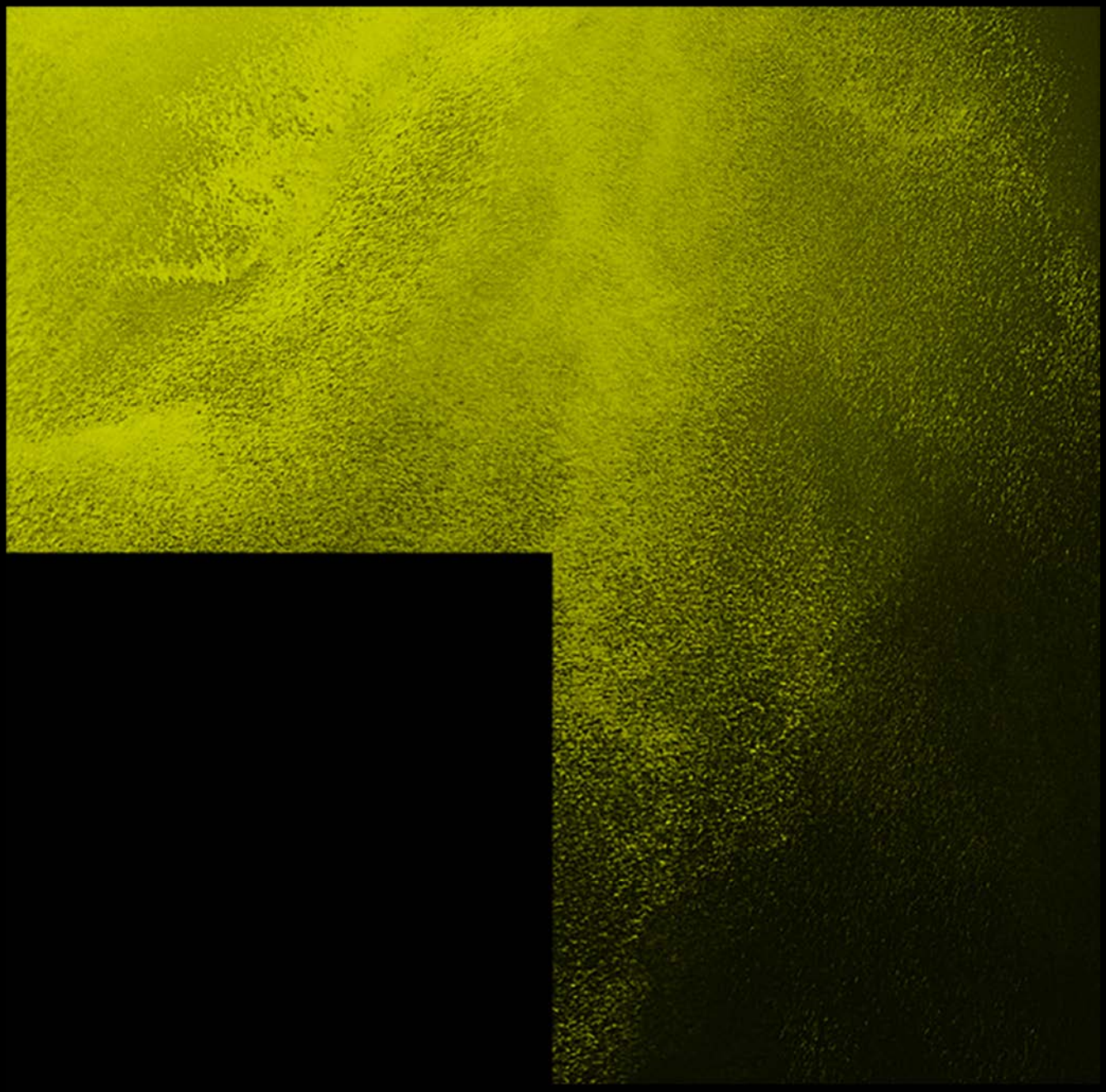
HAHEI WASTEWATER TREATMENT PLANT

Resource Consent Application and Assessment of Effects on the Environment

Thames Coromandel District Council



DOCUMENT CONTROL RECORD

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ISSUE AND REVISION RECORD

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APPENDICES

1.0
APPLICANT AND PROPERTY DETAILS

1.1 APPLICANT AND PROPERTY DETAILS

Applicant	Thames Coromandel District Council
Site Address	Pa Road, Hahei.
Address for Service	Thames Coromandel District Council C/- Harrison Grierson Consultants Limited P O Box 5760 Wellesley Street AUCKLAND 1141 Attention: Anita Simpson
Legal Description	LOT 2 DPS 26648
Site Area	6.75 ha
Project Co-ordinates	NZMS 260 T11:607-802
District Plan	Operative Thames Coromandel District Plan 2010
District Plan Zoning	Rural Zone. Site is also designated – 40/08 TCDC-3 Hahei Wastewater Treatment and Disposal Site
Regional Plan	Operative Waikato Regional Plan 2010 (the "Waikato Regional Plan")

Locality Diagram

2.0 INTRODUCTION

The Hahei wastewater treatment plant (WwTP) is owned and operated by Thames Coromandel District Council (TCDC), consisting of an aeration pond, a retention pond, and a membrane filtration unit (MFU). The treated wastewater is discharged to the Wigmore Stream.

The current consent 117888 was granted in June 2009 and will expire on 31 December 2015. The consent allows for the discharge of up to 700m^3/d of treated municipal wastewater from the Hahei WwTP to the Wigmore Stream. The consent contains various conditions relating to the operation of the plant and to the quality of the treated effluent.

The resident population of Hahei is expected to increase from 398 to 471 over the next 30 years. Hahei also experiences an influx of holiday makers during the Christmas holiday period. The peak holiday population is expected to increase from 4,400 to 5,500 over this time. A recent capacity assessment has indicated that there is limited additional capacity available in the aeration pond. Upgrades to the plant have been considered in this AEE, and are discussed in section 6.0.

TCDC are applying for the following consents:

- A consent to discharge treated wastewater to the Wigmore Stream (renewal of 117888).
- A consent for the occupation and use of the Wigmore Stream by the existing discharge structure.
- A consent for odour discharge to air associated with the treatment processes.
- A consent for seepage to land from the ponds.

This report has been prepared in terms of section 88 and the Fourth Schedule of the Resource Management Act 1991 (RMA). It includes a description of the existing wastewater scheme and the proposed upgrades and changes. It also describes the environment and the changes to the environment that will result from the proposed changes to the existing wastewater scheme. The report includes details of the measures implemented to avoid, remedy, or mitigate adverse effects and an evaluation of alternatives. Draft resource consent conditions have been proposed for review by Waikato Regional Council (WRC).

3.0
SUBJECT SITE AND IMMEDIATE SURROUNDS

The Hahei WwTP is situated south of the beachside town on Pa Road. The treatment plant is located on council owned land with an area totalling 6.75 ha. The WwTP is bordered by farmland to the south, privately owned residential properties to the north and west, and the Wigmore Stream to the east. The nearest dwelling is approximately 100m away to the south east. The location of the plant in relation to the stream and the nearest dwelling is presented below in Figure 1**Error! Reference source not found.**.

FIGURE 1: HAHEI WWTP AND SURROUNDING ENVIRONMENTS

The Hahei WwTP consists of the following process stages:

- An aeration pond;
- A retention pond;
- A membrane filtration unit;
- Disposal to the Wigmore Stream through a perforated pipe diffuser.

The membrane filtration unit is located at the east corner of the retention pond. The outfall pipe runs under the metal road from the membrane unit to the diffuser in the Wigmore Stream to the east of the plant.

1.1 DISTRICT PLAN ZONING

The site that the WwTP lies on is designated 40/08 TCDC-3 "Hahei Wastewater Treatment, and Disposal" in the Thames Coromandel District Plan. The underlying zoning of the treatment plant is Rural, with a small section running adjacent to the stream zoned Open Space. This remains unchanged in the proposed district plan.

The extent of the proposed upgrades will not be confirmed until the detailed design. However, the plant will be fully contained within the current site, and hence it is not expected that the upgrade will require any changes to designations in the area.

3.2 CURRENT RECEIVING ENVIRONMENT

3.2.1 TOWNSHIP DEVELOPMENT

Hahei is a small coastal town on the eastern shores of the Coromandel Peninsula. The majority of the developments in this area are residential houses with a handful of commercial properties. These commercial properties include a holiday park, and shops/small eateries.

Currently only 25% of the residential properties, and the Holiday Park are connected to the Hahei WwTP, with remaining houses on private septic systems. Population is expected to grow approximately 25% in the next 30 years, during which time no additional commercial properties that would significantly increase the load on the WwTP are expected. This has been taken into account in the proposed upgrades, and this resource consent application.

3.2.2 UPSTREAM CATCHMENT

The total catchment area of the Wigmore Stream is small, covering approximately 3.3km^2, with a maximum elevation of 8.8m. The stream's upper reaches are dominated by grazed pasture and the lower reaches have residential housing with septic tanks on the true right bank.

The Wigmore Stream is a highly modified catchment, which is largely pasture with some residential areas. There is also 17 ha of secondary coastal forest, comprising mahoe remnant forest and established revegetation plantings contained within a Significant Natural Area within the catchment.

3.2.3 WIGMORE STREAM

The Hahei WwTP currently discharges treated effluent to the Wigmore Stream. Wigmore Stream near the WwTP is a soft-bottomed, slow-flowing waterway that is influenced by saltwater intrusion which reaches up to the upstream site at times. The mouth of the stream connects to the sea at the main beach at Hahei, 1km downstream of the discharge point.

4.0
EXISTING TREATMENT PLANT PROCESSES

The Hahei wastewater treatment plant has undergone several upgrades since it was first constructed. The process flow diagram in Figure below, is representative of the plant as it currently operates.

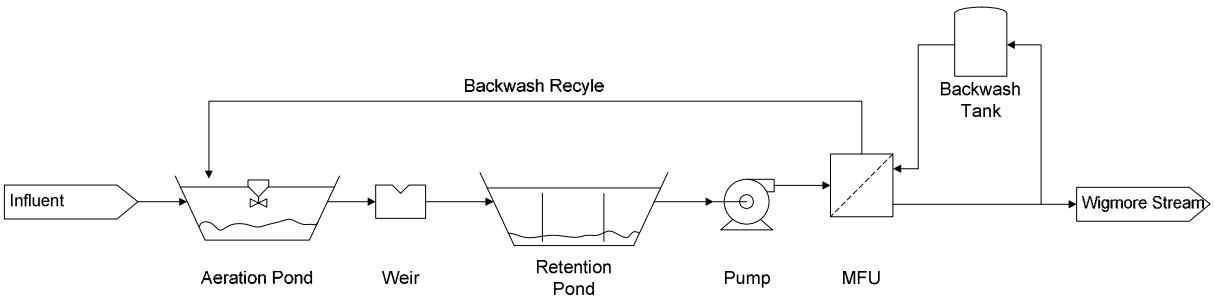


FIGURE 2: PROCESS FLOW DIAGRAM OF THE EXISTING WWTP

4.1 AERATION POND

The aeration pond treats the wastewater by oxidising contaminants. The aeration pond covers an area of 700m^2 with an approximate volume of 1,700m^3. Currently, there are three aerators installed, which are manually switched on or off depending on the dissolved oxygen readings.

FIGURE 3: HAHEI WWTP AERATION POND

TABLE 1: AERATION POND CHARACTERISTICS	
PARAMETER	**VALUE**
Pond Depth	2.4m
Pond Area	700m^2
Pond Volume	1,700m^3
Current Oxidation Capacity	160kgO/day
Current Off Peak Surplus Oxidation Capacity	121%
Current Peak Period Surplus Oxidation Capacity	Exceeded
Off Peak Retention Time	19 days
Peak Period Retention Time	8 days

4.2 RETENTION POND

The retention pond operates as a maturation pond with supplementary aeration. The pond has an approximate volume of 3,320m^3. Additional aerators are installed on the retention pond to promote flow during the off peak period, and to provide additional aeration during the peak period.

As the treatment plant now uses a MFU for tertiary solid removal and pathogen removal, a shorter retention time is acceptable. A minimum of 10 days is recommended.

FIGURE 4: RETENTION POND, BAFFLE CURTAINS AND BRUSH AERATOR

TABLE 2: RETENTION POND RETENTION TIME	
PARAMETER	**VALUE**
Current Off Peak Retention Time	36 Days
Peak Period Retention Time	15 Days
2045 Off Peak Retention Time	30.5 Days
2045 Peak Period Retention Time	12 Days

The retention pond has sufficient retention time to cater for the populations predicated in the forecast study.

4.3 MEMBRANE FILTRATION UNIT (MFU)

The membrane filtration unit contains two cassettes, each with 26 GE Zeeweed 500C membrane modules. With approximately 1,200m^2 of membrane area, the MFU is theoretically capable of treating 600m^3/day. Table 3 below presents the current MFU performance.

TABLE 3: MFU PERFORMANCE			
PARAMETER	**MFU INLET (mg/l)**	**MFU EFFLUENT (mg/l)**	**REDUCTION**
BOD_5	22.0	7.5	66%
Suspended Solids	58.0	4.3	93%
Ammoniacal Nitrogen	12.9	12.0	7.0%
Nitrate Nitrogen	4.9	5.8	-18%
Total Kjeldahl Nitrogen	20.0	12	43%
Soluble Reactive Phosphorus	7.8	7.2	7.7%
Total Phosphorus	9.3	8.0	14.0%
	MFU INLET (CFU/ML)	**MFU EFFLUENT (CFU/ML)**	**LOG REDUCTION**
E. Coli	17,000	5.9	3.5
Enterococci	55,000	4.3	4.2

The existing discharge quality is discussed in section 5.0 using data obtained during the 2009-2014 monitoring period.

4.4 DISCHARGE STRUCTURE

Treated effluent is discharged to the Wigmore Stream via a perforated pipe diffuser. The diffuser is constructed from a one meter length of 80NB PE pipe, fixed to the stream bed.

4.5 SOLID WASTE

Sludge is generated from the biological treatment of organic matter. The excess sludge solids settle to the bottom of the ponds, accumulating and degrading over time. Sludge removal from the ponds is undertaken on an as required basis, typically once every 10 years. Once collected, solid waste is taken offsite to an alternate WwTP that has sludge treatment facilities.

5.0
PLANT PERFORMANCE

The performance of the Hahei WwTP is discussed below with reference to the effluent quality. Sampling of the effluent covered physical parameters, organic components, nutrients, and indicator bacteria. The results from these samples are presented in the sections following.

5.1 PHYSICAL PARAMETERS

5.1.1 PH

The pH levels measured in the effluent are presented below in Figure 5.

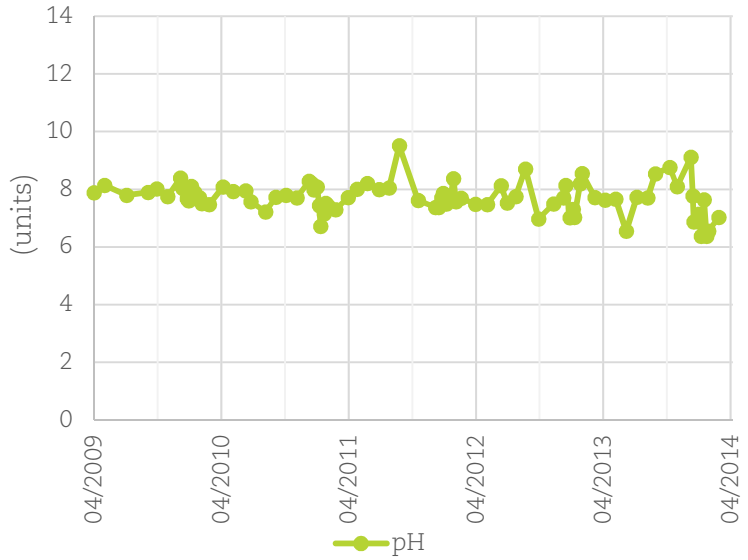


FIGURE 5: EFFLUENT PH

There were no conditions in the resource consent pertaining to the pH of the treated effluent. However, the pH level has consistently been within the 6-10 range, a common condition in other discharge consents.

5.2 ORGANIC COMPONENTS

5.2.1 SUSPENDED SOLIDS

The current resource consent limits for suspended solids are:

"90 percentile, no more than one sample in each preceding 10 samples shall exceed 20 g/m^3. The running average over any consecutive 10 samples shall not exceed 10 g.m^3."

The concentrations of suspended solids measured in the effluent are presented below in Figure 6, along with the current consent limits.

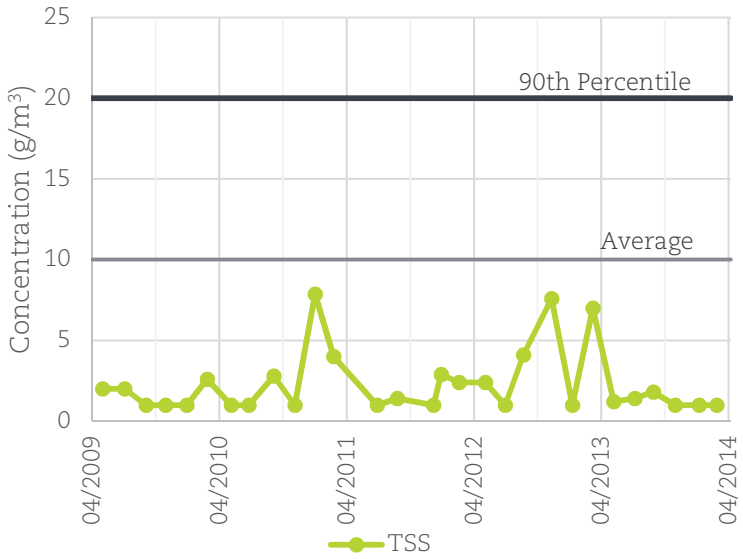


FIGURE 6: EFFLUENT SUSPENDED SOLIDS

There were no instances where the concentration of suspended solids exceeded either limit of the resource consent.

5.2.2 CARBONACEOUS BIOLOGICAL OXYGEN DEMAND

The current resource consent limits for biological oxygen demand are:

"90 percentile, no more than one sample in each preceding 10 samples shall exceed 20 g/m^3. The running average over any consecutive 10 samples shall not exceed 10 g.m^3."

The concentrations and limits of total carbonaceous biological oxygen demand measured in the effluent are presented below in Figure 7.

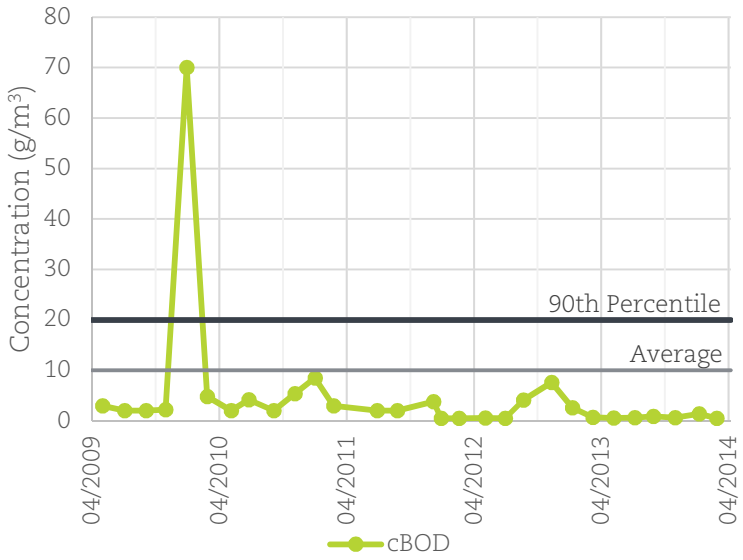


FIGURE 7: EFFLUENT CARBONACEOUS BIOLOGICAL OXYGEN DEMAND

There was one minor instance in which the running average over 10 consecutive samples was higher than the resource consent, this occurred in the period from January

2010 to July 2010 where a single large value in January 2010 brought the running average up to a maximum 10.4 g/m^3.

5.3 NUTRIENTS

5.3.1 TOTAL PHOSPHOROUS

The current resource consent limits for total phosphorus are:

"90 percentile, no more than one sample in each preceding 10 samples shall exceed 20 g/m^3. The running average over any consecutive 14 samples shall not exceed 10 g.m^3."

The concentrations of total phosphorous measured in the effluent are presented below in Figure 8.

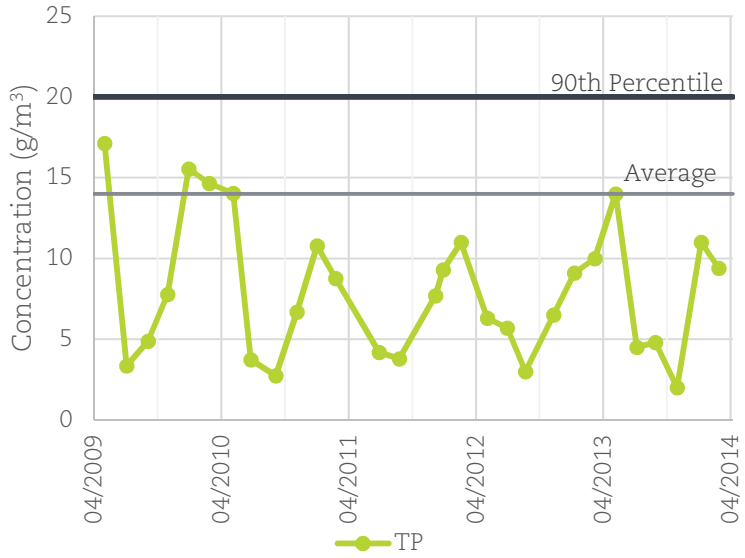


FIGURE 8: EFFLUENT TOTAL PHOSPHOROUS

There were no instances in which the total phosphorous counts exceeded the consent limits.

5.3.2 AMMONIACAL NITROGEN

The current resource consent limits for ammoniacal nitrogen are:

"90 percentile, no more than one sample in each preceding 10 samples shall exceed 40 g/m^3. The running average over any consecutive 10 samples shall not exceed 15 g.m^3."

The concentrations of ammoniacal nitrogen measured in the effluent are presented below in Figure 9.

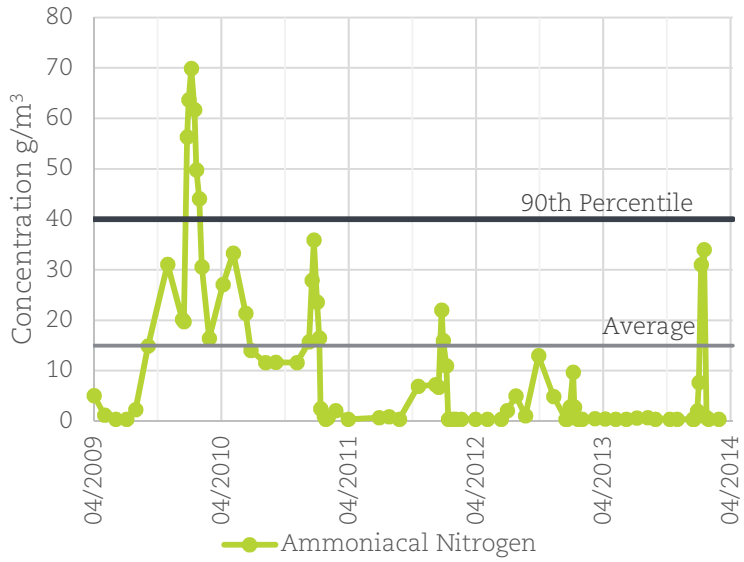


FIGURE 9: EFFLUENT AMMONIACAL NITROGEN

There were five instances where the consent limit for the 90 percentile was breached, these events occurred between January and February 2010. In addition, the running average consent condition was not meet from September 2009 to January 2011.

TCDC worked to rectify this issue by installing additional aerators, and following their installation in January 2011 both consent limits were meet without any further non-compliance

5.3.3 NITRATE NITROGEN

The concentration of nitrate nitrogen measured in the effluent are presented below in Figure 10.

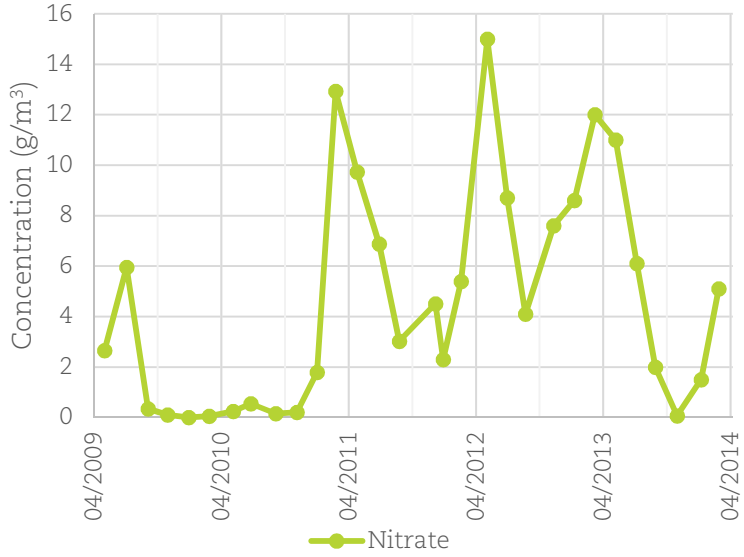


FIGURE 10: EFFLUENT NITRATE NITROGEN

There were no limits specified in the resource consent pertaining to the concentration of nitrate nitrogen in the treated effluent. The increase in nitrate concentration corresponds to increased nitrification after the installation of additional aerators.

5.3.4 TOTAL KJELDAHL NITROGEN

The current resource consent limits for Total Kjeldahl Nitrogen are:

"90 percentile, no more than one sample in each preceding 10 samples shall exceed 40 g/m^3. The running average over any consecutive 10 samples shall not exceed 15 g.m^3."

The concentration of Total Kjeldahl Nitrogen measured in the effluent are presented below in Figure 11.

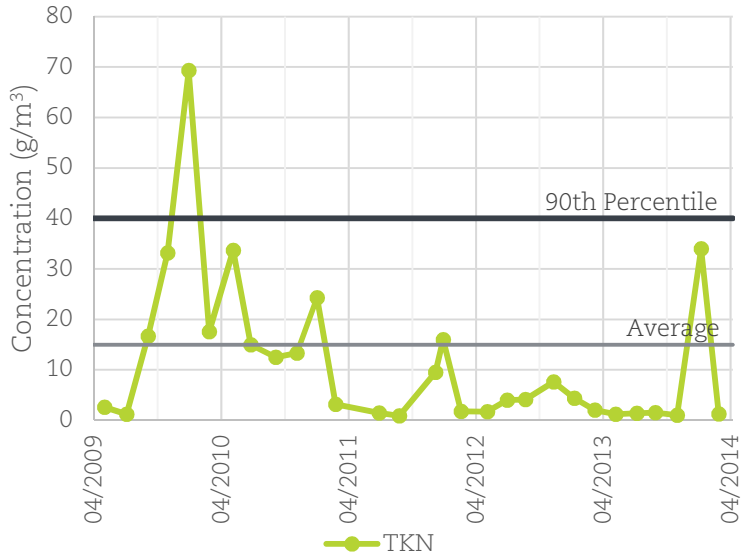


FIGURE 11: EFFLUENT TOTAL KJELDAHL NITROGEN

During November 2010 to August 2011, the running average exceeded the consent conditions. This is attributed to a single high value in January 2010.

5.4 INDICATOR BACTERIA

5.4.1 ENTEROCOCCI

There were no conditions in the resource consent pertaining to the Enterococci concentration of the treated effluent.

The concentration of Enterococci measured in the effluent are presented below in Figure 12.

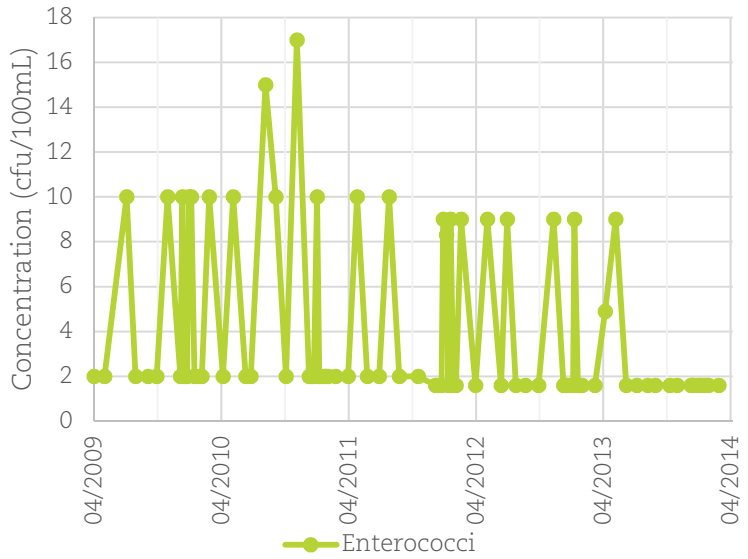


FIGURE 12: EFFLUENT ENTEROCOCCI CONCENTRATION

5.4.2 ESCHERICHIA COLI

The current resource consent limits for Escherichia Coli are:

"90 percentile, no more than one sample in each preceding 10 samples shall exceed 20 cfu/100ml. The running average over any consecutive 10 samples shall not exceed 10 cfu/100ml."

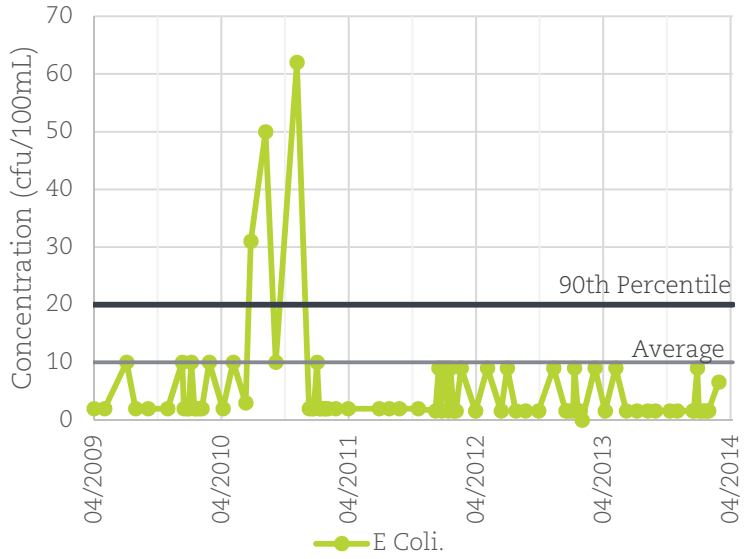


FIGURE 22: EFFLUENT E.COLI

There were a total of three instances that exceeded the resource consent limit for the 90 percentile. The three instances occurred July 2010, August 2010, and November 2010. As a result, the 90th percentile condition was not meet between August 2010 and February 2011.

The running average exceeded the resource consent from August 2010 to February 2011, reaching a maximum running average of 17.2 g/m^3.

6.0 PROPOSAL

6.1 PROPOSED TREATMENT PLANT UPGRADE

The proposed treatment plant upgrade is aimed at meeting potential future short comings with the plants treatment capacity, while remaining cost effective for the rate payers.

Currently, the aeration capacity is adequate but requires close vigilance under peak conditions. The proposed upgrade adds additional aeration as required along with the installation of an inlet screen, fixing the baffles in the retention pond, and undertaking an assessment of the MFU. Figure 33 below shows the process after the proposed upgrades (red outlines the changes).

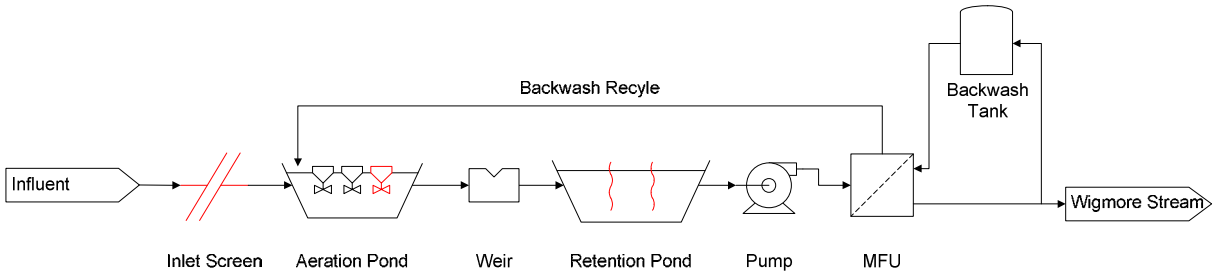


FIGURE 33: PROCESS FLOW DIAGRAM AFTER THE PROPOSED UPGRADES

Thames Coromandel District Council has allowed budget for plant upgrades during the 2016/2017 financial year. Timing and initiation of the proposed upgrades would be undertaken if as and when increased population loads occur.

These funds could be brought forward to the 2015/2015 financial year if required. However it is anticipated that this will not be necessary.

6.2 DESIGN FLOWS AND LOADS

6.2.1 DOMESTIC WASTEWATER

The volume of domestic wastewater is largely dependent on the population of the town. TCDC undertook population projections in 2014 which show that the population connected to the wastewater treatment plant is expected to grow 25% between now and 2045.

Like many other towns in the Coromandel, Hahei is affected by a significant temporary influx of people over the holiday period. TCDC undertook a population study during the holiday period of 2009-2010 to quantify this increase. Results showed that there was an average of 4.89 people per dwelling over this period, which increased to 6.2 people on the night of peak population.

As discussed previously in the report, only 25% of the population is currently connected to the WwTP. Because only those that are connected to the plant will affect the plant load. Table 4 below presents the connected population and the associated growth over the next 30 years.

TABLE 4: SUMMARY OF FLOWS TO THE WwTP

	UNIT	2014	PROJECTED (2045)
Connected Ratings Units		180	226
Off Peak Average	m^3/d	92	109
Peak Period Average	m^3/d	221	278
Peak Period Max.	m^3/d	312	392

While the Peak Period Max is high flow, it is not critical for design of the plant as the existing system has significant buffering capacity within the ponds to cope with peak events.

6.2.2 TRADE WASTE

At present there are no significant trade waste producers in Hahei. There are no known future developments for Hahei which may be trade waste producers. It has therefore been assumed that future flows and loads to the WwTP will be solely of domestic origin.

