Kaikohe Wastewater Treatment Plant Discharge Consent Application

Assessment of Effects on the Environment Report

Prepared for Far North District Council
Prepared by Beca Limited

27 August 2021

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Revision History

Revision Nº	Prepared By	Description	Date
00	Eloise Taylforth and Leon Keefer	Draft for client review	01/08/2021
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Document Acceptance

Action	Name	Signed	Date
Prepared by	Leon Keefer		27 August 2021
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Approved by	Blair Masefield		27 August 2021
on behalf of	Beca Limited		

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1 Introduction

This Assessment of Effects on the Environment (AEE) Report has been prepared by Beca Limited (Beca) on behalf of the Far North District Council (FNDC) (the Applicant) to support a resource consent application pursuant to Section 9(1) and Section 15 of the Resource Management Act 1991 (the RMA) to enable the continued operation of the Kaikohe Wastewater Treatment Plant (WWTP). This involves the discharge of treated municipal wastewater to an unnamed tributary of the Wairoro Stream.

1.1 Project Context

The existing discharge is authorised by CON20100241701, which was granted in August 2005 and is set to expire on 30 November 2021. The WWTP treats municipal wastewater from Kaikohe Township, waste activated sludge from Russell, and sewage and sludge from septic tanks across the District.

The wastewater is treated through a series of ponds and constructed wetlands prior to discharge into an unnamed tributary of the Wairoro Stream. Water quality of the discharge has declined over time due to a range of performance issues within the WWTP, causing seasonal non-compliance with existing consented discharge standards. Non-compliances are exacerbated during times of drought and have related to exceedances of total-ammoniacal nitrogen, flow rate, pH, dissolved oxygen levels, and *E. coli* concentrations of treated wastewater at the Wairoro Stream monitoring sites.

FNDC has been undertaking investigations on long-term wastewater treatment options for this discharge, including significant upgrades to the treatment plant and disposal to land options. It has committed funding to expand the options assessments and engage with tangata whenua to inform the process. This process is part of a district-wide programme addressing Council's 15 ageing wastewater treatment plants in response to:

- the national water quality standards set out in the National Policy Statement for Freshwater Management (2020) (NPSFW);
- greater recognition of tangata whenua's role in managing water and
- contemporary best practice.

The investigations, consultations, funding allocation, design, consenting, and construction timeframes to achieve this programme is understood to be occurring over approximately the next ten years.

The WWTP is identified in the Proposed Northland Regional Plan (PNRP) as *Regionally Significant Infrastructure* and must continue to operate until upgrades or alternative disposal methods are developed. FNDC is seeking a staged discharge consent for a total 15-year duration.

The first 3-year period will enable current discharges to occur while improvements to the existing plant occur so the discharge quality can be substantively improved. By year 6 it is proposed a new plant is commissioned which is either a land or water-based discharge, depending on ongoing Tangata Whenua engagement and best practicable optioneering. Either way the new plant is proposed to achieve discharges that comply with the bottom-line attributes of the NPS:FW and minimum standards of the PNRP.

The improvements are described in detail throughout this report and the supporting documents.

The assessment of effects on the environment undertaken to support this application for resource consent has focused on the potential effects of the discharge on cultural, ecological, and human health values. These effects are considered to be the primary effects of concern given the nature of the discharge and its receiving environment.

1.2 Summary of Consents Required

Consents are required pursuant to s15 of the RMA, relating to the discharge of treated wastewater from the treatment plant to a natural stream and wetland system. This is provided for by:

- Regulation 47(3) of the *Resource Management (National Environmental Standards for Freshwater) Regulations 2020* (NES:F) for the discharge of water (associated with the operation of specified infrastructure) within, or within a 100m setback from, a natural wetland as a restricted discretionary activity; and
- Rule C.6.2.2 of the Proposed Northland Regional Plan (PRP) for the discharge of treated wastewater from a wastewater treatment plant into water and any associated discharge of odour into air resulting from the discharge as a discretionary activity.

Rule C.6.2.2 of the PRP is not subject to any appeals and is therefore treated as operative pursuant to s86 of the RMA, superseding relative rules set out in the predecessor Regional Water and Soil Plan and Regional Air Quality Plan.

1.3 Structure of the Report

Schedule 4 of the RMA sets out the information requirements for a resource consent application. This application has been prepared in a manner consistent with Schedule 4 and contains the following information:

- A description of the existing environment within which the activity takes place.
- Summary of the proposed activities.
- An assessment of alternatives.
- Reasons for consent.
- An assessment of effects on the environment.
- A summary of consultation undertaken to date; and
- An assessment of the relevant statutory framework.

2 Description of Existing Environment

2.1 Site Description and Surrounds

The Kaikohe WWTP is located on Cumber Road, Kaikohe, on a site legally identified as:

- Lot 2, DP 45233 Blk XV, Omapere SD; Sec 27, SO 40585 Blk IV Punakitere SD; Sec 2, SO 12295 Blk IV Punakitere DS; Sec 30 Blk IV Punakitere SD

The site is owned FNDC and operated by Far North Waters, which is an alliance partnership between FNDC and Ventia established to operate and maintain FNDC's 3-Waters assets. Far North Waters operations staff operate the WWTP and monitor its discharge in accordance with the current resource consent and its monitoring programme. A copy of the Record of Title(s) is attached in Appendix A.

The WWTP consists of several biological treatment components, as summarised in the scheme in Figure 1 below and described in Section 3.1 of this report.

Figure 2-1 Kaikohe WWTP detailed process of effluent treatment onsite, Cumber Road, Kaikohe. Image taken from WDC GIS Maps 2021.

2.2 Site Topography and Hydrology

The treatment plant is located to the east of and above the true left bank of the Wairoro Stream. The plant site is relatively flat, being within the Wairoro Stream floodplain and at the foot of a small ridgeline to the east. The plant discharges to an unnamed stream, which subsequently flows through a natural wetland prior to its confluence with the Wairoro Stream.

The Wairoro stream is a relatively small stream located south of the Kaikohe WWTP which, at the point of discharge has a catchment area of approximately 28km^2 and a median flow of 430l/s. The Wairoro Stream

runs from east to west and forms part of the upper catchment of the Punakitere, Otaua, Taheke, and Waima Rivers, which ultimately flows into the Hokianga Harbour.

Te Rūnanga o Te Rarawa are recognised through a Statutory Acknowledgement as having mana over the Hokianga Harbour.

2.3 Land Uses

The Site is located within a Rural Production Zone designated under the FNDP (reference FN171) for the purpose of Kaikohe - Sewage Treatment & Disposal Purposes.

The surrounding land is zoned as Rural Production under the FNDP and comprises of medium to large rural-residential type sections serviced by Cumber Road and surrounded by larger productive farmland in the wider receiving environment.

Properties to the south and east are Crown-owned land, largely covered in forest and are subject to treaty settlement claims

2.3.1 Identified Cultural Heritage

There are a number of cultural heritage items identified on the planning maps in the vicinity of the Site (see Figure 2-2). These include NZAA P05/202 (Pa site) located 300m to the east of the infrastructure, and NZAA P05/430 (burial site) and P05/231 (pits and terraces) located 230m to the south of the infrastructure. An unspecified site of cultural significance (MS09-23) is located approximately 650m to the north.

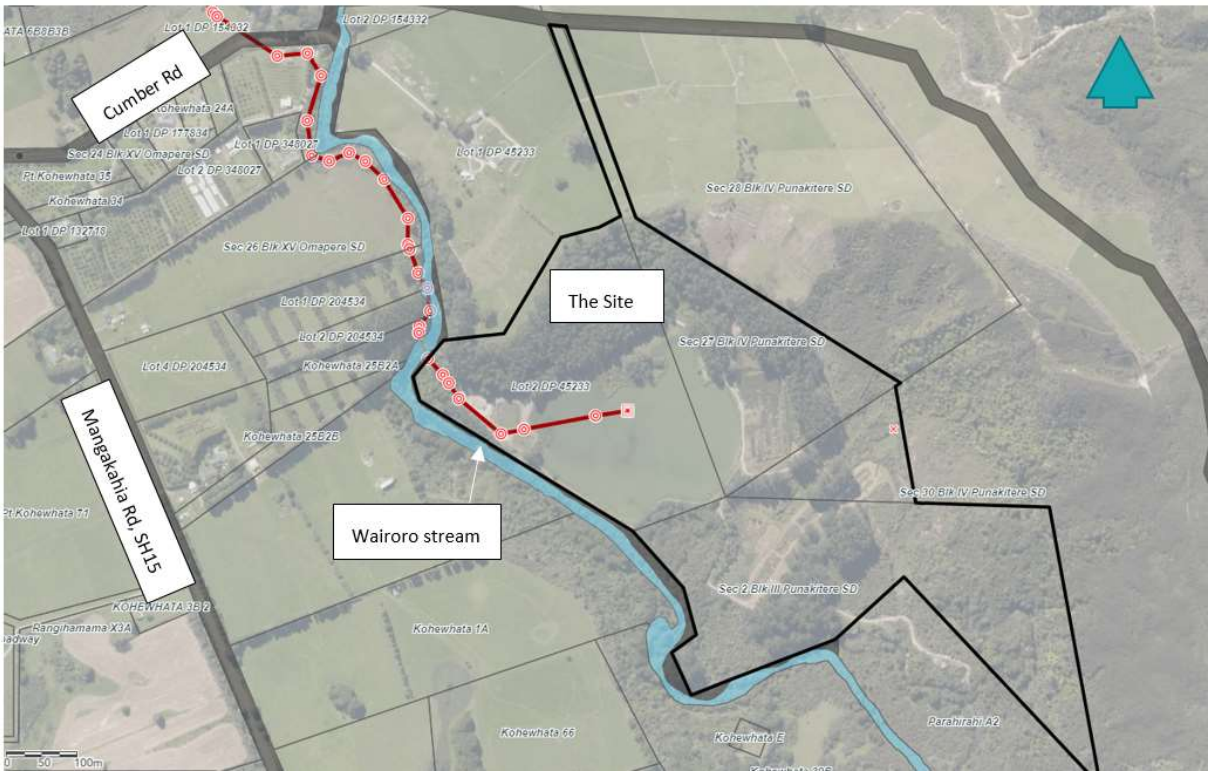

Figure 2-2 Location of Kaikohe WWTP, and unnamed tributary of Wairoro Stream to the immediate west. Image taken from FNDC Planning Maps 2021.

