renewal Working Group (the Working Group) was signed in June 2022.

The Wastewater Working Group consisted of senior representatives from Te Uri o Hua, Te Takotoke, Ngati Kura, Ngāti Whakaeke, Ngāti Tautahi, Matarahurahu and FNDC. The Terms of Reference states that the immediate Kaupapa of the Working Group is to lead the investigation into discharging treated wastewater to land and lead the investigation into the best practicable option (BPO)[2] for upgrading the WWTP. Beca were engaged by FNDC to assist with a best practice decision making process to determine the BPO.

The Working Group attended a number of workshops in 2022 and 2023 to develop options for the BPO. The in-person workshops were the key method of communication and discussion with the Working Group, whilst 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. The purpose of the first workshop was to set the scene of the project and get some initial feedback from the Working Group on the proposed discharge methods and land discharge sites.

There were two streams of technical work undertaken by Beca to support the Working Group, namely:

1. WWTP upgrade optioneering
2. Land discharge investigations

For the WWTP optioneering, Beca prepared a long list of options for a WWTP upgrade using the work that had been previously completed for FNDC by Harrison Grierson in November 2020 and Jacobs in August 2021 as a starting point as well as an additional recommendation from Beca (Moving Bed Bioreactor (MBBR) for pond effluent polishing, plus installation of Dissolved Air Flotation (DAF) for solids separation. These options were assessed using traffic light criteria and the results were presented to the Working Group during the second workshop on 14 October 2022.

A short list of WWTP upgrade options was decided by the Working Group during a follow up online hui on 27 October 2022. These were:

1. Sequenced Batch Reactor (SBR) and UV disinfection
2. 4-stage Bardenpho with secondary clarifier and UV disinfection
3. 4-stage Bardenpho - Membrane filtration (MBR)
4. Moving Bed Bioreactor (MBBR) for pond effluent polishing, plus installation of Dissolved Air Flotation (DAF) for solids separation, and UV disinfection

These options were progressed to high level concept design and capital cost estimates. Flows and loads were developed to provide inputs into the high-level concept designs and cost estimates for the short-listed options. These were based on the current (2022) and expected future (2055) wastewater production volumes at Kaikohe WWTP.

[2] Best practicable option is defined in the RMA as, in relation to a discharge of a contaminant, the best method for preventing or minimising the adverse effects on the environment having regard, among 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.

A proposed list of Multi-Criteria Analysis (MCA) criteria was presented to the Working Group at a workshop on 3 March 2023. Beca asked hapū to highlight the Mātauranga Māori considerations that had not been taken into account and an additional criteria around drinking water quality in the Wairoro Stream was added. The assessment of each option against the criteria was completed using a traffic light system.

The resulting MCA was finalised in an online hui on 17 March 2023. This showed that SBR and MBR were the front runners for the treatment plant upgrade. MBR was selected as the preferred option for the WWTP upgrade during the online hui on 29 June 2023.

During the earlier online hui on 27th October 2022, hapū indicated that the only discharge type they would support was a discharge to land using a deficit and non-deficit slow rate irrigation scheme. The Working Group agreed that the Slow Rate Irrigation option did include the use of a relief valve for discharge to water from the treated wastewater storage facility in the event of wet weather to prevent flooding or overtopping of the storage facility.

FNDC subsequently completed a desktop feasibility assessment to determine a list of viable sites within 10km of the WWTP. A long list of 40 sites was generated and these sites were circulated to the Working Group for their feedback. A traffic light assessment was also undertaken to determine the top 15 land parcels and the results of that assessment were presented to the Working Group at the second workshop on 14 October 2022. Following this Workshop, landowner discussions commenced, and the Working Group discussed the results of these landowner discussions at a follow up online hui on 30 November 2022. The Working Group subsequently determined that site #13, located at on Jordan Road, was the preferred site for land disposal of treated wastewater and should be progressed to the next stage, site investigations. This site was preferred because it was for sale and could be considered for purchase rather than lease.

On 23 February 2023, Manaaki Whenua – Landcare Research, accompanied by Beca and FNDC, undertook a soil appraisal of site #13 to review the suitability of the site for land disposal of treated wastewater. Unfortunately, the results of this study showed that there was an E horizon along with the clayey subsoil suggesting this land parcel would have low hydraulic conductivity. It was determined that only a deficit irrigation scheme would be possible.

To support the assessment of feasibility of treated wastewater discharge from Kaikohe WWTP to land at the preferred site, a high-level discharge to land concept design and cost estimate was prepared.

The proposed WWTP upgrade and the discharge to land scheme were subsequently discussed at a workshop and 23 June 2023. Hapū representatives requested an opportunity to go away and discuss the options with their wider hapū and therefore the final BPO was determined at an online hui on 29 June 2023.

The selected BPO was a new MBR plant with a discharge to the constructed wetlands with improvements made to the wetlands, and continual investigations into a discharge to land scheme. Hapū decided to rule out the site at Jordan Road for discharge to land but wished to keep investigating other sites for a discharge to land scheme. The also wanted to be acknowledged as kaitiaki in the next stage of the process and wanted to have a co-governance role / be involved in the decision-making process.

The BPO determined by the Working Group is considered to be in line with the RMA definition and can be successfully applied to the Kaikohe WWTP and meet the cultural, environmental, social, and economic constraints. However, it should be noted that the BPO is also contingent on the below matters:

- **FNDC to continue to investigate a Discharge to Land Scheme**. As outlined above, whilst an appropriate site has not yet been selected for a discharge to land scheme, the BPO includes a requirement to continue to research options for an alternative site. These investigations could be formed into consent conditions.

- **Improvements to the Constructed Wetlands**. It is recommended that the actions outlined in the Wetland Planting and Maintenance Plan are implemented. The programme set out in the plan indicated that this is recommended for June to May.

During the in-person Workshops and online hui hapū also raised several other matters that they would like included for consideration. These include the following:

- Water savings measures and wastewater management techniques to reduce wastewater discharge volumes.
- Sludge management strategy for the Kaikohe WWTP and the wider district.
- Wastewater re-use options to be investigated.
- Alternative treatment for the crematory waste (hapū would like involved in this discussion).
- Potential for co-management / partnership of the discharge to land scheme once land discharge site determined.
- Septage management for Kaikohe WWTP and the wider district.

Hapū also noted their concerns with discharge of wastewater to land resulting in blood/fluids from embalming making their way into the food chain, even just as fodder for beasts. While this is outside the scope of the WWTP upgrade, hapū would like this to be considered as part of the asset management planning for the FNDC Long Term Plan (LTP).

FNDC is considering the matters that do not directly relate to the application for resource consents.

The final BPO Report is attached as Appendix A.

3 Proposed Upgrades to the Kaikohe Wastewater Treatment Plant

3.1 The Existing Treatment Process

The existing WWTP consists of an inlet screen, two anaerobic ponds, an oxidation pond, a maturation pond (currently part of the Constructed Wetland (CWL)), and a series of CWL cells.

The inlet screen removes large debris and solid materials, protecting downstream equipment and improving treatment efficiency. Wastewater then flows into two anaerobic ponds, where organic matter is broken down in the absence of oxygen, reducing biochemical oxygen demand (BOD) and converting pollutants into simpler compounds. This is followed by the oxidation pond, where sunlight, algae, and microbial activity provide aerobic treatment to further reduce BOD, nutrients, and pathogens.