6.3 PROGRAM FOR UPGRADES

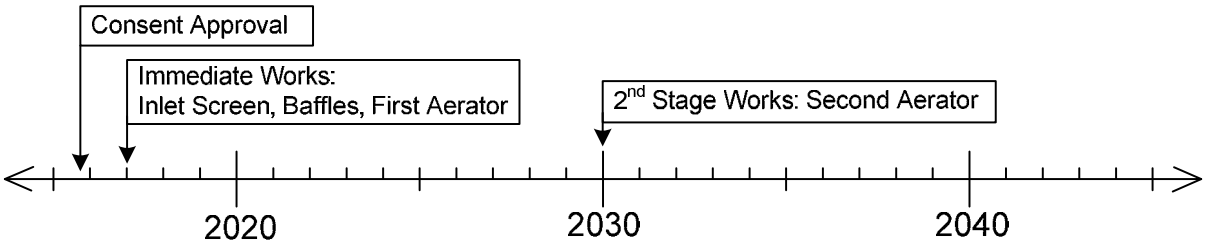


FIGURE 44 : TIMELINE FOR PROPOSED UPGRADES

As the population (and hence flows) gradually grow over time the upgrades will be undertaken in stages. The planned 2016/2017 works will remediate the reduced capacity of the plant under peak conditions, while providing some capacity for growth. Once this capacity is being used, the second stage of upgrades will be undertaken to supply the required capacity to 2045.

Proposed future works to be undertaken once consent is approved include:

- Installation of an inlet screen to remove gross solids;
- Installation of an additional aerator in the aeration pond for supplementary aeration;
- Alteration or replacement of the current baffles in the retention pond to stop short circuiting;
- Optimisation of MFU operation so that throughput can be increased;
- Pond de-sludging (an operational intervention that will be review annually).

Once the upgrades are complete, influent will be passed through an inlet screen, where any gross solids will be removed and disposed of, before flowing into the aeration pond.

In the aeration pond the BOD and ammoniacal nitrogen will be biologically treated with the help of supplementary aeration and sufficient retention time. With the capacity of

an additional aerator the aeration capacity will be increased and surplus aeration will exist until 2030.

From the aeration pond, the effluent will then gravitate to the retention pond for solar UV pathogen inactivation and further solids settling. After the baffle curtains are altered (or replaced) short circuiting will be reduced, achieving a longer effective retention time.

The effluent will then be pumped to the MFU for tertiary treatment. This will filter out bacteria and suspended solids from the effluent. Optimisation of the MFU will increase its throughput to supply additional capacity for the future.

Once there is no longer surplus aeration in the pond, a second aerator will be installed. With the current population forecast this is expected to occur around 2030.

6.4 FINAL EFFLUENT QUALITY

The proposed upgrades aim to reduce the observed concentration spikes in the treated effluent during the peak period. These peaks have historically been within the consent limit, but with future growth these may become more extreme. The final effluent is expected to be similar to the current effluent quality, with lower extreme values during the peak period.

TABLE 5: PROPOSED EFFLUENT QUALITY

PARAMETER	UNITS	RUNNING AVERAGE	90 PERCENTILE
cBOD5	g/m^3	10	20
Suspended Solids	g/m^3	10	20
TKN	g/m^3	15	40
Ammonia	g/m^3	15	40
Total Phosphorus	g/m^3	14	20
Escherichia Coli	cfu/100m	10	20

7.0
ASSESSMENT OF ALTERNATIVES

An options assessment was undertaken to determine the most suitable upgrade option for the Hahei WwTP. This assessment considered the following options:

- Upgrades to the current plant at the current site;
- A new plant at a greenfield site;
- Pumping to Cooks Beach WwTP for treatment there.

These options were comparatively assessed using multi criteria analysis, where the proposed upgrade was selected on the basis of that the population forecast is accurate.

1.1 OTHER SITE UPGRADE OPTIONS

The following treatment upgrade options were also considered at a high level, but were discarded for the options presented below:

TABLE 6: OTHER ONSITE UPGRADE OPTIONS CONSIDERED

PROCESS TYPE	REASONS FOR NOT CONSIDERED FURTHER
In Pond Media	Current ponds have insufficient depth for in pond media installation. Earthworks would be required to raise the embankments. The level of treatment would not increase enough to offset this cost.
Aerated Lagoon	Installation of additional infrastructure presents extra cost over the proposed option. .
SBR	Extensive modification would be required. Effectively building a new plant at the current site. This is unaffordable for the small township.

7.2 NEW PLANT ON A GREENFIELD SITE

This option would involve the construction of a new high rate plant (likely to be a SBR) on a new site in the Hahei area. Cost would be significant as land would need to be purchased in addition to the cost of construction for a new plant. Due to the insignificant projected growth for the immediate future the benefits of this option are heavily outweighed by the large costs and hence the option was omitted.

7.3 TREATMENT AT COOKS BEACH WWTP

The option to pump the wastewater to the Cooks Beach WwTP was also investigated. Due to the hilly nature of the area and the feasible route of the pipeline, significant expenditure would be required for installing the pipework, pump station and any upgrades required to handle the extra flow at the Cooks Beach WwTP. This would make this option unaffordable for the rate payer base, as a result this option was disregarded.

8.0 REASONS FOR THE APPLICATION

8.1 THE WAIKATO REGIONAL PLAN

The Waikato Regional Plan applies across the whole of the Waikato region, and contains objectives, policies, and implementation methods for activities that may have some adverse effects on the environment. Table 7 below summarises the rules and activity type for each of the activities undertaken by the Hahei WwTP. These rules are discussed in detail below.

TABLE 7: REGIONAL PLAN RELATED ACTIVITIES SUMMARY

ACTIVITY	PLAN PROVISION	ACTIVITY TYPE	DURATION SOUGHT
Discharge of treated wastewater to the Wigmore Stream	Rule 3.5.4.5	Discretionary	35 Years
Occupation and use of the Wigmore Stream by the discharge structure	Rule 4.2.4.4	Discretionary	35 Years
Discharge of odour associated with the WwTP processes	Rule 6.1.18.1	Permitted	35 Years
Seepage to the ground from the Ponds	Rule 3.5.4.5	Discretionary	35 Years

8.1.1 DISCHARGE OF TREATED WASTEWATER TO WIGMORE STREAM

As treated effluent will contain some contaminants common to wastewater, it is encompassed by Rule 3.5.4.5:

"Any discharge of a contaminant into water, or onto or into land, in circumstances which may result in the contaminant (or any other contaminant emanating as a result of natural processes from the contaminant) entering water, that is not specifically provided for by ay rule, or does not meet the conditions of a permitted or a controlled activity rule in this Plan, is a ***discretionary activity*** *(requiring resource consent)."*

An assessment of the effects of the discharge, in accordance with section 8.1.2.2 and policies in section 8.1.2.2 of the Plan, is undertaken in section 9.2 of this report.

8.1.2 OCCUPATION OF THE WIGMORE STREAM BY THE DISCHARGE STRUCTURE

As the discharge structure is not specifically outlined in another rule, it is covered by Rule 4.2.4.4:

"The use, erection, reconstruction, placement, extension, alteration or demolition or removal of any structure in, on, under, or over the bed of any lake or river that is not specifically provided for by any rule, or does not comply with the conditions of a permitted or controlled activity rule in this Plan, is a ***discretionary activity*** *(requiring resource consent)."*

To enable the assessment of this application, an assessment of the effects of the discharge structure is covered in section 9.3 of this report.

8.1.3 DISCHARGE ODOUR ASSOCIATED WITH WWTP TO AIR

Section 6.1.18.1 of the Plan outlines the criteria that a discharge to air activity must meet to be classed as a permitted activity. An analysis of the criteria is presented in Table 8 below.

TABLE 8: AIR DISCHARGE PERMITTED ACTIVITY COMPLIANCE TABLE, RULE 6.1.18.1

REQUIREMENTS	COMPLIANCE
a) The activity was lawfully established, except by way of a resource consent before the date of notification of this Plan.	Compliant. The plant was lawfully established under Resource Consent 117888.
b) Any change in the activity shall not increase the scale, frequency, intensity, nature, or duration of any discharge to air compared to when the activity was established or authorised.	Compliant.
c) The activity is not already restricted in sections 3.5.5, 3.5.6, 3.5.7, 5.2.5, 5.2.6, 5.2.7, 5.2.8 or 6.1.12 of this Plan.	Compliant.
d) The process does not involve the treatment of hazardous substances.	Compliant.
e) As Specified in section 6.1.8 conditions a) to e) of this plan	Compliant. Refer to Table 9 below.

TABLE 9: AIR DISCHARGE PERMITTED ACTIVITY COMPLIANCE TABLE RULE 6.1.8

REQUIREMENTS	COMPLIANCE
a) There shall be no discharge of contaminants beyond the boundary of the subject property that has adverse effects on human health, or the health of flora or fauna.	Compliant. The discharge is of odour only.
b) The discharge shall not result in odour that is objectionable to the extent that is causes an adverse effect at or beyond the boundary of the subject property	Compliant. No odour is noticeable past the boundary of the WwTP.
c) There shall be no discharge of particulate matter that is objectionable to the extent that it causes an adverse effect at or beyond the boundary of the subject property.	Compliant.
d) The discharge shall not significantly impair visibility beyond the boundary of the subject property.	Compliant.
e) The discharge shall not cause accelerated corrosion or accelerated	Compliant.

TABLE 9: AIR DISCHARGE PERMITTED ACTIVITY COMPLIANCE TABLE RULE 6.1.8	
REQUIREMENTS	**COMPLIANCE**
deterioration of structures beyond the boundary of the subject property.	

As the discharge to air activity is compliant with all the required criteria it is a permitted activity, and does not require resource consent.

8.1.4 SEEPAGE TO GROUND FROM PONDS

Seepage to ground has been included in this application as the aeration and retention ponds are clay lined, which has the potential for some low level seepage. This is covered by Rule 3.5.4.5 in the Waikato Regional Plan and is deemed a discretionary activity. An assessment of the effects of this discharge are discussed in section 9.5.

8.2 THAMES COROMANDEL DISTRICT PLAN

The subject site is within the Rural Zone of the Thames Coromandel District Plan. The current Hahei WwTP is on a site designated 40/08 TCDC-3 by the Thames Coromandel District Council, "Hahei Wastewater Treatment and Disposal".

8.3 OTHER CONSENT REQUIREMENTS

Section 176A requires an Outline Plan to be submitted unless a waiver is granted or the details are incorporated into the designation. Once the required work for the upgrade is confirmed, an Outline Plan is likely to be necessary and will be submitted to the Thames Coromandel District Council in due course.

8.4 STATUTORY REQUIREMENTS

Section 88(2)b of the Resource Management Act 1991 (the "Act") stipulates that an application shall include an assessment of environmental effects prepared in accordance with the Fourth Schedule and be in such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

Matter to be considered by the Council when assessing an application for resource consent under section 104(1) of the Act include (subject to Part II), any actual and potential effects on the environment and any relevant objectives, policies, rules or other provisions of a Plan or Proposed Plan.

Overall, the Council is required to assess this application for resource consent against the purpose and principles of sustainable management set out in Part II of the Act, which are addressed in section 11.1 of this report.

SECTION 104B

The proposed activity is deemed to be a Discretionary Activity under the provisions of the Regional Plan. Accordingly, after considering this application for resource consent the Council may grant or refuse the application, and if it grants the application it may impose conditions.

8.5 OVERALL STATUS OF THE APPLICATION

Overall, the proposal requires assessment under the Regional Plan as a **Discretionary Activity**.

9.0 NOTIFICATION ASSESSMENT

9.1 PUBLIC NOTIFICATION TEST

Section 95A(1) of the Act states that a consent authority has discretion to decide whether or not to publicly notify a resource consent application. A previous presumption in favour of notification was removed by the Resource Management Amendment Act 2009.

Section 95A(2) states that despite subsection (1), a consent authority must publicly notify an application if:

a) It decides that the activity will have or is likely to have adverse effects on the environment that are more than minor; or

b) The applicants requests public notification; or

c) A rule or national environmental standard requires public notification.

Only clause a) requires evaluation in this case, which is provided below. Clause b) is not applicable as Thames Coromandel District Council does not request notification and clause c) is also not applicable in this case.

Sections 95A(3) and (4) set out the circumstances in which a consent authority must not publicly notify an application. These circumstances are not applicable in this case.

In summary, if the activity proposed by this application is assessed to have, or to be likely to have "more than minor" adverse effects on the environment, then it must be publicly notified. If it is assessed to have no "more than minor" adverse effects on the environment, then Council has discretion on how to process the application.

Section 95D of the Resource Management Act provides further guidance for the Council in deciding whether an activity will have more than minor adverse effects on the environment.

Under section 95D(a), any effects on persons who own or occupy the land in, on or over which the activity will occur, or any effects on land adjacent to the land on which the activity will occur must be disregarded. The adjacent properties are limited by the Wigmore Stream along the eastern border of the plant, however there are adjacent residential properties to the west of the plant, and across Pa road to the north. To the south is privately owned farmland.

Under section 95D(b), an adverse effect of the activity on the environment may be disregarded if the plan or national environmental standard permits an activity with that effect (i.e. the 'permitted baseline'). In this case, the discharge of odour is a permitted activity by the plan.

In addition, in accordance with section 95D(e), any effect on a person who has given written approval to the application must be disregarded. No affected party approvals have been sought regarding this proposal.

Having regard to the above, the potential adverse effects on the environment are considered to primarily relate to effects of discharging treated wastewater into the Wigmore Stream.

9.2 EFFECTS OF DISCHARGE TO WIGMORE STREAM

The effects associated with the proposed activity are the environmental effects resulting from the discharge of treated effluent from the wastewater treatment plant. These effects have been discussed in detail in the ecological assessment carried out by Kessels and Associates Ltd. The report has been included in Appendix 2.

9.2.1 EXISTING ENVIRONMENT

The Wigmore Stream is assessed at two different points as part of the current consent conditions. These are undertaken 50m upstream and 50m downstream from the point of discharge. Both sites are of similar quality, although riparian vegetation is usually slightly denser downstream. There has been no observation of nationally at risk or threatened plant species on the stream.

The streams upper reaches are dominated by grazed pasture, and the lower by residential houses with septic tanks. From the point of discharge the stream flows approximately 1km downstream to its mouth at Hahei beach. Due to its proximity to the ocean saltwater intrusion is often observed, sometimes up to the upstream monitoring point. Observations have been made of fish and invertebrate classed as "at risk" including Inanga and Longfin Eel. The Wigmore Stream is also a likely habitat of some "threatened" and "at risk" birds, including Northern New Zealand Dotterel, Variable Oystercatcher, Red-Billed Gull, and Black Shag.

Detailed flow information is not available for the stream, but predictions by Dr Ed Brown (Hydrologist, Waikato District Council) based on correlations with four flow recorder sites have been made. The mean flow is predicted to be 35 to 50 L/s with an average flow of 40L/s, and Q_5 flows of 1 to 3.6 L/s with an average of 3 L/s. Due to tidal influences the flow of the stream fluctuates in speed and direction, making the actual flow conditions at the point of discharge complex.

Background water quality is of average quality, with high levels of ammoniacal nitrogen, phosphorus, and E.coli, likely due to the land use in the stream catchment. Dissolved oxygen levels are typically low, and turbidity is often high due to the tidal influence.

9.2.2 POTENTIAL WATER QUALITY EFFECTS

The potential effects of the proposed discharge of treated wastewater to Wigmore Stream are presented in Table 10 below.

TABLE 10: SUMMARY OF WATER QUALITY ANALYSIS FOR THE WIGMORE STREAM

PARAMETER	COMMENT
Temperature	Temperature of the Wigmore Stream is monitored as part of the monitoring program, and has historical highs reaching 28+˚C in the summer. This is much higher than the NIWA guideline maximum for sensitive organisms of 20˚C, and the NIWA appropriate temperature threshold of 26˚C in summer. While the WwTP is unlikely to have a measureable effect on the temperature, cumulative effects need to be taken into account by ensuring that monitoring of the effects is undertaken appropriately. .
pH	High pH levels have been recorded upstream of the discharge during the monitoring program. Levels downstream of the discharge point are within normal levels. The effect of the

TABLE 10: SUMMARY OF WATER QUALITY ANALYSIS FOR THE WIGMORE STREAM

PARAMETER	COMMENT
	WwTP on the pH level is likely to be less than minor, given the historical levels of the effluent.
Turbidity and Suspended Solids	Suspended solids measured at the upstream site are already at a high concentration due to sedimentation from the catchment. The high turbidity downstream is more likely to be a result of the natural tidal turbidity maximum than the WwTP discharge. It is considered that the effects of the WwTP discharge on the stream will be less than minor due to the high background concentrations, and the low suspended solids concentration in the discharge.
Dissolved Oxygen	DO levels at both the upstream and downstream monitoring points of the Wigmore Steam are below those recognised as a guideline standard for ecological protection by the WRC and RMA, and below the NOF baseline. There is potential for the WwTP to have a measurable reduction in DO during low flow conditions as the result of the discharge. However, based on the current effluent quality of the WwTP discharge, these effects are predicted to be less than minor.
Ammonia and Nitrate	Ammoniacal nitrogen peaks in the WwTP discharge have been observed during the peak period at the downstream sampling site. . This is unlikely to be solely related to the WwTP as there are several properties with septic tank systems bordering the stream. Porous coastal soils, and the increased use of these systems over the peak period raises the possibility that these septic systems may be contributing to the ammoniacal nitrogen levels. Nitrate levels are in the "A" NOF bound, with no clear pattern that would suggest the WwTP discharge is having any effect on the downstream concentrations. Macroinvertebrate and other ecological monitoring has not shown any consistent differences between the upstream and downstream sites that would indicate an effect on nutrients from the WwTP discharge. The proposed upgrades are focused around ameliorating the summertime peaks in the ammoniacal nitrogen peaks, and hence the effects of discharge on the downstream ammoniacal and nitrate nitrogen levels are predicted to be less than minor.
Total Phosphorous	There is expected to be little change in the phosphorus discharge to the Wigmore Stream as a result of maintaining the current discharge quality and/or proposed upgrades. No evidence for a difference was found between the concentrations of the upstream and downstream sites. The principle reason for concern with phosphorus is the potential increase in nuisance aquatic plants. However, observations from the monitoring program have reported absent or very small amounts due to the high salinity of the stream at the point of, or downstream of the treated wastewater discharge. As a result the proposed discharge is expected to have adverse effects that are less than minor.
E.coli	Levels of E.coli in the WwTP effluent are, on average, below 6 cfu/100mL, significantly lower than the average 1200

TABLE 10: SUMMARY OF WATER QUALITY ANALYSIS FOR THE WIGMORE STREAM	
PARAMETER	**COMMENT**
	cfu/100mL measured upstream of the discharge point. As a result, it is likely the discharge is having a minor positive, to no impact on the Wigmore Stream.
Enterococci	Levels of Enterococci in the effluent are, on average, below 4.5 cfu/100ml, significantly lower than the average 200 cfu/100ml on average measured upstream. As a result, it is likely the effect of discharge will be less than minor.

9.2.3 EVALUATION OF NUTRIENT LOADS

As part of the Ecological Study and Assessment of Environmental Effects, ammoniacal nitrogen loads were calculated and compared against measured data for comparison. These included mean and maximum discharge flows and loads, during mean and Q_5 flows.

- Scenario 1 – Stream Q_5, actual discharge, actual peak NH_4-N
- Scenario 2 - Mean Stream flow, actual discharge, actual peak NH_4-N
- Scenario 3 – Stream Q_5, actual Jan discharge, actual Jan NH_4-N
- Scenario 4 – Mean Stream flow, actual Jan discharge, actual Jan NH_4-N
- Scenario 5 – Stream Q_5, mean discharge, mean NH_4-N
- Scenario 6 – Mean stream flow, mean discharge, mean NH_4-N
- Scenario 7 – To achieve DS NH_4-N <2.2g/m^3 under peak Jan conditions.
- Scenario 8 – To achieve DS NH_4-N <2.2g/m^3 under average Jan conditions
- Scenario 9 - To achieve DS NH_4-N <2.2g/m^3 under average conditions

TABLE 11 - PROJECTED SCENARIOS UNDER CURRENT DISCHARGE FLOWS AND LOADS						
SCENARIO	**STREAM FLOW**	**UPSTREAM AMM-N (MEAN)**	**DISCHARGE FLOW**	**DISCHARGE AMM-N**	**CALCULATED DOWNSTREAM AMM-N**	**MEASURED DOWNSTREAM AMM-N**
	L/s	g/m^3	L/s	g/m^3	g/m^3	g/m^3
1	3	1.45	2.80	36.90	18.56	3.25
2	40	1.45	2.80	36.90	3.77	3.25
3	3	1.35	2.40	24.63	11.70	1.43
4	40	1.35	2.40	24.63	2.67	1.43
5	3	0.41	1.25	6.76	2.28	0.54
6	40	0.41	1.25	6.76	0.60	0.54
7	40	1.45	2.80	44.58	4.27	
8	40	1.35	2.40	52.88	4.27	
9	40	0.70	1.25	88.52	3.37	

Scenarios 1, 3 and 5 show that under low flow scenarios a mass balance greatly over estimates the downstream ammoniacal nitrogen concentration, showing there is other unaccounted for influences on the stream, including likely dilution from the sea water

infiltration. For the other flow scenarios, this over estimation is still present, but the effect is not as great.

9.2.4 DISCHARGE COMPATIBILITY WITH STREAM DESIGNATIONS

The Wigmore Stream is classified under both the Waikato Surface Water Class, and the Waikato Contact Recreation Water Class. The purpose of these classes are to maintain existing aquatic life, ecosystems, aesthetic values, the suitability of water for human consumption, and minimise the risk of sickness from recreational use.

WRC have outlined water class management policies for the management of water resources in section 3.2.3 of the Waikato Regional Plan. The policies pertaining to the applicable classes of water are presented below with comment as how they relate to the discharge from Hahei WwTP.

POLICY 4: WAIKATO REGION SURFACE WATER CLASS

Enable the use of all surface water bodies in the Region, provided that:

TABLE 12: SURFACE WATER CLASS POLICY COMPLIANCE TABLE

POLICY PROVISION	COMMENT
a) Any significant adverse effects on existing aquatic ecosystems are avoided, remedied, or mitigated.	Avoided by providing the highest level of treatment economically affordable to the community.
b) Intake structures are designed to minimise fish entrapment.	Not applicable.
c) Any conspicuous change in visual colour or clarity is avoided, remedied, or mitigated.	Effects on turbidity are likely to be less than minor (section 9.2.2).
d) The water body is not tainted or contaminated to the extent that it is unpalatable or unsuitable for consumption by humans after treatment (equivalent to coagulation, filtration, and disinfection).	Discharge is compliant with this policy
e) The water body is not tainted or contaminated to the extent that is unsuitable for irrigation or stock watering.	Discharge is compliant with this policy.

POLICY 6: WAIKATO REGION CONTACT RECREATION WATER CLASS

The purpose of the contact recreation class is to provide a safe water quality environment for contact recreation in all rivers, streams, and lakes with significant contact recreational use by:

TABLE 13: CONTACT RECREATION WATER CLASS POLICY COMPLIANCE TABLE

POLICY PROVISION	COMMENT
a) Avoiding reductions in clarity that make the water unsuitable for contact recreation.	Effects on turbidity are likely to be less than minor (section 9.2.2).
b) Avoiding contamination to levels that represent a significant risk to human health or to levels that would render the water body unsuitable for human contact.	Discharge bacterial counts are significantly lower than the background levels and are much lower than the National Objectives Framework.
c) Avoiding the development of bacterial and/or fungal growths that are visible to the naked eye.	The WwTP plant achieves a high level of nutrient removal and hence eutrophication effects are likely to be less than minor.
d) Avoiding the development of periphyton growth of mats to the extent they cover more than 25% of the bed of the water.	The WwTP plant achieves a high level of nutrient removal and hence eutrophication effects are likely to be less than minor.

9.2.5 AQUATIC PLANT GROWTH

High concentrations of nutrients such as phosphorus and nitrogen can contribute to excessive growth of nuisance aquatic plants. Effects of the discharges from the WwTP on the aquatic plant growth in Wigmore Stream are likely to be less than minor due to the current low levels of nutrients in the discharge and the high salinity and turbidity of the stream.

9.2.6 FISH PASSAGE AND SPAWNING

A total of 14 species of fish were recorded in Wigmore Stream including two classed as "At Risk – Gradual Decline", Inanga and Longfin Eel. Many of the species recorded migrate between freshwater and the sea as part of their lifecycle.

There is potential or the discharge to affect fish passage if ammoniacal nitrogen is elevated above toxic levels, creating a barrier the fish would be reluctant to cross. This is most likely to occur at low stream flows during the peak period, and would therefore be expected to impact species that migrate during the summer. Current ammoniacal nitrogen peaks during this period are short lived, and are yet to reach toxic concentrations, and therefore predicted to have an effect not more than minor.

Future effluent quality is not predicated to be significantly different to the present situation. With reduced ammoniacal nitrogen peaks during the peak period, the proposed discharge is predicted to have an effect on fish passage that is less than minor.

9.2.7 BIRDS

Contaminant and microbial levels in the discharge are low and will be further diluted to negligible levels when the Wigmore Stream meets the ocean at Hahei Beach. The WWTP discharge is therefore not predicted to have any adverse effect on terrestrial fauna such as birds, lizards and frogs.

9.2.8 SUMMARY

The discharge from the Hahei WwTP has had some impact on dissolved oxygen, temperature, nitrate, ammoniacal nitrogen, but these are predicted to be less than

minor in nature. The plant is anticipated to have no effect on the turbidity/suspended solids or E.coli in the Wigmore Stream as the projected concentrations of these in the effluent will be lower than upstream concentrations. Any potential impacts on increased growth or aquatic plants and algae are less than minor due to suppression of macrophyte and periphyton growth by high salinity and turbidity. Elevation of ammoniacal nitrogen downstream of the WwTP is short-lived and does not reach toxic levels, and therefore the effects on fish passage in Wigmore Stream will potentially be less than minor.

Future discharge to the Wigmore Stream as a result of the proposed upgrades to the WwTP are not predicted to have any adverse effects on the Wigmore Stream that are more than minor.

9.3 EFFECT OF DISCHARGE STRUCTURE ON WIGMORE STREAM

The discharge structure is a buried 1m length of 80NB PE pipe, capped on the end, with five rows of 20mm holes. The structure is secured to the bed of the stream.

As outlined by the Regional Plan, the assessment of the consent application will take into account the matters identified in policy 1 of section 4.2.3:

"*Enable through permitted activity rules the use, erection, reconstruction, placement, alteration, extension, removal, or demolition of structures, in, on, under, or over the beds of rivers or lakes which:*

TABLE 14: DISCHARGE STRUCTURE POLICY COMPLIANCE SUMMARY

POLICY PROVISION	COMMENT
a) Do not significantly adversely affect bed stability.	The low velocity of the discharge, and size of the structure have minimal impact on the bed stability.
b) Do not significantly degrade water quality, flow regimes, and aquatic ecosystems, in a manner that is inconsistent with the policies in section 3.2.3.	Flow regime degradation is minimised by the minimal size of the structure. Polices outlined in section 3.2.3 are analysed above in section 9.2.
c) Do not obstruct fish passage for trout and indigenous fish.	There is no effect on fish passage as discharge structure takes up minimal flow area.
d) Do not adversely affect the natural character of river and lake beds (including caves).	Structure is fixed to the bed of the stream to minimise any effects.
e) Do not increase the adverse effects of flooding on neighbouring properties.	No increase of flooding effects, or probability.
f) Do no obstruct navigation where appropriate.	Only likely stream users are waders and kayakers etc. No obstruction to navigation.
g) Avoid significant adverse effects on the relationship tangata whenua as kaitiaki have with river and lake beds.	The relationship tangata whenua have with the discharge of wastewater is discussed in section 9.9.
h) Do not obstruct existing legal public access where appropriate.	Structure is underwater

In summary, the effects of the discharge structure on Wigmore Stream are less than minor and limited notification is acceptable.

9.4 EFFECTS OF DISCHARGE TO AIR

Although a permitted activity, it is prudent to assess the potential for odour in order to satisfy the duty to avoid, remedy or mitigate adverse effects under section 17 of the Act. The potential sources of odour from the Hahei WwTP are presented below in Table 15.

TABLE 15: DISCHARGE TO AIR ADVERSE EFFECTS MITIGATIONS

POTENTIAL SOURCE	MITIGATION
Inlet Screen	Inlet screen will be enclosed to reduce odour.
Aeration Pond	Aeration pond will be operated correctly to minimise odour.
Retention Pond	Aerators are installed to promote flow during period of non-peak flow.
Sludge	Sludge is not removed or exposed to open atmosphere

The plant in its current configuration has received no odour complaints from the public. The operation of the plant with the proposed upgrades is not anticipated to increase the potential of odour production and as such it is not anticipated that there will be any affected parties.

Adverse effects due to odour emissions from the WwTP are likely to be less than minor and therefore acceptable under section 17 of the Act.

9.5 EFFECTS OF DISCHARGE TO LAND

The potential effects on the environment of seepage from the bases of the ponds have been considered as they pertain to the following areas:

- The immediate area of disposal;
- The underlying soils and groundwater; and
- The most probable final receiving environment which is the Wigmore Stream.

1.1.1 THE EFFECTS ON THE IMMEDIATE AREA

There is potential for seepage to occur from the aeration and retention ponds through the clay liners. The volume of seepage is not known, but is not expected to be high, as intent of the clay liner is to retain water within the pond.

9.5.2 EFFECTS ON THE UNDERLYING SOILS AND GROUNDWATER

Should any seepage occur, then it could enter the ground water as it flows towards the Wigmore Stream. Groundwater level is assumed to be high due to the low lying land close to the Wigmore Stream, and within a short distance of the sea.

Groundwater quality is not known as any seepage flow is expected to be low, it is expected the effect of the seepage on the underlying soils and ground water is less than minor.

9.5.3 EFFECTS ON THE LIKELY FINAL RECEIVING ENVIRONMENT

Given the proximity to the Wigmore Stream it is assumed that the final receiving environment of any seepage from the ponds will be the Wigmore Stream. Any effects of the seepage would therefore been captured in the ecological monitoring surveys. As the ecological surveys have reported that there is no adverse effect more than minor on

Wigmore Stream, it can be concluded that any effect on the final receiving environment from the seepage is less than minor.

9.6 PUBLIC HEALTH EFFECTS

The Hahei WwTP is having minimal contribution to the elevated levels of pathogens in the Wigmore Stream. E. coli and Enterococci concentrations for the monitoring period are presented in Table 16 below.

TABLE 16: INDICATOR BACTERIA IN THE EFFLUENT AND STREAM COMPARISON

PARAMETER	UPSTREAM OF DISCHARGE POINT (cfu/100ml)		DISCHARGE (cfu/100ml)		DOWNSTREAM OF DISCHARGE POINT (cfu/100ml)	
	AVERAGE	90TH %ILE.	AVERAGE	90TH %ILE	AVERAGE	90TH %ILE.
E. coli	2,312	4,410	5.1	10	1,370	3,220
Enterococci	933	2,120	3.4	40	557	2,000

The installed MFU significantly reduces biological concentrations (presented in section 4.3 and 5.4). As a result, the concentration of E. coli in the discharge is significantly less than the National Objective Framework bottom line value of 1000cfu/100mls.

9.7 EFFECTS ON PUBLIC ACCESS

The Wigmore Stream is easily accessible from Pa and Orchard Roads which run adjacent parallel and adjacent to the stream respectively. The plant is situated on the far side of the stream from the road and as such poses no impediment to public access at that particular location.

9.8 SOCIAL AND ECONOMIC EFFECTS

The proposal is expected to result in continuing positive social and economic benefits for the local community and wider district. The treatment plan provides an important service to the Hahei community and is a valued physical resource in this respect. The high level of compliance with the current resource consent indicates that the treatment plant generally functions well and that TCDC operates the plant to a satisfactory standard.

9.9 CULTURAL AND SPIRITUAL EFFECTS

Māori generally believe that the discharge of wastewater to a body of water decreases the mauri of that water regardless of the level of treatment. As such the discharge of treated effluent to the Wigmore Stream may produce some negative spiritual effects.

TCDC have considered the Hauraki Iwi Environmental Plan *Whaia te Mahere Taiao a Hauraki* in their assessment of relevant 104 provisions. Comments relating to the plan can be found in section 10.7.2.

Iwi and iwi organisations whose rohe fall in the catchment of the Wigmore Stream and who have been identified as potentially being affected by the discharge of treated effluent to the Wigmore Stream including the following:

- Hauraki Māori Trust Board;
- Te Kupenga o Ngāti Hako;
- Ngāti Maru Runanga;
- Ngāit Hei Charitable Trust;

It is intended to include these groups in limited notification of the application.

9.10 VISUAL AND AMENITY EFFECTS

The Hahei WwTP has a minor visual impact on the users of the Wigmore Stream. The treatment plant consists of low lying ponds. It lies on the outskirts of the town and is bordered by both residential houses and farmland.

The perceived effect of the discharge may have negative effects on the Wigmore Stream downstream of the discharge. The perceived effects on the amenity of the Wigmore Stream are largely unrelated to the actual quality of the treated effluent as the treated effluent is normally of a higher standard than the receiving waters.

The proposal is not considered to result in adverse effects on the landscape value of cause adverse effects because the proposed upgrades have less then minor impact visually.

9.11 SITE SUITABILITY

The site is already utilised as a wastewater treatment plant. This is formally recognised through the designation "40/08 TCDC-3" which is placed on the site in the TCDC District Plan. The site is suitably located and use is well established.

The continuing operation and the proposed upgrades are considered to be an appropriate use of the site.

9.12 AFFECTED PERSONS

Section 95B(1) of the RMA states that if a consent authority does not publicly notify an application, it must decide if there are any affected person in relation to the activity.

Section 95B(2) of the RMA states that a consent authority must give limited notification to any affected person unless a rule of national environmental standard precludes this (which is not the case here).