2.4 Ecological Context

The WWTP is located to the east of and above the true left bank of the Wairoro Stream, and at the bottom of a small ridgeline that runs through the Punakitere blocks.

2.4.1 Terrestrial Ecology

Vegetation within the site comprises a mixture of mature native riparian trees along the banks of the Wairoro Stream and exotic forestry species within the interior of the site, including pine and eucalyptus. A site visit on 28 July 2021 revealed that a majority of the forestry trees have recently been felled and removed.

The site is bordered to the east and south by densely packed stands of mature gorse, pampas, and tobacco weed interspersed with native tree species.

2.4.2 Natural wetland / swamp

A natural wetland (swamp) is located beyond the gorse and along the foot of the ridgeline to the east. Flows from the WWTP enter this wetland via the unnamed tributary. The wetland is identified in the Northland Regional Council maps as a manuka-gleichenia gumland which includes *Dracophyllum sp.*, *Hakea sp.*, kumerahou, mingimingi, hangehange, raupo-baumea associations, and maire tawake along the wetland margins. A site visit undertaken on 27 July 2021 indicated that this wetland was also subjected to the spread of alligator weed (*Alternanthera philoxeroides*) and duck weed (*Lemna spp.*).

2.4.3 Oxidation Pond and Constructed Wetlands

While technically part of the WWTP and not part of the natural ecology of the area, the oxidation pond and constructed wetlands could potentially provide habitat for plant and animal life. The oxidation pond has been observed as being used by waterfowl, particularly mallards and swans, and the margins of the pond are currently overgrown with an aquatic grass (likely *Spartina*). The maturation pond and constructed wetlands are subject to alligator weed and duckweed growths, and the surrounding kikuyu grasses intrude into the edges of the wetland channels.

2.4.4 Aquatic Ecology

The Wairoro Stream forms part of a larger river complex including the Punakitere, Taheke, and Waima Rivers that flow into the Hokianga Harbour. As described in the Ecological Assessment undertaken by Cawthron Institute (Appendix B), the Wairoro Stream at the location of the WWTP is fed by a catchment of about 30km^2 in size that is primarily pastoral. Flows within the stream have been measured at the water intake weir in Kaikohe township to be at about 430 L/s. As this site is located approximately 4.5km upstream of the WWTP, and numerous smaller tributaries feed into the stream prior to the WWTP, Cawthron modelled the below predicted flows at the Wairoro's confluence with the unnamed tributary:

Attribute	Rates
Mean Annual Low Flow (7-day)	122 L/s
Minimum Flow	36.5 L/s
Median Flow	528 L/s
Avg number of high flow events p.a. (>1,584 L/s)	16

The Ecological Assessment also analysed the results of water samples from 8 different sites along the Wairoro Stream, including 2 sites approximately 50m and 420m upstream of the confluence with the unnamed tributary, and 5 sites between approximately 50m and 2000m downstream. A sampling site was also located on the unnamed tributary immediately upstream of its confluence with the Wairoro Stream.

Results of the water quality sampling indicated that the unnamed tributary has much lower water quality than the Wairoro Stream, with high turbidity and low levels of dissolved oxygen. As such, water quality of the Wairoro Stream does show a marked difference between the upstream sampling sites and the downstream sites, with a noticeable increase in nutrient concentrations (total nitrogen, ammoniacal nitrogen, total phosphorus), increased concentrations of *E. coli*, and an increased presence of green algae.

While the Ecological Assessment determined that nutrient, *E. coli,* and periphyton levels do increase within the Wairoro Stream downstream of the WWTP, the assessment also noted that the EPT, QMCI, and SQMCI analysis showed that the Wairoro Stream's aquatic environment is already at a degraded state and most of the sample sites would likely fall below the national bottom lines set under the NPS:FM.

The Ecological Assessment did not undertake a fish survey. Instead it relies on a fish distribution model that Cawhtron Institute developed for the stream in 2014 that utilised data in the New Zealand Freshwater Fish Database. This model identified that only longfin eel and shortfin eel were likely to be present within the Wairoro Stream within the subject reach.

3 WWTP Process Detail

3.1 Treatment Design

3.1.1 Primary treatment of effluent

The WWTP receives municipal wastewater from Kaikohe via a network of public pipes and from the surrounding district via tanker trucks. Raw effluent enters a 1,000m^2 anaerobic pond via an inlet screen. The purpose of the inlet screen acts as a filter to reduce the volume of solids entering the treatment system and assists with the removal of periphyton. The inlet screen was removed for maintenance approximately at the beginning of 2021 and has been in repair since, with delays in the receipt of parts from Europe due to supply chain issues associated with the ongoing COVID pandemic. An inflow meter is fitted at the anaerobic pond to record inflow from the wastewater network, and effluent loading (kg/day) is measured.

The anaerobic pond provides primary treatment, separating out solids and targeting the removal of Biological Oxygen Demand (BOD).

3.1.2 Secondary treatment of effluent

From the anaerobic pond, the effluent is discharged into a 4.3ha oxidation pond before entering the maturation pond. The oxidation pond has a high retention time of up to 38 days which allows for further BOD removal, nutrient removal, and pathogen reduction through UV disinfection. The oxidation and maturation pond provides secondary treatment of effluent.

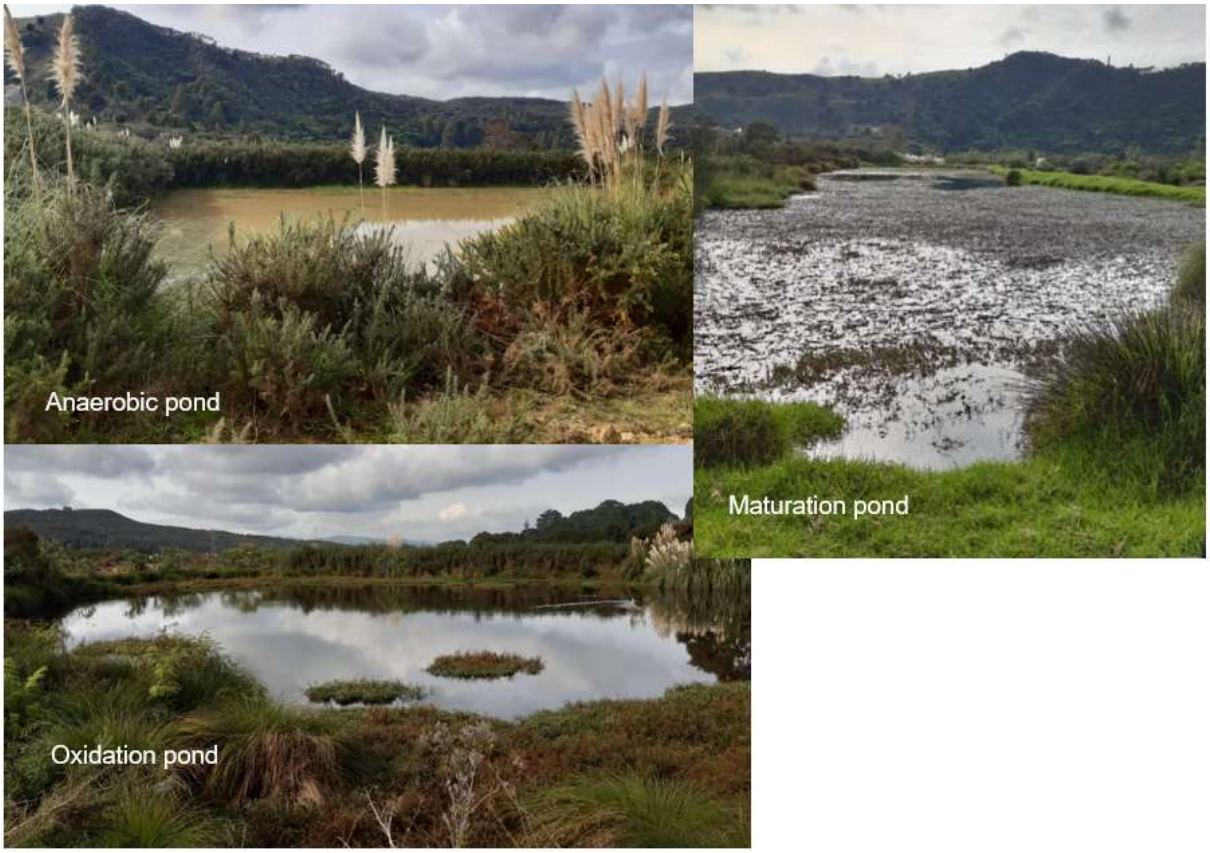

Figure 3-1 Image taken on the primary (anaerobic pond) and secondary (oxidation pond) treatment ponds and maturation pond at Kaikohe WWTP. Image taken by report author dated 23/5/2021 and 28/7/2021.

3.1.3 Tertiary treatment of effluent

The treated effluent then enters a series of constructed wetlands which provide tertiary disinfection treatment, to remove pathogenic bacteria such as *E.coli.* The treated effluent passes through the weir structure at the north end of the constructed wetlands where it enters a natural wetland system, travels south via an unnamed tributary before being discharged in the Wairoro Stream, which runs from east to west. The weir structure is fitted with a flow meter to record the discharge flows into the receiving water environment.

Figure 3-2 Constructed wetland system (left) and weir structure (right) located at the point of discharge at the Kaikohe WWTP. Image taken by report author 28/7/2021.