Next, the treated effluent passes through a maturation pond (currently functioning as part of the CWL), which provides additional polishing by removing residual nutrients and pathogens through natural processes like sedimentation and microbial activity. The rest of the CWL comprises of four cells that filter and polish the effluent using vegetation and soil processes to remove contaminants such as nitrogen, phosphorus, and suspended solids while improving water clarity.

After the CWL, the treated wastewater is discharged into a natural wetland before being released into the Wairoro Stream. Supporting infrastructure includes a sludge lagoon (north of the plant) for storing sludge from anaerobic ponds, oxidation ponds, and the wetlands which are periodically de-sludged. De-sludging was last completed in late 2024. There is also a geotextile bag storage area (east of the oxidation pond) for dewatering sludge to facilitate disposal or reuse.

This process is illustrated in Figure 3-1 and Figure 3-2.

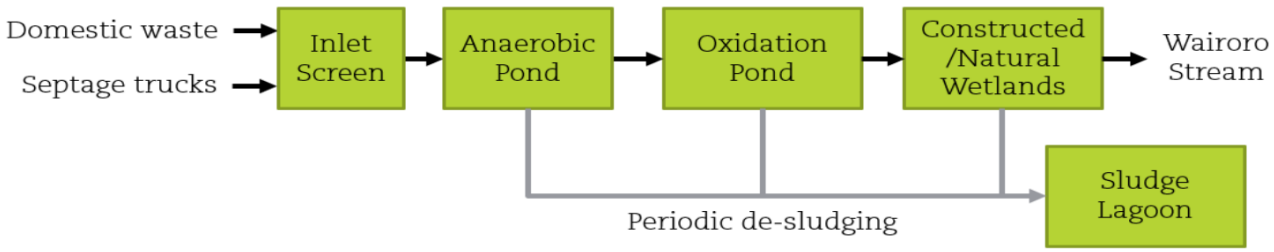

Figure 3-1: Process flow diagram for the existing Kaikohe WWTP.[3]

[3] Sourced from Kaitaia and Kaikohe WWTP Options Assessment, Harrison Grierson, November 2020.

Figure 3-2: Existing Kaikohe WWTP.

3.2 Short Term Upgrades

FNDC's original application identifies short-medium term options for improving the quality of treated wastewater before final discharge:[4]

- **Re-Install screen inlet** – Reinstallation of an inlet screen will allow the effective volume and retention time to be maintained and associated treatment of raw effluent to occur.
- **Removal of surface weed growth** – Removal of surface weeds will improve the amount of surface area available for exposure to sunlight for ultraviolet (UV) disinfection to occur.
- **Wetland planting and maintenance** – Well maintained wetland planting can improve retention time and settling of solids, provide surface area for biofilm growth, enhance aeration, assimilate nutrients and shade the water to reduce algal growth.
- **De-sludge (anaerobic and oxidation) ponds** – Desludging the oxidation and anaerobic ponds will increase the volume and treatment capacity for raw wastewater.
- **Aeration system** – Addition of an aeration system in the oxidation pond has the potential to improve the removal efficiency of biological oxygen demand and ammoniacal nitrogen beyond the current design capacity.
- **Installation of baffle curtains** - Baffle curtains installed in the oxidation pond may improve the WWTP performance by controlling the flow path of wastewater through the pond to increase the retention time (preventing "short circuiting").

[4] Beca Ltd. 27 August 2021. Kaikohe Wastewater Treatment Plant Discharge Consent Application – Assessment of Environmental Effects on the Environment Report. Prepared for Far North District Council. Section 6.2.2.

Desludging of the anaerobic and oxidation ponds was completed in late 2024 which also reduced weed growth. FNDC is reinstalling the main raw sewage screen and installing a septage receiving screen which is expected to be completed by June 2025. It is recommended that wetland planting and maintenance occur. Installation of an aeration system and baffle curtains are unlikely to be required at this stage given the pending major upgrade to the WWTP. However, depending on the final timeframe for the planned major upgrade the other short-term initiatives may be reconsidered by FNDC

3.3 Reason for the Proposed Upgrades

The WWTP requires upgrades to accommodate population growth in the catchment. The town's population is projected to grow from an estimated 4,869 in 2024 to 5,634 by 2060. Additionally, the WWTP must also account for flows generated by 365 new houses (approximately 1,095 people) for which development is being enabled by the Infrastructure Acceleration Fund (IAF) initiative.

Beyond addressing capacity needs, the upgrades are required to resolve existing performance issues at the WWTP. Over time, the plant's treatment quality has deteriorated, resulting in seasonal non-compliance with discharge consent standards. Key challenges include exceedances in total-ammoniacal nitrogen concentration, discharge flow rates, pH, dissolved oxygen concentrations, and *E. coli* concentrations at the consented monitoring sites on the Wairoro Stream.

Table 1 shows the Kaikohe population and average daily flow data for 2024, along with the projected values for 2060. The planned upgrades aim to significantly enhance treatment performance while providing capacity to meet future demand arising from population growth and housing development.

Table 1: Kaikohe population and average daily flow data for 2024 and projected values for 2060.

Design horizon year	Kaikohe population	Average daily flow (m^3/day)
2024	4,869	1,825
2060	6,729	2,549

3.4 The Proposed Upgrades

The process flow diagram and layout of the proposed MBR plant can be seen below. This process was selected by the Working Group through the BPO process. The MBR process produces the highest treated wastewater quality of the short-listed options in the BPO process. The construction of this facility requires reclamation of part of the existing pond near the anaerobic pond to create a building platform, along with upgrades to site access.

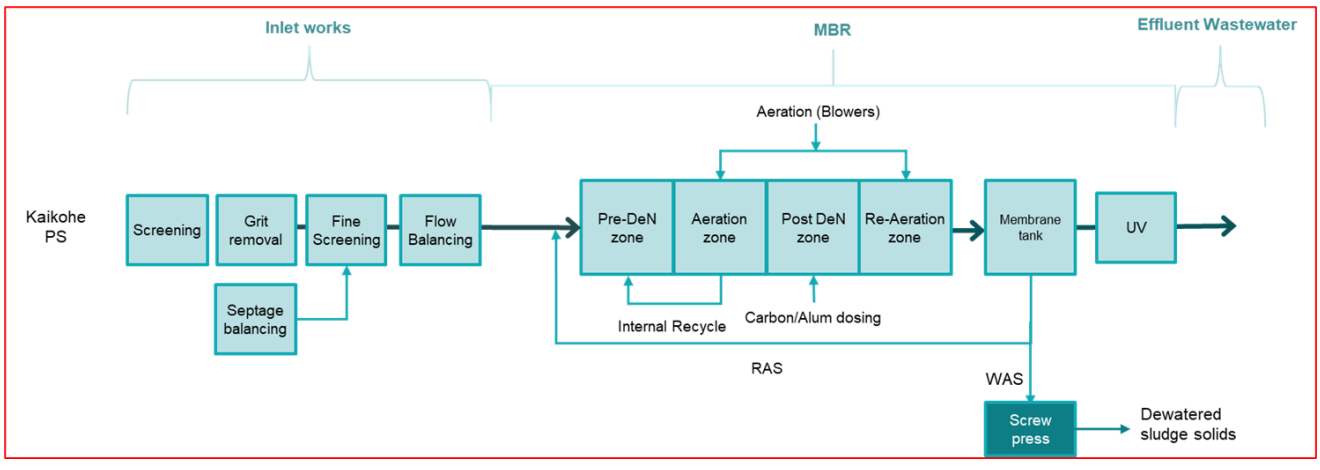

Figure 3-3: Process Flow Diagram of MBR Plant at Kaikohe WWTP.