Section 95E(1) of the RMA states that someone is an affected person if an activity's effects on the person are minor or more than minor (but not less than minor). Subsections (2) and (3) provide further direction for the making of this decision. A consent authority may disregard an adverse effect of the activity if a rule or national environment standard permits an activity with that effect. A consent authority must also decide that a person is not an affected person if the person has given written approval or it is unreasonable in the circumstances to seek the person's written approval.

The permitted baseline is formed by compliance with the odour requirements of the Regional Plan and no effected party approvals have been sought in relation to this proposal.

In this case, it is considered the proposal will have a minor effect on the Wigmore Stream, and as such the following parties are considered to be affect parties:

- Hauraki Māori Trust Board;
- Te Kupenga o Ngāti Hako;
- Ngāti Maru Runanga;
- Ngāit Hei Charitable Trust;
- Adjacent neighbours;

- Mercury Bay Community Board
- Waikato District Health Board

9.13 SPECIAL CIRCUMSTANCES

Section 95A(4) states that an application for resource consent must be notified if special circumstances exist. In this case, it is not considered that this application will give rise to special circumstances as it is for the renewal of a previous discharge consent associated with an established wastewater treatment plant. Therefore notification is not warranted under this section.

9.14 NOTIFICATION SUMMARY

Pursuant to sections 95A to 95E of the Resource Management Act, this application should be processed on a limited notified basis as:

- In accordance with section 95A(4), there are no special circumstances to warrant notification;
- In accordance with section 95E, there are a number of limited parties that may be adversely affected by the proposal; and
- In accordance with section 95D, the adverse effects of the proposal are minor.

10.0
SECTION 104 ASSESSMENT

Subject to Part 2 of the Act, when considering an application for resource consent in accordance with section 104(1) of the Act, regard must be given to:

- Any actual and potential effects on the environment of allowing the activity;
- Any relevant provisions of national policy statements;
- New Zealand coastal policy statements;
- National environmental standards;
- Regional policy statements or proposed regional policy statements;
- Regional and District Plans or proposed plans; and
- Any other matter relevant and necessary to determine the application.

10.1 ACTUAL AND POTENTIAL EFFECTS ON THE ENVIRONMENT

Section 104(1)(a) of the Act requires that regard is given to any actual and potential effects on the environment of allowing the activity. The actual and potential adverse effects of the proposal have been considered in section 9.0 of this report where, overall, they were considered to be minor, and thereby considered to be acceptable.

The proposal is expected to result in continuing positive social and economic benefits for the local community and wider district. The treatment plant provides an important infrastructural service to the Hahei community and is a valued physical resource in this respect.

Past practice has shown that the treatment plant generally functions well and the Thames Coromandel District Council operates the plant to a satisfactory standard. This is reflected in the satisfactory effluent quality.

10.2 RELEVANT NATIONAL POLICY STATEMENT AND PLANS

Section 104(1)(b)(i)(ii) and (iii) of the Act direct Council to consider any relevant provisions of a national environmental standard, national policy statement, and other regulations.

The National Policy Statement for Freshwater Management 2014 (NPSFM) set 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. The national policy statement is a first step to improve freshwater management at a national level.

The national objectives framework (NOF) was included as a part of the National Policy Statement for Freshwater Management 2014 as a means of establishing objectives and limits for freshwater management. The NOF includes a nationally consistent set of bottom lines for freshwater quality parameters with a grading system to indicate the relative level of ecosystem degradation.

10.2.1 NATIONAL POLICY STATEMENT FOR FRESHWATER MANAGEMENT

The NPSFM outlines objectives and policies concerned with:

- Water quality;

- Water quantity;
- Integrates management;
- The National Objective Framework (NOF);
- Monitoring;
- Accounting for freshwater takes and contaminants;
- Tangta whenua roles and interests;
- Progressive implementation.

The NPSFM directs Regional Councils to make changes to their regional plan to implement the policy. In the interim, the NPSFM directs Regional Councils to include specific policies (see policies A4 and B7) which require the consent authority to have regard to the extent of adverse effects to:

- The life-supporting capacity of freshwater including any ecosystem; and
- The health of people and communities via a secondary contact.

The Wigmore Stream is classified contact recreation and surface water, and hence regard should be given to both objectives.

The NPSFM introduces NOF guidelines which have a rating system for each of the water quality parameters assessed. Band A generally refers to high conservation value water quality which is unlikely to affect even sensitive species. Band B generally refers to a high species protection level to which only a small number of the most sensitive species may be impacted. Band C refers to moderate protection level which corresponds to the reduced survival of the most sensitive species. The NOF also have a bottom line which represents significant stress on aquatic species and the approach of the acute impact level. Where the NOF guidelines refer to E.coli the grading's are in terms of risk to public health.

The NOF as relevant to the consent is presented below in Table 17. It should be noted that the NOF limits are meant to be applied to the median value of sampling taken throughout the year. The sampling in the Wigmore Steam period changes between the summer and winter, and may influence the median value. Further to this the data presented spans a 6 year period.

TABLE 17: NATIONAL OBJECTIVE FRAMEWORK VALUES FOR WIGMORE STREAM

PARAMETER	UPSTREAM	DOWNSTREAM
Nitrate Toxicity	A	A
Ammonia Toxicity	C	C
Dissolved Oxygen	C	C
E.coli	D	D

10.3 RELEVANT WAIKATO REGIONAL STATEMENTS AND PLANS

Sections 104(1)(b)(v) and (vi) of the Act direct council to consider any relevant regional policy statements or proposed statements and any plan or proposed plan.

The Waikato Regional Policy Statement promotes the sustainable management of natural and physical resources within the region and is therefore relevant to the consideration of this proposal. Of particular relevance to the proposal is the water chapter (section 3.4). The objective of this chapter is to achieve a net improvement in

the water quality across the region, which is supported by policies to determine the characteristics of the receiving water bodies to enable adverse effects to be avoided, remedied or mitigated.

The Waikato Regional Plan contains policies and methods to manage the natural and physical resources of the Waikato region. The plan implements the Regional Policy Statement.

10.3.1 WAIKATO REGIONAL POLICY STATEMENT

OPERATIVE REGIONAL POLICY STATEMENT

The Operative Waikato Regional Policy Statement (OWRPS) promotes the sustainable management of natural and physical resource within the region.

Of particular relevance to the proposal is the water chapter of the OWRPS. The water chapter identifies wastewater treatment plants as major contributors to pollution and acknowledges that efforts are being made to reduce the impact of these discharges on the receiving water bodies. The objective of the water chapter is to achieve a net improvement in the water quality across the region. This is supported by policies to determine the characteristics of the receiving water bodies to enable avoidance, remedy or mitigation of any adverse effects.

Of further relevance to the proposal are:

- Objective 2.1.5 relating to the relationship of tāngata whenua with the natural and physical resources;
- Objective 3.3.11 relating to river and lake beds management; and
- Policy 3.4 relating to all fresh water bodies.

The proposal is considered to be consistent with the water chapter of the OWRPS because the Hahei WwTP is providing a high degree of treatment through the TCDC's operation and management of the WwTP. TCDC have proactively taken measures to improve water quality by installing a membrane filtration unit that further removes suspended solids and pathogens from the effluent.

PROPOSED REGIONAL POLICY STATEMENT

The Proposed Regional Policy Statement was notified on 3 November 2010, after which submissions were received and hear and a decisions version notified on 2 November 2012. Thirty seven appeals have been lodged with the Environment Court on the decisions version, which are currently working through the progress.

Of relevance to the proposal are objective 3.8 relating to the relationship of tangata whenua with the environment, objective 3.13 relating to the mauri and health of fresh water bodies and policy 8.3 relating to all fresh water bodies.

The proposal is set to explore the most effective and practical options for upgrading the WwTP, in a staged manner, and based on prevailing conditions so as to ensure that the health and wellbeing of Wigmore Stream is protected and potentially enhanced over time through reduced nutrient loading.

10.3.2 WAIKATO REGIONAL PLAN

The relevant objectives and policies of the Regional Plan are listed and assessed below in terms of the discharges to water and air as well as the discharge structure.

3.1.2 OBJECTIVE

The management of water bodies in a way which ensures:

a) That people are able to take and use water for their social, economic, and cultural wellbeing.

b) Net improvement of water quality across the Region.

c) That significant adverse effects on aquatic ecosystems.

d) That significant adverse effects on the relationship tāngata whenua as Kaitiaki have with water and their identified tāonga such as wāhi tapu, and native flora and fauna that have customary and traditional uses in or on the margins of water bodies, are remedied or mitigated.

e) The natural character of the coastal environment, wetlands and lakes and rivers and their margins (including caves), is preserved, and protected from inappropriate use and development.

f) Concentrations of contaminants leaching from land use activities and non-point source dwellings to shallow ground water and surface waters do no reach levels that present significant risk to human health or aquatic ecosystems.

g) That the positive effects of water resource use activities and associated existing lawfully established infrastructure are recognised, whilst avoiding, remedying or mitigating adverse effects on the environment.

3.2.3 POLICIES

POLICY 1: MANAGEMENT OF WATER BODIES

Manage all water bodies to enable a range of water use activities, whilst ensuring that a net improvement in water quality across the Region is achieved over time through:

a) Maintaining overall water quality in areas where it is high, and in other water bodies, avoiding, remedying or mitigating cumulative degradation of water quality from the effects of resource use activities.

b) Enhancing the quality of degraded water bodies.

c) Recognising the positive benefits to people and communities arising from use or development of water resources and by taking account of existing uses of water and the associated lawfully established infrastructure.

POLICY 2: MANAGING DEGRADED WATER BODIES

Enhance the quality of degraded water through improved management of activities that affect water bodies so that:

a) For activities controlled by rules in the Plan;

b) Discharges to water will not further degrade water quality with respect to those parameters of the relevant class(es) for that water body that are not currently met.

POLICY 8: REASONABLE MIXING

The zone of reasonable mixing is the area within which a discharge into water (including any discharge that occurs subsequent to a discharge onto or into land) does not need to achieve the standards specified in the water management class for the receiving water body. The size of the mixing zone must be minimised as far as is

practicable and will be determined on a case-by-case basis, including consideration of the following matters:

a) The nature of the effluent, including its flow rate, composition, and contaminant concentrations.

b) River flow rate and flow characteristics.

c) The design of the discharge.

d) The depth, velocity, and rate of mixing in the receiving water body.

e) Existing contaminant concentrations in the receiving water body both upstream and downstream of the discharge point and the assimilative capacity of the water body.

f) The frequency of the discharge.

g) The speed with which any contaminants will be diluted.

h) The ability of the discharger to alter the location of the discharge and the mixing characteristics of the discharge so as to ensure that adverse effects of the discharge beyond the zone of non-compliance are not inconsistent with the purpose for which the water body is being managed.

i) Whether the discharger has taken all practicable steps to minimise the concentration and volume of contaminants at source.

j) Any effects of the mixing zone on other users of the water body.

k) The extent of adverse effects within the mixing zone.

3.5.3 POLICIES

POLICY 1: ENABLING DISCHARGES TO WATER THAT WILL HAVE ONLY MINOR ADVERSE EFFECTS

Enable through permitted and controlled activity rules, discharges to water that due to their nature, scale and location will:

a) Avoid adverse effects on surface water bodies that are inconsistent with policies in section 3.2.3 of this Plan.

b) Not increase the adverse effects of flooding or erosion on neighbouring properties.

c) Ensure that any adverse effects of sediment on aquatic habitats are confined to a small area relative to the habitat as a whole or are temporary and the area will naturally re-establish habitat values comparable with those prevailing before commencement of the activity.

POLICY 6: TĀNGATA WHENUA USES AND VALUES

Ensure that the relationship of tāngata whenua as Kaitiaki with water is recognised and provided for to avoid significant adverse effects and remedy or mitigate cumulative adverse effects on:

a) The mauri of water;

b) Wāhi tapu sites; and

c) Other identified tāonga.

10.4 COMMENT ON NATIONAL AND REGIONAL POLICIES AND OBJECTIVES

The proposed upgrade to the WwTP will be consistent with these objectives and policies because the proposed and staged upgrade will:

- Continue to provide for the treatment of wastewater from the public wastewater network for the residents of Hahei, enabling them to continue to provide for their social and economic wellbeing whilst avoiding adverse effects on the environment;
- The proposal meets the requirements of the Waikato Regional Plan with regard to the water classes that the stream is classified under, namely Waikato Surface Water and Waikato Contact Recreation;
- The Hahei WwTP has achieved a level of compliance with its current resource consent. Further upgrades will result in a high quality of treated effluent;
- TCDC have proactively undertaken steps to improve the quality of the treated effluent;
- The discharge from the WwTP will not affect the ability for people to safely swim in the downstream sections of the Wigmore Stream; and
- Overall the activities of the Hahei WwTP will maintain or enhance the quality of the treated effluent being discharged in to the Wigmore Stream.

The above assessments, and the consideration of effects on the environment contained within section 9.0 of this report, demonstrate that the effects of the proposal will, overall, be minor. The proposal is therefore considered to have no significant adverse effect in terms of the purpose of the above objectives and policies, rules and assessment criteria.

10.5 RELEVANT THAMES COROMANDEL DISTRICT POLICIES AND OBJECTIVES

The Thames Coromandel District Plan controls the way land is used, developed, and subdivided in the District. Is helps determine where activities can take place in the District, under what restrictions, and what natural and cultural features should be protected.

10.5.1 OPERATIVE THAMES COROMANDEL DISTRICT PLAN

The operative district plant was publicly notified on the 22 March 1997. It became Operative in Part in 2007. Relevant objectives and policies are summarised below.

217 PUBLIC WORKS AND NETWORK UTILITIES

217.3 OBJECTIVES

1. To ensure public works and network utilities are established in a manner which does not have any major adverse effects on the environment.

217.4 POLICIES

1. To protect works and utilities that do not adversely affect the environment but enable the health, safety, and wellbeing of existing and future communities.
2. To ensure that public works and network utilities are placed underground, unless:

a) A natural or physical feature precludes the establishment or operation of the work or utility;

b) The operation and use of the work or utility can only be achieved above ground or is already existing;

c) The surrounding environment is likely to be adversely affected.

3. To ensure, as far as practicable, public works and network utilities are located in accordance with the character and amenity values of the area.

4. To ensure works and network utilities are delivered and utilised in a manner which promotes the social and economic wellbeing of the people, and communities they serve.

5. To ensure previous and current contributions towards Council provided works, utilities and facilities are taken into account.

6. To ensure monitoring plans and programmes identify settlements where water supply, wastewater disposal, stormwater disposal or refuse disposal are satisfactory or unsatisfactory and indicate the options for improving services in those settlements identified as having unsatisfactory services.

7. To ensure all subdivision and land use activities are adequately serviced with utilities and infrastructure.

220 WASTE MANAGEMENT

220.3 OBJECTIVES

1. To avoid, remedy or mitigate the adverse environmental effects of waste generation and disposal.

2. To minimise the quantity of wastes requiring disposal.

220.4 POLICIES

1. To ensure wastes are managed in accordance with the following hierarchy:

d) Reduce the amount of waste produced,

e) Reuse waste items where possible

f) Recycle waste materials where possible

g) Recover resources from waste where possible

h) Dispose of residual waste safely

2. To ensure waste treatment and disposal techniques avoid adverse effects on the environment.

3. To recognise the wide variety of methods available for managing waste and to enable their establishment where they meet environment standards, are suitable for the size and location of settlements, and are easily managed by private owners

4. To ensure land use activities maximise onsite retention and slow release of stormwater and ensure systems are in place which collect contaminates and sediment before stormwater is released into natural systems.

5. To ensure, when managing waste, that the tangata whenua values associated with papatuanuku and taonga are recognised.

331 RURAL ZONE

331.2 PURPOSE

Identifies that part of the district where:

1. Sustainable use and development of primary and other natural resources may be carried out to meet environmental standards for the zone with minimal Council intervention; and

2. Indigenous vegetation, wetlands and natural landforms are retained particularly where they contribute to landscape character amenity values, habitat continuity, connections to or between Conservation Zone and costal environment, backdrop to settlements, scenic corridors along roads and provide shade and protection along margins of rivers, streams and estuaries.

10.5.2 PROPOSED THAMES COROMANDEL DISTRICT PLAN

The proposed district plan covers objectives and policies in greater depth the operative plan. It is currently undergoing hearings relating to submissions received after notification. The objectives and policies relating to the WwTP discharge are summarised below.

SECTION 19 - UTILITIES

19.3 OBJECTIVES AND POLICIES

Objective 1
The social and economic benefits of network utilities are recognised and provided for while ensuring that their adverse effects are mitigated.

Policy 1a
New network utility infrastructure should not be located where they would be adversely affected by a natural hazard identified by a natural hazard overlay.

Policy 1b
The establishment, operation, maintenance and upgrading of network utilities shall be enabled whilst avoiding adverse effects on the costal environment, natural character and historic heritage.

Policy 1c
New network utility infrastructure shall be placed underground, unless:

a) A natural or physical feature precludes the establishment or operation of the underground network utility;

b) The operation and use of the network utility can only be achieved above ground or is already existing

c) The surrounding environment is likely to be adversely affected;

d) It is in the Rural Area, outside of the Costal Environment.

Policy 1e
Network utilities should be developed, operated, maintained, and upgraded to minimise nuisance effects such as noise, light, vibration, odour, or hazardous substances.

SECTION 24 – RURAL AREA

SECTION 24.3 OBJECTIVES AND POLICIES

Objective 1
A variety of land uses occur in the Rural Area without conflict, making efficient use of natural and physical resources.

Policy 1a
Primary production and rural industrial activities and other activities that have a functional need to locate in the Rural Zone should occur where adverse effects on rural character and the natural environment are remedied or mitigated.

Objective 2
The District's rural land resource is safeguarded for primary production.

Policy 2a
The scale and intensity of residential, commercial and industrial activates in the Rural Zone shall be limited to retain the availability and versatility of high class soils for primary production.

Objective 4
Subdivision, use, and development in the Rural Area maintains the rural character and amenity of the zone in which they are located.

Policy 4a
Subdivision, use, and development in the Rural Area should be in keeping with the character and amenity of the zone in which they are located. In particular they should not:

b) Generate significant increases in dust, odour, or other nuisance effects beyond those expected in the zone.

Policy 4b
Activities in the Rural Area shall be self-contained with regard to water, stormwater and wastewater servicing.

Policy 4d
Buildings and structures in the Rural Area should be sited in a manner and designed to a scale, density, and height which complement the character and amenity of the zone in which they are located. In particular they should:

a) Maintain the open space character of the Rural Area; and

b) Maintain amenity values in terms of scale, appearance, or density.

Policy 4e
Land use and development in the Rural Area shall be designed to minimise light spill at night.

SECTION 56 – RURAL ZONE

RULE 25 WASTEWATER TREATMENT PLANT, TREATED WASTE DISPOSAL SITE

1. An activity listed in Rule 25 is a discretionary activity provided:

    a) It meets the standards in Table 6 at the end of section 56; and

    b) In the Coastal Environment, it meets the specific standards in Table 7 at the end of section 56.

2. Any activity listed in Rule 25 that is not a discretionary activity under Rule 25.1 is a **non-complying activity.**

TABLE 6: STANDARDS	
Front yard	15m
Beachfront yard	7.5m
Conservation zone yard	25m
Maximum building height	8m
Maximum site coverage	10%
Maximum height in relation to boundary of the lot	2m and 45˚
Maximum lux level received at any point beyond the site, as measure vertically and horizontally	1 lux

SECTION 50 – OPEN SPACE ZONE

RULE 5 OTHER WATER, WASTEWATER, STORMWATER INFRASTRUCTURE

1. An activity listed in Rule 5 is a permitted activity provided the ground surface and any vegetation that has been disturbed are reinstated upon completion unless covered by a building or landscaping.

2. An activity that is not permitted under Rule 5.1 is a restricted discretionary activity.

3. The Council restricts its discretion to matters in 1, 2 and 3 in Table 5 at the end of section 50.

4. A resource consent application under Rule 5.2 shall be assess without public notification under section 95 and 95A of the RMA.

TABLE 5: RESTRICTED DISCRETIONARY MATTERS			
1	Effects of not meeting the standard(s)	a)	Whether actions (if any) taken to address the adverse effects of not meeting the standard(s) are effective.
2	Utility infrastructure provision and location (including easements) for water, wastewater, solids waste, stormwater, electricity, telecommunications.	a)	Whether the provision and location utility infrastructure on-site is appropriate given the natural hazard risk provisions.
		b)	Whether the activity should be connected to existing reticulation networks.
		c)	In Matarangi, the extent to which the utility infrastructure will retain established open space values.
		d)	Whether the proposed utility infrastructure can better reduce natural hazards and maintain open space by locating outside the Open Space Zone.
3	Natural hazard risk	a)	Whether the activity maintains or decreases the natural hazard risk to a tolerable or acceptable level.
		b)	The extent to which action to avoid or mitigate natural hazard risk are effective.

10.6 COMMENT ON DISTRICT PLAN POLICIES AND OBJECTIVES

The proposed upgrades to the WwTP are consistent with all the relevant objectives and policies in both the operative and proposed District Plans because:

- The WwTP plays an important function in the health and wellbeing of the population, and provides social benefits to the Hahei community, as recognised by section 19 of the proposed plan.
- The effects on the environment are minor, as discussed in section 9.0
- The level of treatment that the plant currently supplies and will continue to supply with the proposed upgrades, is to the highest standard economically feasible for the community.
- Discharged effluent is disposed of in a safely manner with minor adverse effects.
- The proposed upgrade will have no adverse effects on the soil for primary production, no increases in odour, and is physically sized for the surrounding area.
- The plant is fully compliant with the standards for a Rural Zone as outlined in Table 6 of section 56 in the proposed plan.
- As a restricted discretionary activity under the proposed plan, the activity satisfactorily meets the relevant discretionary matters outlined in Table 5 in section 50 of the proposed plan.
- Tangta Whenua will be consulted with as an affected person.

10.7 OTHER MATTERS

10.7.1 VALUE OF CONSENT HOLDER INVESTMENT

As this application is intended to replace a currently operative resource consent, and is being lodged at least 3 months in advance, an assessment on the value of the infrastructure is required. TCDC hold a record of assets and their value as required for annual reporting. The Hahei WwTP is currently valued at $934,000 and the proposed upgrades are expected to add an additional $200,000 in value (approximately).

10.7.2 WHAIA TE MAHERE TAIAO A HAURAKI

The Hauraki Iwi Environmental Plan Whaia te Mahere Taiao a Hauraki was written as a strategy for collective action for the wider Hauraki Iwi to sustain the natural environment and the region's cultural heritage.

The plan was developed by the Hauraki Maori Trust Board in conjunction with the Ministry of Environment's Sustainable Management Fund and Hauraki whānui. The central tenet of the plan is *kia mau ki te mauri o te Taiao o Hauraki*, let the mauri of Hauraki environment be retained.

The plan outlines a range of objectives pertaining to different themes of environmental management. The objectives relevant to this consent application are presented in Table 18 below.

TABLE 18: HAURAKI IWI MANAGEMENT OBJECTIVES RELEVANT TO THIS CONSENT APPLICATION

MANAGEMENT THEME		OBJECTIVE
Papatūānuku	b.	Riparian margins of rivers and streams in the Hauraki tribal region are protected and restored.
	d.	Sustainable land use and energy efficiency practices including safe disposal of contaminants, the reduction, reuse and recycling of waste is standard practice amongst Hauraki Whānui and local communities
	e.	The environmental risks of new, existing, and closed mines, quarries, and landfills and contaminated sites are significantly reduced.
Tangaroa rerenga wai māori	c.	To protect and restore wetland habitats and ecosystems in Hauraki tributary streams.
	d.	To restore and increase inanga spawning in Hauraki rivers.
	f.	To determine and achieve an acceptable 50% recovery rate for tuna and 'whitebait' fisheries.
Tangaroa rerenga wai tai	a.	Protect and restore coast, beach and estuarine habitats and ecosystems in the Hauraki tribal region.
	b.	To develop strategies for better co-ordination and integration with central and local government, the protection and management of the coast.
Ngā nekenekehanga	a.	Environmental performance is being reported annually as part of good corporate governance practice within Hauraki Whānui, government, local authorities and the wider community.
	c.	Hauraki Whānui are participating in environmental decision making at a central, regional, and local government levels and of their own accord.
	i.	To promote and encourage central and local government to contribute resources and support to the development and implementation of Iwi planning documents prepared by Hauraki Whānui.
	j.	Hauraki Whānui role is given effect to in policy, planning, consent, and monitoring processes under the Resource Management Act 1991.

The proposed upgrades and the renewal of the resource consent at the Hahei WwTP will be consistent with these objectives for the following reasons:

- The application acknowledges the need for a catchment wide approach to water quality management;
- The activities of the treatment plant provide safe disposal of contaminants. The option of reusing liquid streams of the plant through irrigation to land has been considered;

- The activities of the treatment plant are having a no more than minor effect on the Wigmore Stream. Future upgrades to the treatment plant will result in a reduction of the nutrient loads in the Wigmore Stream;
- The consent requires environmental monitoring and reporting pertaining to the water quality of the Wigmore Stream;
- Iwi are recognised in this consent application process as an important stakeholder and will be consulted accordingly; and
- By acknowledging Whaia te Mahere Taiao a Hauraki this application supports the implementation of Hauraki Iwi planning documents.

10.7.3 HAURAKI GULF MARINE PARK ACT 2000

As this application falls within the catchment of the Hauraki Gulf as defined by the Hauraki Gulf Marine Park Act 2000 (HGMPA), this Act is also considered to be relevant to the consideration of this application.

The HGMPA seeks to integrate the management of natural, physical and historic resources of the Gulf, its islands and catchment, and deems the protection of the Hauraki Gulf to be a matter of national importance. When considering an application for a resource consent within the Hauraki Gulf, section 9(4) of the Act requires a consent authority have regard to section 7 (which recognises the national significance of the Hauraki Gulf) and section 8 (which outlines objectives of management within the Hauraki Gulf). These provisions are concerned with the protection of the life-supporting capacity of the environment, the protection, and enhancement of natural and cultural resources of the Hauraki Gulf, and the protection of the cultural and historic associations of tāngata whenua.

Overall, it is considered that the proposal is not inconsistent with the HGMPA as the life supporting capacity of the Wigmore Stream is already impacted upon by non-point sources such as rural runoff. The resulting growth of exotic flora and fauna has an effect on the natural character of the stream, and therefore may be considered lacking. The WwTP works to treat discharge to the highest level economically feasible for the township, working to protect the natural resource of the stream and the Hauraki Gulf. Consultation has been undertaken with tāngata whenua to maximise protection of the cultural and historic beliefs.

11.0
RESOURCE MANAGEMENT ACT

11.1 PART 2 OF THE ACT

The application must be considered in relation to the purpose and principles of the Resource Management Act 1991 which are contained in sections 5 to 8 inclusive of the Act.

11.1.1 SECTION 5 - PURPOSE OF THE ACT

Section 5 in Part 2 of the Act identifies the purpose of the Act as being the sustainable management of natural and physical resources. This means managing the use of natural and physical resources in a way that enables people and communities to provide for their social, cultural and economic well-being while sustaining those resources for future generations, protecting the life supporting capacity of ecosystems, and avoiding, remedying or mitigating adverse effects on the environment.

It is considered that the proposal is in accordance with the purpose of the Act and will not have an adverse effect on the sustainable management of natural and physical resources. The effects of the proposal in terms of adverse effects on the environment are discussed in detail in section 9.0 of this report.

11.1.2 SECTION 6 - MATTERS OF NATIONAL IMPORTANCE

Section 6 of the Act sets out a number of matters of national importance, including:

a) The preservation of the natural character of the coastal environment (including the coastal marine area), wetlands, and lakes and rivers and their margins, and their protection from inappropriate subdivision, use, and development.

a) The protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development.

b) The protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna.

c) The maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers.

d) The relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu, and other tāonga.

e) The protection of historic heritage from inappropriate subdivision, use, and development.

f) The protection of recognised customary activities.

The proposal is not considered to affect any matters of national importance as it relates to an existing wastewater treatment plant and will result in a continued high level of treatment.

11.1.3 SECTION 7 - OTHER MATTERS

Section 7 identifies a number of "other matters" to be given particular regard to in the consideration of any assessment for resource consent, and includes:

a) Kaitiakitanga.

aa) The ethic of stewardship.

b) The efficient use and development of natural and physical resources.

ba) The efficiency of the end use of energy.

c) The maintenance and enhancement of amenity values.

g) Intrinsic values of ecosystems.

d) Maintenance and enhancement of the quality of the environment.

h) Any finite characteristics of natural and physical resources.

i) The protection of the habitat of trout and salmon.

j) The effects of climate change.

k) The benefits to be derived from the use and development of renewable energy.

The proposal is not considered to adversely affect any of these matters.

11.1.4 SECTION 8 – TREATY OF WAITANGI

Section 8 of the Act requires that the principals of the Treaty of Waitangi are taken into account by all persons exercising functions and powers under the Act. While the RMA does not define the principles of the Treaty, the Court of Appeal and Waitangi Tribunal propose the principals to include, early consultation in good faith, the principle of partnership, the need for active protection.

Section **Error! Reference source not found.** of this report discusses consultation with tāngata whenua. It is considered that the process undertaken to consult with Maori as part of this application is consistent with section 8 of the Act.

11.2 SUMMARY

Overall, and for the reasons stated above, the proposal is considered to be in accordance with the purpose and principles of the Act, as stated in sections 5 to 8 of Part 2.

12.0
CONSULTATION

Thames Coromandel District Council are renewing the existing consent application, with the only proposed upgrades timed to occur as population growth triggers additional capacity requirements. Therefore as the impact of the plant and proposed upgrades are minor TCDC are proposing that the consent renewal application be notified, limited to the list of affected parties discussed in Section 9.12.

TCDC have evaluated options for capacity upgrade to the plant and selected the option that provides acceptable effluent quality, with minor effects on the environment that is affordable for the community long term. However TCDC is open to different options should a potential submitter have an alternative solution.

TCDC intend to coincide the consultation period with the period of notification, and are looking to seek support from those nominated affected parties and key stakeholders.

13.0
PROPOSED CONDITIONS

13.1 GENERAL

1. The discharge of treated wastewater shall be operated and maintained in general accordance with the application and supporting information for this resource consent as provided in the following documents:

   a) the report "Thames Coromandel District Council, Hahei Wastewater Treatment Plant Resource Consent Application and Assessment of Effects on the Environment" dated January 2015 by Harrison Grierson Limited;

   subject to the resource consent conditions below, which shall prevail should any inconsistency occur between conditions and the above documents.

2. The consent holder shall ensure contractors are made aware of the conditions of this resource consent and ensure compliance with those conditions.

3. The treatment plant and discharge to the Wigmore Stream shall be managed and operated by an appropriately trained operator.

4. The consent holder shall pay to the Waikato Regional Council any administrative charge fixed in accordance with section 36 of the Resource Management Act 1991, or any charge prescribed in accordance with regulations made under section 360 of the Resource Management Act.

13.2 DISCHARGE LIMITS

5. The maximum volume of treated wastewater discharged to the Wigmore Stream shall not exceed 700 cubic metres in any 24 hour period.

6. The maximum discharge rate of treated wastewater to the Wigmore Stream shall not exceed 8.1 litres per second.

13.3 DISCHARGE QUALITY

7. The consent holder shall ensure that all waste entering, and treated in, the Hahei Wastewater Treatment Plant, goes through all stages of treatment available at the plant prior to discharge and that this include the Micro Filtration Unit.

8. The following limits shall apply to the discharge to the Wigmore Stream during the term of this consent:

Parameter	***90 percentile,*** *not more than one sample in each preceding 10 samples shall exceed:*	***Running average,*** *over any consecutive 10 samples shall not exceed:*
a) Suspended solids, (g/m^3)	20	10
b) Carbonaceous biochemical oxygen demand ($CBOD_5$), (g/m^3)	20	10
c) Escherichia coli, cfu/100ml	20	10
d) Total ammoniacal nitrogen, (g/m^3)	40	15
e) Total Kjeldahl Nitrogen, (g/m^3)	40	15
f) Total Phosphorus, (g/m^3)	20	14

9. Notwithstanding the stated limits in condition 8, the consent holder shall make all reasonable and practical efforts to ensure that final effluent quality is maximised within the capabilities of the treatment system in operation.

10. The point at which compliance with condition 8 of this consent shall be determined is from a grab sample taken at the point of discharge from the treatment plant and prior to discharge to the Wigmore Stream.

11. The discharge limits set out in condition 8 of this consent may be reviewed at any time following a period of continuous sampling and monitoring under condition 16 a) to h) of this consent that includes two complete periods of summer sampling (for the period from the start of third week of December to start of third week of February).

    Any review of the discharge limits shall be to determine whether the limits are reasonable to achieve with appropriate operation of the treatment plant. The discharge limits may be modified by approval in writing from the Waikato Regional Council at its discretion, following consultation by the consent holder with the Waikato Regional Council after provision of a written report by the consent holder on what changes are proposed to the discharge limits and technical justification for those changes.

13.4 METERING AND MONITORING

12. The consent holder shall ensure that a flow meter is available to record, on a continuous basis, the quantity of effluent discharged on a daily basis. The meter shall have a reliable calibration to flow, which shall be maintained to an accuracy of +/- 5%. Access to the meter shall be available to Waikato Regional Council staff at all reasonable times.

13. Calibration of the flow meter shall be undertaken by the consent holder, at the request of Waikato Regional Council, if during the term of this consent the accuracy is determined to be less than that required by condition 12. The calibration shall be undertaken by an independent qualified person and evidence documenting the calibration shall be forwarded to the Waikato Regional Council within one month of the calibration being completed.

14. The consent holder shall ensure that an alarm system is installed to operate in the event of any mechanical failure. The details of the alarm system shall be included within the operations and management plan as required by condition 23 of this consent.

15. In order to gather and analyse further information in relation to establishing a scientifically reliable calibration to flows in the Opitinui River the consent holder shall continue to maintain and monitor a flow recorder which shall as a minimum record Wigmore Stream flow in litres per second every 15 minutes at a suitable location upstream of the discharge authorised by this consent. The necessity for flow recording may be modified at any time following approval in writing from the Waikato Regional Council following a request in writing from the consent holder to do so. The approval process will consider a written report by the consent holder with data and explanation to show that sufficient flow monitoring of the Wigmore Stream has been obtained to achieve the intention of this condition.