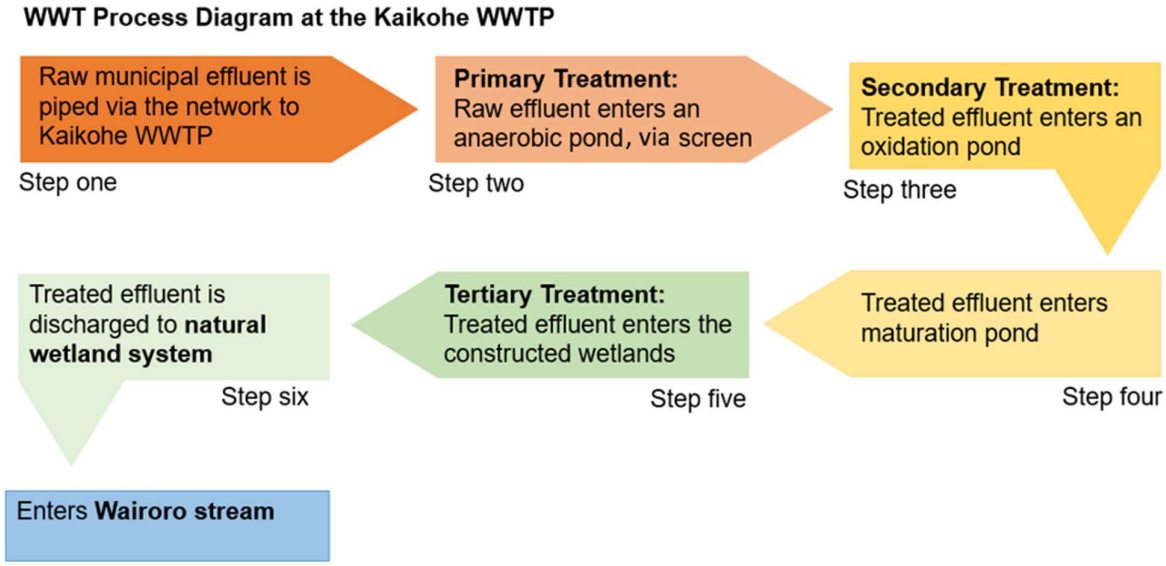

Figure 3-3 Treatment process diagram at Kaikohe WWTP from the public wastewater network. Diagram prepared by report author 2021.

3.2 WWTP Performance

A WWTP Performance Assessment (Appendix C) was undertaken by Jacobs to assess the effectiveness of the original plant design in light of the contemporary influent quantities and environmental factors. This assessment considers the plant's total mass loadings as well as influent volumes, as demonstrated in the Table below.

Table 3.1 Kaikohe WWTP loading and removal efficiency. Based on average influent rate of 1662m3/day, and effluent load as reported in logbook between May 2018 and April 2020. See Table 7, Jacobs Report dated March 2021.

Parameter	Average influent load (kg/day)	Average effluent load (kg/day)	Removal efficiency
BOD	455	31	93%
TSS	767	81	89%
TN	105	74	29%
Ammoniacal nitrogen	94	63	33%

The review determined that the original design is capable of treating the current influent to largely meet the current resource consent standards, provided the plant is maintained and operated to its design specifications. However, as confirmed in the Performance Assessment (Appendix C) and the Ecological Assessment (Appendix B), discharges from the WWTP are likely contributing to an increase in nutrients, which potentially exacerbates algal growth and *E. coli* populations downstream.

This assessment has informed a range of measures to improve actual plant performance to address existing treatment limitations and implement short-term improvements to support the continued operation of the WWTP until a comprehensive plant upgrade can be undertaken. These are set out in detail in Jacob's Interim Options Report (Appendix D). The preferred interim options that form part of this application are summarised below.

3.3 Proposed Discharge

FNDC proposes to continue discharging wastewater from the Kaikohe WWTP to water and is applying for a consent duration of 15 years. It is proposed to continue discharge wastewater using the existing WWTP processes, with some improvements, until a full upgrade is implemented. The full upgrade will include consideration of the treated wastewater route (land discharge or otherwise) and will be fine-tuned to meet the requirements of the receiving environment.

The long-term treatment solution will be in accordance with good management practice and will also consider wastewater discharge to land. As this is being developed, initial upgrades will be implemented to enhance the treatment provided by the existing plant. This will be managed through a schedule of water quality standards that are progressively improved to a defined timeline as follows.

Within the 15-year duration there are three distinct stages:

- Stage 1 – Years 0-3: Implement existing WWTP improvements
- Stage 2 – Years 3-6: Commission new / upgraded WWTP
- Stage 3 – Operation of a new / upgraded WWTP

3.3.1 Stage 1: Existing plant improvements

Within the first 3 years of consent, a range of initial improvements will be undertaken at the plant. It is anticipated that these improvements will start to be implemented prior to the conclusion of this resource consent process.

The following upgrades are expected to bring the WWTP up to its original design specifications:

- Reinstate the inlet screen as soon as practicable;
- Aquatic weed removal and ongoing management at the outlet monitoring weir, within the ponds and constructed wetlands;
- Improved wetland planting within the constructed wetlands; and
- Desludging the anaerobic and oxidation ponds.

Weed removal and wetland planting reinstatement are programmed to occur before the end of March 2022. The desludging of the anaerobic and oxidation ponds is a prerequisite activity for further upgrades and has been listed in the draft annual plan for financial year 22/23.

Following the desludging of the ponds, it is proposed to introduce improved aeration to the oxidation pond to improve its efficiency through the installation of mechanical aerators and/or baffles and curtains. This is expected to improve the performance of the WWTP above its current consent requirements.

With the implementation of these improvements, it is anticipated that the discharge water quality will improve, with reduced BOD, reduced ammoniacal nitrogen (and other nutrients), improved *E. coli* disinfection, and subsequently less impacts on the receiving environments. A set of proposed limits these improvements are modelled to achieve is provided in Table 3.2. These limits will apply to the WWTP operation during Stage 2 in years 3-6.

3.3.2 Stage 2: Proposed standards and monitoring

The existing resource consent requires that FNDC undertake monitoring of changes to the quality of the Wairoro Stream and its tributary. Through experience, FNDC has indicated that environmental factors, such as periods of heavy rain or drought, result in significant difficulties in accurate and reliable monitoring data. This creates difficulties in determining actual effects of treated wastewater discharges on the receiving environment.

Therefore, it is proposed that the monitoring of the WWTP's effluent water quality is undertaken at the 'end-of-pipe', after treatment but prior to discharge into the receiving stream. This will provide FNDC with a clearer understanding of the plant performance and the ability to improve or modify treatment processes within the plant. This approach allows for greater control over the discharge and a clear understanding of the contributors.

Monitoring is proposed to be undertaken on a monthly basis with reporting to be aligned with other FNDC wastewater discharge consents to reduce compliance complexity and allow for efficiencies across the network.

The proposed monitoring will measure the parameters set out in Table 3.2 at the outlet weir at the end of the constructed wetland (CWL).

Table 3.2. Proposed water quality standards for WWTP discharge for years 2-6.

Parameter	Monitoring Basis	Proposed Limit
Flow	30-day rolling average of dry weather discharges at CWL 'Dry weather' defined as TAIPA	30-day rolling average of dry weather flow of 1,900 m^3/d 95th percentile dry weather flow of 2,400m^3/d
pH	pH	6.5 – 9.0
Dissolved Oxygen	Reduction in concentration from influent pipe to discharge from CWL	1 mg/L 95th percentile concentration of <30 mg BOD/L To be measured between 11am and 3pm.

E. coli	Reduction in cell count from influent pipe to discharge from CWL and maximum concentration of cells at CWL discharge	Disinfection performance of 4 log removal, achieving a geometric mean of effluent sampling results of <1000 MPN/100ml
Ammoniacal nitrogen (NH_4^+N)	NH_4^+N at CWL discharge	22 mg/L 95th percentile concentration of 30 mg NH_4-N/L

3.3.3 Stage 3: Operation of a new / upgraded WWTP and Proposed Standards

Following the implementation of the initial upgrades, a long-term solution is proposed to be designed and implemented, consisting of either a continued discharge to water or a discharge to land:

If the long-term solution selected by FNDC involves continuing to discharge to the Wairoro Stream, a full upgrade to the Kaikohe WWTP will be implemented to achieve the water quality standards that are set out in the PNRP Appendix H.3 and the NPS:FM national bottom-line attributes. FNDC have approved a budget of ~$13.5 million in the Long-Term Plan to implement improvements and upgrades to the WWTP between 2023 and 2026. For the purposes of this application, FNDC proposes that the full upgrade will be implemented by Year 6 of the resource consent.

At this point in time, the treatment methodology has not yet been determined and is subject to a Best Practicable Options investigation including input from tangāta whenua. In November 2020, Harrison Grierson prepared a preliminary options assessment to commence discussions to address long-term upgrade options for the plant and to enable sufficient budget to be allocated in the Long-Term Plan for a significant plant upgrade. This included investigating 5 potential options, as detailed in Section 4.2 of this report.

The proposed Stage 1 upgrades have been developed so they are compatible with and able to be incorporated into future full upgrades that are currently being developed.

Where a discharge to land scheme is taken forward, point-source discharges to the Wairoro Stream from the Kaikohe WWTP would be superseded. As discussed in section 4.1 of this report, FNDC is currently investigating the feasibility of a discharge to land option and will be seeking input from a range of key stakeholders over the next 2 years.

3.4 Continuous Improvement Plan

Where effluent monitoring results indicate that the proposed upgrades and measures are insufficient to achieve the proposed limits, further methods will need to be developed in cooperation with hapū and implemented to achieve the proposed limits. This approach is currently being utilised for the operation of FNDC's Taipā WWTP through a working group consisting of hapū, Council representatives, and an independent suitably qualified professional engineer. It is envisaged that a similar process will be implemented to undertake improvements at Kaikohe.

4 Consideration of Alternatives

Pursuant to s105(1)(c), FNDC has considered multiple alternative methods of discharge and offers the proposed method as the Best Practicable Option (BPO). This section considers three wastewater discharge options that are being considered for Kaikohe:

- Discharges to land (long-term)
- Discharges to water with significant upgrades to the WWTP (long-term); and
- Discharges to water short-term).

4.1 Discharge to Land Feasibility – Long-Term Options

In January 2021, FNDC prepared a feasibility assessment (Appendix E) to investigate methods of wastewater disposal to land. This investigation was part of a wider Council programme to determine the feasibility of utilising wastewater disposal to land schemes across the district as either replacement systems or supplementary systems to the existing 15 municipal WWTP.

The Kaikohe disposal to land investigation was a desktop assessment that identified potential sites within a certain proximity to the existing WWTP that met certain criteria, such as appropriate topography, geology, and existing land uses. Several disposal techniques are utilised in such schemes, and the assessment considered 4 different methods:

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

The disposal area needed for disposal to land schemes depends on how free draining the soils are. The assessment of the clay-loam soils at Kaikohe determined that an efficient wastewater disposal field would require 56ha of land and upgrades to the existing plant prior to any land applications. A preliminary cost estimate for this option was determined at $17.1 million with a confidence interval of -35% to +50%. FNDC has committed funding to furthering land-based disposal investigations, to engage with landowners and tangāta whenua around site selection and progress a preliminary design to enable a refined cost estimate.