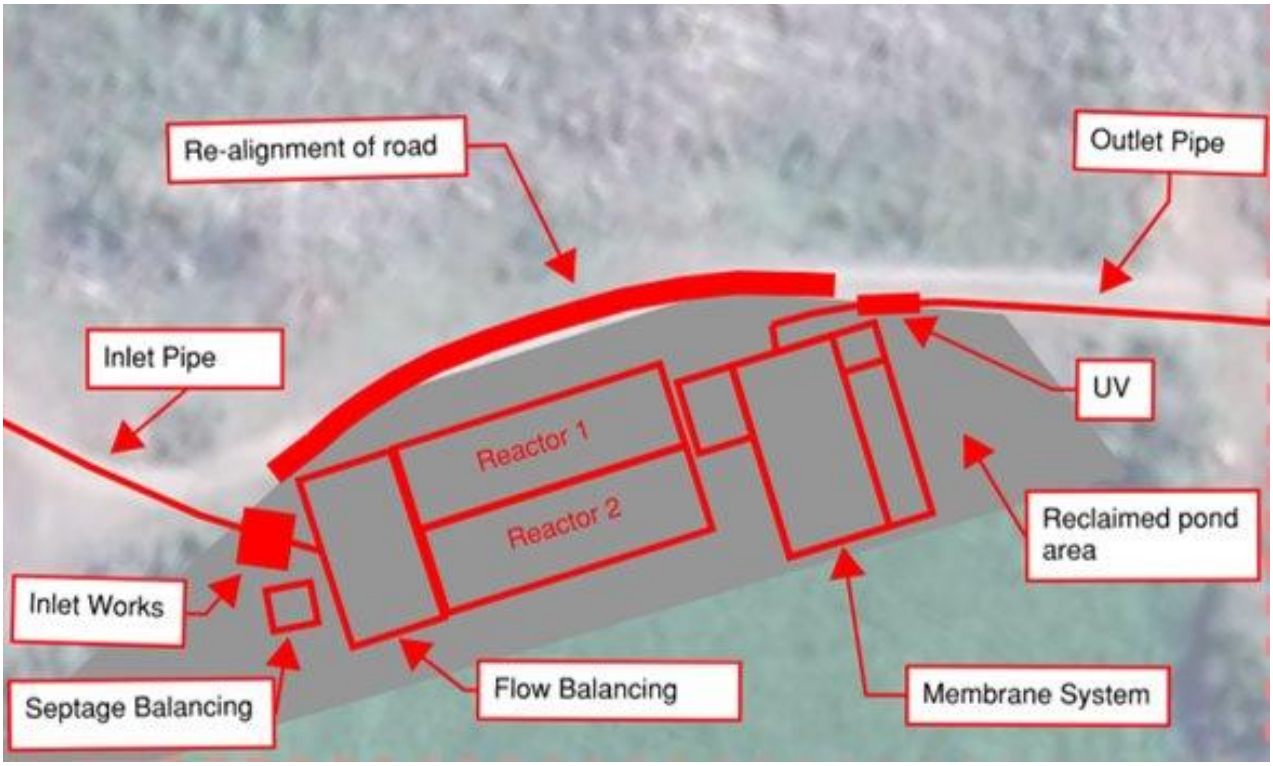

Figure 3-4: Potential Layout of MBR Plant at Kaikohe WWTP.

The treatment process includes the following key components:

- **Inlet Works** – Preliminary treatment of incoming wastewater by removing large solids and grit and diurnal flow balancing.
- **Peak wet weather flow balancing in portion of existing pond** – Peak wet weather flows will be stored in the pond and returned to the plant for treatment once peak flow has passed.
- **Biological Reactors** – Comprising four zones—pre-denitrification, aeration, post-denitrification, and re-aeration.
- **Membrane System** - Ultrafiltration for advanced solids-liquid separation.
- **Ultra-Violet (UV) Disinfection** – To inactivate bacteria and viruses in the treated wastewater.

Septage is the solids that are removed by tanker from septic tanks for properties in the district not serviced by a community wastewater scheme. As part of the upgrade, a new septage balancing tank will be installed to support the management of septage and ensure consistent operation of the treatment process.

Treated wastewater will be separated from the activated sludge in the membrane tanks. The treated water will then undergo UV disinfection before being discharged to the constructed wetlands (or potentially land in future).

Waste activated sludge (WAS) from the MBR will be pumped to a decanting storage tank for thickening. The thickened sludge will be dewatered using a screw press, and the resulting dewatered sludge will be transported offsite for disposal or further treatment. An alternative option for the sludge which will also be considered is on site storage and treatment in a pond with dewatering from time to time and disposal offsite.

The concept design for the new MBR WWTP is being further refined currently which may result in changes to the size of units required and location but treatment performance will not be affected.

3.5 Construction Programme

Implementing the WWTP upgrade will involve several activities. The treatment plant upgrade works detailed design will need to be undertaken and contractors selected to carry out the work. Early works will involve reclaiming part of the oxidation pond, constructing the new WWTP building platform and upgrading the access road into the WWTP. The existing pond-based system will need to continue operation while the construction of the new WWTP is undertaken. Once the new WWTP is commissioned the higher quality treated wastewater will be discharged, but at times peak wet weather flows may need to bypass the new WWTP until part of the main pond is developed into the peak flow storage pond. The table below provides an indication of typical durations of each stage. A project-specific programme will be defined once the WWTP concept design has been completed and procurement strategy developed by FNDC.

Table 2 - Indicative Typical Construction Programme

Stage	Duration
Detailed Design and Procurement	9-12 months
Early works (building platform and access)	6-9 months
WWTP construction	18-24 months
WWTP commissioning	3-6 months
Peak wet weather flow storage pond construction	6-12 months
Total time (indicative)	Approximately 5 years.

4 Environmental Effects of the Upgraded Wastewater Treatment Plant

4.1 Effects of the Existing Treatment Plant Discharge

FNDC's 2021 resource consent application included an assessment of environmental effects[5] (AEE) of the existing Kaikohe WWTP discharge. The AEE assessed the potential environmental and public health effects of continuing to discharge wastewater using the existing WWTP processes, with some improvements, until a full upgrade was implemented. This AEE drew from ecological assessments undertaken by the Cawthron Institute in 2014[6] and 2021[7].

Following on from the AEE, in 2023, as part of the BPO selection process, Beca were commissioned by FNDC to undertake an assessment of ecology and water quality effects[8] within the Wairoro Stream at and around the Kaikohe WWTP discharge point to provide an improved understanding of the current conditions and characteristics of the receiving environment; and to subsequently compare the results to the previous reports by the Cawthron Institute.