13.5 DISCHARGE AND SURFACE WATER MONITORING

16. The consent holder shall measure and characterise the quality, quantity and variability of the treated effluent being discharged to the Wigmore Stream and

the effects of the discharge on the quality and variability of surface water. To this end, the consent holder shall, undertake sampling and analysis of the discharge and surface water as follows:

Frequency	*Sample Type and/or Location*	*Parameter to sample/record*
a) Every 15 minutes	➢ Wigmore Stream	➢ Water level, ➢ Instantaneous flow
b) Daily	➢ Treatment Plant	➢ Rainfall
c) Daily	➢ Discharge	➢ Volume ➢ Instantaneous flow ➢ Date and time of discharge (eg dd/mm/yy from 0800 hours to 1600 hours
d) Fortnightly in the period from the start of the third week in December to the start of the third week in February	➢ Inlet of MFU ➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream ➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road bridge Downstream samples to be collected within the period 1 hour either side of local low tide during daylight hours and while discharge is operating.	➢ Total Ammoniacal Nitrogen ➢ Escherichia coli ➢ Enterococci ➢ Conductivity ➢ pH ➢ Sample date and time ➢ Time of low tide occurrence closest to sample time
e) Monthly	➢ Inlet of MFU ➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream ➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road bridge Downstream samples to be collected within the period 1 hour either side of local low tide during daylight hours and while discharge is operating.	➢ Total Ammoniacal Nitrogen ➢ Escherichia coli ➢ Enterococci ➢ Conductivity ➢ pH ➢ Sample date and time ➢ Time of low tide occurrence closest to sample time

Frequency	*Sample Type and/or Location*	*Parameter to sample/record*
f) Every two months - every second sampling date to coincide with e)	➢ Inlet of MFU ➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream ➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road bridge Downstream samples to be collected within the period 1 hour either side of local low tide during daylight hours and while discharge is operating.	➢ $CBOD_5$ ➢ Nitrate Nitrogen ➢ Suspended solids ➢ Total Kjeldahl Nitrogen ➢ Soluble Reactive Phosphorus ➢ Total Phosphorus by Persulphate Digestion ➢ Turbidity ➢ Sample date and time ➢ Time of low tide occurrence closest to sample time
g) Once a year in January/ February	➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road Bridge. Downstream samples to be collected within the period 1 hour either side of local low tide during daylight hours and while discharge is operating.	Macroinvertebrate Community Index Sample date and time Time of low tide occurrence closest to sample time
h) Once a year in January/ February	➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream; series of samples collected at hourly intervals over a full 24 hour period	Escherichia coli Enterococci Sample date

17. The monitoring programme set out in condition 16 a) to f) inclusive of this consent may be modified at any time following a minimum period of monitoring that includes complete data from two periods of summer sampling (for the period from the start of third week of December to start of third week of February) as well as all sampling required outside of peak periods since the commencement of this consent. Any review of the monitoring programme shall be to determine whether the monitoring programme is adequate to characterise the discharge and to identify effects of the discharge on the Wigmore Stream. The monitoring programme may be modified following approval in writing from the Waikato Regional Council. This approval process shall consider a written report by the consent holder on what changes are proposed to the monitoring programme and the technical justification for those changes.

18. All samples taken in relation to monitoring under this consent shall be undertaken by a suitably qualified and experienced person(s) with relevant training in the taking and transporting of water quality samples and in accordance with the Monitoring Implementation Plan titled "Wastewater Sampling at Hahei WWTP and Wigmore Stream" by United Water, dated 1-04-2009 (Environment Waikato document number 1472702), or any subsequent update. This plan shall detail methods and map locations for how, when and where sampling will take place and shall be updated, as a minimum every 2 years, or more often if any method or location changes. The Waikato Regional Council shall be provided with an updated copy of the Monitoring Implementation Plan within a month of any update to the plan.

19. All sample analyses shall be undertaken in accordance with the methods detailed in the "Standard Methods For The Examination Of Water And Waste Water, 2005" 21st edition by A.P.H.A. and A.W.W.A. and W.E.F., or any other method approved in advance by the Waikato Regional Council.

13.6 PERIODIC REPORTING

20. The consent holder shall provide to the Waikato Regional Council a data report by 1 December each year that this consent is current. This report shall include all data collected under conditions 15 and 16 of this consent for the period 1 April to 30 September of the current year and shall identify any noncompliance within that period.

21. The consent holder shall provide to the Waikato Regional Council a written monitoring report by 1 June each year that this consent is current for the 12 month period of 1 April of the preceding year to 31 March of the current year. As a minimum this report shall include the following:

    a) A summary of the monitoring results required by conditions 15 and 16 of this consent for the 12 month period of 1 April of the preceding year to 31 March of the current year and a critical analysis of the information in terms of compliance and environmental effects;

    b) A comparison of data with previously collected data identifying any emerging trends;

    c) Comment on compliance, and any reasons for non-compliance or difficulties in achieving compliance, with condition 8 of this consent;

    d) Comment on any works that have been undertaken, or that are proposed to be undertaken in the up-coming year, to improve the environmental performance of the treatment and/or disposal system;

    e) Report on and discuss any complaints received regarding the treatment and/or discharge of treated effluent; and

    f) Any other issues considered important by the consent holder.

13.7 CONTINGENCY PLAN

22. The consent holder shall engage appropriately experienced persons to compile an updated plan that details contingency measures that will be put in place in the event of any bypasses, other extraordinary events or failure of any critical part of the treatment plant. This plan shall identify measures and notification protocols to be undertaken by the consent holder that will take into account any potential adverse effects on the Wigmore Stream and users, including but not limited to ecological effects, downstream recreational use, and the Medical Officer of Health. This plan shall be provided to the Waikato Regional Council within 3 months of the commencement of this consent to a standard acceptable to the Waikato Regional Council. Subsequently this contingency plan shall be updated at three yearly intervals with updated copies supplied to the Waikato Regional Council.

13.8 MANAGEMENT PLAN

23. The consent holder shall provide the Waikato Regional Council with an updated management plan which details the procedures that will be implemented to operate in accordance with the conditions of this resource consent and the procedures that will be put into place to maximise wastewater treatment and minimise odour production. This plan shall be lodged with the Waikato Regional Council within 3 months of the commencement of this consent, and shall be reviewed and updated as a minimum annually. The plan shall address, but may not be limited to, the following:

    a) a description of the entire treatment and disposal system facility and how it is operated;

    b) a description of routine maintenance procedures to be undertaken;

    c) an outline of the methods to be utilised to monitor the treatment plant in an operational sense including: monitoring of influent waste water and monitoring of treatment performance;

d) a description of the methods to be used to ensure that sampling of the discharge as required by condition 16 of this consent is representative of overall discharge quality;

e) specific management procedures for the efficient functioning of the treatment system including Micro Filtration Unit, including measures to ensure compliance with condition 8 of this consent relating to discharge quality parameters;

f) procedures for recording routine maintenance and all repairs that are undertaken;

g) contingency measures in place to deal with unusual events;

h) chain of command and responsibility, including contact details;

i) other actions necessary to comply with the requirements of this resource consent;

j) procedures for improving and/or reviewing the management plan.

24. The consent holder shall manage the wastewater treatment and discharge in accordance with the management plan referred to in condition 22 of this consent. Any changes to the management plan shall be advised to the Waikato Regional Council in writing after consultation between the consent holder and the Waikato Regional Council.

13.9 UNAUTHORISED DISCHARGE

25. The consent holder shall notify the Waikato Regional Council as soon as practicable, and as a minimum requirement within 72 hours, of any discharge to Wigmore Stream from a source that has bypassed any part of the treatment system. The consent holder shall, within 7 days of the discharge occurring, provide a written report to the Waikato Regional Council, identifying the extent of the discharge, possible causes, steps undertaken to remedy the effects of the discharge and measures that will be undertaken to ensure future compliance with this consent.

13.10 ODOUR

26. The operation of the wastewater treatment plant shall be carried out in such a way that the potential for odours is kept to a practicable minimum. The activities authorised by this resource consent shall be undertaken in such a manner that they do not produce an objectionable odour at or beyond the outer boundary of the land to which this resource consent relates.

27. Should an event occur which results in an objectionable or offensive odour, the consent holder shall provide written information on the odour incident including all of the details required by the complaints register of the site as outlined in condition 28 of this consent. This information shall be forwarded to the Waikato Regional Council within 5 days of the complaint being received.

13.11 COMPLAINTS

28. The consent holder shall maintain and keep a complaints register for all complaints, including odour, discharge, and water quality complaints regarding operations at the site received by the consent holder. The register shall record:

a) the date, time and duration of the event that has resulted in a complaint,

b) any corrective action undertaken by the consent holder in response to the complaint, including actions taken to prevent similar events in the future.

c) the location of the complainant when the event was detected,

d) the possible cause of the event, and

e) the weather conditions and wind direction at the site when the event allegedly occurred.

29. The register outlined in condition 28 shall be available to the Waikato Regional Council at all reasonable times. Waikato Regional Council shall be informed of complaints received by the consent holder which may infer non-compliance with the conditions of this resource consent to the Waikato Regional Council within 24 hours of the complaint being received. In addition, the consent holder shall provide written information on the incident including all of the details required by (a) to (e) of condition 29 of this consent, which shall be forwarded to the Waikato Regional Council within 5 days of the complaint being received

13.12 WIGMORE STREAM MOUTH

30. The consent holder shall be responsible to ensure that the Wigmore Stream, from the treated effluent discharge point to its mouth, is kept clear of debris and that the stream mouth is not blocked by sand, to the extent that the flow of the Wigmore Stream is unimpeded into the coastal marine area. The consent holder's obligations in respect of this condition are limited to the works that can be undertaken without the need for resource consent under the relevant rule(s) of the Waikato Regional Coastal Plan.

13.13 REVIEW

31. The Waikato Regional Council may, within the six month period following receipt of the monitoring information required by conditions 15 and 16 of this consent, serve notice on the consent holder under section 128(1) of the Resource Management Act 1991 and commence a review of the conditions of this resource consent for the purpose of reviewing the compliance limit(s) of any contaminant and/or, if necessary and appropriate, to require the holder of this resource consent to adopt the best practicable option to remove or reduce adverse effects on surface water quality or ecology due to the discharge.

32. The Waikato Regional Council may, within the year of the second, fourth and sixth anniversary of the commencement of this consent, serve notice on the consent holder under section 128 (1) of the Resource Management Act 1991, of its intention to review the conditions of this resource consent for the following purposes:

a) To review the effectiveness of the conditions of this resource consent in avoiding or mitigating any adverse effects on ground or surface water quality from the exercise of this resource consent and if necessary to avoid, remedy or mitigate such effects by way of further or amended conditions; or

a) If necessary and appropriate, to require the holder of this resource consent to adopt the best practicable option to remove or reduce adverse effects on surface water quality due to the discharge; or

b) To review the adequacy of and the necessity for monitoring undertaken by the consent holder.

Costs associated with any review of the conditions of this resource consent will be recovered from the consent holder in accordance with the provisions of section 36 of the Resource Management Act 1991.

13.14 ACCESS

33. This resource consent is granted by the Waikato Regional Council subject to its officers or agents being permitted access to the property at all reasonable times for the purpose of carrying out inspections, surveys, investigations, tests, measurements or taking samples.

14.0 CONCLUSION

The applicant seeks resource consent to continue to discharge treated effluent from the Hahei Wastewater Treatment Plant to the Wigmore Stream, with the proposed upgrades occurring during the proposed period of consent, timed with population growth.

In terms of section 95, the adverse effects of the proposal on the environment are considered to be *minor* as discussed in Section **9.0** of this report and the application should proceed on a limited notified basis, with notice served to the parties listed in section 9.12of this report.

In terms of section 104(1)(a), the adverse effects of the proposal will be *minor* The proposal is also not contrary to the relevant objectives, policies and assessment criteria of the Regional Plan in terms of section 104(1)(b).

Hence, in accordance with section 104B of the Act, it is considered appropriate for consent to be granted subject to fair and reasonable conditions.

15.0 LIMITATIONS

15.1 GENERAL

This report is for the use by Thames Coromandel District Council only, and should not be used or relied upon by any other person or entity or for any other project.

This report has been prepared for the particular project described to us and its extent is limited to the scope of work agreed between the client and Harrison Grierson Consultants Limited. No responsibility is accepted by Harrison Grierson Consultants Limited or its directors, servants, agents, staff or employees for the accuracy of information provided by third parties and/or the use of any part of this report in any other context or for any other purposes.

APPENDIX 1
RESOURCE CONSENT 117888

APPENDIX 1
RESOURCE CONSENT 117888

Resource Consent Certificate

Resource Consent: 117888

File Number: 60 25 05A

Pursuant to the Resource Management Act 1991, the Waikato Regional Council hereby grants consent to:

Thames Coromandel District Council
Private Bag
Thames 3540

(hereinafter referred to as the Consent Holder)

Consent Type:	Discharge permit
Consent Subtype:	Discharge to water
Activity authorised:	Discharge up to 700 cubic metres per day of treated municipal wastewater from the Hahei WWTP into the Wigmore Stream
Location:	Pa Rd - Hahei
Map Reference:	NZMS 260 T11:607-802
Consent duration:	This consent will commence on the date of decision notification and expire on 31 December 2015

Subject to the conditions overleaf:

CONDITIONS

General

1. The discharge of treated wastewater shall be operated and maintained in general accordance with the application and supporting information for this resource consent as provided in the following documents:
   a) the report "Thames Coromandel District Council, Hahei WWTP Resource Consent Application" dated January 2008 by GHD Limited;
   subject to the resource consent conditions below, which shall prevail should any inconsistency occur between conditions and the above documents.

2. The consent holder shall ensure contractors are made aware of the conditions of this resource consent and ensure compliance with those conditions.

3. The treatment plant and discharge to the Wigmore Stream shall be managed and operated by an appropriately trained operator.

4. The consent holder shall pay to the Waikato Regional Council any administrative charge fixed in accordance with section 36 of the Resource Management Act 1991, or any charge prescribed in accordance with regulations made under section 360 of the Resource Management Act.

Discharge Limits

5. The maximum volume of treated wastewater discharged to the Wigmore Stream shall not exceed 700 cubic metres in any 24 hour period.

6. The maximum discharge rate of treated wastewater to the Wigmore Stream shall not exceed 8.1 litres per second.

Discharge Quality

7. The consent holder shall ensure that all waste entering, and treated in, the Hahei Wastewater Treatment Plant, goes through all stages of treatment available at the plant prior to discharge and that this include the Micro Filtration Unit.

8. The following limits shall apply to the discharge to the Wigmore Stream during the term of this consent:

Parameter	***90 percentile,*** *not more than one sample in each preceding 10 samples shall exceed:*	***Running average,*** *over any consecutive 10 samples shall not exceed:*
a) Suspended solids, (g/m^3)	20	10
b) Carbonaceous biochemical oxygen demand ($CBOD_5$), (g/m^3)	20	10
c) Escherichia coli, cfu/100ml	20	10
d) Total ammoniacal nitrogen, (g/m^3)	40	15
e) Total Kjeldahl Nitrogen, (g/m^3)	40	15
f) Total Phosphorus, (g/m^3)	20	14

9. Notwithstanding the stated limits in condition 8, the consent holder shall make all reasonable and practical efforts to ensure that final effluent quality is maximised within the capabilities of the treatment system in operation.

10. The point at which compliance with condition 8 of this consent shall be determined is from a grab sample taken at the point of discharge from the treatment plant and prior to discharge to the Wigmore Stream.

11. The discharge limits set out in condition 8 of this consent may be reviewed at any time following a period of continuous sampling and monitoring under condition 16 a) to h) of this

consent that includes two complete periods of summer sampling (for the period from the start of third week of December to start of third week of February). Any review of the discharge limits shall be to determine whether the limits are reasonable to achieve with appropriate operation of the treatment plant. The discharge limits may be modified by approval in writing from the Waikato Regional Council at its discretion, following consultation by the consent holder with the Waikato Regional Council after provision of a written report by the consent holder on what changes are proposed to the discharge limits and technical justification for those changes.

Metering and Monitoring

12. The consent holder shall ensure that a flow meter is available to record, on a continuous basis, the quantity of effluent discharged on a daily basis. The meter shall have a reliable calibration to flow, which shall be maintained to an accuracy of +/- 5%. Access to the meter shall be available to Waikato Regional Council staff at all reasonable times.

13. Calibration of the flow meter shall be undertaken by the consent holder, at the request of Waikato Regional Council, if during the term of this consent the accuracy is determined to be less than that required by condition 12. The calibration shall be undertaken by an independent qualified person and evidence documenting the calibration shall be forwarded to the Waikato Regional Council within one month of the calibration being completed.

14. The consent holder shall ensure that an alarm system is installed to operate in the event of any mechanical failure. The details of the alarm system shall be included within the operations and management plan as required by condition 24 of this consent.

15. Within 3 months of the commencement of this consent the consent holder shall install a flow recorder which shall as a minimum record Wigmore Stream flow in litres per second every 15 minutes at a suitable location upstream of the discharge authorised by this consent. The data logger shall be linked by telemetry to the Waikato Regional Council. It shall be cross referenced to the Waikato Regional Council flow recorder located on the Opitonui River downstream of Awaroa Stream Confluence (Environment Waikato Site Number 660.1 – Map Reference NZMS 260: T11:428-883). The necessity for flow recording may be modified at any time following approval in writing from the Waikato Regional Council following a request in writing from the consent holder to do so. The approval process will consider a written report by the consent holder with data and explanation to show that sufficient flow monitoring of the Wigmore Stream has been obtained to have a scientifically reliable calibration to flows in the Opitonui River.

Discharge and Surface Water Monitoring

16. The consent holder shall measure and characterise the quality, quantity and variability of the treated effluent being discharged to the Wigmore Stream and the effects of the discharge on the quality and variability of surface water. To this end, the consent holder shall, undertake sampling and analysis of the discharge and surface water as follows:

Frequency	*Sample Type and/or Location*	*Parameter to sample/record*
a) Every 15 minutes	➢ Wigmore Stream	➢ Water level, ➢ Instantaneous flow
b) Daily	➢ Treatment Plant	➢ Rainfall
c) Daily	➢ Discharge	➢ Volume ➢ Instantaneous flow ➢ Date and time of discharge (eg dd/mm/yy from 0800 hours to 1600 hours
d) Weekly in the period from the start of the third week in December to the start of the third week in February	➢ Inlet of MFU ➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream ➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road bridge Downstream samples to be collected within the period 1 hour either side of local low tide during daylight hours and while discharge is operating.	➢ Total Ammoniacal Nitrogen ➢ Escherichia coli ➢ Enterococci ➢ Conductivity ➢ pH ➢ Sample date and time ➢ Time of low tide occurrence closest to sample time
e) Monthly	➢ Inlet of MFU ➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream ➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road bridge Downstream samples to be collected within the period 1 hour either side of local low tide during daylight hours and while discharge is operating.	➢ Total Ammoniacal Nitrogen ➢ Escherichia coli ➢ Enterococci ➢ Conductivity ➢ pH ➢ Sample date and time ➢ Time of low tide occurrence closest to sample time

Frequency	*Sample Type and/or Location*	*Parameter to sample/record*
f) Every two months - every second sampling date to coincide with e)	➢ Inlet of MFU ➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream ➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road bridge Downstream samples to be collected within the period 1 hour either side of local low tide during daylight hours and while discharge is operating.	➢ $CBOD_5$ ➢ Nitrate Nitrogen ➢ Suspended solids ➢ Total Kjeldahl Nitrogen ➢ Soluble Reactive Phosphorus ➢ Total Phosphorus by Persulphate Digestion ➢ Turbidity ➢ Sample date and time ➢ Time of low tide occurrence closest to sample time
g) Every four months – to coincide with e) and f)	➢ Wigmore Stream 50m upstream of discharge ➢ Wigmore Stream downstream at Pa Road bridge	➢ Macroinvertebrate Community Index ➢ Sample date and time ➢ Time of low tide occurrence closest to assessment time
h) Once per year in January	➢ Discharge, following all treatment stages and prior to entering the Wigmore Stream; series of samples collected at hourly intervals over a full 24 hour period	➢ Escherichia coli ➢ Enterococci ➢ Sample date

17. The monitoring programme set out in condition 16 a) to h) inclusive of this consent may be modified at any time following a minimum period of monitoring that includes complete data from two periods of summer sampling (for the period from the start of third week of December to start of third week of February) as well as all sampling required outside of peak periods since the commencement of this consent. Any review of the monitoring programme shall be to determine whether the monitoring programme is adequate to characterise the discharge and to identify effects of the discharge on the Wigmore Stream. The monitoring programme may be modified following approval in writing from the Waikato Regional Council. This approval process shall consider a written report by the consent holder on what changes are proposed to the monitoring programme and the technical justification for those changes. Prior to supplying this written report the consent holder shall seek comment from (submitters) Ron Egan and John North on the proposed changes and provide any comment received to the Waikato Regional Council.

18. All samples taken in relation to monitoring under this consent shall be undertaken by a suitably qualified and experienced person(s) with relevant training in the taking and transporting of water quality samples and in accordance with the Monitoring Implementation Plan titled "Wastewater Sampling at Hahei WWTP and Wigmore Stream" by United Water, dated 1-04-2009 (Environment Waikato document number 1472702), or any subsequent update. This plan shall detail methods and map locations for how, when and where sampling will take place and shall be updated, as a minimum every 2 years, or more often if any method or location changes. The Waikato Regional Council shall be provided with an updated copy of the Monitoring Implementation Plan within a month of any update to the plan.

19. All sample analyses shall be undertaken in accordance with the methods detailed in the "Standard Methods For The Examination Of Water And Waste Water, 2005" 21st edition by A.P.H.A. and A.W.W.A. and W.E.F., or any other method approved in advance by the Waikato Regional Council.

Periodic Reporting

20. The consent holder shall provide to the Waikato Regional Council a data report by 1 December each year that this consent is current. This report shall include all data collected under conditions 15 and 16 of this consent for the period 1 April to 30 September of the current year and shall identify any non compliance within that period.

21. The consent holder shall provide to the Waikato Regional Council a written monitoring report by 1 May each year that this consent is current for the 12 month period of 1 April of the preceeding year to 31 March of the current year. As a minimum this report shall include the following:
    a) A summary of the monitoring results required by conditions 15 and 16 of this consent for the 12 month period of 1 April of the preceeding year to 31 March of the current year and a critical analysis of the information in terms of compliance and environmental effects;
    b) A comparison of data with previously collected data identifying any emerging trends;
    c) Comment on compliance, and any reasons for non-compliance or difficulties in achieving compliance, with condition 8 of this consent;
    d) Comment on any works that have been undertaken, or that are proposed to be undertaken in the up-coming year, to improve the environmental performance of the treatment and/or disposal system;
    e) Report on and discuss any complaints received regarding the treatment and/or discharge of treated effluent; and
    f) Any other issues considered important by the consent holder.

Contingency Plan

22. The consent holder shall engage appropriately experienced persons to compile a plan that details contingency measures that will be put in place in the event of any bypasses, other extraordinary events or failure of any critical part of the treatment plant. This plan shall identify measures and notification protocols to be undertaken by the consent holder that will take into account any potential adverse effects on the Wigmore Stream and users, including but not limited to ecological effects, downstream recreational use, and the Medical Officer of Health. This plan shall be provided to the Waikato Regional Council within 3 months of the commencement of this consent to a standard acceptable to the Waikato Regional Council. Subsequently this contingency plan shall be updated at three yearly intervals with updated copies supplied to the Waikato Regional Council.

Effects Investigations Monitoring and Reporting

23. The consent holder shall measure and characterise the effects of the discharge, and including in particular the contaminant ammonia, on the water quality, aquatic life and ecology of the Wigmore Stream and shall in particular consider the effects when the Wigmore Stream is at or below mean annual low flow. To this end, the consent holder shall retain a suitably qualified person or persons to prepare and undertake an ecological survey and investigation of the Wigmore Stream. The survey and investigation scope, including appropriate seasonal survey timing, shall be provided to Environment Waikato within 3 months of the commencement of this consent for approval. The basis for approval shall be limited to an assessment of whether the plan, if complied with, will satisfy this condition of consent and is in accordance with best practice. The investigation shall determine the current ecological health of the Wigmore Stream, the causes of any degradation of the stream, and shall identify and quantify the effects of the discharge authorised by this consent on the Wigmore Stream and downstream coastal waters. The survey and investigation shall be carried out at the next appropriate seasonal timing occurrence as approved in the survey scope and repeated every 3 years for the duration of this resource consent. The consent holder shall report all the results and findings of each investigation required by this condition to the Waikato Regional Council in writing within two months of the completion of the survey and investigation.

Management Plan

24. The consent holder shall provide the Waikato Regional Council with a management plan which details the procedures that will be implemented to operate in accordance with the conditions of

this resource consent and the procedures that will be put into place to maximise wastewater treatment and minimise odour production. This plan shall be lodged with the Waikato Regional Council within 3 months of the commencement of this consent, and shall be reviewed and updated as a minimum annually. The plan shall address, but may not be limited to, the following:

a) a description of the entire treatment and disposal system facility and how it is operated;
b) a description of routine maintenance procedures to be undertaken;
c) an outline of the methods to be utilised to monitor the treatment plant in an operational sense including: monitoring of influent waste water and monitoring of treatment performance;
d) a description of the methods to be used to ensure that sampling of the discharge as required by condition 16 of this consent is representative of overall discharge quality;
e) specific management procedures for the efficient functioning of the treatment system including Micro Filtration Unit, including measures to ensure compliance with condition 8 of this consent relating to discharge quality parameters;
f) procedures for recording routine maintenance and all repairs that are undertaken;
g) contingency measures in place to deal with unusual events;
h) chain of command and responsibility, including contact details;
i) other actions necessary to comply with the requirements of this resource consent;
j) procedures for improving and/or reviewing the management plan.

25. The consent holder shall manage the wastewater treatment and discharge in accordance with the management plan referred to in condition 24 of this consent. Any changes to the management plan shall be advised to the Waikato Regional Council in writing after consultation between the consent holder and the Waikato Regional Council.

Unauthorised Discharge

26. The consent holder shall notify the Waikato Regional Council as soon as practicable, and as a minimum requirement within 24 hours, of any discharge to Wigmore Stream from a source that has bypassed any part of the treatment system. The consent holder shall, within 7 days of the discharge occurring, provide a written report to the Waikato Regional Council, identifying the extent of the discharge, possible causes, steps undertaken to remedy the effects of the discharge and measures that will be undertaken to ensure future compliance with this consent.

Odour

27. The operation of the wastewater treatment plant shall be carried out in such a way that the potential for odours is kept to a practicable minimum. The activities authorised by this resource consent shall be undertaken in such a manner that they do not produce an objectionable odour at or beyond the outer boundary of the land to which this resource consent relates.

    Note: Chapter 6.4 of the Waikato Regional Plan provides guidance on the assessment of the effect of odour and dust emissions.

28. Should an event occur which results in an objectionable or offensive odour, the consent holder shall provide written information on the odour incident including all of the details required by the complaints register of the site as outlined condition 29 of this consent. This information shall be forwarded to the Waikato Regional Council within 5 days of the complaint being received.

Complaints

29. The consent holder shall maintain and keep a complaints register for all complaints, including odour, discharge and water quality complaints regarding operations at the site received by the consent holder. The register shall record:
    a) the date, time and duration of the event that has resulted in a complaint,

b) any corrective action undertaken by the consent holder in response to the complaint, including actions taken to prevent similar events in the future.
c) the location of the complainant when the event was detected,
d) the possible cause of the event, and
e) the weather conditions and wind direction at the site when the event allegedly occurred.

30. The register outlined in condition 29 shall be available to the Waikato Regional Council at all reasonable times. Waikato Regional Council shall be informed of complaints received by the consent holder **which may infer non-compliance** with the conditions of this resource consent to the Waikato Regional Council within 24 hours of the complaint being received. In addition, the consent holder shall provide written information on the incident including all of the details required by (a) to (e) of condition 29 of this consent, which shall be forwarded to the Waikato Regional Council within 5 days of the complaint being received

Wigmore Stream Mouth

31. The consent holder shall be responsible to ensure that the Wigmore Stream, from the treated effluent discharge point to its mouth, is kept clear of debris and that the stream mouth is not blocked by sand, to the extent that the flow of the Wigmore Stream is unimpeded into the coastal marine area. The consent holder's obligations in respect of this condition are limited to the works that can be undertaken without the need for resource consent under the relevant rule(s) of the Waikato Regional Coastal Plan.

Upgrade Reporting

32. The consent holder shall provide a written report on or before the third and fifth anniversaries of the commencement of this consent that shall outline:
    a) What investigations have been undertaken to date to identify suitable treatment and disposal options for wastewater at Hahei upon the expiry of this consent;
    b) What investigations have been undertaken or identified in relation to potential effects of disposal options being considered for wastewater at Hahei upon the expiry of this consent;
    c) What consultation has been undertaken in relation to potential treatment and disposal options for wastewater at Hahei upon the expiry of this consent.

Review

33. The Waikato Regional Council may, within the six month period following receipt of the monitoring information required by condition 23 of this consent, serve notice on the consent holder under section 128(1) of the Resource Management Act 1991 and commence a review of the conditions of this resource consent for the purpose of reviewing the compliance limit(s) of any contaminant and/or, if necessary and appropriate, to require the holder of this resource consent to adopt the best practicable option to remove or reduce adverse effects on surface water quality or ecology due to the discharge.

34. The Waikato Regional Council may, within the year of the second, fourth and sixth anniversary of the commencement of this consent, serve notice on the consent holder under section 128 (1) of the Resource Management Act 1991, of its intention to review the conditions of this resource consent for the following purposes:
    a) To review the effectiveness of the conditions of this resource consent in avoiding or mitigating any adverse effects on ground or surface water quality from the exercise of this resource consent and if necessary to avoid, remedy or mitigate such effects by way of further or amended conditions; or
    b) If necessary and appropriate, to require the holder of this resource consent to adopt the best practicable option to remove or reduce adverse effects on surface water quality due to the discharge; or
    c) To review the adequacy of and the necessity for monitoring undertaken by the consent holder.

Costs associated with any review of the conditions of this resource consent will be recovered from the consent holder in accordance with the provisions of section 36 of the Resource Management Act 1991.

Access

35. This resource consent is granted by the Waikato Regional Council subject to its officers or agents being permitted access to the property at all reasonable times for the purpose of carrying out inspections, surveys, investigations, tests, measurements or taking samples.

In terms of S116 of the Resource Management Act 1991, this consent commences on 12th June 2009

Dated at Hamilton this ***23rd*** *day of* ***June 2009***

For and on behalf of the
Waikato Regional Council

.....

Advice notes

1. In accordance with section 125 RMA, this consent shall lapse five (5) years after the date on which it was granted unless it has been given effect to before the end of that period.
2. Where a resource consent has been issued in relation to any type of construction (e.g. dam, bridge, jetty) this consent does not constitute authority to build and it may be necessary to apply for a Building Consent from the relevant territorial authority.
3. This resource consent does not give any right of access over private or public property. Arrangements for access must be made between the consent holder and the property owner.
4. This resource consent is transferable to another owner or occupier of the land concerned, upon application, on the same conditions and for the same use as originally granted (s.134-137 RMA).
5. The consent holder may apply to change the conditions of the resource consent under s.127 RMA.
6. The reasonable costs incurred by Waikato Regional Council arising from supervision and monitoring of this/these consents will be charged to the consent holder. This may include but not be limited to routine inspection of the site by Waikato Regional Council officers or agents, liaison with the consent holder, responding to complaints or enquiries relating to the site, and review and assessment of compliance with the conditions of consents.
7. If you intend to replace this consent upon its expiry, please note that an application for a new consent made at least 6 months prior to this consent's expiry gives you the right to continue exercising this consent after it expires in the event that your application is not processed prior to this consent's expiry.

APPENDIX 2
ECOLOGICAL ASSESSMENT

Thames-Coromandel District Council

Hahei Wastewater Treatment Plant
Assessment of Ecological Effects

KesselsEcology
SURVEY, ASSESSMENT AND RESTORATION

Table of Contents

Appendix III Proposed Criteria for Determining Significance of Indigenous Biodiversity- Proposed Waikato Regional Policy Statement

Appendix IV Standards for Contact Recreation and Surface Water Classes, Waikato Reigonal Plan

Prepared by: Dr Jennifer Price

Reviewed by: Brenda Bartels, David Riddell and Gerry Kessels

PWF Ref: TCDC.00305

Version: DRAFT I

Executive Summary

Background

The Hahei Wastewater Treatment Plant (WWTP) currently discharges treated effluent to the Wigmore Stream, approximately 1 km upstream from Hahei Beach. The current consent for the discharge of treated domestic wastewater from the Hahei WWTP plant to the Wigmore Stream expires on 31 December 2015. As part of the consent application, Kessels Ecology was contracted by Thames-Coromandel District Council (TCDC) to provide an Assessment of Effects on Ecology of the Hahei WWTP discharge on the receiving environment, including options for avoiding, remedying and mitigating any adverse effects and suggestions for future monitoring. The ecological assessment was based on the following:

- Ecological surveys of Wigmore Stream including collection and analysis of macroinvertebrate and water quality samples and habitat parameters; and
- A review of all relevant literature and databases.

Methods

Field surveys of water quality and aquatic habitat were carried out upstream and downstream of the WWTP discharge to assess effects of the discharge, the current ecological state of the area and identify sensitive species in the receiving environment.

Existing databases and literature were reviewed to ascertain the characteristics of flora and fauna habitats within the study area, particularly threatened species within the Wigmore Stream and coastal area immediately downstream.

Ecological Features

Wigmore Stream near the WWTP is a soft-bottomed, slow-flowing waterway that is influenced by saltwater intrusion which extends to the upstream site at times. Water quality in Wigmore Stream near the WWTP is influenced by inputs of sediment, nutrients and microbes from pastoral and residential land use in the catchment. Background concentrations of ammoniacal-N, suspended sediment and *E. coli* are high.