These investigations are ongoing and are expected to be completed prior to the end of 2023. Given the requirement to continue the operation of the WWTP to provide for the community of Kaikohe, it is proposed to continue to discharge to water in the short to medium term (Stages 1-2)

4.2 Discharge to Water – Long-Term Options

FNDC has been considering full upgrades to the Kaikohe WWTP, with a continued discharge to water, in parallel with its consideration of discharges to land. Through 2020, FNDC engaged Harrison Grierson to assist with identifying the BPO for a long-term discharge to the Wairoro Stream. This assessment (Appendix F) used the new discharge standards set out in Appendix H.3 of the PNRP to assess a long list of options through a multi-criteria analysis (MCA). These options included:

- Do-nothing (*status quo*);
- Minor upgrades (modifications to existing treatment processes);
- Major upgrades (significant reconfiguration of existing assets and construction of new plant processes);
- Side stream treatment plant (diverting a portion of flows into a separate mechanical plant for treatment); and
- Industrial re-use (diverting a portion of flows into a separate mechanical plant to be re-used by nearby industries).

All options considered that de-sludging of the existing ponds would be required for pond-based treatment systems.

A qualitative MCA was undertaken between FNDC and Harrison Grierson to develop a short-list of long-term treatment plant upgrade options. This list included 5 potential options that were scored quantitatively against criteria (cultural impacts, environmental values, practicability to implement, operability, and financial burden) and then assessed against a risk matrix. These options included a range of mechanical upgrades:

- In-pond upgrades (additional aerators, baffle curtains), chemical dosing, and tertiary treatment (through sand filters and UV treatment);
- Bioreef/Aquamats within the oxidation pond, chemical dosing, Actiflo (mechanical settlement devices), UV treatment, and the removal of the constructed wetlands;
- Intermittently Decanted Aerated Lagoon (IDAL), which would involve modifications to the existing anaerobic and oxidation ponds, where secondary settled wastewater is decanted in batches rather than continuously;
- A side-stream Bionutrient Reactor Plant, which would treat a portion of the wastewater influent and discharge back into the existing treatment stream prior to discharge; and
- A stand-alone Bionutrient Reactor Plant, which would supplant the existing treatment system.

All options were considered by FNDC and Harrison Grierson to score low in terms of impacts on Māori cultural values; however, it is noted that local tangāta whenua were not involved in this assessment. FNDC are in the process of seeking input from multiple hapū with stated interests in this options analysis. The IDAL treatment process was identified in the report as the BPO due to its ability to:

- Achieve the required levels of wastewater treatment to achieve water quality standards in the PNRP; while
- Having the lowest required Capital and Operational Expenditures; and
- Providing for the future growth of the community, industrial, and capacity needs for wastewater treatment.

As noted in 3.5 of this report, consultation with tangāta whenua is ongoing to review options for a full WWTP upgrade.

Given the IDAL treatment process will not be required if discharge to land is considered feasible after further investigation, it is not financially prudent to implement the upgrade before the outcome of that investigation is known.

4.3 Discharge to Water – Short-Medium Term Options

To address the ongoing wastewater discharge of the WWTP prior to a full-scale upgrade being implemented, FNDC engaged Jacobs to identify options to implement initial upgrades to improve water quality of the discharge (refer Appendix D). A range of interim options are proposed to be implemented, as discussed in section 3.3 of this report. These were selected as the 'BPO' following a MCA process that considered the options':

- Ability to be implemented quickly (available funding, constructability);
- Improvement on the existing plant performance;
- Operability and maintenance requirements; and
- Compatibility with a future plant upgrade (IDAL as the preferred option to date).

The options assessed included:

- Aeration of the oxidation pond to improve treatment performance;
- Installation of baffle curtains in the oxidation pond to reduce 'short-circuiting' and increase water residence time within the pond;
- Use of AquaMats so a similar technology within the oxidation pond to improve denitrification;

- Installation of a nitrifying filter; and
- Construction of Advanced Wetland System (to replace existing constructed wetlands).

The options assessment determined that, following the required maintenance activities at the plant including desludging, aeration of the oxidation pond would likely achieve a significant improvement in plant performance with relatively small costs and installation requirements. Baffle curtains could also be installed to further improve oxidation pond performance, but this may be an unnecessary step given the expected improvements that would result from the aeration of the pond. These measures are low-cost and are relatively simple to implement.

AquaMats, nitrifying filters, and Advanced Wetland Systems were all considered to require high capital costs, had issues with constructability, and would not be compatible with a future IDAL plant, meaning that these would become redundant following a full upgrade and a sunk cost to Council.

Aeration and baffle curtains are compatible with and able to be incorporated into the future full upgrade.

4.4 Best Practicable Option Summary

FNDC is currently investigating a range of future options for wastewater discharges from the Kaikohe WWTP, including Wastewater Discharges to Land and a full upgrade to the WWTP with continued discharge to the Wairoro Stream. These investigations are contingent on a wide range of factors, including outcomes from tangāta whenua engagement, funding availability, potential land acquisition, design, procurement, and construction.

As the Kaikohe WWTP must continue to operate to provide for the community's health and safety, and social and economic wellbeing, the range of maintenance activities and initial upgrades described in Section 3.3 of this report are considered by FNDC to be the BPO to improve the performance of the existing plant prior to the full-scale upgrades that will achieve the required PNRP water quality standards for discharges to flowing rivers.

The BPO has been determined to be a two-step process. Initially FNDC will invest in the practicable interventions identified in the short to medium term (Stage 1 upgrades). The second step is to undertake another BPO exercise to layer in the both cultural values and the viability of land-based wastewater discharge schemes so that a final BPO for the Kaikohe WWTP can be determined and inform the investment of this significant capital expenditure.

Ideally a BPO for a long-term solution would be concluded now and form the basis of this application; however, due to the existing consent expiring and the need for the continued operation of the plant, this process is being undertaken concurrently.

5 Resource Consent Requirements

5.1 Reasons for Consent

The Applicant seeks discharge consent from NRC under Sections 15(1) and 15(2) of the RMA.

The proposed discharge is subject to the proposed Northland Regional Plan and the National Environmental Standards for Freshwater. Aspects of the proposed Northland Regional Plan (PNRP) are under appeal; however, the relevant Rule that applies to the proposal is not subject to appeal and is therefore considered to be treated as operative pursuant to s86 of the RMA.

The relevant rules that apply are described in the table below.

Table 5.1 Reasons for consent

Proposed Northland Regional Plan		
Rule	Status	Comment
C.6.2.2 Wastewater treatment plant discharge	Discretionary Activity	This is not provided for as a permitted activity.
Resource Management (National Environmental Standard for Freshwater) Regulations 2020		
Rule	Status	Comment
S47(3) Maintenance and operation of specified infrastructure that does not meet the permitted conditions under s46(4).	Restricted Discretionary Activity	The WWTP is 'specified infrastructure' under the NES:FW, but is considered to have potential adverse effects on the receiving environment.

The activities for which resource consents are sought are inextricably linked to such a degree that they are appropriate to 'bundle' and the most restrictive activity class be applied to the overall bundle. In this case, the most restrictive activity is Discretionary.

No other activities are considered relevant to the proposal.

FNDC seeks a duration of 15 years for the duration of the above consents applied for under s15(1) and s15(2) of the RMA.

5.2 Water Quality Standards and Guidelines

Policy H.3.1 of the PNRP sets out the water quality standards in Table 20 for ecosystem health in continually or intermittently flowing rivers. The standards as set out in the PNRP provided a range of minimum values for a range of attributes. This policy was appealed by the Royal Forest and Bird Protection Society New Zealand and the Minister of Conservation and heard in the Environment Court in May 2021. A decision was issued on 30 July 2021. This decision upheld that the values set out in Table 20 are to be considered as standards to be met rather than guidelines, and prescribe the minimum values as set out in Annexure A of the Decision, attached as **Appendix H**.

5.3 Existing resource consents

The existing resource consent (council reference: CON20100241701) for the discharge of contaminants into water associated with the operation of the WWTP expires 30 November 2021. A copy of the consent and conditions is attached in **Appendix H.** The consent allows the Kaikohe WWTP to discharge treated wastewater to the wetland which feeds into the Wairoro Stream subject to conditions that specify monitoring and reporting requirements set out in condition seven, and discharge limits from the constructed wetland

weir structure as outlined in condition two. The compliance limits detailed in conditions seven of resource consent CON20100241701 were based on the ANZECC (2000) guidelines.

6 Assessment of Effects on the Environment

This Assessment of Environmental Effects (AEE) has been prepared in accordance with Schedule 4 of the RMA and the relevant matters of discretion from the relevant Auckland Council Plans.

6.1 Positive Effects

The Kaikohe WWTP is a lifeline utility that provides for the social and economic wellbeing and health and safety of the community of Kaikohe, its surrounds, and the wider Far North District. The plant receives approximately 1700m^3 of wastewater per day from the dwellings and businesses serviced by the municipal wastewater network, as well as septage from septic tank service providers that empty tanks from non-reticulated properties from around the district, and waste activated sludge from the Russell WWTP. The plant also provides treatment for the nearby Northland Region Corrections Facility near Ngāwha.

As the plant provides treatment of the sewage generated by approximately 4,500 people within the community, it is considered critical for the ongoing well-being of Kaikohe.

6.2 Ecological Effects

The Applicant engaged the Cawthron Institute to prepare an Ecological Assessment (Appendix B) for the Kaikohe WWTP discharge to the Wairoro Stream and the associated effects on the downstream aquatic fauna near the WWTP.

Water quality samples taken from the Wairoro Stream were also assessed against the National Policy Statement for Freshwater Management (NPS: FM) 2020 attributes for ammonia, nitrate-nitrogen, nitrate and dissolved oxygen (DO).

6.2.1 Decline in Water Quality

Where wastewater discharges meet these relevant water quality standards, the resulting adverse effects on the downstream environment are deemed to be acceptable with less than minor or even negligible effects on habitat, water clarity, fish, and human health. If specific parameters are exceeded, there is a potential corresponding adverse effect.