This 2023 Water Quality and Ecology Assessment (attached at Appendix B) includes:

- An analysis of historical (2017 to 2022) water quality monitoring data (collected as a condition of consent) at sites upstream and downstream of the Kaikohe WWTP discharge point to Wairoro Stream. Parameters included dissolved oxygen, temperature, pH, Escherichia coli (*E. coli*), ammoniacal nitrogen, dissolved inorganic nitrogen and dissolved reactive phosphorus.
- An analysis of an additional round of water quality sampling undertaken by Beca in 2023 at seven sites (three upstream, three downstream and one at the discharge point). Parameters included those listed above and additionally total suspended solids, total nitrogen, dissolved inorganic nitrogen, total phosphorus, total suspended solids, turbidity, carbonaceous biological oxygen demand ($cBOD_5$) and specific conductivity.
- A review of existing ecological assessments undertaken by Cawthron Institute in 2014 and 2021.
- A comparison of water quality data against relevant guidelines including the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018), the PRPN and the NPS-FM.
- A dye dilution and dispersion study to determine the mixing zone within Wairoro Stream.
- An in-stream ecological assessment, comprising eDNA sampling, macroinvertebrate community index (MCI) sampling, a stream habitat assessment and a periphyton coverage assessment.

The following assessment of effects draws from both the AEE prepared in 2021 as well as Water Quality and Ecology Effects Assessment completed in 2023.

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[5] Kaikohe Wastewater Treatment Plant Discharge Consent Application: Assessment of Effects on the Environment Report. Beca, 2021.

[6] Assessment of Ammonia Effects on the Wairoro Stream Fauna near the Kaikohe Wastewater Treatment Plant. Cawthron Institute, September 2014. Report No. 2517

[7] Ecological Survey of the Wairoro Stream near the Kaikohe Wastewater Treatment Plant. Cawthron Institute, July 2021. Report No. 3601

[8] Water Quality and Ecology Effects Assessment – Kaikohe Wastewater Treatment Plan. Beca, June 2023.

4.1.1 Water Quality Effects

The 2021 AEE and the 2023 Water Quality and Ecology Effects Assessment suggest that the existing discharge from the WWTP was adversely affecting the water quality of the Wairoro Stream downstream of the discharge.

The AEE (drawing on the Cawthron Institute ecological assessment[9]) highlighted higher concentrations of ammoniacal nitrogen, total nitrogen and total phosphorus in Wairoro Stream downstream of the WWTP when compared to upstream of the WWTP. A reduction in dissolved oxygen levels downstream of the WWTP was also observed compared to upstream of the WWTP. The report suggested a series of small upgrades to the WWTP to help mitigate these effects.

The 2023 Water Quality and Ecology Effects Assessment identified water quality issues within Wairoro Stream downstream of the WWTP. Primarily, concentrations of total phosphorus and dissolved reactive phosphorus, total nitrogen and dissolved inorganic nitrogen, and ammoniacal nitrogen were all observed to have higher concentrations downstream of the WWTP when compared to upstream. For total phosphorus, dissolved reactive phosphorus and ammoniacal nitrogen, the downstream concentrations were significantly above the relevant guideline values downstream of the WWTP while the upstream concentrations remained below the guideline values. Therefore, the effects of the WWTP discharge on these parameters were considered significant.

For dissolved inorganic nitrogen and total nitrogen, concentrations observed upstream were already marginally above the relevant guideline values, however, the downstream concentrations were significantly more elevated and therefore the effect of the WWTP discharge on these parameters was assessed as moderate.

Figure 4-1 and Figure 4-2 (taken from the 2023 Water Quality and Ecology Effects Assessment at Appendix B) provide an example of the significant difference between the observed water quality of the Wairoro Stream upstream and downstream of the WWTP discharge.

[9] Ecological Survey of the Wairoro Stream near the Kaikohe Wastewater Treatment Plant. Cawthron Institute, July 2021. Report No. 3601

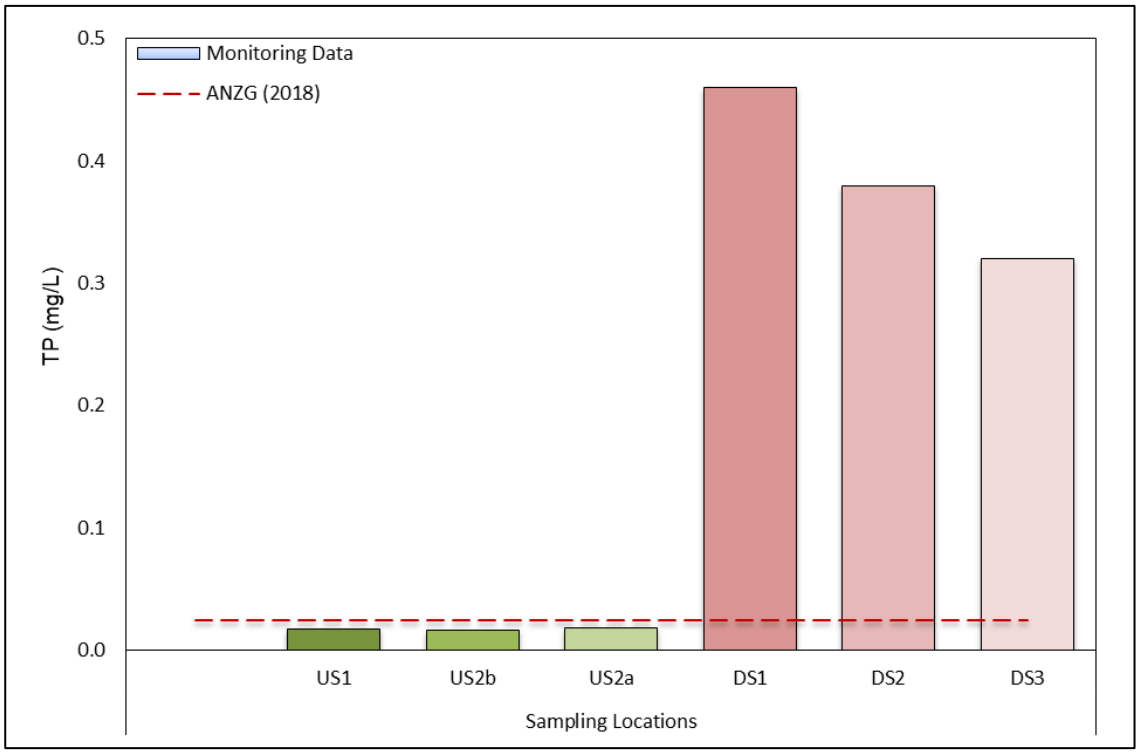

Figure 4-1. Concentrations of total phosphorus (TP) within Wairoro Stream, upstream (US1, US2b and US2a) and downstream (DS1, DS2 and DS3) of the Kaikohe WWTP discharge on 18 April 2023[10].