Water quality measurements taken by Veolia upstream and downstream of the WWTP were compared to National Objectives Framework and WRC guidelines. Peak ammoniacal-N concentrations in January were within the NOF “C” band at both sites, indicating the potential for moderate stress on sensitive fish and macroinvertebrate taxa Nitrate measurements were within the “A” band at both sites, indicating that toxic effects of nitrate are very unlikely to be present. Total nitrogen was within Waikato Regional Council’s (WRC) “Satisfactory” guideline at both sites.

E. coli concentrations were higher on average at the upstream site compared to the downstream site. The median measurement at the upstream site was within the “D” band, meaning that the site is not suitable for secondary contact recreation (boating and wading) due to a high risk of gastroenteritis (>5%). The median at the downstream site was within the “C” band, indicating a moderate risk of gastroenteritis (1.0-5.0%) from secondary exposure.

Median phosphorus concentrations were well within the WRC “Satisfactory” levels for ecosystem health, both upstream and downstream of the WWTP.

Water clarity in Wigmore Stream is influenced by the tidal turbidity maximum as well as inputs of sediment from the catchment.

Macrophytes were not observed during our surveys of Wigmore Stream, likely due to the periodically high salinity. Periphyton was only observed at very low levels on some sampling occasions, which is not surprising given high turbidity and lack of stable substrates.

Aquatic macroinvertebrate communities showed variability among seasons, reflecting the amount of freshwater flow and salt water intrusion. There were no consistent differences between the upstream and downstream site that would suggest an effect of the WWTP,

though marine species are more common at the downstream site. Fish communities were also influenced by saltwater intrusion, and were fairly similar between the upstream and downstream sites, with more marine species present at the downstream site and higher numbers of inanga at the upstream site.

Assessment of Ecological Effects

Planned upgrades to the Hahei WWTP treatment system will avoid significant increases in nutrient and microbial concentrations in the effluent as the volume of treated effluent increases. As such, consent limits will not change from current levels.

The following confounding factors influence the Wigmore Stream and should be taken into account when assessing effects of the WWTP:

- overall poor condition of habitat in the lower Wigmore Stream;
- effects of upstream catchment landuse;
- estuarine influences on water quality and biota;
- periodic closure of stream mouth immediately downstream of the discharge; and
- use of septic tanks by residential properties adjacent to the Wigmore Stream.

This study has assessed the effects of the proposed discharge of treated wastewater on the Wigmore Stream. Predicted effects on ecological and physical aspects of the stream are as follows:

- Depletion of dissolved oxygen concentrations, particularly during summer low flows and high temperatures. These effects are predicted to be minor.
- Increased concentrations of nitrate and ammoniacal nitrogen. The current temporary elevation of ammoniacal nitrogen concentrations downstream of the WWTP during summer will be ameliorated by upgrades to the plant. These effects are therefore predicted to be minor.
- Turbidity/suspended solids. Effects on Wigmore Stream are likely to be minor given the existing conditions of very high natural and human-induced turbidity, and that the projected concentrations of suspended solids in the effluent will be lower than upstream concentrations.
- Concentrations of *E. coli*. Effects on Wigmore Stream are likely to be negligible due to the low concentrations in effluent compared to background concentrations.
- Increased growth of aquatic plants and algae. Effects on Wigmore Stream and downstream areas are predicted to be minor due to suppression of macrophyte and periphyton growth by high salinity and turbidity.
- Disruption of fish passage or spawning. These effects are predicted to be minor.
- Effects on terrestrial fauna. These effects are predicted to be minor.
- Effects on the marine environment. These effects are predicted to be minor.

No additional mitigation is considered necessary as the future discharge from the WWTP is not predicted to have any adverse effects on the Wigmore Stream that are more than minor.

Monitoring

Monitoring of effects of the WWTP should continue for the duration of the consent. It is recommended that the current water quality sampling regime should continue, and that analysis of this data is carried out every year to assess whether concentrations of potential toxic compounds, particularly ammoniacal-N, rise above toxic levels in the Wigmore Stream.

The sampling of macroinvertebrates three times per year since 2010 has provided an ample baseline of seasonal data with which to compare future results. Macroinvertebrate sampling gives

an indication of the conditions in the stream over the preceding weeks or months and therefore gives a more time-integrated picture of conditions compared to water quality samples, which provide a snapshot of one moment in time. Because effects are most likely to be evident during early January when the population of Hahei is highest, it is recommended that macroinvertebrate sampling is carried out yearly, in January or February. Samples should be taken in accordance with current methods, with two samples taken at the upstream site and two at the downstream site, as there is not enough habitat for more samples to be taken.

Along with yearly macroinvertebrate sampling, habitat and aquatic plant assessment should also be carried out in mid to late January along with spot water quality measurements, in accordance with current methods.

1 Introduction

The Hahei Wastewater Treatment Plant (WWTP) currently discharges treated effluent to the Wigmore Stream. The current consent for the discharge of treated domestic wastewater from the Hahei WWTP plant to the Wigmore Stream, approximately 1 km upstream of Hahei Beach, expires on 31 December 2015. As part of the consent application, Kessels Ecology was contracted by Thames-Coromandel District Council (TCDC) to provide an Assessment of Effects on Ecology of the Hahei WWTP discharge on the receiving environment, including options for avoiding, remedying and mitigating any adverse effects and suggestions for future monitoring. The ecological assessment was based on the following:

- Ecological surveys of Wigmore Stream including collection and analysis of macroinvertebrate and water quality samples; and
- A review of all relevant literature and databases including previous survey information and water quality data collected as part of consent requirements.

This assessment forms part of the application to renew the resource consent for the WWTP and should be read in conjunction with accompanying application documents.

2 Methods

2.1 Monitoring Overview

The location of the WWTP in relation to Hahei is shown in Figure 1. Since 2008, consent conditions have required that aquatic surveys of the Wigmore Stream are carried out as part of an ongoing monitoring programme, with surveys undertaken three times per year in March, August and November. Surveys are required to include aquatic macroinvertebrate sampling and an assessment using the Waikato Regional Council's Regional Ecological Monitoring of Streams (REMS) guidelines (Collier and Kelly 2005). Fish sampling is required every 5 years. Sampling should coincide with bi-monthly water quality measurements carried out by Veolia, and sampling time should be recorded along with the nearest low tide time.

Consent conditions require that Veolia carries out bi-monthly sampling of water quality parameters including carbonaceous biochemical oxygen demand, suspended solids, total nitrogen, nitrate, ammoniacal nitrogen, total phosphorus, dissolved reactive phosphorus, conductivity, pH, enterococci and *E. coli*. In addition to monthly sampling, ammoniacal nitrogen, pH, conductivity, *E. coli* and enterococci are measured weekly in the period from the third week of December until the third week of February.

For ecological monitoring, the downstream (DS) site is located 50 m below the discharge point and the upstream (US) site is approximately 30 m above the discharge point (Figure 2). A 100 m long reach of stream is surveyed at each of the sites. Water quality samples are collected at the upstream and downstream sites shown on Figure 2. The stream near the downstream water quality location is too deep for wading, so the downstream ecological survey site was located slightly upstream in an area that was more accessible.

Table 1 GPS coordinates (NZTM) for sampling sites used during biological monitoring of Wigmore Stream.

Site	Northing	Easting
Upstream top	5918444.6	1850187.2
Upstream bottom	5918426.6	1850185.2
Downstream top	5918528.8	1850257.0
Downstream bottom	5918549.8	1850262.0

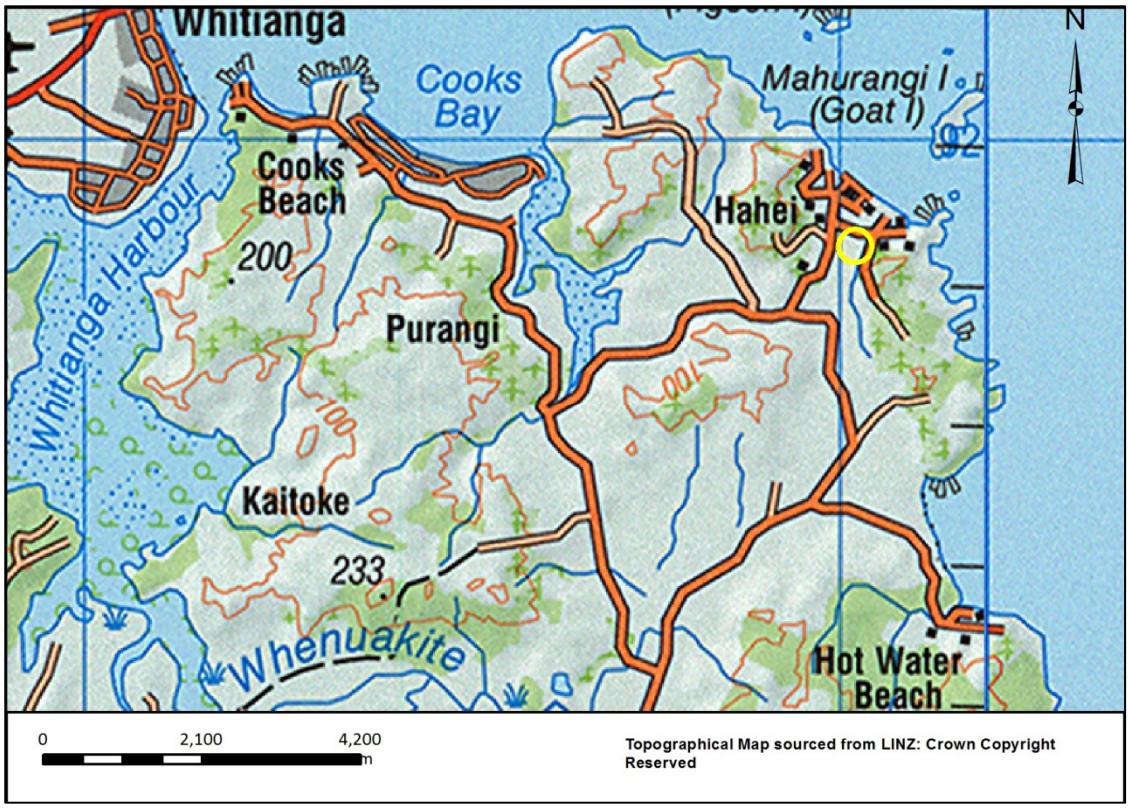


Figure 1 Location of Hahei WWTP (yellow circle).

2.2 Physical Habitat

Instream and riparian margin assessments were undertaken at each site using Waikato Regional Council's REMS methodology (Collier and Kelly 2005). Qualitative habitat assessments were made using the soft-bottomed REMS scoring system. Criteria are scored on a scale from 1 to 20, with scores between 1 and 5 labelled as "poor"; 6-10, "marginal"; 11-15, "suboptimal"; and 16-20 "optimal". Wetted width and water depth at five points (including the deepest point or thalweg) were measured at five transects equally spaced along a 100 m section of stream.

2.3 Aquatic Macrophytes and Periphyton

The composition and cover of aquatic macrophytes and periphyton were measured at each site using rapid assessment protocols developed by Waikato Regional Council (Collier et al. 2006), which are based on visually estimating periphyton and macrophyte cover.

2.4 Water Quality

Standard physicochemical water parameters including temperature, dissolved oxygen, electrical conductivity and pH were recorded at each site during each survey using a YSI Pro-plus field meter. Water quality measurements were taken prior to any other sampling which may have disturbed the substrate.

Water quality was also measured monthly at the upstream and downstream sites by Veolia Water, including the following parameters: carbonaceous biochemical oxygen demand, suspended solids, nitrate, ammoniacal nitrogen, total Kjehldal nitrogen, total phosphorus, soluble reactive phosphorus, enterococci, *E. coli*, turbidity, conductivity, and pH. The yearly means of these parameters were compared between upstream and downstream sites using paired equivalence tests in Trend and Equivalence Analysis software v. 3.31 (Jowett, 2012).

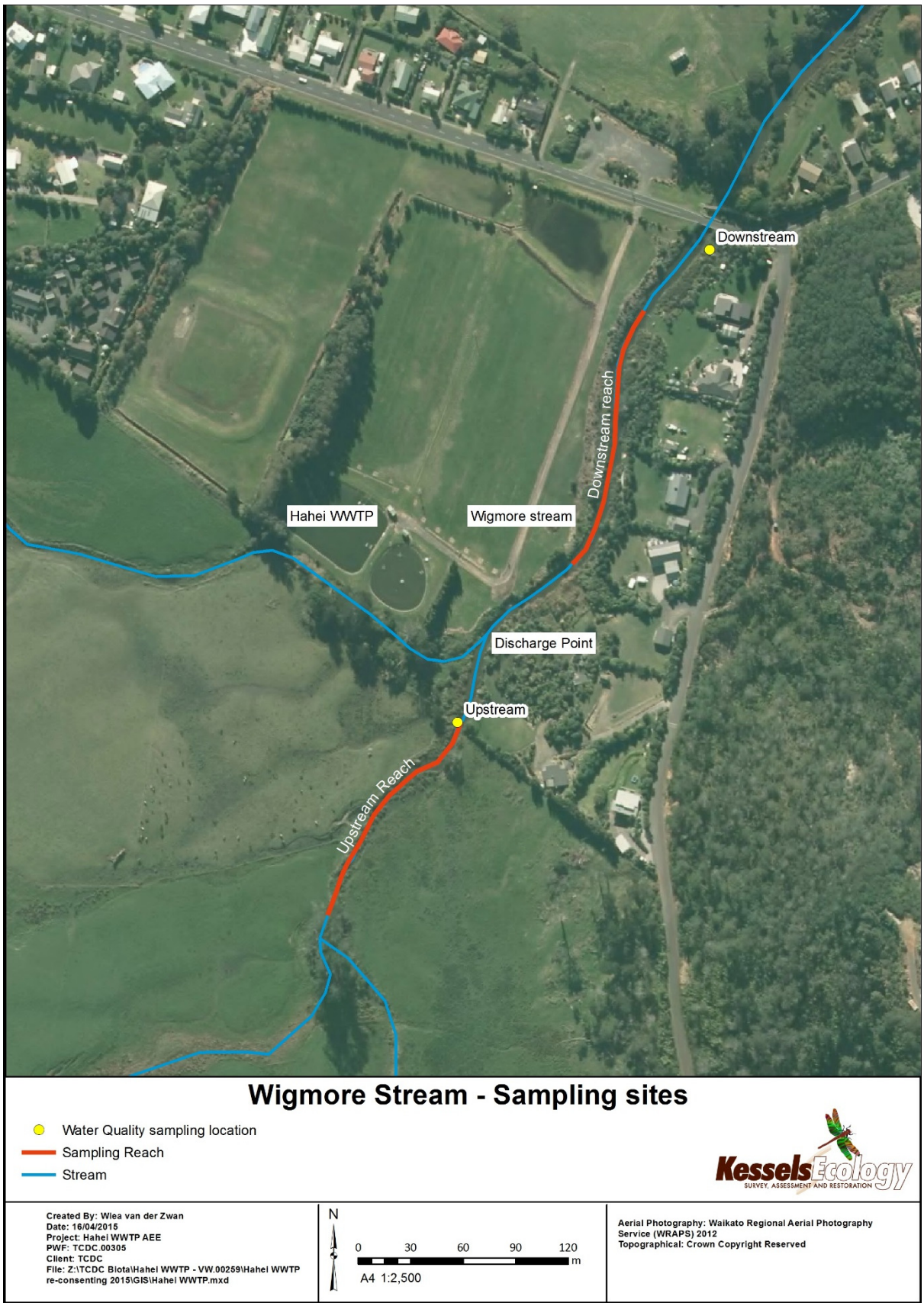


Figure 2 Survey site locations for the Hahei WWTP monitoring. Red lines represent 100 m survey reaches assessed using the Regional Ecological Monitoring of Streams (REMS) method. Yellow points show water quality sampling sites.

2.5 Aquatic Macroinvertebrates

Aquatic macroinvertebrate samples were collected and processed in accordance with Environment Waikato's regional guidelines (Collier and Kelly 2005), which are based on protocols developed for the Ministry for the Environment by Stark et al. (2001).

Two samples were collected from each site using Ministry for the Environment (MfE) Protocol C2 (soft-bottomed streams- semi-quantitative). Habitat is insufficient to collect more than two samples per site. All samples were processed using MfE Protocol P2 (200 count with scan for rare taxa) by qualified taxonomists.

The following indices were calculated:

Total taxa richness- the number of invertebrate taxa present in each sample. Sites with more taxa are considered likely to be of higher environmental quality than sites with fewer taxa.

EPT taxa richness (excluding Hydroptilidae)- the number of taxa of mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera) in the sample. These taxa are highly sensitive to environmental perturbations, and samples with higher numbers of these taxa indicate high environmental quality. The percentage of EPT taxa was also calculated. The family Hydroptilidae is not included in this index because this taxon is able to survive in more degraded environments than other EPT taxa.

MCI and QMCI- The Macroinvertebrate Community Index (MCI) and Quantitative Macroinvertebrate Community Index (QMCI) indicate organic enrichment (Stark 1998). The indices are calculated by giving each taxon a score from 1 to 10, with 1 indicating highly tolerant taxa and 10 indicating highly sensitive taxa. The MCI uses presence/absence data, and the QMCI uses abundance of each taxon. Higher MCI and QMCI scores indicate high habitat and water quality.

% Dominant taxon- The percentage of individuals in the sample belonging to the single most dominant taxon. A high percentage of individuals belonging to one dominant taxon can indicate poor stream health.

2.6 Fish

Fish were surveyed in the Wigmore Stream in 2010 and 2014 (Aldridge and Robb 2011, Price 2014). In 2014, fish were surveyed by setting 3 fine-mesh fyke nets, 3 coarse-mesh fyke nets, and 6 Gee minnow traps at each site in general accordance with national protocols (Joy et al. 2013). Traps were set over a 100 m reach at each site in the afternoon, left overnight and collected between 8 and 10 am the following morning. Gee minnow traps were baited with cat biscuits, while fyke nets were unbaited. Fish captured were counted, measured and returned to the stream alive. Large invertebrates caught in the nets were counted and returned to the stream alive. Results are reported as catch per unit effort (fish caught per trap per night).

For the 2010 survey, six Gee minnow nets and two fyke nets were set over a 50 m reach at each of the two survey sites (Aldridge and Robb 2011). In addition to trap nets, an hour long spotlighting survey was conducted at the two sites, upstream and downstream, half an hour after sunset. This spotlighting survey was not repeated in 2014 as an increase in the number of fyke nets used was considered to yield more robust results.

2.7 Literature Review

Existing databases and literature were reviewed to ascertain the characteristics of flora and fauna habitats within the study area. A review was conducted of threatened species within the Wigmore Stream and coastal areas immediately downstream. Specifically, the following main documents and databases were consulted for the ecological assessment:

- New Zealand Freshwater Fish Database;
- Freshwater Ecosystems of New Zealand (FENZ); and

- WRC's Proposed Regional Policy Statement.

2.7.1 Freshwater Ecosystems of New Zealand (FENZ)

Freshwater Ecosystems of New Zealand (FENZ) is a geodatabase of biodiversity values and pressures of New Zealand's lakes, rivers and wetlands (Department of Conservation 2010, Leathwick et al. 2010). A search of FENZ was carried out to gain an understanding of broad patterns in biodiversity values and pressures in the area.

A brief description of the FENZ layers used follows. For further information, see the user guide compiled by Leathwick et al. (2010).

The regional rankings of importance for rivers are based on "ordering sites according to their ability to provide representative protection of a full range of ecosystems, after taking account of both human pressures and the desirability of maintaining upstream-downstream connections" (Leathwick et al. 2010). Rankings are calculated for planning units, rather than individual stream reaches. Lower numbers represent the planning units with higher contributions to biodiversity protection.

The FENZ layer "River rankings-protect mask" was also reviewed. In this layer, rivers with scores ranging from 0 to 21.1 already have 80% of their extent protected. Scores above 21.1 indicate rivers with less than 80% protection. Lower ranks indicate those rivers that, if protected, would most strongly complement the existing network of protected rivers.

The "River and Stream Pressures- Natural Cover" layer was also explored. This layer includes the percentage of natural unmodified land cover in the catchment.

2.8 Threatened Species

Any threatened species found were recorded and assessed in accordance with Hitchmough et al. (2007) and any subsequent published updates to this document including those found in Hitchmough (2013), Robertson et al. (2013) and Goodman et al. (2014).

2.9 Assessment of Ecological Significance

Following the field surveys an assessment of ecological significance was undertaken. Waikato Regional Council's assessment of Significant Natural Areas of the Waikato Region was searched to check for any Significant Natural Areas (SNAs) in the vicinity (Kessels et al. 2009). As the WRC SNA assessment was largely a desktop exercise, a further assessment of the ecological significance of the site was undertaken using WRC's Proposed Regional Policy Statement criteria for assessing sites of significant indigenous vegetation and habitats of indigenous fauna. The detailed RPS criteria are appended as Appendix III.

This assessment followed the WRC 'Guidelines to apply Regional Criteria and Determine Level of Significance' ("*Environment Waikato Technical Report TR2002/15*") recognising the minor updates to the criteria in the recently created Proposed RPS.

3 Description of Ecological Features

3.1 Ecological Context

The sampling sites on Wigmore Stream are located near Pa Road in Hahei. The total catchment area of the stream is small, covering approximately 3.3 km^2, with a maximum elevation of 8.8 m (NZFFD, 2012). The stream's upper reaches are dominated by grazed pasture and the lower reaches have residential housing with septic tanks on the true right bank. The mouth of the stream connects to the sea at the main beach at Hahei, 1 km downstream of the discharge point. The Hahei wastewater treatment plant (WWTP) is situated near the left stream bank and is surrounded by retired pasture with plantings along the road edge as well as some recent planting along the stream bank.

The mouth of the Wigmore Stream emerges at the eastern end of Hahei Beach, which is approximately 1.3 km long. To the east of the stream mouth is a small area of soft sediments before a small peninsula fringed by rocky intertidal areas and reefs in the subtidal zone.

Sediments in the marine area adjacent to Hahei are dominated by coarse sand, and common animals include starfish *Astropecten polyacanthus* and *Ludia varia*, hermit crabs *Paguristes setosus* and snails *Cominella adspersa* (at 24 m depth; Thrush et al. 1995). Sea floor habitat in the area consists of coastal contiguous reef, patch reef and large areas of soft sediment (Willis et al. 2003).

The Hahei Beach Marginal Strip is classified as a Significant Natural Area (see Section 3.9 for a description). Hahei (Te Whanganui a Hei) marine reserve (area 9 km^2), which includes Cathedral Cove, begins at the western end of Hahei Beach approximately 1.3 km from the mouth of the Wigmore Stream.

3.1.1 FENZ

FENZ ranks rivers and streams at a "planning unit" or subcatchment level based on their "ability to provide representative protection of a full range of ecosystems, after taking account of both human pressures and the desirability of maintaining upstream-downstream connections" (Leathwick et al., 2010). The planning unit containing Wigmore Stream has a regional ranking of 388 based on this system, of a total of 2254 river units in the region.

The "River and Stream Pressures- Natural Cover" layer gives the percentage of natural unmodified land cover in the catchment. The score for Wigmore Stream was 0.06, meaning that the catchment has been highly modified. The catchment is largely pasture, with some residential areas. There is also 17 ha of secondary coastal forest, comprising mahoe remnant forest and established revegetation plantings contained within a Significant Natural Area within the catchment (see Figure 7 for location).

The "River rankings-protect mask" layer gives a score of 63.6, meaning that if protected, these waterways would provide a moderately suitable complement to existing protected areas, meaning that streams of this type are already moderately well protected in this ecological region.

3.2 Stream Habitat

Wigmore Stream near the WWTP is a soft-bottomed, slow-flowing waterway that is influenced by saltwater intrusion which reaches up to the upstream site at times. The stream is wadeable at the upstream site and usually wadeable at the downstream site.

During the 2014-15 survey period there was no obvious change in stream shape or habitat between sampling events or compared to previous years. The upstream site was generally narrower and shallower than the downstream site, with coarser sediment and a wider variety of sediment sizes (Table 2). Siltation was lower at the upstream site and a higher abundance of woody debris provided habitat for aquatic biota (Photo 1). At both sites, the substrate was loose, uncompacted and easily moved, with over 75% of the stream bed covered in fine sediment.

During the July and November 2014 surveys, habitat at the upstream site was judged to be of slightly better quality than at the downstream site, but in March 2015, habitat was found to be slightly better at the downstream site (Table 3). This qualitative habitat survey method gives a good general indication of conditions at the site, but slight differences between observers can be expected. Overall, this component of the survey results indicates that there was little change in habitat quality over time.

As noted during previous surveys, riparian vegetation was slightly sparser at the upstream site, with lower growing riparian plants, mostly grasses and rushes (*Juncus* spp.) (Table 4, Photo 1). Planted riparian banks at the downstream site provided a greater degree of shading, and a greater diversity of plant species was found there (Table 4, Photo 2).

Table 2 Substrate composition at survey sites in Wigmore Stream in July 2014, November 2014 and March 2015.

	Percentage Composition					
	July 2014		November 2014		March 2015	
Substrate Type	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Cobble	8					
Coarse Gravel	16		12		4	
Fine Gravel	8		8	4		
Sand		8	16	4	40	20
Silt	68	92	64	92	56	80

Table 3 Qualitative habitat assessment scores for Wigmore Stream monitoring sites in July 2014, November 2014 and March 2015.

Habitat Parameter	July 2014		November 2014		March 2015	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Riparian Vegetative Zone Width	Suboptimal	Suboptimal	Marginal	Suboptimal	Marginal	Optimal
Vegetative Protection	Suboptimal	Suboptimal	Marginal	Suboptimal	Marginal	Optimal
Bank Stability	Suboptimal	Suboptimal	Suboptimal	Suboptimal	Optimal	Optimal
Channel Sinuosity	Suboptimal	Suboptimal	Suboptimal	Marginal	Suboptimal	Marginal
Channel Alteration	Suboptimal	Suboptimal	Optimal	Optimal	Suboptimal	Marginal
Sediment Deposition	Marginal	Marginal	Optimal	Marginal	Marginal	Marginal
Pool Variability	Suboptimal	Marginal	Suboptimal	Marginal	Suboptimal	Suboptimal
Abundance and Diversity of Habitat	Suboptimal	Suboptimal	Suboptimal	Marginal	Suboptimal	Suboptimal
Periphyton	Marginal	Marginal	Marginal	Optimal	Marginal	Marginal
TOTAL SCORE	102	96.5	109	100	97	102

Table 4 Stream bank vegetation at upstream and downstream survey sites in Wigmore Stream (based on field observation) during the 2014-15 surveys.

Sample Site	Stream bank vegetation	Estimated % shading
Upstream	Urban garden plantings, karo, flax, wattle, *Juncus* spp., kikuyu grass, blackberry, saltmarsh ribbonwood, *Convolvulus*, woolly nightshade, rank grass and associated weeds.	5-10
Downstream	Karo, ponga, flax, bracken, wattle, *Pinus radiata*, kanuka, *Juncus* spp., woolly nightshade, akeake, raupo, saltmarsh ribbonwood, pampas, cabbage tree, inkweed, poplar, *Convolvulus*, sedges, rank grass and associated weeds.	15-20

Photo 1 Hahei WWTP upstream site, Wigmore Stream. Note the woody debris and overhanging vegetation which provide cover for aquatic biota.

Photo 2 Hahei WWTP downstream site, Wigmore Stream. Note the salt tolerant plant species and residential plantings along the true right bank.

3.3 Aquatic Macrophytes and Periphyton

No aquatic macrophytes were recorded at either site during the 2014-15 field surveys, with the exception of small amounts of the terrestrial grass *Paspalum* sp. and rushes *Juncus* sp. recorded at the margins of both sites (average <5% coverage). While these provide cover for fish and macroinvertebrates, they are not considered true macrophytes. No macrophytes were observed during previous surveys due to their sensitivity to high salinity.

No periphyton was recorded during any of the surveys in the 2013-14 or 2014-15 seasons. Very small amounts of thin film and filamentous algae were recorded at the upstream and downstream sites in November 2012 and March 2013 (<2%). Though high water levels and turbidity made sampling difficult in 2010-11 and 2011-12, thin brown films were noted that appeared more prevalent at the downstream site. These were not considered to be at an excessive level (Robb 2012).

3.4 Water Quality

3.4.1 Spot Measurements During Ecological Surveys

3.4.1.1 Conductivity

Conductivity is a measure of dissolved compounds in the water, and is therefore a general measure of water quality (higher conductivity indicates poorer water quality). Conductivity in the Wigmore Stream was highly variable, with no evidence of a consistent pattern between sites. Very high conductivity levels are an indicator of saltwater intrusion at this site, as sea water typically has a conductivity of 50,000 µS/cm compared to freshwater streams which are typically below 500 µS/cm. Conductivity is highly dependent on the time samples are taken in relation to the tidal cycle. High conductivity often indicated a high degree of saltwater intrusion during the November and March surveys (Table 5). Conductivity remains high if the stream outlet is blocked or partially blocked.

3.4.1.2 Dissolved oxygen

Dissolved oxygen is essential to aquatic fauna, which may become stressed or die if insufficient oxygen is present. Dissolved oxygen is depleted by microbial metabolism and respiration by plants and animals, and is typically lower in water bodies with high amounts of organic matter breakdown. High levels of organic matter breakdown may be natural (e.g. in the case of some wetlands) or human-induced (e.g. below effluent discharges).

In the most recent year of surveys, spot dissolved oxygen was lowest during the July 2014 survey, in contrast to the previous years when dissolved oxygen measurements were usually highest in winter (Table 5). These differences in spot measurements may be due to measurements being taken at different times of day, since dissolved oxygen fluctuates in streams on a daily basis.

Several different guidelines and standards are available for dissolved oxygen. Habitat for aquatic biota is considered impaired at dissolved oxygen concentrations below 6 mg/L (Franklin 2010); this concentration has been suggested as a guideline for the seven-day minimum concentration to protect New Zealand fish communities (Franklin 2014). The National Objectives Framework bottom line (see Section 3.4.2) for dissolved oxygen is 5.0 mg/L (7 day mean minimum) and 4.0 (1 day minimum). A minimum threshold of 80% saturation is recognised as a guideline standard for ecological protection by the Waikato Regional Council, and Resource Management Act[1] (Tulagi 2013). ANZECC guidelines are the most stringent, with a range of 98-105% saturation for slightly disturbed ecosystems.

Measurements at both sites in the Wigmore Stream were often below 80%. Dissolved oxygen concentrations were below the 4 mg/L guideline on several occasions at both the upstream and downstream sites, most notably during March surveys.

Most upstream and downstream DO measurements taken on the same day were similar to each other and did not suggest an effect of the WWTP effluent. Low concentrations at both the upstream and downstream sites show that background conditions in Wigmore Stream are degraded due to wider catchment influences.

[1] Third Schedule, classes AE, F and FS

3.4.1.3 Temperature

During the 2014/15 sampling season, stream temperatures were highest during the November survey, reaching 28.1℃ at the downstream site (Table 5). These measurements were taken in the late afternoon to coincide with low tides, so were higher than other measurements from previous years which were taken in the morning. A daily maximum of 20℃ is recommended as guideline for sensitive organisms including macroinvertebrates (Richardson et al. 1994, NIWA 2004). Native fish are generally more tolerant of high water temperatures, and a temperature threshold of 26℃ is considered appropriate for these species (NIWA 2004). Other than the high measurements in November, temperatures in the most recent year of sampling were similar to those measured in the previous years (Table 5). Temperatures were typically slightly higher at the downstream site, likely due to slight differences in timing of measurements along with natural increases in temperature due to widening of the stream and saltwater influence.

3.4.1.4 pH

No consistent differences in pH were observed between spot measurements at the upstream and downstream sites since 2010. Notably, pH was very high (9.97) at the upstream site in March 2015, but much lower (7.49) at the downstream site (Table 5).

Table 5 Results of water quality parameters measured in Wigmore Stream during ecological surveys upstream and downstream of the Hahei WWTP, March 2010-March 2015.

	July 2014		November 2014		March 2015	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Temperature (˚C)	10.5	9.6	27.6	28.1	22.9	24.8
Conductivity (µS/cm)	379	657.4	108.3	12550	6769	25157
DO (%)	46.5	59.5	78.3	73.4	63.5	70.4
DO (mg/L)	5.13	7.01	5.71	5.51	5.33	5.61
pH	6.89	6.99	6.94	7.05	9.97	7.49
Time since low tide (h:mm)	0:45		0:50		0:40	
	August 2013		November 2013		March 2014	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Temperature (˚C)	11.1	11.5	20.9	22.2	19.1	20.2
Conductivity (µS/cm)	238.7	553	1052	915	3732	22343
DO (%)	72.9	72.3	38.8	43.6	51.8	53.6
DO (mg/L)	8.04	7.63	3.64	3.56	3.67	4.79
pH	7.35	7.38	6.74	6.4	6.76	6.8
Time since low tide (h:mm)	1:26		1:38		1:48	
	August 2012		November 2012		March 2013	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Temperature (˚C)	14.5	13.9	17.4	17.4	25.4	26
Conductivity (µS/cm)	147.7	160.6	310.8	87.3	39315	35941
DO (%)	76.4	89	58.7	56.6	30.5	39.1
DO (mg/L)	7.76	9.2	5.69	5.46	2.24	2.79
pH	5.9	5.89	7.01	7.01	6.79	6.95
Turbidity	Slightly turbid	Slightly turbid	Slightly turbid	Slightly turbid	Turbid	Turbid
Time since low tide (h:mm)	1:09		3:15		0:59	
	July 2011		November 2011		March 2012	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Temperature (˚C)	10.8	11.5	21.7	22.3	23.3	22.6
Conductivity(µS/cm)	200.2	666	5064	6410	367.4	356.51
DO (%)	74	76.6	71	75.5	59.3	51.1
DO (mg/L)	8.42	8.36	6.16	6.32	4.42	3.86
pH	6.6	6.84	6.8	6.8	7.10	7.01
Turbidity	Clear	Slightly turbid	Slightly turbid	Slightly turbid	Slightly turbid	Slightly turbid
Time since low tide (h:mm)	2:30		00:30		05:20	
	July 2010		November 2010		March 2010	
	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Temperature (˚C)	12.5	13	23	27.3	24.6	24.9
Conductivity(µS/cm)	137.8	204.3	214.2	118.1	53000	53000
DO (%)	100.4	97.20	86.2	57.6	37	37
DO (mg/L)	10.74	10.30	7.35	4.57	2.74	2.72
pH	7.44	7.13	6.51	6.84	7.26	7.29
Turbidity	Slightly turbid	Highly turbid	Slightly turbid	Slightly turbid	Slightly turbid	Slightly turbid

3.4.2 National Objectives Framework

As part of the National Policy Statement for Freshwater Management (2011) a National Objectives Framework (NOF) has been proposed as a way to set objectives and limits for freshwater management (Ministry for the Environment 2013 a & b). The NOF allows waterways to be assessed against a nationally consistent set of environmental bottom lines, with a grading system to indicate the relative level of ecosystem degradation. Objectives are included to assess the state of the waterway for human health and ecosystem health purposes.