The performance of the WWTP has been in decline in recent years due to operational and maintenance issues, resulting in some exceedances of the existing resource consent conditions as well as the NPS:FM and PNRP water quality standards. These exceedances are described in more detail in the Ecological Assessment (Appendix B), with the key findings being:

- Reduction in dissolved oxygen (DO) levels;
- Higher levels of ammoniacal nitrogen, total nitrogen, and phosphorous;
- Variations to the discharge pH; and
- Exceedances of the consented quantity of discharge (flow).

A review of the plant performance by Jacobs (Appendix C) reports on possible causes of these issues, including:

- Higher amounts of algae (periphyton) growth in the oxidation pond and downstream environment, due to a faulty influent screen;
- Reduced oxidation pond capacity due to a build-up of sludge; and
- Reduced maturation pond and wetland treatment efficiency due to an abundance of aquatic weeds.

Exceedances of the discharge quantities (flows) is considered to be an imprecise quantum. The flow meter installed to monitor water discharge quantities is understood to require a clear ‘line of sight’ between sensors

and the water flowing through the device. The flow meter is installed above a V-notch weir over which the discharge flows. Due to the seasonal growth of the riparian kikuyu grass, there are inconsistencies in the data that indicate that measurements cannot be relied on as accurate.

As discussed in the Ecological Assessment (Appendix B), the water quality of the discharges could potentially result in eutrophication of downstream environments, resulting in in decreased aquatic habitat values for fish and macroinvertebrates. These effects are primarily the result of the concentrations of total nitrogen, total phosphorous, and total ammoniacal nitrogen in the existing discharge.

6.2.2 Proposed Mitigation Measures

The Applicant has identified the operational and maintenance deficiencies that have caused the performance of the WWTP to decline. Modelling as detailed in section 3 has indicated that the WWTP has the capacity to provide significantly improved treatment and more efficient removal of BOD, ammonia and nitrates. The proposed initial upgrades and improved ongoing maintenance will improve the water quality of the effluent, as summarised below.

a. Re-Install screen inlet

The inlet screen at the inlet of the anaerobic pond reduces the amount of larger solid particles and non-digestible solids that build up in layers of sludge at the base of the ponds. The build-up of sludge reduces the volume of the ponds and the treatment capacity. The reinstallation of an inlet screen will allow the effective volume and retention time to be maintained and associated treatment of raw effluent to occur.

b. Removal of surface weed growth

The removal of surface weed growth that has been observed at the oxidation and maturation ponds will improve treatment capacity, retention time, and reduce potential for anoxic conditions and sludge to form at the base of the ponds. Overall, removal of surface weeds will improve the amount of surface area available for exposure to sunlight for ultraviolet (UV) disinfection to occur.

c. 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. Overall improved performance and effluent quality of the targeted measures can be achieved.

d. De-sludge (anaerobic and oxidation) ponds

Desludging the oxidation and anaerobic ponds will increase the volume and treatment capacity for raw effluent as current design model anticipates.

e. **Aeration system**

The proposed addition of an aeration system in the oxidation pond has the potential to improve the removal efficiency of BOD, ammoniacal-N beyond the current design capacity. Performance capacity has been measured based on overall WWTP design capacity as measured from the monitoring site between constructed wetland and natural wetland. As per the Jacobs Options Assessment Report (Appendix E), the desludging and proposed aeration device will overall reduce the concentrations of BOD, and ammoniacal-N. BOD removal within the oxidation pond would increase from 79% to 93% removal efficiency with the aeration provided.

f. **Installation of baffle curtains**

Baffle curtains may be installed in the oxidation pond to improve the WWTP performance by controlling the flow path of effluent through the pond to increase the retention time (preventing “short circuiting”) that effluent is treated. This will provide improved removal efficiency of BOD and ammoniacal-N.

The Applicant has sought that these recommendations be given effect to and be incorporated into a Continuous Improvement Plan (CIP) that requires the implementation of these measures within 3 years of a consent being granted. It is anticipated that with the incorporation of the above operational and maintenance improvements the Kaikohe WWTP will have the capacity to treat raw effluent to a standard that is significantly improved over its existing operation. The proposed monitoring outlined in Table 3.2 will enable FNDC to proactively adjust processes within the plant to achieved improved water quality at the discharge location.

These improvements will remain in effect until a more permanent upgrade solution is determined, which will ultimately bring the WWTP up to the required specifications to meet the relevant standards set out in the NPS:FM and PNRP.

6.2.3 Summary of Ecological Effects

As discussed in section 2 of this report and the Ecological Assessment (Appendix B), the existing ecological values of the Wairoro Stream are degraded upstream and downstream of the existing WWTP discharge location. It is recognised that the existing WWTP discharges contribute to this degraded state and can result in more than minor effects on aquatic life, including fish and macroinvertebrates, due to levels of ammoniacal nitrogen and other nutrients in the water. These factors can also lead to downstream algae and cyanobacteria blooms. 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.

The desludging of the oxidation pond and aeration of effluent are anticipated to result in the greatest magnitude of water quality improvements, and discharges from the WWTP following these improvements are expected to have significantly reduced nutrient concentrations. While the Wairoro Stream will remain degraded due to a number of other external factors, the contribution of the WWTP discharge to this degraded state will be minimised and adverse effects on aquatic ecology as a result of the discharge are expected to be no more than minor.

If the discharge to water is to continue following the further investigations of the feasibility of the discharge to land, the full upgrade will be designed, constructed, and commissioned to comply with the require water quality standards as set out in Appendix H.3 of the PNRP and on that basis effects on the receiving environment are expected to be less than minor, six years from the granting of this consent.

6.3 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 environments 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. The Ministry of Health notes that illnesses resulting from the ingestion of *E. coli* or norovirus typically involves gastroenteritis and could lead to fever. Effects are typically more pronounced in children, elderly, and the immunocompromised, but are typically mild and treated with rest and fluids.

6.3.1 Faecal Coliforms *(Escherichia coli)* Assessment

The Ecological Assessment (Appendix B) and Plant Performance Assessment (Appendix C) took water samples within the Wairoro Stream and waters within the plant.

The Ecological Assessment determined that *E. coli* is present within the Wairoro Stream upstream as well as downstream of the WWTP discharge, though in higher concentrations downstream of the WWTP discharge. This is indicative of the existing rural and pastoral land uses within the catchment, with numerous potential sources of organic input such as dairy farms, grazing pastures, and septic tank leakages. The results of spot

sampling undertaken by Cawthron Institute in October 2020 is presented in Figure 7 of Appendix B and reproduced in Figure 6-1 below.

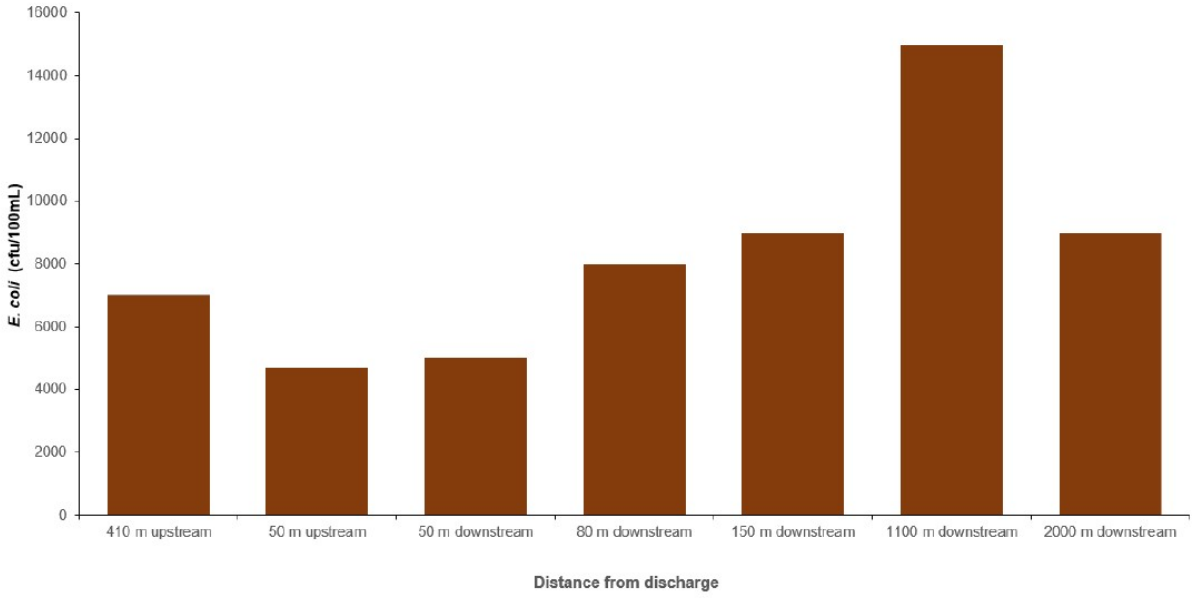

Figure 6-1. (Figure 7 from the Cawthron Institute Ecological Assessment, Appendix B) E. coli levels recorded from seven sites in Wairoro Stream upstream and downstream of the Kaikohe WWTP discharge on 14 October 2020.

Based on the modelling undertaken and described in the Jacobs Performance Assessment (Appendix C), it is expected that the proposed initial upgrades to the WWTP will enable a 4 $\log_{10}$ removal (99.99%) of *E. coli*, which results in reducing the potential for an *E. coli* infection of a downstream user to be negligible.

6.3.2 Norovirus Assessment

A Quantitative Microbial Risk Assessment (QMRA) was undertaken by ESR (Appendix D) and investigated the potential risks associated with human norovirus contaminating downstream environments as a result of the WWTP discharge. Norovirus was considered in isolation given that the WWTP is considered to be the most likely source of such a pathogen, whereas *E. coli* and cyanobacteria could potentially result from dairying and other stock effluent, of which there are numerous sources within the Wairoro Stream catchment and the downstream environs.

The QMRA assessment determined that the WWTP design will likely be able result in virus removal rates of 2 $\log_{10}$ (99%) and feasibly greater than 3 $\log_{10}$ (99.9%). As modelled in the QMRA and following dilution by the downstream water environments including freshwater rivers and the Hokianga Harbour, this would result in recreational water quality attribute classes consistent with NPS:FM bands ‘fair’, ‘good’, and ‘excellent’, indicating that the risk to human health due to discharges from the Kaikohe WWTP is low. This conclusion had one exception, where water quality at the point of discharge could potentially have a recreational water class as ‘poor’ or ‘fair’, depending on the level of viral reduction.