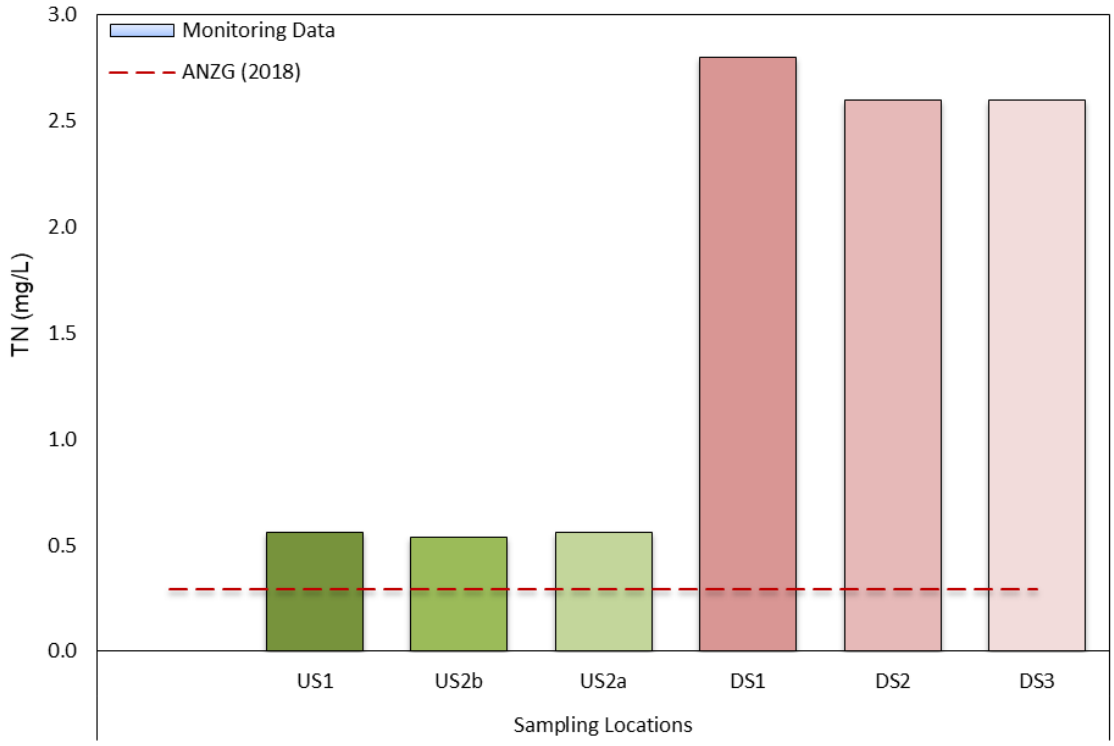

Figure 4-2. Concentrations of total nitrogen (TN) within Wairoro Stream, upstream (US1, US2b and US2a) and downstream (DS1, DS2 and DS3) of the Kaikohe WWTP discharge on 18 April 2023[11].

[10] Beca, June 2023. Water Quality and Ecology Effects Assessment – Kaikohe Wastewater Treatment Plan.

[11] Beca, June 2023. Water Quality and Ecology Effects Assessment – Kaikohe Wastewater Treatment Plan.

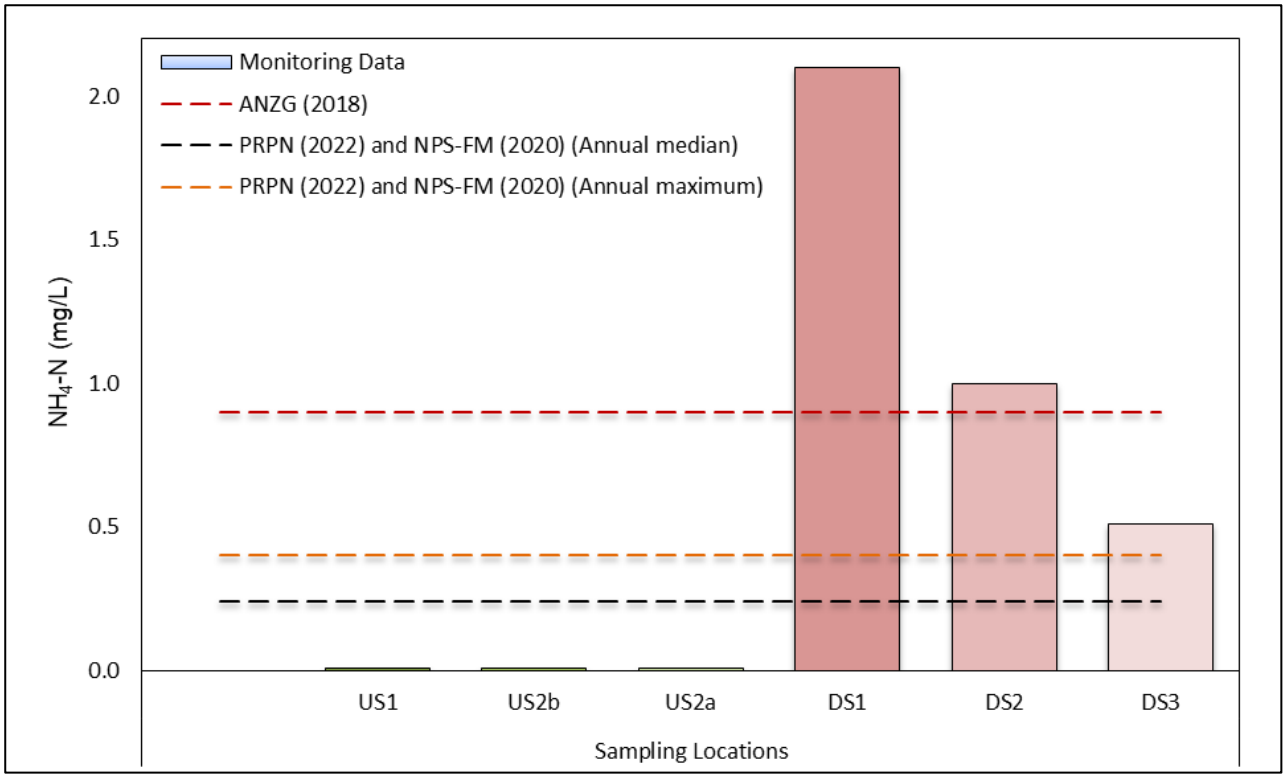

Figure 4-3. Concentrations of ammoniacal nitrogen (NH_4-N) within Wairoro Stream, upstream (US1, US2b and US2a) and downstream (DS1, DS2 and DS3) of the Kaikohe WWTP discharge on 18 April 2023[12].

4.1.2 Ecological Effects

Both the 2021 AEE and the 2023 Water Quality and Ecology Effects Assessment acknowledge the degraded state of ecological values within the Wairoro Stream both upstream and downstream of the WWTP discharge. As the Wairoro Stream flows through an agriculturally dominant catchment, there is a high likelihood that there are multiple sources of organic and nutrient inputs into this freshwater system. However, the AEE also notes that the WWTP discharge contributes to this degraded state.

Drawing from the ecological assessments undertaken by the Cawthron Institute in 2014[13] and 2021[14], the AEE notes that the water quality of the WWTP discharge could potentially result in eutrophication of downstream environments, resulting in decreased aquatic habitat values for fish and macroinvertebrates. These effects were primarily the result of the concentrations of total nitrogen, total phosphorous, and total ammoniacal nitrogen in the existing discharge. During times of drought, these effects are compounded and could potentially lead to significant effects; although, due to the limited biodiversity of the stream and the resident populations being pollution tolerant, significant ecological effects have not been observed[15].

[12] Beca, June 2023. Water Quality and Ecology Effects Assessment – Kaikohe Wastewater Treatment Plan.

[13] Cawthron Institute, September 2014. Assessment of Ammonia Effects on the Wairoro Stream Fauna near the Kaikohe Wastewater Treatment Plant. Report No. 2517.