An interpretation of the grading system is given in Table 8. For more information, see the Ministry for the Environment website[2]. In addition to the NOF guidelines, ANZECC (2000) trigger values, the Resource Management Act and Waikato Regional Council's (WRC) guideline values were used to compare water quality between sites.

3.4.3 Compliance Water Quality Monitoring

For resource consent compliance Veolia carries out water quality monitoring upstream and downstream of the WWTP (see Figure 1 for site locations).

A summary of water quality measurements taken between February 2007 and March 2015, along with relevant standards and guidelines, is given in Table 7.

3.4.3.1 Timing of samples

According to the existing resource consent, downstream samples are to be collected "within the period 1 hour either side of local low tide during daylight hours and while discharge is operating". The average time between low tide and the downstream sample was 2:57 (mm:ss); well within this condition.

3.4.3.2 Nitrogen

High concentrations of nitrogenous compounds can contribute to nuisance algal and plant growth in rivers and are toxic to aquatic animals at high concentrations. Ammonia is a compound of nitrogen that is an indicator of water and habitat quality in streams, rivers and lakes. Nitrate and nitrite are oxidised forms of nitrogen that can indicate pollution from inorganic fertiliser use or human or animal wastes.

Median ammoniacal nitrogen concentrations were within the NOF "B" band at both sites, indicating 95% protection from toxic effects. An equivalence test showed that concentrations were slightly higher at the downstream site than the upstream site. 95th percentile concentrations were within the "C" band, indicating 80% protection. These results reflect the annual population pattern of Hahei, characterised by a large influx of people in summer (especially January) and relatively low population throughout the rest of the year. Since mid-2010, summertime peaks in ammoniacal-N in Wigmore Stream have remained within NOF bottom lines (Figure 3).

See Figure 3 for changes in ammoniacal-N in discharge compared to upstream and downstream sites. The differences between the discharge, upstream and downstream ammoniacal-N provide an indication of the location of the source of the N. In January 2013, 2014 and 2015, a peak in the discharge occurred at the same time as a peak downstream of the WWTP, while upstream concentrations remained low. This pattern suggests that the ammoniacal-N may have come from the WWTP discharge. However, during summer 2010, the upstream site also showed a peak in ammoniacal-N, suggesting that a source of ammoniacal-N further up in the catchment.

Nitrate measurements were within the "A" band at both sites, indicating that toxic effects of nitrate are very unlikely. However, nitrate was slightly higher on average at the downstream site.

Median total Kjeldahl nitrogen exceeded the WRC "Satisfactory" guideline at the upstream site, but not at the downstream site. No evidence was found for a difference in average concentrations between upstream and downstream sites.

[2] http://www.mfe.govt.nz/publications/water/freshwater-reform-2013/index.html

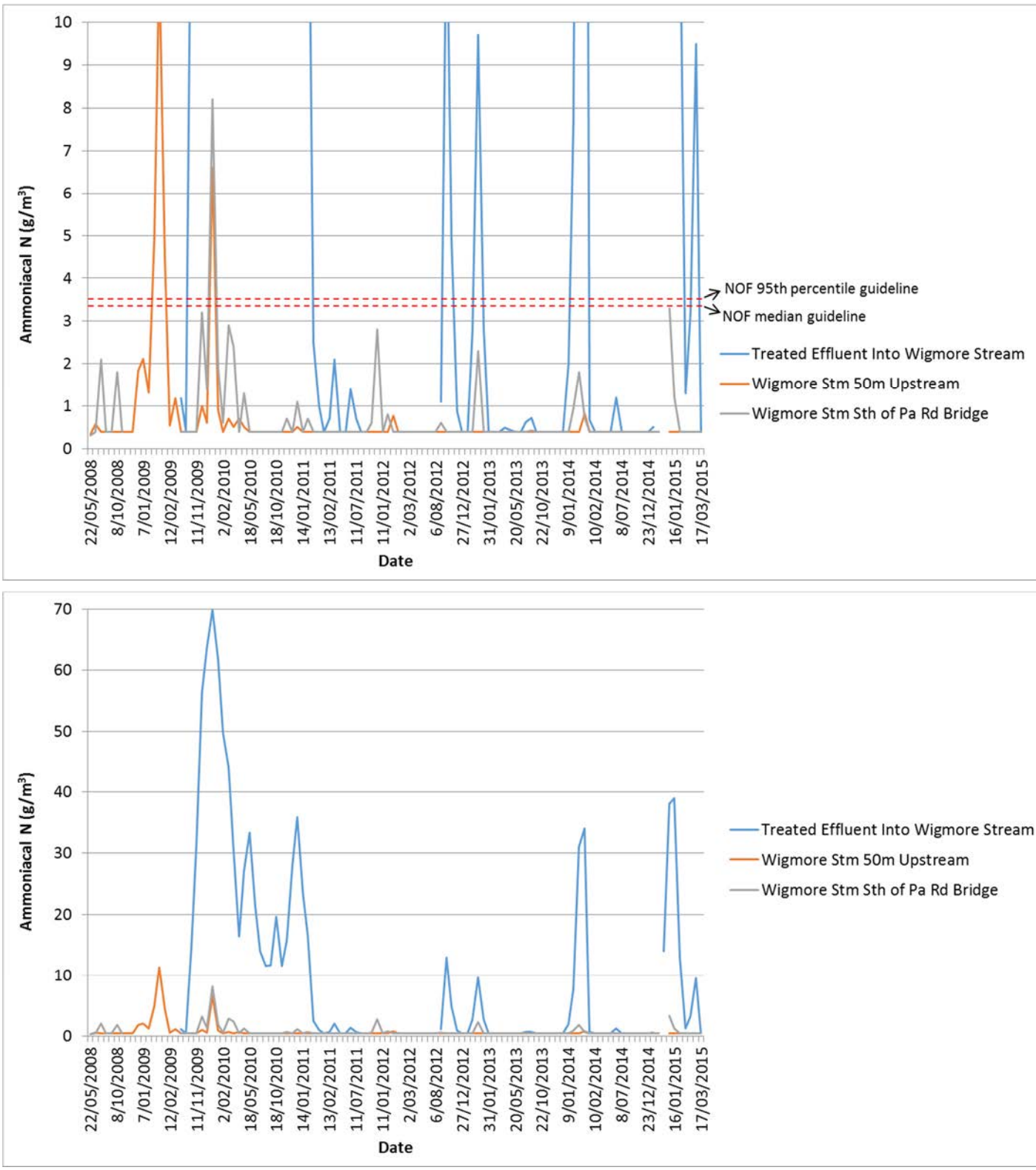


Figure 3 Ammoniacal N concentrations measured in Wigmore Stream 2008-2015, with treated effluent concentrations shown for comparison. The upper graph shows a zoomed-in version of the lower graph. NOF Bottom Line guidelines adjusted to pH of Wigmore Stream in accordance with Hickey (2014). The current consent limit for the discharge is 40 g/m³ (for the 90th percentile of measurements) or 15 g/m³ (for the running average)

3.4.3.3 Escherichia coli and Enterococci

Escherichia coli is a bacterium commonly found in the digestive systems and faeces of humans and animals. The presence of *E. coli* means that other harmful bacteria, viruses and other microorganisms are likely to be present. *E. coli* concentrations can show whether a waterway is safe for recreational activities such as swimming (primary contact) and boating (secondary contact).

E. coli numbers were higher on average at the upstream site compared to the downstream site (Table 7) indicating that the source is not likely to be the WWTP. *E. coli* is likely to be introduced from wild sources, and/or stock that have access to the stream, in upper sections of the catchment. Septic tanks may also leach microbes if not functioning correctly. The median measurement at the upstream site for 2007-2015 was within the "D" band, meaning that the site is not suitable for secondary contact recreation (boating and wading) due to a high risk of gastroenteritis (>5%). The median at the downstream site was within the "C" band, indicating a moderate risk of gastroenteritis (1.0-5.0%) from secondary exposure.

Enterococci are used as an indicator of safety for recreational activities in marine waters. Both the upstream and downstream sites were categorised as "poor" for contact recreation using the Ministry for the Environment's guidelines (measured using the 95th percentile values). No evidence was found for a consistent difference in mean enterococci levels between sites.

3.4.3.4 Conductivity

Conductivity is measured both during ecological surveys and as part of compliance monitoring. As with measurements undertaken during ecological surveys, conductivity is highly dependent on the time samples are taken in relation to the tidal cycle. Because there is a possibility the time of sampling in relation to the tides may influence water quality results, a correlation analysis was carried out of ammoniacal-N and *E. coli* concentrations in relation to conductivity. The correlation coefficients show the strength of the correlation, with 1 meaning a perfect positive correlation, -1 meaning a perfect negative correlation, and 0 meaning no correlation.

Correlations showed that there was a slight positive relationship between ammoniacal-N and conductivity at the downstream site, meaning that when conductivity was higher, ammoniacal-N also tended to be higher. There was no relationship between ammoniacal-N and conductivity at the upstream site or between *E. coli* and conductivity at either site (lack of relationship indicated by significance values greater than 0.05). Overall these results do not show any dilution effect of salt water intrusion at the time of sampling at low tide. Instead, as could be expected, they show that ammoniacal-N was highest when general water quality was lowest.

Table 6 Kendall tau correlations (with significance in brackets) between conductivity and ammoniacal-N and *E. coli* in Wigmore Stream. Significant correlation shown in bold italics.

	Ammoniacal-N	***E. coli***
Conductivity (upstream)	0.11 (p=0.18)	-0.06 (p=0.37)
Conductivity (downstream)	***0.31 (p=0.00)***	0.03 (p=0.64)

3.4.3.5 Phosphorus

Together with nitrogen, phosphorus is an essential nutrient for plants and an excess may result in nuisance growth of aquatic plants and periphyton (slime and algae). Phosphorus can be derived from a range of sources such as erosion of sediments, fertiliser or human and animal wastes. Median phosphorus concentrations were well within the WRC "Satisfactory" levels for ecosystem health, both upstream and downstream of the WWTP, but exceeded the more stringent ANZECC

trigger values for slightly disturbed lowland river ecosystems. No evidence was found for a difference in concentrations between upstream and downstream sites.

3.4.3.6 Turbidity

Highly turbid (murky) water can inhibit growth of aquatic plants and algae that are important components of the food chain. High amounts of sediment in the water can also cause problems for some indigenous fish and insect larvae whose delicate gills can become clogged with sediment. A potential source of this turbidity is soil from erosion of stream and river banks; point source discharges also have the potential to contribute to turbidity if they are high in suspended material. Erosion capacity varies depending on many factors such as catchment geology, topography of the land, flow patterns, bank disturbance and land use.

Wigmore Stream in the vicinity of the WWTP is tidally influenced, which has important consequences for natural turbidity. A turbidity maximum is likely to occur in this area; this is a natural phenomenon occurring at the edge of saltwater intrusion caused by mixing of salt- and freshwater. Correspondingly, mean concentrations of suspended solids were elevated at the downstream site compared to the upstream site. However, an equivalence test showed no evidence for a difference in the suspended solids concentrations at the upstream and downstream sites (Table 7).

3.4.3.7 pH

pH levels in Wigmore Stream varied little over the monitoring period, as shown by the small confidence intervals. There was little variation between the upstream and downstream sites (Table 7).

Table 7 Summary of water quality measurements taken February 2007-March 2015 upstream and downstream of Hahei WWTP. Where relevant, medians have been highlighted according to their National Objectives Framework band (see Appendix V for an explanation of bands). Band A = green; Band B = yellow, Band C = orange, and Band D = red. Results of paired equivalence tests show differences between upstream and downstream measurements; non-equivalence shown in bold italics. Additional parameters shown overleaf.

	Ammonia (as N)		Carbonaceous BOD		Dissolved Reactive Phosphorus		*E. coli*		Enterococci		Nitrate Nitrogen	
	US	**DS**	**US**	**DS**	**US**	**DS**	**US**	**DS**	**US**	**DS**	**US**	**DS**
Mean	0.70	0.72	1.64	1.29	0.15	0.12	3403.59	1641.57	1551.67	910.32	0.09	0.14
95% confidence interval	0.24	0.19	0.34	0.25	0.10	0.08	1288.57	537.81	663.32	382.60	0.03	0.05
Median	0.4	0.4	2	0.87	0.013	0.023	1200	720	340	310	0.0515	0.0935
N	115	105	45	35	53	43	107	97	114	104	52	42
Minimum	0.35	0.31	0.5	0.5	0.005	0.005	0	18	8.2	9.8	0.002	0.002
Maximum	11.395	8.2	7	3.1	1.764	1.4	41000	20000	24000	14000	0.7	0.87
95th percentile	1.47	2.38	3.04	2.06	0.93	0.58	15360	6060	4810	3225	0.25	0.40
Guidelines and Standards												
ANZECC 2000 Guideline	0.021				0.01						0.444[1]	
NOF Bottom Line	3.37 (Median) 3.59 (95th percentile)[2]						1000 *E. coli*/100 ml (Median; for secondary contact recreation)				6.9 (Median) 9.8 (95th percentile)	
WRC- "Satisfactory"	<0.88 g N/m^3						126 *E. coli*/100 ml (Median; contact recreation)					
MfE- "Poor"									500/100 ml (95th percentile)			
Paired equivalence test												
t, df	3.968, 103		0.316, 34		1.327, 41		2.226, 96		1.179, 102		2.287, 40	
p	***<0.001***		***0.009***		0.192		***0.028***		0.21		***0.028***	

[1]The ANZECC Nitrate standard is for nitrate + nitrite but there is very little nitrite in the system, so the nitrate measurement can be used as an approximation.

[2]Guidelines have been adjusted for pH of Wigmore Stream (in accordance with Hickey 2014) as ammonia is less toxic at low pH levels. See Appendix II for adjusted guidelines.

Table 7 (continued) Summary of water quality measurements taken February 2007-March 2015 upstream and downstream of Hahei WWTP. Results of paired equivalence tests show differences between upstream and downstream measurements; non-equivalence shown in bold italics.

	pH		Phosphorus (Total)		Suspended Solids (Total)		Total Kjeldahl Nitrogen		Turbidity	
	US	**DS**	**US**	**DS**	**US**	**DS**	**US**	**DS**	**US**	**DS**
Mean	6.93	6.90	0.22	0.16	16.64	21.44	1.20	0.61	7.35	7.57
95% confidence interval	0.09	0.07	0.12	0.09	7.60	7.45	0.63	0.17	1.92	3.01
Median	6.88	6.89	0.04	0.048	9.1375	13.9375	0.5475	0.445	6.2	4.8
N	98	97	53	43	36	36	46	36	25	25
Minimum	6.02	6.09	0.011	0.012	1	1.6	0.1	0.1	2.39	1.9
Maximum	8.57	8.37	2.096	1.6	110	104.4	13.183	2.1	25	37
95th percentile	7.62	7.50	1.24	0.64	51.6	60.5	4.61	2.0	16.48	19.28
Guidelines and Standards										
ANZECC 2000 Guideline	7.2-7.8		0.026						5.6	
NOF Bottom Line										
WRC- "Satisfactory"	6.5-9		0.4				0.5			
Paired equivalence test										
t, df	0.742, 95		1.617, 41		2.867, 35		0.581, 35		0.265, 24	
p	0.46		0.114		***0.007***		0.565		0.793	

Table 8 National Objectives Framework values and attributes for rivers. Summarised from MfE (2013) and DairyNZ Ltd (2014).

Value	Attributes	Numeric Attribute Band			
		A	B	C	D
Ecosystem health and general protection for indigenous species*	• Nitrate (toxicity) • Ammoniacal nitrogen (toxicity) • Dissolved oxygen (DO) • Periphyton • Temperature** • pH** • Sediment** • Invertebrates** • Fish**	99% protection from toxicants (nitrate, ammoniacal-nitrogen) No stress due to hypoxia (DO) Rare blooms indicative of limited nutrient enrichment or modification of flows and habitat (periphyton)	95% protection from toxicants (nitrate, ammoniacal-nitrogen) Occasional minor stress from hypoxia Occasional blooms of plants reflecting minor alteration of flow or nutrient availability (periphyton)	80% protection from toxicants (nitrate, ammoniacal-nitrogen) Moderate stress on sensitive fish and macroinvertebrate taxa Periodic short-duration nuisance blooms reflecting moderate nutrient enrichment and/or alteration of flow regime or habitat (periphyton)	Impacts on the growth of multiple species that approach acute toxicity concentrations for sensitive species (nitrate, ammoniacal-nitrogen) Significant, persistent stress on a range of aquatic fauna with loss of ecological integrity (DO) Regular and/or extended-duration nuisance blooms reflecting significant nutrient enrichment and/or flow alteration (periphyton)
Human health for secondary* contact (e.g. wading, boating)	• *Escherichia coli* (*E.coli*) • Planktonic cyanobacteria • Benthic cyanobacteria**	Very low risk of gastroenteritis (<0.1%) from secondary exposure (*E.coli*)	Low risk of gastroenteritis (0.1-1.0%) from secondary exposure (*E.coli*)	Moderate risk of gastroenteritis (1.0-5.0%) from secondary exposure (*E.coli*)	High risk of gastroenteritis (>5.0%) from secondary exposure (*E.coli*)

*These two 'objectives' are enshrined as national values under the NOF; **These numeric attributes are not compulsory in the NOF (MfE, 2013b) but are under consideration for inclusion for 2016-2019.

3.5 Aquatic Macroinvertebrates

As in previous years, aquatic macroinvertebrate communities in the 2014-15 sampling year showed variability among seasons, reflecting the amount of freshwater flow and salt water intrusion (Table 9). Molluscs (dominated by the New Zealand mudsnail *Potamopyrgus antipodarum*) were slightly more prevalent at the downstream site compared to the upstream site in July and November (Figure 4). Crustaceans (mostly mysid shrimp) were more prevalent at the upstream site than the downstream site in July, but roughly equal in other months. In July, a higher percentage of true fly larvae at both sites likely indicated that water was less saline due to increased stream flows, as these species are not tolerant of highly saline conditions. The NZ mudsnail *Potamopyrgus antipodarum* was the dominant taxon in all samples.

The marine taxa, estuarine paddleworms (Nereidae) and the mussel *Xenostrobus securis*, were also present in several samples. Paddleworms were most abundant in March, and indicated low freshwater flows and increased salt water intrusion.

Diversity was noticeably reduced during the March 2015 survey compared to other seasons; this pattern was also noted in the 2013-14 summer season (Table 9).

Macroinvertebrate diversity fluctuated seasonally in the Wigmore Stream between March 2010 and March 2015 (Figure 5). Diversity tended to be higher during winter, and reduced in spring and summer. Comparisons of the average number of taxa between March 2010 and March 2015 did not show a consistent difference between sites over time; the downstream site had a higher value on some occasions, while the upstream site had a higher value at other times (Figure 6).

MCI and QMCI indices have been calculated for reference purposes but have not been used to draw conclusions on effects of the discharge, as they were not originally designed to be used in tidally influenced streams and rivers. The MCI-sb index was slightly higher at the downstream site in all seasons, while the QMCI-sb index was higher at the upstream site in July and November, but roughly equal in March.

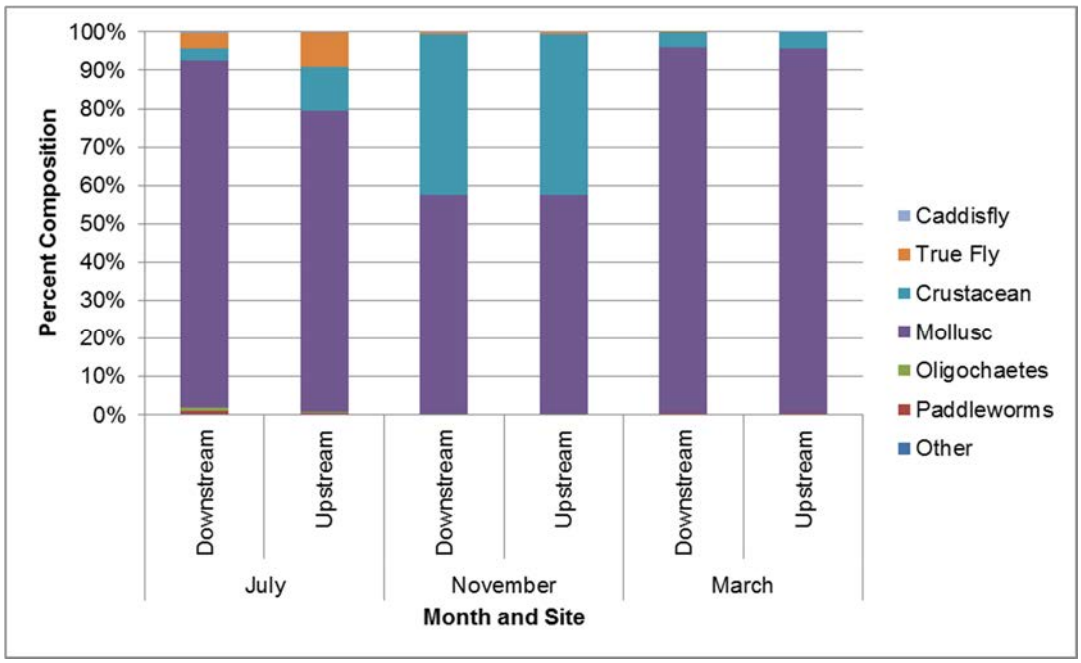


Figure 4 Percentage composition of aquatic macroinvertebrates in samples taken during the 2014-15 sampling period at Wigmore Stream, Hahei. Note that "Other" refers to combined values for Damselfly, Dragonfly, Beetle, Moth and Spider.

Table 9 Average aquatic macroinvertebrate metrics calculated from samples collected from Wigmore Stream upstream and downstream of the wastewater discharge in July 2014, November 2014 and March 2015.

	July 2014		November 2014		March 2015	
	Upstream	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
Taxa richness	12	14	9	12	7.5	7
% EPT taxa richness*	0.5	1	0.5	0.5	1	0
MCI-sb	87.0	90.8	77.0	79.7	87.4	87.7
QMCI-sb	2.80	2.35	3.93	2.64	2.27	2.25
% Dominant Taxon	73.6	88.5	55.6	82.4	95.3	95.4
Dominant Taxon	*Potamopyrgus*	*Potamopyrgus*	*Potamopyrgus*	*Potamopyrgus*	*Potamopyrgus*	*Potamopyrgus*
	August 2013		**November 2013**		**March 2014**	
	Upstream	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
Taxa richness	12	14.5	8.5	8.5	6.5	9
% EPT taxa richness*	0.0	0.0	15.0	0.0	0	0.0
MCI-sb	74.2	88.1	83.1	89.0	92.7	88
QMCI-sb	3.1	3.3	5.22	4.2	5.75	4.8
% Dominant Taxon	62.4	64.2	72.7	60.5	81.8	52.5
Dominant Taxon	*Potamopyrgus*	*Potamopyrgus*	Mysid shrimp	Mysid shrimp	Mysid shrimp	Mysid shrimp
	August 2012		**November 2012**		**March 2013**	
	Upstream	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
Taxa richness	16	15	9	11	7.5	7.5
EPT taxa richness*	2	2	2	1	0	0
% EPT taxa richness*	4.9	4.1	1.1	1.1	0	0
MCI-sb value	78	88	77	96	77	90
QMCI-sb value	3.9	3.1	4.5	3.4	5.2	3.3
% Dominant taxon	44.7	53.5	53.5	62.9	76.5	69.6
Dominant taxon	*Potamopyrgus*	*Potamopyrgus*	Mysid shrimp	*Potamopyrgus*	*Potamopyrgus*	Mysid shrimp
	July 2011		**November 2011**		**March 2012**	
	Upstream	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
Taxa richness	13.00	13.50	8.75	9.25	8.00	8.00
EPT taxa richness*	1.50	1.50	1.25	1.25	1.00	1.00
% EPT taxa richness*	15.60	10.35	0.43	0.39	0.16	0.33
MCI-sb value	86.62	85.10	87.12	89.64	100.00	92.00
QMCI-sb value	4.26	4.46	3.12	2.59	3.59	2.89
% Dominant taxon	42.16	47.48	83.71	86.38	83.16	82.85
Dominant taxon	Mysid shrimp True Fly (Tanytarsini)	Mysid shrimp, *Potamopyrgus*	Mysid shrimp, *Potamopyrgus*	*Potamopyrgus*	*Potamopyrgus*	*Potamopyrgus*
	July 2010		**November 2010**		**March 2010**	
	Upstream	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
Taxa richness	9.5	12.5	9.5	9.5	6	4
EPT taxa richness*	0	0.5	1	1	1	0
% EPT taxa richness*	0	3.125	10.79545	10.55556	16.7	0.0
MCI-sb value	79.3	88.05	93.15	83.4	80.7	83
QMCI-sb value	2.72	2.445	3.545	4.3	2.8	2.4
% Dominant taxon	77	88.5	63	66.9	72	92
Dominant taxon	*Potamopyrgus*	*Potamopyrgus*	Mysid shrimp, *Potamopyrgus*	Mysid shrimp	*Potamopyrgus*	*Potamopyrgus*

*excluding Hydroptilidae

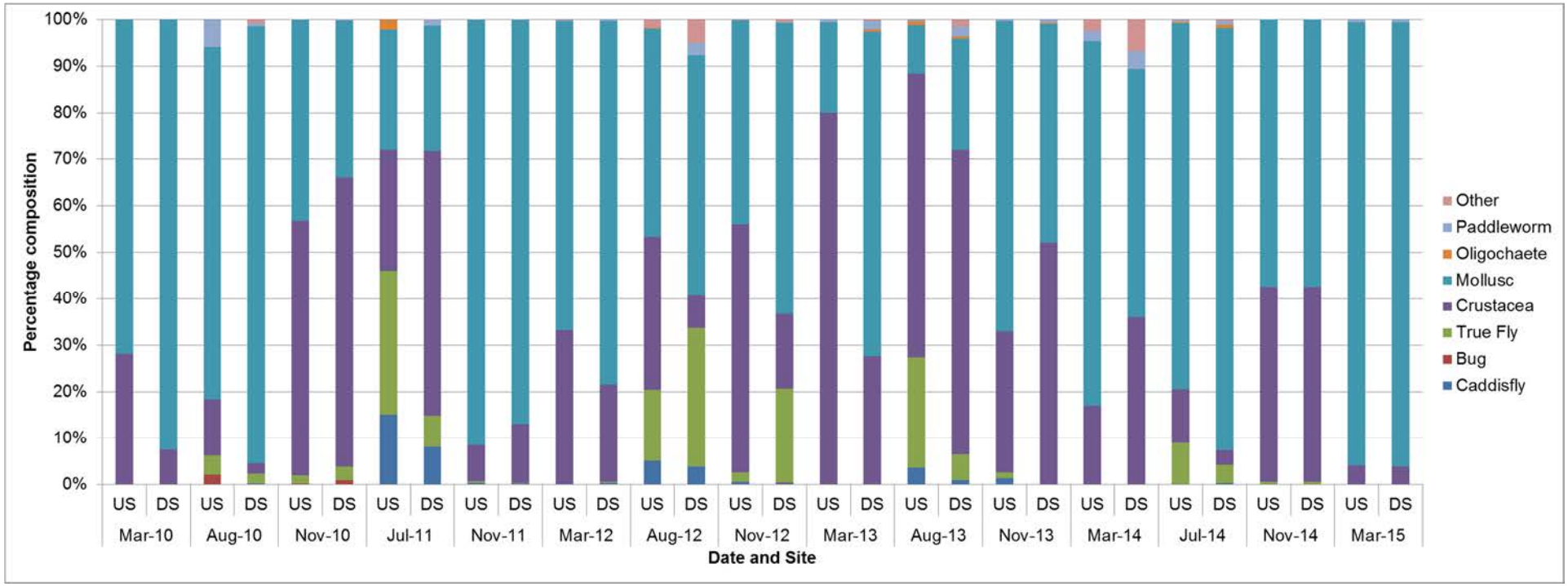


Figure 5 Percentage composition of aquatic macroinvertebrate samples taken between March 2010 and March 2015 from Wigmore Stream, Hahei. Note that "Other" refers to combined values for Dragonfly, Damselfly, Springtail, Spider, Moth and Mite.

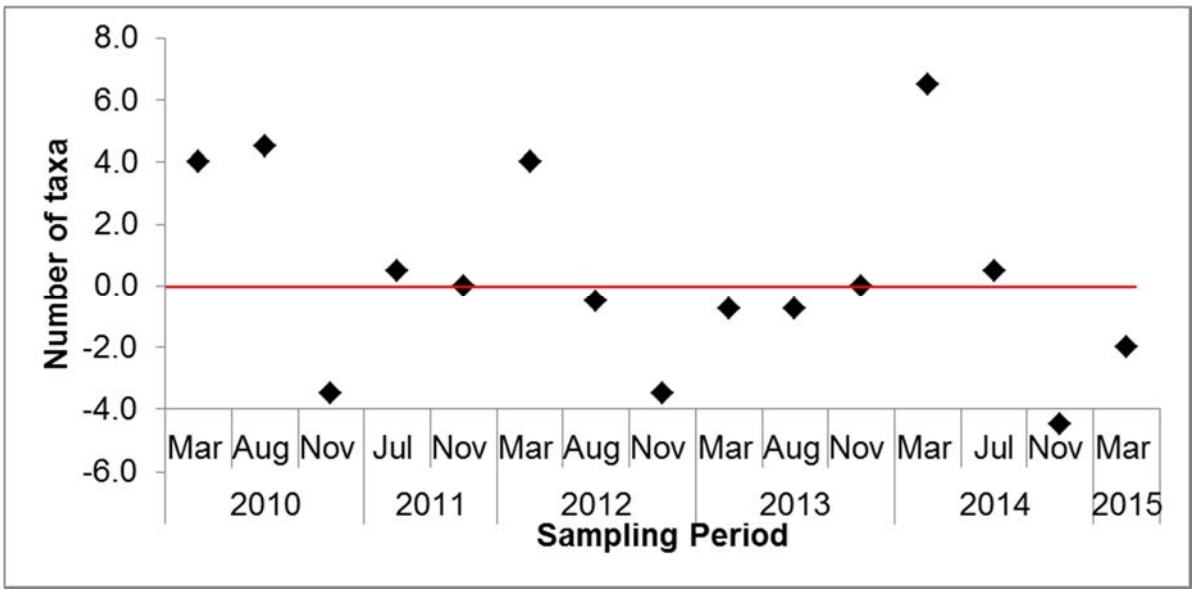


Figure 6 Difference (upstream-downstream values) in average taxa richness for the Wigmore Stream, Hahei, between March 2010 and March 2014. The red line shows 0. Positive values indicate when the metric was higher at the upstream site.

3.6 Fish

A list of species caught, with species and common names and threat status in accordance with Goodman et al. (2014), is provided in Table 10. Overall, fish communities were similar between the upstream and downstream sites, with some exceptions (Tables 11 and 12). For example, significantly more inanga were caught upstream than downstream site; minnow traps were particularly effective for capturing inanga. This is likely related to differences in salinity and habitat at the two sites. Parore were only caught at the downstream site, and only juveniles were caught (for lengths see Table 13). Parore is a marine species and would not be expected to inhabit the upstream site with its lower salinities.

2014 fish survey results were similar to the results of the 2010 survey. In both years, more marine species were caught at the downstream site (Aldridge and Robb 2011). In 2010, inanga, gambusia, shortfin eel, longfin eel, common bully, cockabully and parore were caught. More species were caught in 2014, likely due to the increased sampling effort. Inanga were more numerous at the upstream site in 2010, a pattern which was also evident in 2014. Numbers of inanga caught per Gee minnow trap were similar in 2010 and 2014. The number of inanga caught in fyke nets increased in 2014, potentially due to the introduction of fyke nets that separate larger fish such as eels from smaller fish such as inanga, preventing predation within the net.

Table 10 List of fish and invertebrate species caught in fish survey, with threat status (Allibone et al. 2010) and typical habitat (McDowall 1990).

Common name	Species	Threatened?	Typical habitat
Cockabully	*Forsterygion nigripenne*	No	Estuaries
Common bully	*Gobiomorphus cotidianus*	No	Freshwater
Crab	*Helice crassa*	No	Estuaries
Crans bully	*Gobiomorphus basalis*	No	Freshwater
Gambusia	*Gambusia affinis*	No	Freshwater
Giant bully	*Gobiomorphus gobioides*	No	Freshwater near coast
Goby	*Favonigobius exquisitus*	No	Estuaries
Inanga	*Galaxias maculatus*	At Risk- Gradual Decline	Freshwater (as adults)
Longfin eel	*Anguilla dieffenbachii*	At Risk- Gradual Decline	Freshwater (as adults)
Parore	*Girella tricuspidata*	No	Estuaries, coastal waters
Shortfin eel	*Anguilla australis*	No	Freshwater (as adults)
Shrimp	Mysidae and *Paratya*	No	Freshwater, estuaries
Smelt	*Retropinna retropinna*	No	Freshwater (as adults)
Unidentified fish larva	-	-	-
Yellow eye mullet	*Aldrichetta forsteri*	No	Estuaries, coastal waters

Table 11 Numbers of fish caught in Wigmore Stream, March 2014.