The assessment also considered the potential impact of the Kaikohe WWTP discharge to the Hokianga Harbour cumulatively with 3 other WWTPs (Ōpononi-Ōmāpere, Rawene, and Kohukohu), which will also contribute to risks associated with recreational water contact. However, the modelling suggested that the combined discharges from the four WWTP results in a similar risk profile to the Kaikohe WWTP’s discharge, particularly in the upper harbour.

Based on the results of the QMRA and the treatment capabilities of the existing plant, the risks to human health as a result of WWTP discharges are considered to be low and effects less than minor. With the proposed initial improvements, the risks will be further reduced.

6.4 Odour Effects

The Kaikohe WWTP utilises the biological processes fostered within the pond and wetland systems to breakdown effluent, removing harmful bacteria and viruses and reducing nutrient levels through microbial metabolization As with any metabolic process, chemical compounds are broken down by living organisms, resulting in new and different compounds that lead to the generation of gaseous compounds and their associated odours. When a plant is operating as designed, odours are not readily noticeable unless immediately adjacent to raw effluent.

Objectionable odours are exacerbated during periods when the treatment ponds become anaerobic, meaning the dissolved oxygen levels within the pond fall, typically after a large die-off of an organism population within the pond. This can occur after a sudden change in influent concentrations (for example increased wastewater, or decreased dilution due to a lack of rainwater), as the aerobic organisms that have increased in population to digest wastewater will not be able to survive in anaerobic environments. As the dead organisms (usually algae or bacteria) decompose, sulfur compounds, ammonia, and amines can be released to the air. Conditions usually persist until oxygen levels within ponds can be restored, typically a few days depending on the original cause for the population die off. When anaerobic conditions occur within the vicinity of receivers, obnoxious odours can cause nuisance effects on neighbouring properties where prevailing winds carry these compounds across a site boundary.

The Kaikohe WWTP is located within a rural environment with minimal development and few neighbouring receivers, the nearest two residential dwellings being approximately 285m to the north and 295m to the west. FNDC has confirmed with NRC that only one odour complaint has been received regarding the operation of the plant. This occurred on 25.07.2012; however, no enforcement action was undertaken. This indicates that the plant as currently operated very rarely results in obnoxious odours beyond the boundary of the site.

The proposed initial improvements and long-term upgrades are expected to improve plant performance and in turn result in fewer occurrences of anaerobic conditions within the oxidation pond. As such, it is anticipated that the chances of objectionable odours being produced will decrease. Given the singular complaint during the operation of this plant, it is considered that the odour effects resulting from the plant operation are currently less than minor and will be reduced further following the initial upgrades. A complaints register will continue to be maintained and the plant operators will be able to respond to complaints if and when they arise.

6.5 Hydrological Effects on Wetland

The outflow from the WWTP is mostly consistent with minor variations during times of rain due to an unquantifiable rate of rainwater infiltration to the wastewater network. Due to the consistent flow from the WWTP, water flow into the receiving tributary provides a source of water for the natural wetland. While no wetland delineation has been undertaken, as no changes to the volume of discharges is proposed, no changes to the extent of wetland is expected to occur as a result. Adverse hydrological effects on the downstream environment, including the extent of natural wetland, are therefore considered to be less than minor.

6.6 Cultural Effects

As described in section 7 of this report, consultation with mana whenua is ongoing to establish the magnitude of effects on cultural values.

6.7 Summary of Effects

The WWTP is considered to have more than minor ecological effects at present, which can be exacerbated where weather conditions result in low flows, leaving receiving waters with less dilution to absorb the potential effects. With the proposed initial upgrades, it is expected that adverse ecological effects resulting from the proposed discharge will ultimately be no more than minor, with less than minor ecological effects following a full upgrade or a land-based discharge scheme. However, it is noted that the existing degraded state of the Wairoro Stream is unlikely to significantly improve despite performance enhancements at the WWTP due to the stream's catchment runoff.

Human health effects resulting from the WWTP are considered to be no more than minor as a result of the plant's current ability to reduce *E. coli* and viruses. Human interaction with waters within the Wairoro Stream and further downstream are not well defined, but are anticipated to be limited due to a lack of public access along streams. The Hokianga Harbour, as the ultimate receiving environment, is recognised as a destination for several forms of contact recreation, including swimming, boating, and fishing. The QMRA has assessed the potential for human health effects resulting from the existing and enhanced discharges as being less than minor, though cumulative effects from other WWTP and other sources of *E. coli* do present some human health risks.

Adverse effects associated with wetland hydrology will be less than minor.

Adverse effects on cultural values are anticipated to be significant. Ongoing engagement is being undertaken to determine the magnitude of effects and measures to address these and identify further forms of mitigation.

7 Consultation

FNDC staff are in the process of consulting with key stakeholders regarding this resource consent application as well as the long-term future of the Kaikohe WWTP. Consultation on the renewal of the discharge consent commenced in April 2020.

To engage with stakeholders, FNDC have requested feedback online, provided information on the proposal and the WWTP on social media outlets and the main FNDC website, and undertook two community drop-in sessions – in Kaikohe and Rawene – in June 2021. The community drop-in sessions were not well attended by members of the wider communities; however key representatives from tangata whenua groups have been engaged with FNDC through hui and written correspondence. To date, representatives from the following iwi and hapū haven been consulted:

- Te Rūnanga-Ā-Iwi-O Ngāpuhi;Hauāuru Takiwa;
- Te Uri o Hua
- Ngāti Whakaeke;
- Ngāti Tautahi;
- Ngāti Pakau me Ngāti Te Rauwawe Roopu Kaitiaki Trust, and
- Te Rūnanga o Te Rarawa

Feedback to date has confirmed that there is little interest from hapū in providing commentary on the proposal without genuine opportunities for iwi on the decision-making process, including the long-term upgrades and options for wastewater disposal at Kaikohe. A general interest in the investigation and implementation of a land-based discharge system has been raised and this is part of a separate, ongoing district wide programme of work to find alternative means to discharge treated wastewater.

Consultation with hapū is currently being facilitated through legal representation engaged by Ngāti Whakaeke and Ngāti Tautahi. An online hui was held on the 23rd of August 2021 and attended by 5 groups. The outcome of this hui was to agree to the proposed implementation dates for the initial upgrades set out in section 3 of this report, and to provide a methodology to continue engagement throughout the optioneering process for the long-term WWTP upgrades

Te Rūnanga o Te Rarawa, who are recognised with statutory acknowledgment over the Hokianga Harbour, have been engaged by FNDC to prepare a cultural impact assessment (CIA) covering the potential effects on the Hokianga. This CIA has not yet been prepared and will be submitted to Council once available.

8 Statutory Framework

The section below provides an assessment of the proposal against the relevant statutory documents, including:

- The Resource Management Act 1991 (RMA);
- National Environmental Standard for Freshwater (NES:F);
- National Policy Statement for Freshwater Management 2020 (NPS:FM);
- Northland Regional Policy Statement (RPS); and
- Proposed Northland Regional Plan (appeals version) (PNRP).

8.1 Resource Management Act 1991

8.1.1 Assessment against Part 2

The RMA outlines the functions, powers, and duties of consenting authorities to be exercised in order to give effect to the purpose and principles of the RMA and defines a hierarchy whereby priority is given to the matters set out in Part 2 – Purpose and Principles.

As set out in Section 5 of the RMA, the purpose of the Act is to promote the sustainable management of natural and physical resources, which includes enabling "people and communities to provide for their social, economic, and cultural wellbeing." This must be achieved in the context of Section 5(2), in particular the responsibility of (c) for "avoiding, remedying, or mitigating any adverse effects of activities on the environment."

The positive aspects of continued operation in providing for people and communities while undertaking continued process improvements and maintenance will enable the discharge to progressively improve water quality requirements and reduce any actual or potential adverse effects on ecosystem health.

Table 8.1 Assessment against part 2 of the RMA

Section	Purpose	Comment
6a	*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*	The WWTP improvements recommended in the Jacobs Report are expected to address the current non-compliances of FNDC's existing regional discharge consent by reducing the nutrient (and bacterial) concentrations in the discharge, which (subject to meeting standards set out in NPSFM) will improve the quality of water being discharged in Wairoro Stream. Reduction of nutrient input will improve the ecological condition (i.e. algal growth, macroinvertebrate communities) downstream of the discharge thereby preserving the natural character of the natural wetland that it discharges to, and the Wairoro Stream.
6c	*the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna*	The improvements will also incorporate the weed management and wetland maintenance planting of the constructed and natural wetland systems to protect the ecosystems. This will help protect the downstream wetland environment as well as the receiving tributary.
6e	*the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga*	The importance of water in te ao Māori is acknowledged. FNDC is currently seeking input from numerous mana whenua groups with interests in the wider catchment,

		whenua, the Hokianga Harbour, and the communities serviced by the WWTP.
7a	*kaitiakitanga*	FNDC acknowledges that a range of improvements are required to manage effects on the ecosystem health and mauri of receiving waters. Through consultation with mana whenua, it is intended that a working group is established to identify and action opportunities to empower mana whenua to carry out their roles as kaitiaki.
7c	*the maintenance and enhancement of amenity values*	The implementation of the proposed improvements to the operational and maintenance of the WWTP will reduce any odour and visual amenity generated from poor / declining performance of the pond. This is typical of anoxic conditions developing in the treatment plants due to lack of maintenance and build-up of sludge, algae and weeds.
7d	*intrinsic values of ecosystems*	Existing water quality within the receiving environment is noted as being degraded due to numerous sources of nutrient input and extensive modifications to surrounding land within the catchment. Further pressure on ecosystems is placed from aquatic weeds and unfenced tributaries, leading to reduced native vegetation. The proposed improvements will enhance the existing downstream quality of the environment while reducing environmental pressures on the ecosystems.
7f	*maintenance and enhancement of the quality of the environment*	

Having regard to the above, it is considered that the discharge from the Kaikohe WWTP will achieve the principles of the RMA subject to the Applicant giving effect to the initial improvements within a reasonable length of time and adopting a continual improvement approach to monitoring. Modelling has demonstrated that the performance of the WWTP will improve and meet its design capacity and treat effluent adequately to improve the quality of its discharge to become more aligned with the NPS:FM.