[14] Cawthron Institute, July 2021. Ecological Survey of the Wairoro Stream near the Kaikohe Wastewater Treatment Plant.. Report No. 3601.

[15] Beca, 2021. Kaikohe Wastewater Treatment Plant Discharge Consent Application: Assessment of Effects on the Environment Report.

In the 2023 ecological surveys, despite the significant water quality effects outlined above (and the elevated levels of nutrients identified downstream of the discharge point), ecological data indicated that the WWTP discharge did not appear to be having a significant effect on the structure and species composition of macroinvertebrates or native fish in Wairoro Stream. At-Risk native freshwater fish and sensitive macroinvertebrate species within both the upstream and downstream reaches of the WWTP discharge. Also, there was not a significant difference in periphyton coverage between downstream and upstream sites. However, that the results of this assessment were based on a survey that was undertaken during the autumn of 2023 after an extended and atypically wet summer in the months prior. As such, the conditions in Wairoro Stream likely did not reflect more typical low-flow summer conditions. The 2023 assessment surmised that low flow/base flow stream conditions may result in a higher level of impact on the macroinvertebrate communities.

4.1.3 Human Health Effects

Treated wastewater has the potential to contain faecal coliforms (such as *E. coli*) and pathogens (such as noroviruses) that survive the treatment process and discharge into the receiving environment downstream. With these pathogens in the water, there is a risk that the health of contact recreation users or water take users downstream are adversely affected.

Concentrations of *E.coli* were identified above the NPS-FM guideline value (for medians) at sites both upstream and downstream of the WWTP in 2023 and historically (in sampling undertaken by Cawthron in 2020), indicative of the existing rural and pastoral land uses within the catchment[16]. However, the concentrations were slightly more elevated downstream. Figure 4-4 shows the recorded E. Coli levels during the 2023 sampling.

[16] Beca, 2021, Kaikohe Wastewater Treatment Plant Discharge Consent Application: Assessment of Effects on the Environment Report.

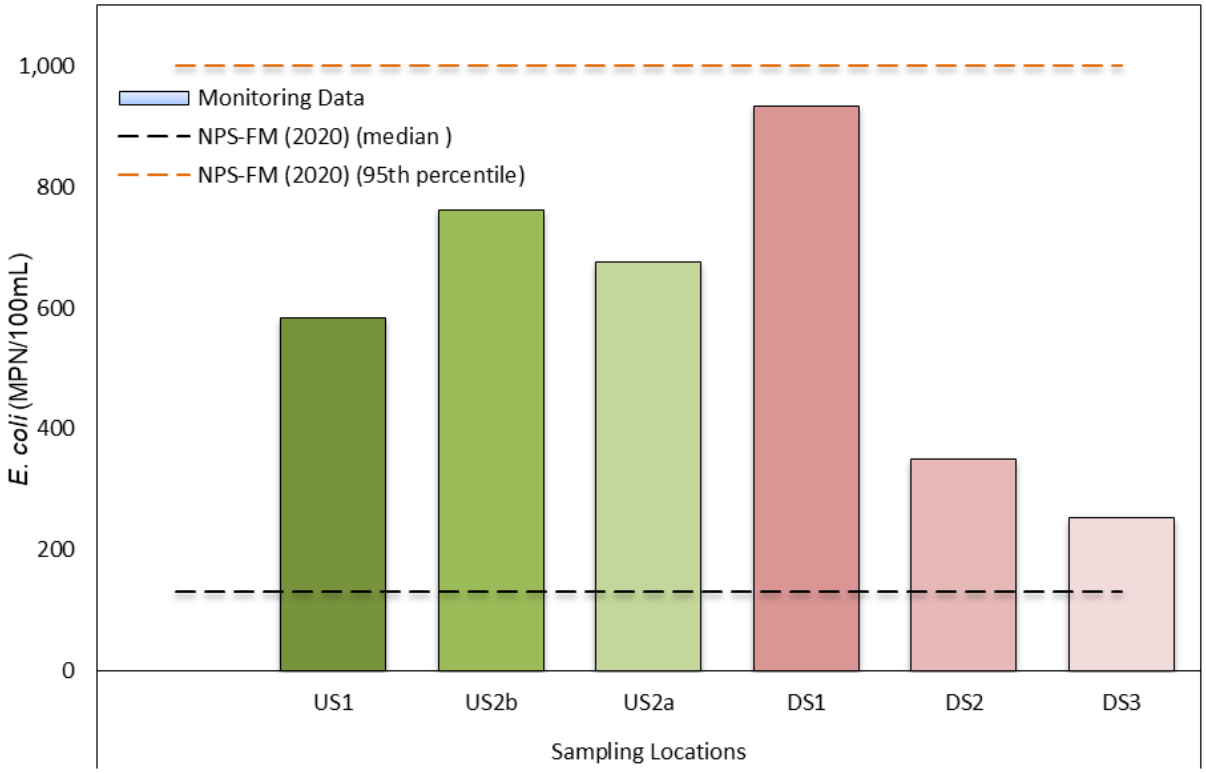

Figure 4-4. Levels of *E. coli* within Wairoro Stream, upstream (US1, US2b and US2a) and downstream (DS1, DS2 and DS3) of the Kaikohe WWTP discharge on 18 April 2023[17].

Furthermore, as part of the AEE prepared in 2021 a Quantitative Microbial Risk Assessment (QMRA) was undertaken by ESR[18] to understand the potential risks associated with human norovirus contaminating downstream environments because of the WWTP discharge. The assessment looked at individual illness risk (as a percentage) at seven sites in the environs of the WWTP discharge for gastrointestinal illness associated with norovirus from swimming. At a 3 $\log_{10}$ viral removal (99.9% reduction), the risk of norovirus illness would equate to the 'good' to 'excellent' attribute bands[19] for most sites under mean flows except at the point of discharge from the WWTP into the Wairoro Stream which would only achieve 'good' (*note: ESR assumed that the probability of infection with Campylobacter could be equated to the probability of illness due to norovirus*). Under mean annual low flows, however, the location at the point of discharge would be 'fair' whilst the water quality of the Wairoro Stream at Tāheke marae and Moehau marae would be 'good'. The QMRA showed that 4 $\log_{10}$ viral removal (99.99% reduction) would be required to ensure the 'excellent' attribute band could be met.

This is significant as, during the BPO selection process, local hapū were consulted about the value of Wairoro Stream and any particular locations downstream of the WWTP discharge that were used for swimming or gathering of mahinga kai. Several swimming and kai gathering areas were identified downstream of the WWTP discharge including between the point of discharge and Tāheke marae. As a

[17] Beca, June 2023. Water Quality and Ecology Effects Assessment – Kaikohe Wastewater Treatment Plan.

[18] ESR, June 2021. Screening Quantitative Microbial Risk Assessment (QMRA): Kaikohe Wastewater Treatment Plant. Report No. CSC21013.

[19] Under the National Policy Statement for Freshwater Management 2020 (NPS-FM,) the Attribute Bands were recorded as Excellent = < 0.1% infection risk 95% of the time, Good = 0.1 - 1% infection risk 95% of the time, Fair = 1 - 5% infection risk 95% of the time, Poor = >5% infection risk at least 5% of the time.

result, the human health effects resulting from the current discharge at the WWTP could be significant especially during mean annual low flows when swimming is likely to occur.