	Downstream			Upstream			Overall Total
Species	Fyke	Minnow	Total	Fyke	Minnow	Total	
Cockabully	11	1	12	14	2	16	28
Common bully	1		1				1
Crab		1	1				1
Crans bully	3		3	3		3	6
Gambusia	12	23	35	16	15	31	66
Giant bully	7		7	3		3	10
Goby	4		4	2		2	6
Inanga	50		50	189	243	432	482
Longfin eel	3		3	4		4	7
Parore	23	1	24				24
Shortfin eel	38	10	48	4		4	52
Shrimp	1000	220	1220		610	610	1830
Smelt	1		1				1
Unidentified fish larva	1		1				1
Yellow eye mullet	2		2	1		1	3

Table 12 Numbers of fish caught (catch per unit effort; average number of fish per trap per night) in Wigmore Stream, March 2014. Results from March 2010 included for comparison.

	2010				2014			
	Downstream		Upstream		Downstream		Upstream	
Species	Fyke	Minnow	Fyke	Minnow	Fyke	Minnow	Fyke	Minnow
Cockabully	0.5				1.8	0.2	2.3	0.3
Common bully			17	1	0.5		0.5	
Crab						0.2		
Gambusia	5	9.2	1.5	20.5	2.0	3.8	2.7	2.5
Giant bully					1.2		0.5	
Goby					0.7		0.3	
Inanga					8.3		31.5	40.5
Longfin eel	0.5		0.5		0.5		0.7	
Parore	1				3.8	0.2		
Shortfin eel	7.5	0.5	1	0.2	6.3	1.7	0.7	
Shrimp					166.7	36.7		101.7
Smelt					0.2			
Unidentified fish larva					0.2			
Yellow eye mullet					0.3		0.2	

Table 13 Mean lengths (± standard deviation) of fish caught in Wigmore Stream, March 2014.

	Downstream			Upstream			Overall
Species	Fyke	Minnow	Total	Fyke	Minnow	Total	
Cockabully	62 ± 23	59 ± 0	62 ± 22	64 ± 27	44 ± 2	62 ± 26	62 ± 24
Common bully	75 ± 0		75 ± 0				75 ± 0
Crab							
Crans bully	58 ± 7		58 ± 7	69 ± 7		69 ± 7	64 ± 9
Gambusia							
Giant bully	152 ± 13		152 ± 13	165 ± 15		165 ± 15	156 ± 14
Goby	40 ± 3		40 ± 3	43 ± 4		43 ± 4	41 ± 3
Inanga	55 ± 8		55 ± 8	48 ± 5	50 ± 7	49 ± 7	50 ± 7
Longfin eel	540 ± 182		540 ± 182	785 ± 282		785 ± 282	680 ± 261
Parore	36 ± 6	20 ± 0	36 ± 7				36 ± 7
Shortfin eel	278 ± 113	225 ± 40	267 ± 104	615 ± 212		615 ± 212	293 ± 147
Shrimp							
Smelt	70 ± 0		70 ± 0				70 ± 0
Unidentified fish larva	28 ± 0		28 ± 0				28 ± 0
Yellow eye mullet	110 ± 71		110 ± 71	170 ± 0		170 ± 0	130 ± 61
Grand Total	127 ± 132	194 ± 81	132 ± 130	121 ± 207	50 ± 7	74 ± 125	97 ± 130

3.7 Birds

Hahei Beach provides habitat for the Northern New Zealand dotterel, which is classified as Nationally Vulnerable (Robertson et al. 2013). Variable oystercatchers (Recovering) are also present on the beach areas (Humphries and Tyler 1990), including around the stream mouth. Other threatened and at-risk species are summarised in Table 14.

A range of common species of bush, aquatic habitats and open country are likely to use the habitat around and downstream of the WWTP. These include little shag, white-faced heron,

Australasian harrier, morepork, paradise shelduck, mallard, ring-necked pheasant, Californian quail, pukeko, spur-winged plover, southern black-backed gull, kereru, kingfisher, shining cuckoo, eastern rosella, welcome swallow, fantail, grey warbler, blackbird, house sparrow, starling, yellowhammer, chaffinch, greenfinch, goldfinch, silvereye, song thrush, skylark, tui, bellbird and Australian magpie (Robertson et al. 2007). Species which are less common in the district, such as kaka (Threatened- Nationally Vulnerable), may visit occasionally.

Birds using the WWTP ponds themselves are likely to be predominantly mallards and paradise shelducks; other waterfowl are scarce or absent in the vicinity of Hahei (Robertson et al. 2007). Brown teal (At Risk- Recovering) have however responded well to recent conservation efforts in the northern Coromandel and are expanding their range[3]. They have been seen on the Coromandel WWTP ponds in recent years (D. Riddell, *pers. comm.*), and a watch should be kept on the ponds at Hahei, with any sightings reported to the Department of Conservation.

Table 14. Threatened or at risk species likely to use habitat within vicinity of Hahei WWTP.

Common Name	Threat Status	Habitat
Northern New Zealand dotterel	Threatened- Nationally Vulnerable	Sandy beaches, sandspits, tidal estuaries
Variable oystercatcher	At Risk- Recovering	Sandy beaches, sandspits, dunes, tidal estuaries
Red-billed gull	Threatened- Nationally Vulnerable	Many coastal habitats, occasional user of pasture and wetland habitats.
Black shag	At Risk- Naturally Uncommon	Open freshwater habitats (lakes, ponds, rivers, streams), occasionally coasts
Little black shag	At Risk- Naturally Uncommon	Open water, coastal and freshwater
Pied shag	Threatened- Nationally Vulnerable	Mainly open coasts, occasionally lakes and rivers
Caspian tern	Threatened- Nationally Vulnerable	Coasts, estuaries, occasionally lakes and rivers
White-fronted tern	At risk- Declining	Coasts, estuaries

3.8 Lizards and Frogs

Copper skinks (*Oligosoma aeneum*) may be present in terrestrial habitats bordering the WWTP, such as beneath the trees around the western and southern margins of the ponds. They may also occur along the stream in areas of rough cover, as may shore skinks (*Oligosoma smithi*), particularly closer to and around the stream mouth. The high level of human modification and lack of suitable cover may exclude this species however. Other species such as Auckland green gecko (*Naultinus elegans*), common gecko (*Woodworthia maculata*) and forest gecko (*Mokopirirakau granulatus*) may possibly be present in the general area, such as in the second-growth scrub east of Orchard Rd, but are unlikely to occur on the WWTP property or areas potentially affected by its discharge.

Native frogs (*Leiopelma* spp.) have not been reported in the locality and are highly unlikely to be present at this site. The two species found on the Coromandel Peninsula live along the margins of undisturbed rocky, bush-clad streams (*L. hochstetteri*) or under cover objects such as logs or rocks in forest, mostly at higher altitudes (*L. archeyi*).

3.9 Ecological Significance Determination

A review of the report "Significant Natural Heritage of the Thames-Coromandel District" (Kessels et al. 2009) showed that no significant natural areas (SNAs) directly border Wigmore Stream in

[3] http://www.doc.govt.nz/news/media-releases/2013/pateke-thrive-on-the-coromandel-peninsula/

the vicinity of the WWTP. However, an SNA (TC307) is found near the Wigmore Stream mouth at Hahei Beach (Figure 7).

Section 11A of the Proposed Waikato Regional Policy Statement (RPS) was used to assess ecological significance of the receiving environment of the WWTP discharge: Wigmore Stream downstream of the WWTP, and the Hahei Beach Marginal Strip. Table 15 below outlines our assessment against those criteria. The detailed RPS criteria are appended as Appendix III.

Wigmore Stream was classified as Regionally Significant as it meets criteria 3 and 8. The stream provides habitat for At Risk fish species (longfin eels and inanga) as well as providing a migration corridor to upstream areas.

The Hahei Beach Marginal Strip was classified as Nationally Significant under these criteria. It is a protected and under-represented fore-dune, and part of a back-dune, which are originally rare ecosystems. It an area of *Spinifex* tussockland which is in relatively good condition as a link between land and sea environments, although the back-dune is limited. The dune area was judged to meet significance criteria 1, 3, 4, 5 and 11, and Criterion 9 was also likely to be met.

Figure 7 Significant Natural Areas in the vicinity of the Hahei WWTP.

Table 15. Criteria for determining significance of indigenous biodiversity, with assessment of Wigmore Stream downstream of the WWTP and Hahei Beach Marginal Strip.

Criteria		Assessment of Wigmore Stream downstream of WWTP	Assessment of Hahei Beach Marginal Strip
1.	It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Nga Whenua Rahui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.	No	Yes
2A	In the Coastal Marine Area, it is indigenous vegetation or habitat for indigenous fauna that has reduced in extent or degraded due to historic or present anthropogenic activity to a level where the ecological sustainability of the ecosystem is threatened.	No	No
3.	It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: • classed as threatened or at risk, or • **endemic** to the Waikato region, or • at the limit of their natural range.	Yes- habitat for longfin eel and inanga which are classified as "At Risk-Declining"	Yes- habitat for New Zealand dotterel
4.	It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.	No	Yes
5.	It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, chenier plain, or karst ecosystems, hydrothermal vents or cold seeps.	No	Yes
6.	It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities) that has not been created and subsequently maintained for or in connection with: • waste treatment; • wastewater renovation; • hydro electric power lakes (excluding Lake Taupō); • water storage for irrigation; or • water supply storage; unless in those instances they meet the criteria in Whaley et al. (1995).	No	No
7.	It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type. Note this criterion is not intended to select the largest example only in the Waikato region of any habitat type.	No	No
8.	It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity	Yes- banks of Wigmore Stream likely to provide spawning habitat for inanga. The stream near the WWTP is a critical migration route for diadromous fish between sea and areas upstream and therefore provides connectivity between habitats.	No

	between habitats.		
9.	It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because: • its structure, composition, and ecological processes are largely intact; and • if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. stock, discharges, erosion, sediment disturbance), can maintain its **ecological sustainability** over time.	No- though the stream retains habitat value for indigenous species, it is in a degraded state at present and significant restoration throughout the catchment would be required to return it to an unaltered state.	Likely
10.	It is an area of indigenous vegetation or habitat that forms part of an **ecological sequence**, that is either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type.	No	No
11.	It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse effects.	No	Yes

4 Assessment of Ecological Effects

4.1 Planning context

The proposed WWTP discharge requires consent from Waikato Regional Council to discharge treated wastewater to a watercourse (Wigmore Stream), which is a discretionary activity under Section 3.5.4.4 of the Regional Plan.

Wigmore Stream is classified under the Contact Recreation and Waikato Surface Water classes under the Regional Plan. Relevant policies for these water classes are provided in the box below, and standards are listed in Appendix IV. An analysis of whether the proposed WWTP discharge meets the policy requirements is provided in Table 16.

The coastal areas surrounding the mouth of the Wigmore Stream are classified as an Area of Significant Conservation Value in the Waikato Regional Coastal Plan (Area 21; Purangi Estuary and Te Whanganui-a-Hei Cathedral Cove) Marine Reserve south to Hereheretaura Peninsula). The Hahei Beach marginal strip is also classified as Nationally Significant under Section 11A of the Proposed Waikato Regional Policy Statement (RPS), as described in Section 3.9.

Policy 4: Waikato Region Surface Water Class

Enable the use of all surface water bodies in the Region, provided that:

a. Any significant adverse effects on existing aquatic ecosystems are avoided, remedied or mitigated.
b. Intake structures are designed to minimise fish entrapment.
c. Any conspicuous change in visual colour or clarity is avoided, remedied or mitigated.
d. The water body is not tainted or contaminated to the extent that it is unpalatable or unsuitable for consumption by humans after treatment (equivalent to coagulation, filtration and disinfection).
e. The water body is not tainted or contaminated to the extent that it is unsuitable for irrigation or stock watering.

Policy 6: Contact Recreation Water Class

The purpose of the contact recreation class is to provide a safe water quality environment for contact recreation in all rivers, streams, and lakes with significant contact recreational use by:

a. Avoiding reductions in clarity that make the water unsuitable for contact recreation.
b. Avoiding contamination to levels that represent a significant risk to human health or to levels that would render the water body unsuitable for contact recreation.
c. Avoiding the development of bacterial and/or fungal growths that are visible to the naked eye.
d. Avoiding the development of periphyton growths or mats to the extent that they cover more than 25% of the bed of the water body.

Table 16. Analysis of proposed WWTP discharge against relevant policy requirements. Policies not met shown in grey shading.

Policy	Requirements met?
Waikato Region Surface Water Class	
Any significant adverse effects on existing aquatic ecosystems are avoided, remedied or mitigated.	Yes; future increases in effluent ammonia concentrations from the WWTP will be avoided by WWTP plant upgrades.
Intake structures are designed to minimise fish entrapment.	Not applicable.
Any conspicuous change in visual colour or clarity is avoided, remedied or mitigated.	Yes; higher suspended solids concentrations downstream of the WWTP are related to the mixing of salt and freshwater.
The water body is not tainted or contaminated to the extent that it is unpalatable or unsuitable for consumption by humans after treatment (equivalent to coagulation, filtration and disinfection).	Yes; background *E. coli* concentrations in the stream (i.e. water upstream of the WWTP) do not comply with this policy and are higher than downstream concentrations.
The water body is not tainted or contaminated to the extent that it is unsuitable for irrigation or stock watering.	Yes; background *E. coli* concentrations in the stream (i.e. water upstream of the WWTP) do not comply with this policy and are higher than downstream concentrations.
Contact Recreation Water Class	
Avoiding reductions in clarity that make the water unsuitable for contact recreation.	Yes; higher suspended solids concentrations downstream of the WWTP are related to the mixing of salt and freshwater.
Avoiding the development of periphyton growths or mats to the extent that they cover more than 25% of the bed of the water body.	Yes; very little periphyton is present in the stream.
Avoiding the development of bacterial and/or fungal growths that are visible to the naked eye.	Yes; no bacterial or fungal growths have been observed.
Avoiding contamination to concentrations that represent a significant risk to human health or to concentrations that would render the water body unsuitable for contact recreation.	Yes; background *E. coli* concentrations in the stream (i.e. water upstream of the WWTP) do not comply with this policy and are higher than downstream concentrations.

4.2 Current and proposed discharge

The current consented discharge limit for the Hahei WWTP is 700 m^3/day (on average over a 24-hour period); and the average measured daily flow is 178 m^3/day. The consent states that the maximum allowable rate of discharge shall not exceed 8.1 l/s.

Current limits for the discharge to the Wigmore Stream are provided in

Table 17. These limits are proposed to be retained in the new consent. Current and proposed discharge rates for the Hahei WWTP discharge are provided in Table 18. The average concentrations of various parameters in the current discharge and the projected discharge in 2045 are provided in Table 19.

The following immediate upgrades to the WWTP are proposed as part of the new consent:

- Installation of an inlet screen;
- Installation of an additional aerator (4kW);
- Repair or replace existing baffle curtains;
- MFU optimisation (higher throughput and integrity check);
- Pond de-sludging (subject to pond survey results).

These upgrades will improve the performance of the plant. Repairing and replacing baffle curtains and de-sludging the pond will improve retention time, and an additional aerator will facilitate conversion of ammoniacal-N to nitrite and nitrate. These actions will ameliorate the high ammoniacal-N levels in the discharge measured during summer.

A second aerator (1.5kW) is proposed to be installed in 2030. However, this upgrade strategy needs to be reviewed to take into account of the population growth rate and the future consent condition, which will be renewed around 2035.

Table 17. Current consent limits for the discharge to the Wigmore Stream.

Parameter	90th percentile (not more than one sample in each preceding 10 samples shall exceed):	Running average, over any consecutive 10 samples shall not exceed:
Suspended solids (g/m^3)	20	10
Carbonaceous biochemical oxygen demand (CBOD, g/m^3)	20	10
Escherichia coli (cfu/100 ml)	20	10
Total ammoniacal nitrogen (g/m^3)	40	15
Total Kjeldahl nitrogen (g/m^3)	40	15
Total phosphorus (g/m^3)	20	14

Table 18. Current and projected Hahei wastewater flows.

Year	Average Off Peak Flow (m^3/day)	Average Peak Flow m^3/day)	Peak Night Flow (m^3/day)
2015	92	221	312
2045	109	278	392

Table 19. Mean and 95th percentile concentrations of various parameters in the treated effluent discharged to Wigmore Stream: current values and projected values for 2045.

Parameter	Units	Current		Projected 2045	
		Average	95th percentile	Average	95th percentile
Flow	m^3/d	92	221	109	278
$cBOD_5$	g/m^3	6	20	6-10	20
	kg/d	0.5	4.4	0.6	5.6
Total Suspended Solids	g/m^3	7	20	10	20
	kg/d	0.6	4.4	1	5.6
Ammonia	g/m^3	11	20	15	20
	kg/d	1	4.4	1.6	5.6
Total Kjeldahl Nitrogen	g/m^3	11	40	15	40
	kg/d	1	8.9	1.6	11
Total Phosphorus	g/m^3	8	20	14	20
	kg/d	0.7	4.4	1.5	5.6
Enterococci	cfu/100ml	3	10	5	10
E.coli	cfu/100ml	5	10	5	10

Table 20 shows projected scenarios for downstream ammoniacal-N concentrations under current discharge and ammonia loading rates. These calculations are based on a mass balance approach and use equivalent methods employed by WRC in the evaluation report for the previous Hahei WWTP consent application. Both a low flow scenario (Q_5; 3 L/s) and average stream flow (40 L/s) have been considered. Measured upstream concentrations of ammoniacal-N have been used. Calculated downstream ammoniacal-N concentrations were compared to measured values.

Scenarios 1, 3 and 5 show that under low flow scenarios, a mass balance approach greatly overestimates ammoniacal-N at the downstream site compared to actual measured values. This shows that there is another unaccounted for influence on concentrations, most likely further dilution by inputs of sea water. Under mean stream flow scenarios (2, 4, 6), calculated ammoniacal-N values were still overestimated in mass balance calculations compared to measured values, but the difference was not as great.

Scenarios 7-9 calculate the discharge ammoniacal-N concentrations required to achieve the NOF bottom line ammoniacal-N concentrations at the downstream site. The NOF bottom line has been adjusted to the pH in Wigmore Stream as shown in Appendix II. Scenarios 7 and 8 use the 95th percentile NOF bottom line and examine peak and average conditions in January. Scenario 9 calculates the discharge ammoniacal-N required to achieve the NOF bottom line under median conditions. These scenarios suggest that ammoniacal-N in the discharge would have to reach much higher levels that they do currently to cause a significant deterioration in downstream concentrations. However, due to the uncertainty in this analysis due to tidal influence, the ecological effects assessment has focussed on water quality and macroinvertebrate sampling, for which a good multi-year dataset exists.

Table 20. Projected scenarios under current discharge and ammonia loading rates.

Scenario	Stream flow	Upstream ammoniacal-N (mean)	Discharge flow	Discharge ammoniacal-N	Calculated downstream ammoniacal-N	Measured downstream ammoniacal-N
	L/s	g/m^3	L/s	g/m^3	g/m^3	g/m^3
1 - stream Q_5, actual discharge, actual peak NH_3-N	3.00	1.45	2.80	36.90	18.56	3.25
2 - mean stream flow, actual discharge, actual peak NH_3-N	40.00	1.45	2.80	36.90	3.77	3.25
3 - stream Q_5, actual Jan discharge, actual Jan NH_3-N	3.00	1.35	2.40	24.63	11.70	1.43
4 - mean stream flow, actual Jan discharge, actual Jan NH_3-N	40.00	1.35	2.40	24.63	2.67	1.43
5 - stream Q_5, mean discharge, mean NH_3-N	3.00	0.41	1.25	6.76	2.28	0.54
6 - mean stream flow, mean discharge, mean NH_3-N	40.00	0.41	1.25	6.76	0.60	0.54
7 - to achieve DS ammonia <2.2 g/m^3 under peak January conditions	40.00	1.45	2.80	44.58	4.27	
8 - to achieve DS ammonia <2.2 g/m^3 under average January conditions	40.00	1.35	2.40	52.88	4.27	
9 - to achieve DS ammonia <1.3 g/m^3 under average (mean) conditions	40.00	0.70	1.25	88.52	3.37	

4.3 Hydrology

4.3.1 Flows

Flow has not been measured in the Wigmore Stream but Q_5 was estimated by Dr. Ed Brown of Waikato Regional Council to be 3 l/s as part of the previous consent evaluation report for Hahei WWTP. This was based on correlations with four flow recorder sites which gave a range of Q_5 flows from 1 to 3.6 l/s. Regarding mean flow, the consent evaluation report stated:

> "Mean flow of the Wigmore Stream has been estimated by Dr. Brown to be in the order of 35 to 50 l/s, in correlation to the four recorder sites, with an average of 40 l/s. However he notes that there are no gaugings at this flow for the Wigmore Stream itself so there is a high level of uncertainty with this estimate."

The accuracy of the Q_5 and mean flow estimates is not known. Actual flow conditions at the site are complex due to the tidal influence, meaning that flows often fluctuate in speed and direction. Given the large amount of existing ecological and water quality data for this site, an assessment of effects can be made without more detailed flow measurements and dispersal modelling.

For the purposes of this assessment it is appropriate to allow for a mixing zone within the stream, and examine ecological effects outside the "zone of reasonable mixing". The Resource Management Act (sections 70 and 107) states that a discharge should not cause certain adverse effects after 'reasonable mixing'. Waikato Regional Council sets out the following policy in Section 3.2.3 of the Regional Plan:

Policy 8: Reasonable Mixing

The zone of reasonable mixing is the area within which a discharge into water (including any discharge that occurs subsequent to a discharge onto or into land) does not need to achieve the standards specified in the water management class for the receiving water body. The size of the mixing zone must be minimised as far as is practicable and will be determined on a case-by-case basis, including consideration of the following matters:

The nature of the effluent, including its flow rate, composition and contaminant concentrations.
River flow rate and flow characteristics.
The design of the outfall.
The depth, velocity and rate of mixing in the receiving water body.
Existing contaminant concentrations in the receiving water body both upstream and downstream of the discharge point and the assimilative capacity of the water body.
The frequency of the discharge.
The speed with which any contaminants will be diluted.
The ability of the discharger to alter the location of the discharge and the mixing characteristics of the outfall so as to ensure that adverse effects of the discharge beyond the zone of non-compliance are not inconsistent with the purpose for which the water body is being managed.
Whether the discharger has taken all practicable steps to minimise the concentration and volume of contaminants at source.
Any effects of the mixing zone on other users of the water body.
The extent of adverse effects within the mixing zone.

The mixing zone for the Hahei WWTP effluent would be dependent on freshwater and tidal flow changes. Water quality measurements taken upstream and downstream of the WWTP provide us with an indication of how well the effluent is mixing into the stream under present conditions.

4.4 Effects on Aquatic Ecosystems

The proposed discharge of treated wastewater to Wigmore Stream has several potential ecological effects. The following areas are considered in this section:

- Dissolved oxygen concentrations in Wigmore Stream, particularly during summer low flows and high temperatures;
- Concentrations of suspended solids, *E. coli*, nitrogen and phosphorus;
- Growth of aquatic plants and algae; and
- Fish passage or spawning.

The following confounding factors influence the Wigmore Stream and should be taken into account when assessing effects of the WWTP:

- overall poor condition of habitat the lower Wigmore Stream;
- effects of upstream catchment landuse;
- estuarine influences on water quality and biota;
- periodic closure of stream mouth immediately downstream of the discharge; and
- use of septic tanks by residential properties adjacent to the Wigmore Stream.

4.4.1 Dissolved oxygen

Dissolved oxygen (DO) in Wigmore Stream was assessed using point measurements during ecological surveys. These measurements did not show any consistent pattern between upstream and downstream of the WWTP. The mean difference between the upstream and downstream measurements was -0.48% or -0.04 mg/L, meaning that on average, DO was slightly higher at the downstream site compared to the upstream site. DO varies in streams on a daily cycle, peaking in the late afternoon due to plant photosynthesis, and reaching a minimum early in the morning due to respiration by plants and organic matter breakdown by microorganisms. Therefore differences in timing of DO measurements can influence results. However, significant differences in the DO between sites should still be detectable, if present, using spot measurements.

Dissolved oxygen concentrations were below the 4 mg/L guideline on several occasions at both the upstream and downstream sites, most notably in March but also during other sampling months. Recent and past measurements of dissolved oxygen showed that concentrations were low at both the upstream and downstream sites, showing that background conditions in Wigmore Stream are degraded due to wider catchment influences.

Changes in effluent biological oxygen demand (BOD) in the effluent are predicted to be modest. Based on the effects of the current WWTP discharge, the effects of the proposed discharge on the DO of Wigmore Stream are predicted to be minor. Nonetheless, monitoring of DO should continue during ecological surveys, with an effort to measure DO at both sites within as short a time frame as possible to aid comparison.

4.4.2 Ammoniacal and nitrate nitrogen

Ammoniacal-N is the key nutrient of concern in this system due to its potential toxic effects on stream biota. In January 2013, 2014 and 2015, a peak in ammoniacal-N in the discharge occurred at the same time as a peak downstream of the WWTP, while upstream concentrations remained low. This pattern suggests that the ammoniacal-N may have come from the WWTP discharge. However, during summer 2010, the upstream site also showed a peak in ammoniacal-N, suggesting a source is also discharging into the stream further up in the catchment.

When interpreting these patterns, it is important to consider the effects of other sources of ammoniacal-N in the vicinity of the WWTP discharge. There are approximately six dwellings on the eastern bank of Wigmore Stream between the WWTP discharge point and the downstream water quality sampling point at the Pa Rd bridge. These properties are not serviced by the WWTP and dispose of wastewater via septic tank systems. Septic tanks vary greatly in their performance depending on age and functioning of the system as well as the type of system used. Intermittent use of septic tank systems can affect the treatment efficiency in the case of incomplete formation of a bacterial clogging mat in the soil treatment system. Leaching of microbes and nutrients can result, particularly in porous coastal soils (Postma et al. 1992). Leaching from the systems adjacent to Wigmore Stream is likely highest during the same times over summer when discharge from the WWTP is highest; however, the magnitude of effects of septic tanks is unknown at present. It is not possible to separate the effects of the septic tanks from the effects of the WWTP discharge.

Nitrate-N was within the "A" NOF band at both upstream and downstream sites, with no clear pattern in the time series graph that would indicate a clear influence of the WWTP on downstream concentrations in the Wigmore Stream (Appendix III).

Macroinvertebrate and other ecological monitoring techniques have not shown any consistent differences between upstream and downstream sites that would indicate an effect of nutrients in the WWTP discharge on stream biota. Recent ammoniacal-N concentrations in the Wigmore Stream were within NOF bottom lines during summertime discharge peaks; therefore toxic effects are unlikely to have been a factor. Nevertheless, it is considered that the planned upgrades to the WWTP (see section 4.2) will ameliorate the current summertime peaks of ammoniacal-N in the discharge, avoiding increases in N concentrations downstream. Therefore the effects of the discharge on ammoniacal-N concentrations in the stream are predicted to be minor.

4.4.3 Phosphorus

Median phosphorus concentrations were well within the WRC "Satisfactory" levels for ecosystem health, both upstream and downstream of the WWTP. No evidence was found for a difference in mean phosphorus concentrations between upstream and downstream sites. Peaks in total phosphorus at the downstream site have generally coincided with peaks in the discharge; however, on two of four such instances, total phosphorus was also elevated at the upstream site.

Phosphorus is of concern because of its ability to cause nuisance growth of aquatic plants and periphyton (slime and algae). However, aquatic plants and periphyton have been absent or present in very small amounts during all ecological surveys, due to high salinity. Due to the lack of aquatic plants and periphyton in Wigmore Stream, it is predicted that the adverse effects of phosphorus in the discharge on the stream ecosystem will be minor.

4.4.4 Suspended solids

Current mean concentrations of suspended solids in the effluent are far lower than most measured values at the upstream site, indicating inputs of sediment from the catchment. Adding to the effects of these high background suspended solids concentrations, water clarity in Wigmore Stream is influenced by the tidal turbidity maximum. The presence of saltwater intrusion means that higher suspended sediment measurements downstream of the WWTP are more likely to be due to the natural turbidity maximum than the WWTP discharge.

It is considered that the effects of the WWTP discharge on suspended solids Wigmore Stream will be minor given the high background concentrations and continuing low concentrations in the treated effluent.

4.4.5 E. coli and enterococci

Current *E. coli* and enterococci concentrations in the discharge are much lower than the upstream concentration in Wigmore Stream and are projected to remain low, at an average of 5 cfu/100 mL (colony forming units per 100 mL) in 2045, due to tertiary treatment at the WWTP. Therefore the effect of the WWTP on *E. coli* and enterococci concentrations in the Wigmore Stream and downstream coastal areas will be negligible.

4.4.6 pH

No consistent differences in pH were observed between spot measurements at the upstream and downstream sites since 2010. Effects of the discharged effluent on pH in the Wigmore Stream are predicted to be minor.

4.4.7 Temperature

Temperatures were typically slightly higher at the downstream site, likely due to slight differences in timing of measurements along with natural increases in temperature due to widening of the stream and saltwater influence. Effects of the discharged effluent on temperature in the Wigmore Stream are predicted to be minor.

4.4.8 Aquatic plant growth

High concentrations of nutrients such as phosphorus and nitrogen can contribute to excessive growth of nuisance aquatic plants, such as macrophytes, phytoplankton, cyanobacteria, and filamentous and attached algae. This can negatively affect amenity values, cause reductions in dissolved oxygen concentrations when plant material is decomposed, cause wide fluctuations in oxygen concentrations, and cause toxic effects in the case of cyanobacteria blooms.

Macrophytes were not observed during our surveys of Wigmore Stream, likely due to the periodic high salinity. Periphyton was only observed at very low levels on some sampling occasions, which is not surprising given high turbidity and lack of stable substrates in the canal and river. Plant or periphyton growth in the riverine and estuarine environments in this area are likely to be limited by turbidity, salinity and lack of stable habitat. It is therefore concluded that effects of the small planned increases in nitrogen and phosphorus loads associated with the WWTP discharge on aquatic plant and algal growth in Wigmore Stream and downstream areas will be minor.

4.4.9 Fish passage and spawning

Wigmore Stream provides habitat as well as a migration corridor for several indigenous fish species that must migrate between freshwater and the sea as part of their life cycle. In the Waikato region, juvenile long-and shortfin eels migrate upstream between mid-November and the end of March (Table 21; Hamer 2007). Common smelt juveniles migrate upstream between mid-August and November, while juvenile inanga migrate between May and mid-November (Hamer 2007). Other migratory species that are not present near the Hahei WWTP but may be present in the upper catchment include banded kokopu (migrating August-November), koaro (September-November) and common bully (November-February). These species' upstream migrations also have the potential to be affected by the WWTP discharge. Timing of upstream and downstream migrations is summarised in Table 21.

There is potential for fish passage to be affected in Wigmore Stream if the discharge causes ammoniacal nitrogen to become elevated above toxic levels, forming a barrier that fish would be reluctant to cross. This is most likely to occur at low flows during spring tides and would therefore be expected to impact on those species migrating during summer, such as long- and shortfin eels and common bully. Ammoniacal nitrogen is presently elevated in the Wigmore Stream for short periods (weeks) each year and still does not reach toxic concentrations; planned upgrades in the near future will ameliorate this effect. Future effluent concentrations are not predicted to be significantly different to the present situation. Therefore the effect of the WWTP discharge on fish passage is predicted to be minor.

Table 21. Upstream and downstream migration and spawning periods of fish species found in Wigmore Stream or likely to migrate upstream past the WWTP discharge. Source: Hamer 2007.

Species	Migration periods	Spawning	Spawning habitat
Long- and shortfin eels	Upstream (juveniles): Mid-November to the end of March (peak December-March) Downstream (adults): February-May	Do not spawn in freshwater	
Common smelt	Upstream: Mid-August to November (juveniles) Downstream: March-June (larvae)	Peak March-May	Sand banks of rivers
Inanga	Upstream: May to mid-November (peak August-October) (juveniles) Downstream: September-June (larvae)	Peak March-May	Tidal estuary edge vegetation
Banded kokopu (likely)	Upstream: August-November (peak September-October) (juveniles) Downstream: May-July (larvae)	Peak May-June	Stream margin vegetation during flood
Common bully (likely)	Upstream: October-February (peak December-February) (juveniles) Downstream: October-November (larvae)	October-February	Under firm, flat surfaces in streams
Koaro (possible)	Upstream: September-November (peak September-October) Downstream: April-June (larvae)	April-June	Cobbles at stream edge

4.5 Effects on Terrestrial Fauna

Contaminant and microbial levels in the discharge are low and will be further diluted to negligible levels when the Wigmore Stream meets the ocean at Hahei Beach. The WWTP discharge is therefore not predicted to have any adverse effect on terrestrial fauna such as birds, lizards and frogs.

4.6 Effects on the Marine Environment

The Wigmore Stream flows directly into the sea at the western end of Hahei Beach, meaning that the already diluted treated effluent in the stream will be diluted to negligible levels. The WWTP discharge is therefore not predicted to have any adverse effect on the marine environment.

5 Key Findings and Recommendations

5.1 Key Findings

5.1.1 Ecological Features

Habitat quality appears to be increasing at Wigmore Stream downstream site as native vegetation in the riparian margins establishes. In the long term, increased shading, bank stability and presence of vegetation with increase habitat complexity and provide cover for aquatic biota.

Diversity of the macroinvertebrate fauna at this site was generally reduced in spring and summer compared to winter. This may be attributable to the higher temperatures, higher salinities and lower dissolved oxygen concentrations over spring and summer. High temperatures and low DO, combined with saltwater intrusion, made conditions in the stream inhospitable for sensitive freshwater organisms, and facilitated colonisation of estuarine and marine species such as paddleworms, mussels and marine gastropods.

Ecological surveys did not conclusively show any effects of the wastewater discharge on the receiving environment. There was a clear seasonal pattern in invertebrate diversity but no consistent differences between sites. The effects of periodic saltwater intrusion are likely to significantly affect the freshwater macroinvertebrate community at both sites, but most notably at the downstream site. Diversity and species composition are therefore more reliable indicators of water and habitat quality than MCI and QMCI at this site.

The following confounding factors influence the Wigmore Stream and should be taken into account when assessing effects of the WWTP:

- overall poor condition of habitat the lower Wigmore Stream;
- effects of upstream catchment landuse;
- estuarine influences on water quality and biota;
- periodic closure of stream mouth immediately downstream of the discharge; and
- use of septic tanks by residential properties adjacent to the Wigmore Stream.