The Applicant is in the process of engaging with mana whenua to give effect to Te Tiriti o Waitangi as described in this report.

8.1.2 Section 104 of the RMA

Section 104 of the RMA sets out the matters a consent authority must, subject to Part 2 – Purpose and Principles of the Act, have regard to when considering resource consent applications. The matters that are relevant in considering this application are as follows:

a) under section 104(1)(a) any actual and potential effects on the environment of allowing the activity, refer to section 6 of this AEE;

b) under section 104(1)(b)

   i. Any relevant provisions of the National Policy Statement for Freshwater Management (section 104(1)(b)(iii)); and,

   ii. Any relevant provisions of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020, the Proposed Northland Regional Plan (Appeals version) (section 104(1)(b)(i)(vi)); and

c) There are no other known matters under section 104(1)(c).

The effects have been assessed above The subsequent sections contain an analysis of all the relevant provisions of statutory planning documents.

8.1.3 Section 105 of the RMA

The activity relates to a discharge of air, water into water or land that may enter water requires a resource consent. As such, section 105 of the RMA requires the consent authority to consider the following additional matters:

a) Under section 105(1)(a) the nature of the discharge and the sensitivity of the receiving environment to adverse effects. The activity involves the discharge of treated wastewater into the Wairoro Stream. The receiving environment has been assessed as having moderate ecological values. The discharge also relates to the discharge of odour into air.

b) Under section105(1)(b) the Applicant's reasons for the proposal is outlined in section 3 of this AEE report.

c) Alternative methods of discharge is also addressed in section 4 of this AEE report.

8.1.4 Section 107 of the RMA

Section 107 of the RMA restricts the consent authority from granting a consent to discharge of water into water or on land, if after reasonable mixing, the water is likely to give rise to all or any of the following effects in the receiving waters:

a) the production of conspicuous oil or grease films, scums, foams or floatable or suspended materials;

b) any conspicuous change in the colour to visual clarity;

c) and emission of objectionable odour; and,

d) any significant adverse effects on aquatic life.

The discharge does not relate to a contaminant that would otherwise cause an objectional odour beyond the boundary of the site, or result in the production of grease, film, scum, foam or suspended materials, or result in a conspicuous change in the colour or clarity of receiving waters.

However; the monitoring and reporting data from the 2010 – 2020 period indicates elevated levels of nutrients leading to degraded water quality. The receiving waters are already in a degraded state, with only pollution-tolerant fish and invertebrate populations inhabiting the Wairoro Stream. No significant adverse effects on aquatic life are anticipated due to ongoing discharges, and the proposed initial upgrades will enhance the water quality of the discharge, mitigating further effects as discussed in Section 6 of this report.

8.2 National Policy Statement Freshwater Management (2020)

In determining an application to discharge treated wastewater to water, a consent authority will be required to consider any freshwater quality objectives that are established through future plan changes under the National Policy Statement for Freshwater Management; or any transitional requirements that may apply.

The National Policy Statement for Freshwater Management 2020 (NPS:FM) recognises Te Mana o te Wai and sets out objectives and policies that direct local government to manage water in an integrated and sustainable way, while providing for economic growth within set water quantity and quality limits. An assessment of the activity against the objectives and policies under the NPS: FM is outlined below.

Key objectives and policies under the NPS relevant to the proposed described in this application are as follows:

- Objective 2.1(1) sets out that the natural and physical resources are managed in a way that prioritises the following: firstly, the health and well-being of water bodies and freshwater ecosystems; secondly, the health needs of people; and thirdly, the ability of people and communities to provide for their social, economic and cultural well-being, now and in the future.
- Policy 2.2(1) sets out that freshwater is managed in a way that gives effect to Te Man o te Wai.
- Policy 2.2(3) requires that tangata whenua are actively involved in freshwater management, and Maori freshwater values are identified and provided for.
- Policy 2.2(3) sets out that freshwater is managed in an integrated way that considers the effects of the use and development of land on a whole-of-catchment basis, including the effects on receiving environments.
- Policy 2.2(5) sets out that freshwater is managed through a National Objectives Framework to ensure that the health and well-being of degraded water bodies and freshwater ecosystems is improved, and the health and well-being of all other water bodies and freshwater ecosystems is maintained and (if communities choose) improved.
- Policy 2.2(9) sets out that habitats of freshwater species are protected.
- Policy 2.2(12) sets out that the national target for water quality improvement is achieved.
- Policy 2.2(13) sets out that the condition of water bodies and freshwater ecosystems is monitored over time, and action is taken where freshwater is degraded and to reverse deteriorating trends.

As detailed in the sections above, the proposed operational improvements and maintenance plan will improve the treatment capacity of the WWTP and the quality of the treated water through the increased removal of nutrients (ammonia, nitrogen and phosphorous) as well as bacteria. It is anticipated that these improvements will improve the current condition of the receiving water body (Wairoro Stream) over time to meet the conditions of consent for water quality monitoring thereby reversing deteriorating trends beyond the mixing zone. By achieving compliance through the establishment of the CIP the activity will be able to achieve the te mana o te wai objective and be in general compliance with the policies of this document as set out above.

8.3 Northland Regional Policy Statement 2016

The Northland Regional Policy Statement (RPS) provides an overview of the key resource management issues across Northland while setting out policies and methods for underling regional and district plans to achieve Part 2 of the RMA. The RPS provides specific policies, relevant to this application for resource consent, that seek to improve the overall quality of Northland's fresh and coastal waters, protecting indigenous biodiversity in freshwater environments, and recognising the importance of regionally significant infrastructure and the role these serve to the economic and social wellbeing of communities.

The RPS was made operative in 2016 and updated in 2018. Given its status, it is considered that the more recent PNRP adequately gives effect to the RPS. As such, the proposed activities subject of this application have been assessed against the relevant objectives and policies of the PNRP.

8.4 Proposed Northland Regional Plan

While the PNRP is not yet fully operative, the specific rules pertaining to the proposed municipal wastewater discharge has no outstanding appeals and relates to the protection of water and is therefore treated as operative pursuant to s86B and s86F of the RMA. The Northland Soil and Water Regional Plan and the Regional Air Quality Plan have therefore not been assessed as part of this application.

Relevant key policies that the consent authority must consider in determining an application subject to the above rules are as follows:

Relevant Policies	Commentary
Policy D1.1 – When an analysis of effects on tangāta whenua and their taonga is required A resource consent application must include in its assessment of environmental effects an analysis of the effects of an activity on tangāta whenua and their taonga if one or more of the following is likely: 1. adverse effects on mahinga kai or access to mahinga kai, or 2. any damage, destruction or loss of access to wāhi tapu, sites of customary value and other ancestral sites and taonga with which Māori have a special relationship, or 3. adverse effects on indigenous biodiversity in the beds of waterbodies or the coastal marine area where it impacts on the ability of tangāta whenua to carry out cultural and traditional activities.	The proposed discharge will involve the discharge of treated wastewater to water. Given the potential adverse effects on indigenous biodiversity in freshwater, it is considered that an analysis of effects on tangāta whenua and their taonga is required. As noted above, consultation with tangāta whenua is ongoing to enable cultural impacts to be understood.
D.1.2 – Requirements of analysis of effects on tangāta whenua and their taonga If an analysis of the effects of an activity on tangāta whenua and their taonga is required in a resource consent application, the analysis must: 1. include such detail as corresponds with the scale and significance of the effects that the activity may have on tangāta whenua and their taonga, and 2. Have regard to (but not be limited to): a. Any relevant planning document recognised by an iwi authority to the extent that its content has a bearing on the resource management issues of the region; and b. The outcomes of any consultation with tangāta whenua with respect to the consent application; and c. Statutory acknowledgements in Treaty Settlement legislation; and 3. Follow best practice, including requesting, in the first instance, that the relevant tangāta whenua undertake the assessment.	A review of publicly available iwi management plans for this area was undertaken, but no plans were found. Consultation with tangāta whenua is currently underway, including with Te Rūnanga o Te Rarawa whom are recognised through a Statutory Acknowledgement as having mana over Hokianga Harbour. FNDC are currently seeking the input from the relevant tangāta whenua to undertake a cultural impact assessment. This will not be available until after lodgement.
D.1.4 – Managing effects on places of significance to tangāta whenua Resource consent for an activity may generally only be granted if the adverse effects from the activity on the values of Places of Significance to tangāta whenua in the coastal marine area and water bodies are avoided, remedied or mitigated so they are no more than minor.	As discussed in this report engagement with tangāta whenua is ongoing to assist in the identification and mitigation of adverse effects on cultural values resulting from the proposed activity.
D.1.5 Places of significance to tangāta whenua For the purposes of this Plan, a place of significance to tangāta whenua:	

1. Is in […] a water body where the values which may be impacted are related to: a. Quality […] of water; or b. Aquatic ecosystems and indigenous biodiversity; and 2. Is ancestral land, water, site, wāhi tapu, or other taonga; and 3. Is either a Site or Area of Significance to tangāta whenua or a Landscape of Significance to tangāta whenua, described in a mapped location; and 4. Has historical associations or traditional associations.	
D.2.3 Climate change and development Particular regard must be had to the potential effects of climate change on a proposed development requiring consent under this Plan, taking into account the scale, type and design-life of the development propose	Climate change will not have effects on what is proposed.
D.2.5 Benefits of regionally significant infrastructure Particular regard must be had to the national, regional and locally significant social, economic, and cultural benefits of regionally significant infrastructure.	The Kaikohe WWTP is regionally significant infrastructure. The positive effects of this plant have been described in Section 6 of this report.
D.2.7 Minor adverse effects arising from the establishment and operation of regionally significant infrastructure Enable the establishment and operation (including reconsenting) of regionally significant infrastructure by allowing any minor adverse effects providing: 1. The regionally significant infrastructure proposal is consistent with: a. all policies in Section D.1 Tangāta whenua, and b. Policy D.2.16 Managing adverse effects on historic heritage, and c. Policy D.2.17 Managing adverse effects on natural character, outstanding natural landscapes and outstanding natural features, and d. Policy D.2.18 Managing adverse effects on indigenous biodiversity, and 2. the regionally significant infrastructure proposal will not likely result in over-allocation having regard to the allocation limits in H.4.3 Allocation limits for rivers, and 3. other adverse effects arising from the regionally significant infrastructure are avoided, remedied, mitigated or offset to the extent they are no more than minor.	All adverse effects associated with the proposed discharge will be remedied or mitigated to have no more than minor effects; however, at this time the cultural effects cannot yet be assessed, nor can the appropriate measures to avoid, remedy, mitigate, or offset these effects be identified.
D.2.8 Maintenance, repair and upgrading of regionally significant infrastructure Enable the maintenance and upgrading of established regionally significant infrastructure wherever it is located by allowing adverse effects where:	It is anticipated that the initial improvements will not result in increased adverse effects during their implementation, and that the resulting effects will be much improved over those prior to the upgrades. During the construction of