4.1.4 Odour Effects

FNDC's 2021 application for new consents for discharges associated with the operation of the Kaikohe WWTP highlights that the plant has very rarely resulted in unacceptable odours beyond the boundary of the site. It also concludes that "*…odour effects resulting from the plant operation are currently less than minor and will be further reduced following the initial upgrades.*"[20] The assessment is still valid, that is the actual and potential odour effects of an upgraded WWTP are likely to be less than minor.

4.1.5 Hydrological Effects on the Natural Wetland

At this stage there are no proposed changes to the role of the natural wetland system that receives treated wastewater. The discharge is unlikely to change the water level range and hydrological function of the wetland. Long-term, the volume of treated wastewater discharging through the wetland is predicted to increase. When inputs increase additional water will overflow from the wetland to the Wairoro Stream and not alter wetland water levels.

4.2 Likely Effects of the Upgraded Treatment Plant

The proposed upgrades to the WWTP are anticipated to provide superior viral and nutrient removal capabilities across the treatment process. This in turn will result in a higher degree of nitrogen, phosphorus and ammonia removal from treated wastewater that ultimately discharges into the receiving environment (Wairoro Stream). A high-level summary of the likely effects of the proposed treatment plant on specific receptors is provided in Sections 4.2.1 to 4.2.3.

4.2.1 Water Quality Effects

With the increased ability of the updated WWTP to remove nitrogen, phosphorus, ammonia and *E. coli* during the treatment process, the concentrations of these parameters in the discharge will be much lower and consequently the concentrations observed in the receiving environment of Wairoro Stream would also be lower than the existing conditions. The difference between the observed upstream and downstream concentrations will reduce measurably and the water quality downstream of the WWTP discharge is anticipated to improve compared to the existing conditions.

Table 3 outlines the expected percentage reduction in the levels of nutrients (total nitrogen and total phosphorus), ammonia and *E. coli* compared to the current plant discharge. This shows that the proposed plant will have significantly greater total nitrogen and ammonia removal capacity than the existing WWTP and total phosphorus will also reduce slightly. The *E. coli* concentration will reduce significantly due to the membrane process and UV disinfection.

[20] Beca Ltd. 27 August 2021. Kaikohe Wastewater Treatment Plant Discharge Consent Application – Assessment of Effects on the Environment Report. Prepared for Far North District Council.

Table 3. Summary of expected removal efficiencies with the proposed upgrades compared to the existing plant conditions.

Measured Parameter	Expected % reduction compared to existing plant (at 2060)
Total Nitrogen Load	56%
Total Phosphorus Load	12%
Ammoniacal Nitrogen Load	90%
E. coli Concentration	99.5%

These estimates are based on removal efficiencies that will be confirmed during the concept design phase of the upgrade process.

It is recommended that a mass balance assessment be completed following the concept design phase, using the proposed annual median contaminant concentrations from the new WWTP, along with the predicted WWTP average discharge volumes and the flow records of the Wairoro Stream (Mean and Mean Annual Low Flow), in order to demonstrate that the proposed discharge will result in significant improvements within the receiving environment and the relevant water quality standards can be met.

4.2.2 Ecological Effects

As outlined above, the proposed upgrade to the WWTP will result in superior wastewater quality including increased removal of nutrients, and particularly ammoniacal nitrogen (a toxicant to aquatic life). It is anticipated that this will contribute towards an overall improvement in downstream in-stream ecological conditions.

The existing discharge does not appear to have a significant negative impact on the presence of At-Risk native freshwater fish and sensitive macroinvertebrate species downstream of the WWTP discharge, nor a significant impact on periphyton coverage, during average flows; however, the effect on low flow / baseflow stream conditions is not as well documented but in-stream ecological conditions are expected to be negatively affected by the existing discharge. As such, the improved wastewater quality from the upgraded treatment plant is anticipated to result in improvements to ecology during low flow conditions in particular.

4.2.3 Human Health Effects

The existing WWTP discharge was assessed as presenting a risk to human health via the exposure of the public to faecal coliforms and viral pathogens during swimming activities downstream of the discharge. With the expected upgrades to the plant, the resulting treated wastewater from the treatment plant will be of a substantially improved quality. As a result, the areas currently unsuitable for swimming will have significantly improved water quality (with respect to concentrations of faecal coliforms and viral pathogens) which will contribute positively to health outcomes. Based on the current design parameters, it is expected that the treated wastewater will meet the water quality standard for rivers in primary contact sites during the bathing season as set out in the Proposed Northland Regional Plan – 95th percentile limit of 540 E. coli (units/100ml).

4.2.4 Social and Cultural Effects

In selecting the MBR upgrade to the WWTP, the Working Group considered several social and cultural values including:

- Swimming and other forms of contact recreation in terms of a reduction in human health risks, as the Wairoro Stream is culturally significant and used by people for kai collection and swimming.
- Wahi tapu sites along the Wairoro Stream.
- Improved amenity values.

It is understood that the selected MBR upgrade will best provide for these values. However, it is noted that a cultural effects assessment has not been prepared at this time. For more information about the Working Group assessment process see the Best Practicable Options Report at Appendix A.

5 Statutory and Planning Considerations

5.1 Relevant Planning Documents

The AEE accompanying FNDC's 2021 application contains an assessment of its original proposal against relevant provisions (objectives and policies) in the National Policy Statement for Freshwater Management (as published in August 2020), the Regional Policy Statement for Northland 2016, and the Proposed Regional Plan for Northland 2017 (appeals version at the time).

5.1.1 National Policy Statement for Freshwater Management 2020

The NPS-FM was amended in January 2024 but its primary objective and 15 policies remain the same, although it is noted that section 104(2F) of the RMA now states:

> When considering an application and any submission received, a consent authority must not have regard to clause 1.3(5) or 2.1 of the NPSFM 2020 (which relates to the hierarchy of obligations in the NPSFM 2020).

Clause 2.1 of the NPS-FM sets out the primary objective.

It is considered that 2021 assessment of the proposal against the relevant policies in the NPS-FM remains relevant in relation to the proposed upgrades. That is, the quality of the treated wastewater will be of a sufficiently high standard (through the removal of nutrients, faecal pathogens and organic contaminants) to:

- Protect the habitats of indigenous freshwater species (refer Policy 9)
- Contribute to national targets for water quality improvements (refer Policy 12)
- Help communities to provide for their social, economic, and cultural well-being in a way that is consistent with the NPS-FM (refer Policy 15)

Senior representatives from Te Uri o Hua, Te Takotoke, Ngati Kura, Ngāti Whakaeke, Ngāti Tautahi, and Matarahurahu were actively involved alongside FNDC in decision-making processes regarding the Kaikohe WWTP upgrades. In this regard, the amended proposal is consistent with Policy 2 of the NPS-FM.

5.1.2 Regional Policy Statement for Northland 2016

The RPS provides an overview of the key resource management issues across Northland and contains policies and methods to achieve integrated management of the natural and physical resources of the whole region. A key focus of the RPS is an objective and policies on improving the overall quality of Northland's fresh and coastal waters including by, of relevance to the proposal, improving microbiological water quality to minimise risks to human health. Other relevant provisions provide for protecting indigenous biodiversity in freshwater environments and recognising the importance of regionally significant infrastructure, and the role these serve to the wellbeing of communities. It is considered that the amended proposal is consistent with the RPS.

5.1.3 Proposed Regional Plan for Northland 2017 (

All appeals on the PRPN have been resolved and its objectives and policies provide a coherent framework for considering the amended proposal. Overall, the amended proposal is consistent with the PRPN and better aligns with the direction in Policy D.4.1 and better contributes to the achievement of Objective F.1.2, particularly because of the high level of treatment that the MBR will provide. The objective and policy reflect the direction in the RPS about improving water quality and are as follows:

> Policy D.4.1
> When considering an application for a resource consent to discharge a contaminant into water or onto or into land where it may enter water or onto land where it may enter water:
> 1) ensure that the quality of fresh and coastal water is at least maintained, and

2) where a water quality standard in H.3 Water quality standards and guidelines is currently met:
   a) ensure that the quality of water in a river, lake or the coastal marine area will continue to meet the standards in H.3 Water quality standards and guidelines; and
   b) consider whether any improvements to water quality are required in order to achieve F.1.2 Water quality;
3) where a water quality standard in H.3 Water quality standards and guidelines is currently exceeded, ensure that any resource consent for a new discharge will not, or is not likely to, cause or contribute to a further exceedance of a water quality standard in H.3 Water quality standards and guidelines;
4) where a water quality standard in H.3 Water quality standards and guidelines is currently exceeded and the exceedance of the water quality standard is caused or contributed to by an existing activity for which a replacement resource consent is being considered, ensure any replacement resource consent granted for the existing discharge includes a condition(s) that:
   a) requires the quality of the discharge to be improved over the term of the consent to reduce the contribution of the discharge to the exceedance of the water quality standard in H.3 Water quality standards and guidelines; and
   b) sets out a series of time bound steps, demonstrating how the activity will be managed to achieve the water quality improvements required by (4)(a).
5) ensure that the discharge will not cause an acute toxic adverse effect within the zone of reasonable mixing.

Objective F.1.2

Manage the use of land and discharges of contaminants to land and water so that:

1) existing water quality is at least maintained, and improved where it has been degraded below the river, lake or coastal water quality standards set out in H.3 Water quality standards and guidelines, and
2) the life-supporting capacity, ecosystem processes and indigenous species, including their associated ecosystems, of fresh and coastal water are safeguarded, and the health of freshwater ecosystems is maintained, and
3) the health of people and communities, as affected by contact with fresh and coastal water, is safeguarded, and
4) the health and safety of people and communities, as affected by discharges of sewage from vessels, is safeguarded, and
5) the quality of potable drinking water sources, including aquifers used for potable supplies, is protected, and
6) the significant values of Outstanding Freshwater Bodies and natural wetlands are protected, and
7) kai is safe to harvest and eat, and recreational, amenity and other social and cultural values are provided for.

5.2 Purpose and Principles of the RMA

The purpose of the RMA is to promote the sustainable management of natural and physical resources, which means:

> …managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while—
>
> (a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and
>
> (b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and
>
> (c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.

The amended proposal meets the sustainable management purpose of the RMA by assisting with the maintenance of public health standards and the enabling of broader social and economic outcomes for Kaikohe. Treated wastewater from the upgraded WWTP is expected to not compromise the life-supporting capacity of Wairoro Stream and its associated ecosystems and adverse effects will be appropriate avoided,

remedied and mitigated through a high performing WWTP, operational standards and the implementation of any required actions in response to regular monitoring of the plant and the receiving environment.

Sections 6-8 of the RMA set out matters that decision-makers on resource consents must recognise and provide for, have regard to or take into account when consenting an application. It is considered that the amended proposal is consistent with the following relevant matters:

- "*the preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and the protection of them from inappropriate subdivision, use, and development*" (RMA s6(a))
- "*the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga*" (RMA s6(e))
- "*the maintenance and enhancement of amenity values*" (RMA s7(c))
- "*intrinsic values of ecosystems*" (RMA s7(d))
- "*maintenance and enhancement of the quality of the environment*" (RMA s7(f))

6 Proposed Conditions

FNDC has not proposed specific conditions of resource consent. That is because the design process has not been completed and the timeframe for the upgrades has not been finalised. However, it seeks standard conditions of consent that cover discharge quality standards for key parameters, discharge rates, monitoring and reporting, and operational and maintenance activities. FNDC will provide further information on these matters prior to a decision being made by NRC on the application.

It is noted that Te Uri o Hua, Te Takotoke, Ngati Kura, Ngāti Whakaeke, Ngāti Tautahi and Matarahurahu have identified that they would like the following matters covered in conditions of resource consent:[21]

- A requirement to keep hapū engaged.
- A requirement to continue investigating a discharge to land scheme. This should specify a timeframe by which a decision would need to be made on a proposed discharge to land scheme, and a timeframe for when the scheme should be implemented.
- A requirement for adequate wastewater quality monitoring.
- A requirement to only allow only appropriate connections. The purpose of this is to ensure that new connections fit with the proposed sizing and design of the new WWTP.

FNDC requests a 35-year duration consent which provides for the staged upgrade of the existing WWTP.

[21] Section 6.2 of the attached Best Practicable Option Report (Appendix A).

7 Conclusion

In August 2021, FNDC applied for a new consent to discharge treated wastewater from the Kaikohe WWTP. The application was placed on hold while further work was done on selecting the best practicable option for treating and discharging wastewater from the WWTP. Timeframes for processing the application were extended by NRC under section 37 of the Resource Management Act 1991.

A Working Group consisting of senior representatives from Te Uri o Hua, Te Takotoke, Ngati Kura, Ngāti Whakaeke, Ngāti Tautahi, Matarahurahu and FNDC was formed. The Working Group lead the investigation into upgrading the WWTP and discharging treated wastewater to land. This work has largely been completed and the preferred option is a MBR plant with a discharge to the existing constructed wetlands, improvements made to the final treatment wetlands, and continual investigations into a discharge to land scheme.

The upgraded WWTP will provide for increased growth within Kaikohe, achieve a much higher level of treatment and better environmental outcomes. The upgrades are currently going through design stages, and they are expected to be implemented within several years.

The upgraded WWTP will achieve significantly improved total nitrogen and ammonia removal capacity than the existing system and total phosphorus will also reduce slightly. The *E. coli* concentration, an indicator of the presence of faecal pathogens, will reduce significantly due to the membrane process and ultraviolet light disinfection process. The enhanced quality of the discharge is likely to result in the quality of water in the Wairoro Stream improving.

This document updates (i.e., amends) FNDC's application to reflect the proposed upgrades to the WWTP. The amended proposal is consistent with National Policy Statement for Freshwater Management, the Regional Policy Statement for Northland and the Proposed Regional Plan for Northland. Overall, the effects of the amended proposal remain no more than minor in terms stream water quality, its freshwater ecology, contact recreation, odour and other amenity values.

A resource consent is sought with a duration of 35 years with conditions that reflect a staged upgrade. FNDC will provide more detailed information on the calculated quality of treated wastewater for key parameters prior to a decision being made on the application.

Appendix A – Kaikohe Wastewater Treatment Plant– Best Practicable Option Report

(Attached separately)

B

Appendix B – Water Quality and Ecology Effects Assessment 2023

(Attached separately)