1. The adverse effects whilst the maintenance or upgrading is being undertaken are not significant or they are temporary or transitory; and 2. The adverse effects after the conclusion of the maintenance or upgrading are the same, or similar, to those arising from the regionally significant infrastructure before the activity was undertaken.	the full upgrade, there may be temporary disruptions to the plant's treatment capacities, but these are to be managed during that time to be minimised.
D.2.9 Appropriateness of regionally significant infrastructure proposals When considering the appropriateness of a regionally significant infrastructure activity in circumstances where adverse effects are greater than envisaged in Policies D.2.6 and D.2.7, have regard and give appropriate weight to: 1. the benefits of the activity in terms of D.2.5, and 2. whether the activity must be recognised and provided for by a national policy statement, and 3. any demonstrated functional need for the activity, and 4. the extent to which any adverse environmental effects have been avoided, remedied or mitigated by route, site or method selection, and 5. any operational, technical or location constraints that limit the design and location of the activity, including any alternatives that have been considered which have proven to be impractical, or have greater adverse effects, and 6. whether the activity is for regionally significant infrastructure which is included in Schedule 1 of the Civil Defence Emergency Management Act as a lifeline utility and meets the reasonably foreseeable needs of Northland, and 7. the extent to which the adverse effects of the activity can be practicably reduced, inclusive of any positive effects and environmental offsets proposed, and 8. whether an adaptive management regime (including modification to the consented activity) can be used to manage any uncertainty around the occurrence of residual adverse effects, and 9. whether the activity helps to achieve consolidated development	The Kaikohe WWTP provides a critical utility for the township. The treatment of wastewater is a vital component to a community to provide for the health and wellbeing of its denizens. A Continuous Improvement Plan is proposed to be developed in consultation with tangāta whenua to implement a range of improvements to the existing plant operation in accordance with good management practice. As set out in this report and the Jacobs Options Report (Appendix E), a range of practical and implementable improvements are proposed to be undertaken to improve the quality of the discharge.
D.2.14 Resource consent duration When determining the expiry date for a resource consent, have particular regard to: 1. security of tenure for investment; 2. administrative benefits of aligning the expiry date with other resource consents for the same activity in the surrounding area or catchment; 3. certainty of effects; 4. whether the activity is associated with regionally significant infrastructure; and	FNDC has considered numerous factors to reach its proposed consent duration of 15 years. Given the proposed full upgrade of the plant will require a significant capital investment and require years of design and implementation, a minimum duration of 25 years would typically be sought. However, given that this consent also covers a programme of initial improvements that will precede a full upgrade, the

5. the following additional matters where the resource consent application is to re-consent an activity: a. the applicant's past compliance with the conditions of any previous resource consent; and b. the applicant's voluntary adoption of good management practice.	certainty of effects must be reconciled against monitoring results, and low flows within the stream during summer months has resulted in non-compliant conditions of consent, a shorter duration is considered appropriate. 15 years will be sufficient to provide certainty to invest in a full plant upgrade as well as provide sufficient time to implement the proposed improvements.
D.2.18 Managing adverse effects on indigenous biodiversity Manage the adverse effects of activities on indigenous biodiversity by: 4. recognising damage, disturbance or loss to the following as being potential adverse effects: a. connections between areas of indigenous biodiversity, and b. the life-supporting capacity of the area of indigenous biodiversity, and c. flora and fauna that are supported by the area of indigenous biodiversity, and d. natural processes or systems that contribute to the area of indigenous biodiversity, and 5. assessing the potential adverse effects of the activity on identified values of indigenous biodiversity, including by: a. taking a system-wide approach to large areas of indigenous biodiversity such as whole estuaries or widespread bird and marine mammal habitats, recognising that the scale of the effect of an activity is proportional to the size and sensitivity of the area of indigenous biodiversity, and b. recognising that existing activities may be having existing acceptable effects, and c. recognising that minor or transitory effects may not be an adverse effect, and d. recognising that where effects may be irreversible, then they are likely to be more than minor, and e. recognising that there may be more than minor cumulative effects from minor or transitory effects,	The existing discharge from the WWTP has been assessed as having some minor adverse effects on aquatic habitats arising from increased periphyton growth and nutrient loads. As the catchment is subject to non-point source discharges from dairy farms and other agricultural activities, there are numerous sources of nutrients, periphyton, and potential human health risks. The proposal includes a range of improvements in the short term until either the discharge is taken to land or a more significant plant upgrade can be undertaken to bring the plant up to spec to meet the NPS:FM water quality guidelines. A duration of 15 years is sought, balancing the regional importance of the discharge with the potential for minor adverse effects on aquatic habitats until improvements can be implemented.
D.3.1 General approach to managing air quality **D.3.2 General approach to managing adverse effects of discharges to air** **D.3.4 Dust and odour generating activities**	Air discharges (odour) associated with the operation of the plant have not been assessed in great detail. The WWTP as designed will not result in the discharge of odours beyond the site boundaries, and the treated wastewater will not result in

	odour discharges in the downstream receiving environment.
D.4.1 Maintaining overall water quality When considering an application for a resource consent to discharge a contaminant into water: 1) have regard to the need to maintain the overall quality of water including the receiving water's physical, chemical and biological attributes and associated water quality dependent values, and 2) have regard to the coastal sediment quality guidelines in H.3 Water quality standards and guidelines, and 3) generally not grant a proposal if it will, or is likely to, exceed or further exceed a water quality standard in H.3 Water quality standards and guidelines.	The proposed upgrades to the plant will in the immediate short-term maintain and improve the quality of the discharge. In the medium- to long-term, discharges will be brought closer to achieving the standards set out in H.3. Over the duration of this consent, he proposal will achieve policy D.4.1.
D.4.3 Municipal, domestic and production land wastewater discharges An application for resource consent to discharge municipal, domestic, horticultural or farm wastewater to water will generally not be granted unless: 1) the storage, treatment and discharge of the wastewater is done in accordance with recognised industry good management practices, and 2) a discharge to land has been considered and found not to be environmentally, economically or practicably viable.	As discussed in section 4 of this report, a discharge to land has been considered and will continue to be considered for future upgrades. It is not feasible to implement this prior to the expiry of the WWTP's existing discharge consent. The proposed treatment methods are in accordance with good management practices.
D.4.4 Zone of reasonable mixing When determining what constitutes the zone of reasonable mixing for a discharge of a contaminant into water, or onto or into land in circumstances which may result in that contaminant (or any other contaminant emanating as a result of a natural process from that contaminant) entering water, have regard to: 1) using the smallest zone necessary to achieve the required water quality in the receiving waters as determined under Policy D.4.1, and 2) ensuring that within the mixing zone contaminant concentrations and levels of dissolved oxygen will not cause acute toxicity effects on aquatic ecosystems.	A reasonable mixing zone within the receiving environment has not been fully determined. As noted throughout the Ecological Assessment (Appendix B), other sources of contaminants may enter the stream within the potential mixing zone and the Wairoro Stream is currently in a degraded state upstream of the discharge point. FNDC is proposing to implement an 'end-of-pipe' monitoring programme that will provide useable data to the plant operators to detail the actual performance of the plant and respond accordingly.

9 Conclusion

FNDC is seeking resource consent for the relevant discharges under S15(1) and 15(2) of the RMA from NRC to continue the operation of the Kaikohe WWTP. FNDC seek a duration of 15 years for the proposed discharge consents. The WWTP is a regionally significant piece of infrastructure that provides for the social and economic wellbeing and the health and safety of Kaikohe and its surrounds. It is recognised that in more recent years the plant has breached consent conditions as they relate to discharge quality and quantity, and FNDC have therefore taken an approach to progressively upgrade the plant to achieve improved water quality outcomes while optioneer a long-term solution for wastewater treatment.

Environmental effects of the activities for which resource consents are sought have been assessed in section 6 of this AEE Report. It is considered, given the proposed operational process improvements and maintenance to the existing WWTP, that the actual or potential adverse effects on aquatic ecology will be mitigated over time to be no more than minor. If the discharge to water is to continue, a full upgrade of the plant will be undertaken, with the ecological effects becoming less than minor. Other adverse effects have also been considered, including effects on human health, hydrological effects on the downstream wetland, and obnoxious odour effects. These effects will be less than minor and are unlikely to manifest beyond the boundary of the WWTP site.

Consultation with tangāta whenua is ongoing to determine the potential for adverse effects on cultural values, as well as to facilitate their involvement in the decision-making process for land-based discharges and/or future plant upgrade options. At present, it is considered that adverse effects on cultural values could potentially be significant, and FNDC are working with tangāta whenua on the development of the CIP associated with is WWTP as well as on the implementation of upgrades and treatment plant renewals across the district to address treated wastewater discharges to water holistically.

The proposed end-of-pipe monitoring will enable the plant operators to be more reactive and efficient in resolving any issues that may arise within the plant process, resulting in improved environmental outcomes.

The proposal has been assessed against the statutory documents, objectives, and policies and is consistent with all those assessed, noting that cultural aspects of the proposal have not yet been assessed.

With the proposed improvements to the WTTP and the long-term upgrades proposed, the Kaikohe WWTP will achieve Part 2 of the RMA.

A

Appendix A – Record of Title

B

Appendix B – Ecological Assessment (Cawthron Institute)

C

Appendix C – Kaikohe WWTP Performance Assessment (Jacobs, August 2021)

D

Appendix D – Quantitative Microbial Risk Assessment (ESR, June 2021)

Appendix E – Kaikohe WWTP Interim Upgrade Options Report (Jacobs, August 2021)

Appendix F – Wastewater to Land Discharge Feasibility Assessment (FNDC, February 2021)

G

Appendix G – Kaikohe WWTP Long-term upgrades for discharge to water (Harrison Grierson)