Water quality measurements taken by Veolia upstream and downstream of the WWTP were compared to National Objectives Framework and WRC guidelines. Peak ammoniacal-N concentrations were elevated downstream compared to upstream, and were within the NOF “C” band at both sites, indicating the potential for moderate stress on sensitive fish and macroinvertebrate taxa. Nitrate measurements were within the “A” band at both sites, indicating that toxic effects of nitrate are very unlikely to be present. Total nitrogen was within the WRC “Satisfactory” guideline at both sites.

E. coli numbers were higher on average at the upstream site compared to the downstream site. The median measurement at the upstream site was within the “D” band, meaning that the site is not suitable for secondary contact recreation (boating and wading) due to a high risk of

gastroenteritis (>5%). The median at the downstream site was within the "C" band, indicating a moderate risk of gastroenteritis (1.0-5.0%) from secondary exposure.

Median phosphorus concentrations were well within the WRC "Satisfactory" levels for ecosystem health, both upstream and downstream of the WWTP.

Water clarity in Wigmore Stream is influenced by the tidal turbidity maximum as well as inputs of sediment from the catchment.

Macrophytes were not observed during our surveys of Wigmore Stream, likely due to the periodically high salinity. Periphyton was only observed at very low levels on some sampling occasions, which is not surprising given high turbidity and lack of stable substrates in the canal and river.

5.1.2 Effects of Proposed Discharge

This study has assessed the effects of the proposed discharge of treated wastewater on the Wigmore Stream. Predicted effects on ecological and physical aspects of the stream, terrestrial and marine environments are as follows:

- Depletion of dissolved oxygen concentrations, particularly during summer low flows and high temperatures. These effects are predicted to be minor.
- Increased concentrations of nitrate and ammoniacal nitrogen. The current temporary elevation of ammoniacal nitrogen concentrations downstream of the WWTP during summer will be ameliorated by upgrades to the plant. These effects are predicted to be minor.
- Turbidity/suspended solids. Effects on Wigmore Stream are likely to be minor given the existing conditions of very high natural and human-induced turbidity, and that the projected concentrations of suspended solids in the effluent will be lower than upstream concentrations.
- Concentrations of *E. coli*. Effects on Wigmore Stream are likely to be negligible due to the low concentrations in effluent compared to background concentrations.
- Increased growth of aquatic plants and algae. Effects on Wigmore Stream and downstream areas are predicted to be minor due to suppression of macrophyte and periphyton growth by high salinity and turbidity.
- Disruption of fish passage or spawning. These effects are predicted to be minor.
- Effects on terrestrial fauna. These effects are predicted to be minor.
- Effects on the marine environment. These effects are predicted to be minor.

Avoidance, remediation, mitigation and monitoring strategies for these effects are described in the following section.

5.2 Recommendations for Avoidance, Remediation, and Mitigation of Effects

Planned upgrades to the Hahei WWTP treatment system will avoid significant increases in nutrient and microbial concentrations in the effluent as the volume of treated effluent increases. As it is not considered that the future discharge from the WWTP will have any adverse effects on the Wigmore Stream that are more than minor, no additional mitigation is necessary.

Monitoring of effects of the WWTP should continue. It is recommended that the current water quality sampling regime should continue for the duration of the consent, and that analysis of this data is carried out every year to assess whether concentrations of potential toxic compounds e.g. ammoniacal-N rise above toxic levels in the Wigmore Stream.

The sampling of macroinvertebrates three times per year since 2010 has provided an ample baseline of data with which to compare future results. We now have a good understanding of seasonal dynamics of macroinvertebrate communities in this system. Drawing conclusions from the macroinvertebrate data is made more complex by the influence of saline waters; however, it is

considered that macroinvertebrate sampling still holds value as a method of detecting significant effects on stream biota, should they occur. Macroinvertebrate sampling gives an indication of the conditions in the stream over the preceding weeks or months and therefore gives a more time-integrated picture of conditions, rather than water quality samples which provide a snapshot of one moment in time. Because effects are most likely to be evident during early January when population is highest, it is recommended that macroinvertebrate sampling is carried out yearly in January or February (with January being preferable). Methods should remain the same as used currently with two samples taken at the upstream site and two at the downstream site; there is not enough habitat for more samples to be taken. Fish sampling should continue every 5 years to detect any long term changes.

Along with yearly macroinvertebrate sampling, habitat and aquatic plant assessment should also be carried out in mid-late January along with spot water quality measurements, in line with current methods.

6 Glossary of terms

Climbing fish: Some New Zealand fish species are excellent climbers as juveniles and are able to climb up obstacles such as weirs and waterfalls given the right conditions. Species include juvenile eels, koaro, banded and giant kokopu, and shortjaw kokopu.

EPT or **Ephemeroptera, Plecoptera and Trichoptera:** Refers to scientific names for mayflies, stoneflies and caddisflies, three orders of stream macroinvertebrates that are considered to be generally sensitive to poor habitat conditions.

Macroinvertebrate: Animals without a backbone that can be seen with the naked eye.

Macrophyte: Aquatic plants. Can be emergent (with parts growing above and below the water's surface), submerged (growing completely under water) or floating.

MCI or **Macroinvertebrate Community Index:** An indicator of aquatic habitat quality based on the presence/absence of species that have a predefined tolerance score. Different scores are used in soft and hard-bottomed streams. MCI-sb indicates that the soft-bottom index was used.

Mesohabitat: Literal translation is "middle' habitat. Used in stream ecology to describe stream sections with similar depth and velocity characteristics (e.g. pools, riffles, runs).

Neap tide: When the tidal range is at its minimum (i.e. lower high tides and higher low tides). Occurs twice per month.

Periphyton: Algae and bacteria growing on the surface of rocks or other surfaces.

Phytoplankton: Microscopic plants that are planktonic (suspended in the water column)

QMCI or **Quantitative Macroinvertebrate Community Index:** An indicator of aquatic habitat quality based on the relative abundances of macroinvertebrate taxa that have a predefined tolerance score. Different scores are used in soft and hard-bottomed streams. QMCI-sb indicates that the soft-bottom index was used.

Riparian zone: The zone along the edge of stream and river beds.

Spring tide: When the tidal range is at its maximum (i.e. higher high tides and lower low tides). Occurs twice per month.

Stream morphology: Shape and composition of stream channels.

Supersaturation (DO): When more oxygen is dissolved in water than would be in a state of equilibrium. Occurs when photosynthesis by plants elevates dissolved oxygen above 100%.

Swimming fish: Fish that can negotiate obstacles only by swimming around them (not climbing). Some species are capable of small vertical jumps. New Zealand examples include inanga, smelt and most bully species.

Taxon or **taxa:** A group of organisms judged to be similar by a taxonomist. The smallest taxonomic grouping used is typically a 'species'.

Thalweg: Continuous line running along the deepest part of a channel.

95th percentile: the value that is higher than 95% of all other values.

95% confidence interval (of the mean): there is a 95% probability that the true mean lies within this interval.

7 References

Aldridge, B. T. A., and M. Robb. 2011. Hahei Wastewater Monitoring Scheme: Biological Sampling for Wigmore Stream Annual Resource Consent Compliance Report 2010. Client report, Kessels & Associates Limited.

ANZECC (Australian and New Zealand Environment and Conservation Council). 2000. Australian and New Zealand guidelines for fresh and marine water quality. Volume 1 - The Guidelines. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

Beard, S. 2010. Regional Rivers Water Quality Monitoring Programme Data Report 2009. Environment Waikato Technical Report TR2010/11.

Biggs, B. J. F. 2000. New Zealand Periphyton Guideline: Detecting, Monitoring and Managing Enrichment of Streams. Report prepared by the National Institute of Water and Atmospheric Research for the Ministry for the Environment, Christchurch.

Blair, J. and Robb M. 2013. Hahei WWTP: Results of the Biological Survey, Wigmore Stream, August 2012- March 2013. Client Report, Kessels & Associates Ltd.

Collier K.J. and Kelly J. 2006. Patterns and Trends in the Ecological Condition of Waikato Streams Based on the Monitoring of Aquatic Invertebrates from 1994 to 2005. Waikato Regional Council, Hamilton.

Collier K.J. and Kelly J. 2005. Regional Guidelines for Ecological Assessments of Freshwater Environments: Macroinvertebrate Sampling in Wadeable Streams. Waikato Regional Council, Hamilton.

Collier K.J., Kelly J. and Champion P. 2007. Regional Guidelines for Ecological Assessments of Freshwater Environments: Aquatic Plant Cover in Wadeable Streams. Waikato Regional Council, Hamilton.

DairyNZ Ltd. 2014. Water Quality Status and Trends: Mangere River (Northland). Report prepared for Northland Regional Council by DairyNZ Ltd, Hamilton.

Davies-Colley, R. and Wilcock, B. 2004. Water quality and chemistry in running waters. In: Harding, J. S., Mosley, M. P., Pearson, C. P., and Sorrell, B. K (ed). Freshwaters of New Zealand. New Zealand Hydrological Society Inc. and New Zealand Limnological Society Inc. Christchurch.

Davies-Colley, R., Franklin, P., Wilcock, B., Clearwater, S., Hickey, C. 2013. National Objective Framework-Temperature, Dissolved Oxygen and pH. Proposed thresholds for discussion. NIWA Client Report HAM2013-056. NIWA, Hamilton.

Dean, T. L., & Richardson, J. 1999. Responses of seven species of native freshwater fish and a shrimp to low levels of dissolved oxygen. New Zealand Journal of Marine and Freshwater Research, 33(1): 99-106.

DOC (Department of Conservation). 2010. Freshwater Ecosystems of New Zealand (FENZ) geodatabase. Department of Conservation.

Franklin, P. 2010. *Dissolved oxygen criteria for fish and the determination of ecological flows*. NIWA Internal Report 146, National Institute of Water and Atmospheric Research.

Franklin, P. A. 2014. Dissolved oxygen criteria for freshwater fish in New Zealand: a revised approach, New Zealand Journal of Marine and Freshwater Research 48(1) 112-126

Goodman, J. M., Dunn, N. R., Ravenscroft, P. J., Allibone, R. M., Boubee, J. A. T., David, B. O., Griffiths, M., Ling, N., Hitchmough, R. A. and Rolfe, J. R. 2014. Conservation status of New Zealand freshwater fish, 2013. New Zealand Threat Classification Series 7. 12 p. Department of Conservation.

Joy, M., David, B., and Lake, M. 2013. Field Guide: New Zealand Freshwater Fish Sampling Protocols. Part 1: Wadeable Rivers and Streams. Massey University, Palmerston North.

Joy, M., and Henderson, I. 2007. A New Fish Index of Biotic Integrity using Quantile Regressions: the Fish QIBI for the Waikato Region. Waikato Regional Council, Hamilton.

Kessels, G. H. A., Deichmann, B., Kendal, H., Stewart, P., Clark, R., Robb; M., & Hermans, A. 2009. Significant Natural Areas of the Thames-Coromandel District: Terrestrial and Wetland Ecosystems. Environment Waikato technical report 2010/36, prepared by Kessels & Associates Ltd.Hamer, M. 2007. The Freshwater Fish Spawning and Migration Calendar Report. Waikato Regional Council, Hamilton.

Hickey, C. 2014. Derivation of indicative ammoniacal nitrogen guidelines for the National Objectives Framework. Report prepared for the Ministry for the Environment, National Institute for Water and Atmospheric Research.

Hitchmough, R., Bull, L., and Cromarty, P. (comp.) 2007. New Zealand Threat Classification System Lists 2005. Department of Conservation, Wellington.

Hitchmough, R. 2013. Summary of changes to the conservation status of taxa in the 2008–11 New Zealand Threat Classification System listing cycle. New Zealand Threat Classification Series 1. Department of Conservation, Wellington.

Humphries, E. A. and Tyler, A. M. 1990. Coromandel Ecological Region: Survey Report for the Protected Natural Areas Programme. Department of Conservation, Hamilton.

Kessels, G.H.A.; Deichmann, B.; Kendal, H.; Stewart, P., Clark, R.; Robb, M.; Hermans, A. 2009. Significant Natural Heritage of the Thames-Coromandel District. Report prepared for Environment Waikato, Kessels & Associates Ltd., Hamilton. 45 p.

Leathwick, J. R., West, D., Gerbeaux, P., Kelly, D., Robertson, H., Brown, D., Chadderton, W. L., Ausseil, A.-G. 2010. Freshwater Ecosystems of New Zealand: User Guide. Department of Conservation.

McDowall, R. M. 1990. The Reed Field Guide to New Zealand Freshwater Fishes. Reed Publishing (NZ) Ltd, Auckland.

MfE (Ministry for the Environment). 2003. Microbiological Water Quality Guidelines for Marine and Freshwater Recreational Areas. Ministry for the Environment, Wellington.

MfE (Ministry for the Environment). 2013a. Freshwater reform 2013 and beyond. Ministry for the Environment, Wellington.

MfE (Ministry for the Environment). 2013b. Proposed amendments to the National Policy Statement for Freshwater Management 2011-2012. Ministry for the Environment, Wellington.

NIWA. 2004. *WAIORA Version 2.0*. National Institute of Water and Atmospheric Research.

NZFFDB (New Zealand Freshwater Fish Database). 2012. National Institute for Water and Atmospheric Research. Available at http://fwdb.niwa.co.nz/

Postma, F. B., Gold, A. J., & Loomis, G. W. 1992. Nutrient and microbial movement from seasonally-used septic systems. Journal of Environment and Health 55(2): 5-11.

Richardson, Jody , Boubée, Jacques A. T. and West, David W.1994. Thermal tolerance and preference of some native New Zealand freshwater fish. New Zealand Journal of Marine and Freshwater Research 28: 399–407

Robb, M. 2012. Hahei WWTP: Results of the Biological Survey, Wigmore Stream, July 2011-March 2012. Client Report, Kessels & Associates Ltd.

Robertson, C. J. R., Hyvonen, P., Fraser, M. J., and Pickard, C. R. 2007. Atlas of bird distribution in New Zealand, 1999-2004. The Ornithological Society of New Zealand, Inc., Wellington.

Robertson H.A., Dowding J.E., Elliott G.P., Hitchmough R.A., Miskelly C.M., O'Donnell C.J.F., Powlesland R.G., Sagar P.M., Scofield R.P., Taylor G.A. 2013. Conservation status of New Zealand birds, 2012. New Zealand Threat Classification Series 4. Department of Conservation, Wellington, New Zealand.

Stark, J. D., I. K. G. Boothroyd, J. S. Harding, J. R. Maxted, and M. R. Scarsbrook. 2001. Protocols for sampling macroinvertebrates in wadeable streams. Ministry for the Environment.

Stark J.D. and Maxted J.R. 2007. A user guide for the Macroinvertebrate Community Index. Report prepared by the Cawthron Institute for the Ministry for the Environment.

Thrush, S. F., Hewitt, J. E., Cummings, V. J., & Dayton, P. K. 1995. The impact of habitat disturbance by scallop dredging on marine benthic communities: what can be predicted from the results of experiments? Marine Ecology Progress Series 129(1): 141-150.

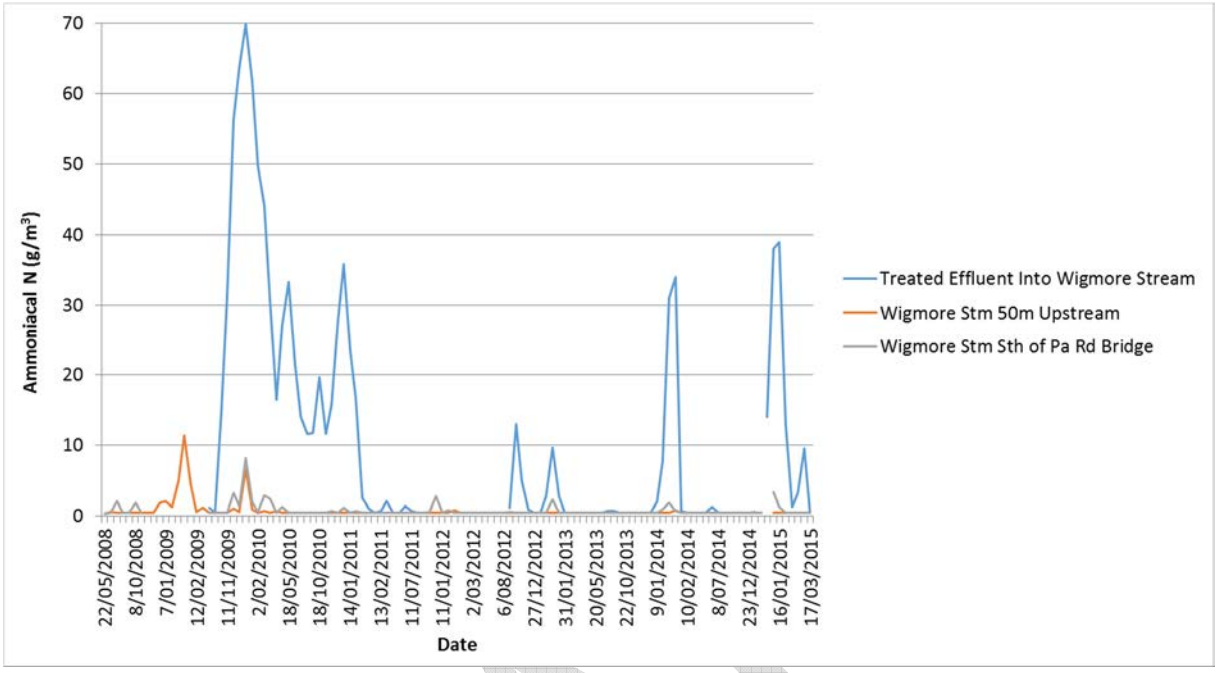
Tulagi, A. 2013. Regional Rivers Water Quality Monitoring Programme: Data Report 2012. Waikato Regional Council Technical Report 2013/13.

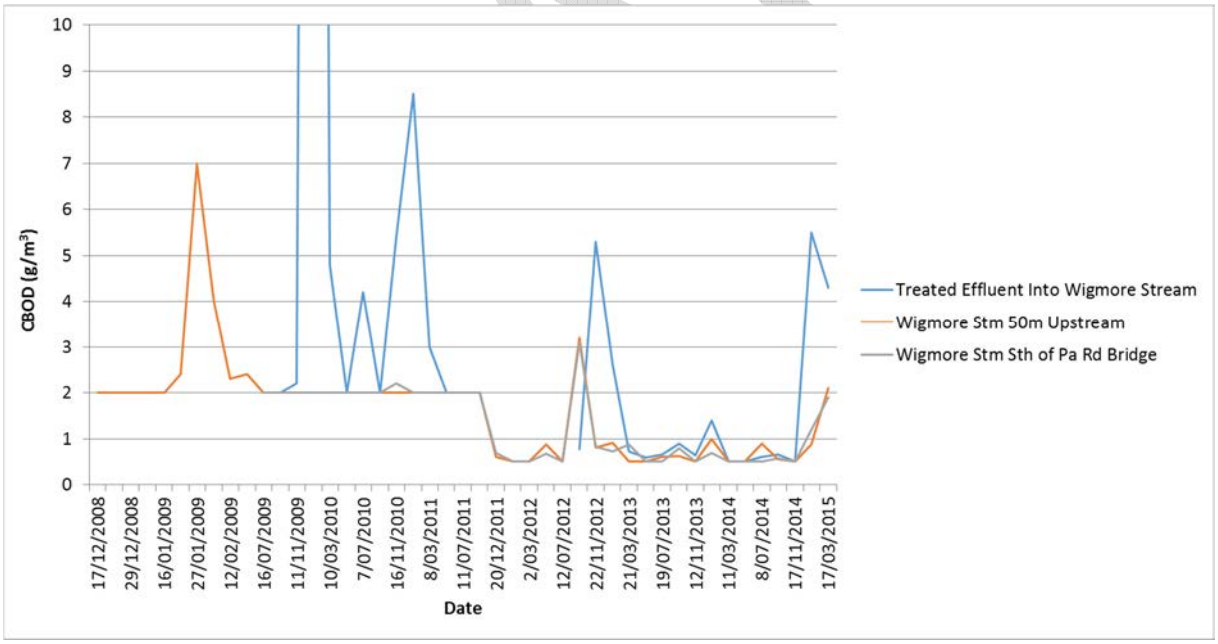
Whaley, K.; Clarkson, B.D.; Leathwick, J.R. 1995. Assessment of criteria used to determine 'significance' of natural areas in relation to section 6(c) of the Resource Management Act(1991). Unpublished Landcare Research Contract Report LC9596/021 to Environment Waikato. 34 p.

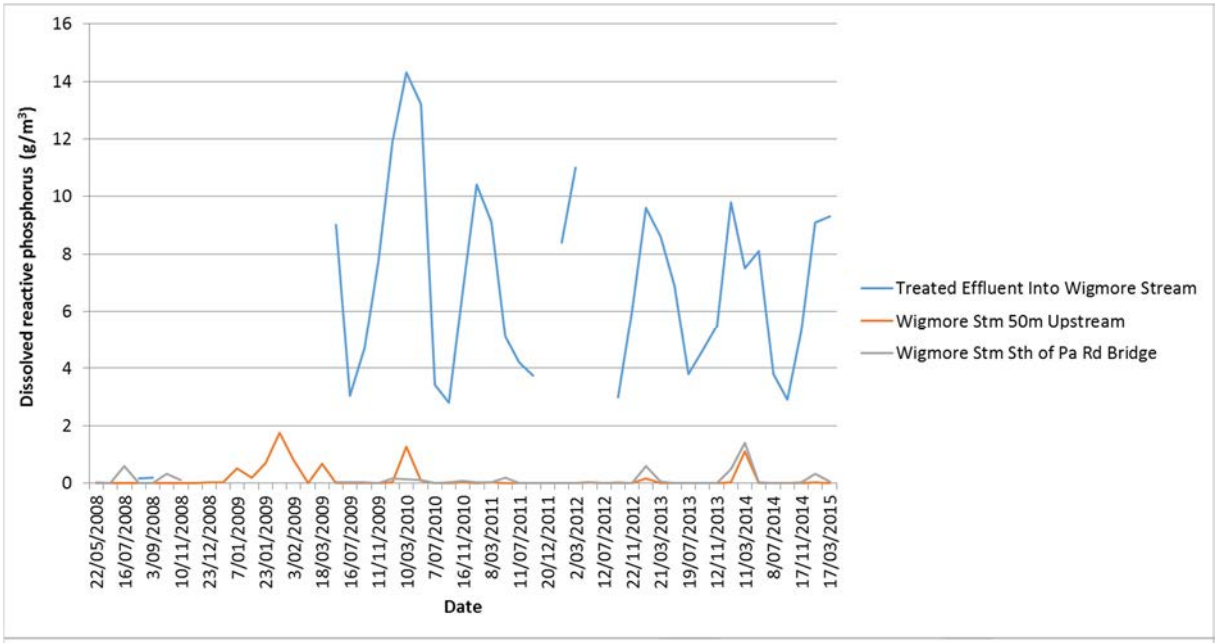
Wilcock B., Young R., Gibbs M. and McBride G. 2011. Continuous measurement and interpretation of dissolved oxygen data in rivers. Report prepared for Horizons District Council by the National Institute of Water and Atmospheric Research (NIWA).

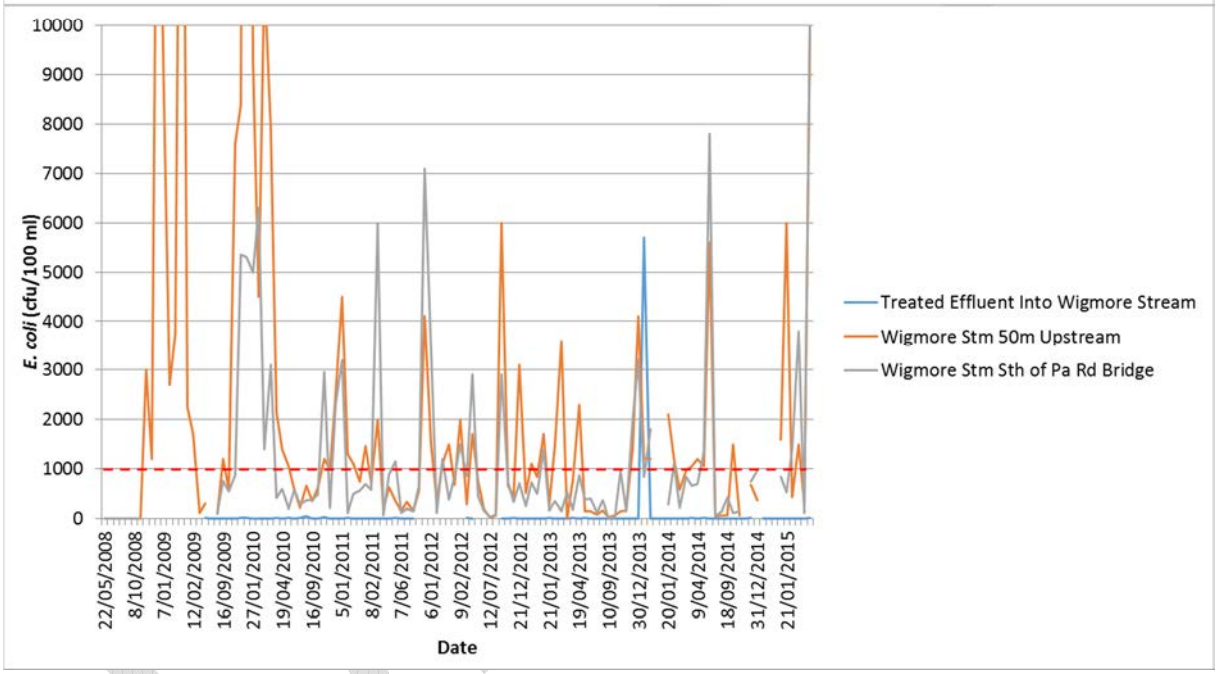
Willis, T. J., Millar, R. B., & Babcock, R. C. 2003. Protection of exploited fish in temperate regions: high density and biomass of snapper *Pagrus auratus* (Sparidae) in northern New Zealand marine reserves. Journal of Applied Ecology 40(2): 214-227.

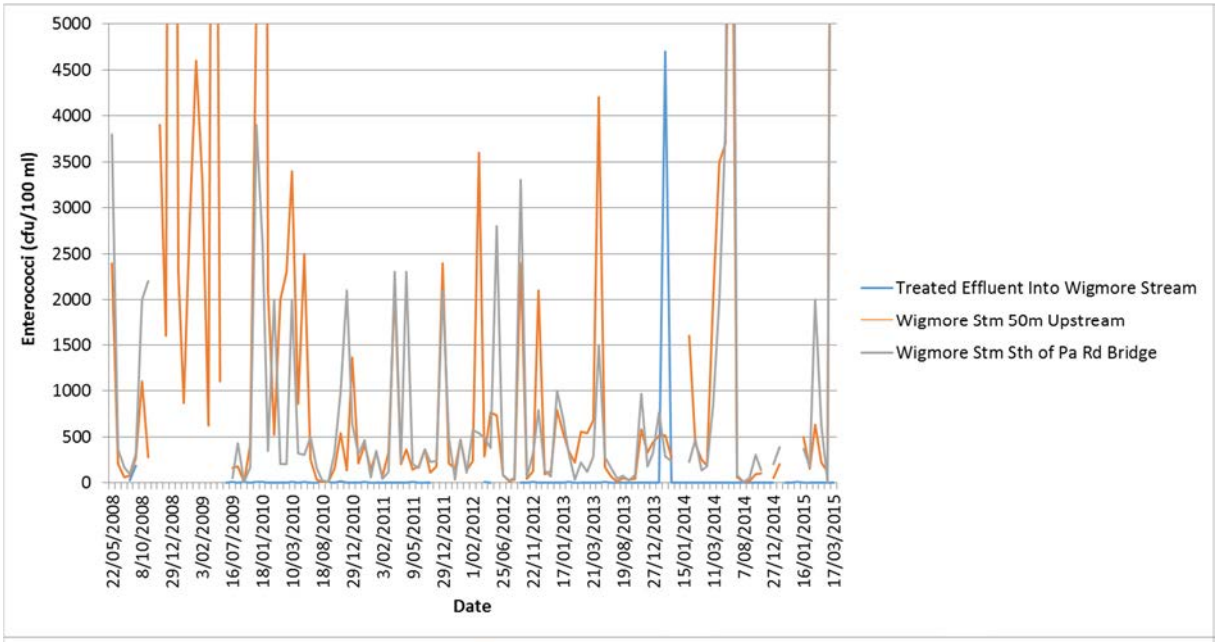
Appendix I
Time Series Plots of Water Quality

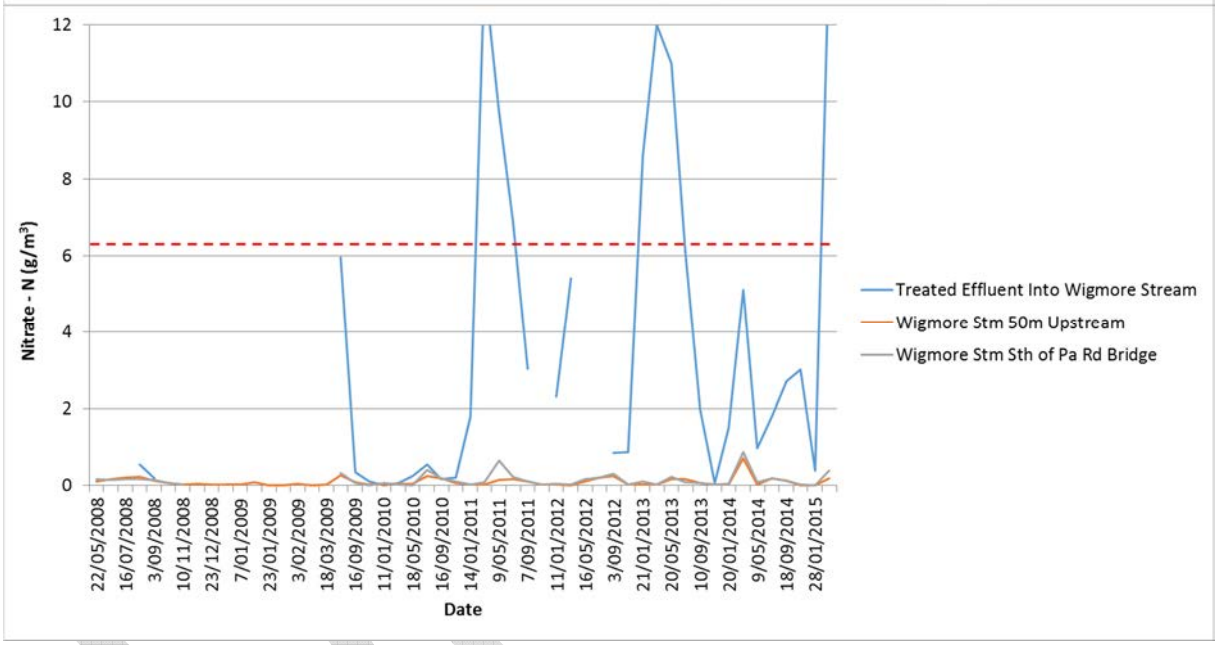


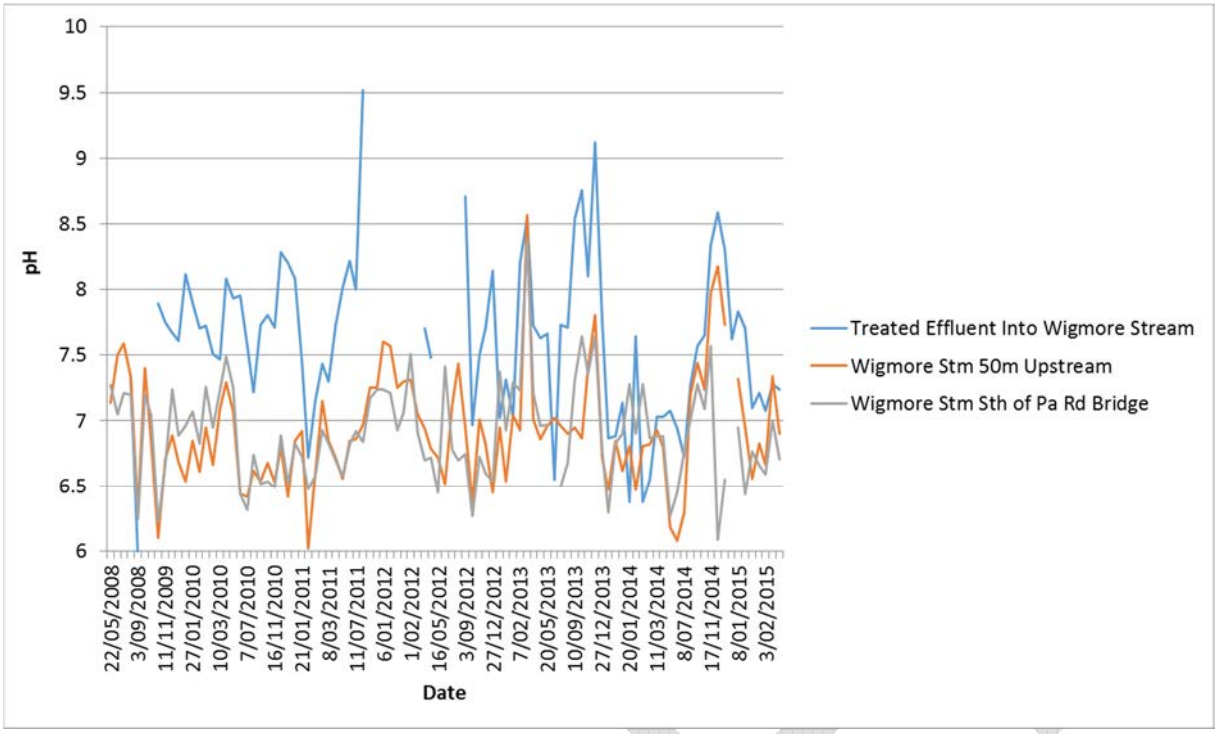


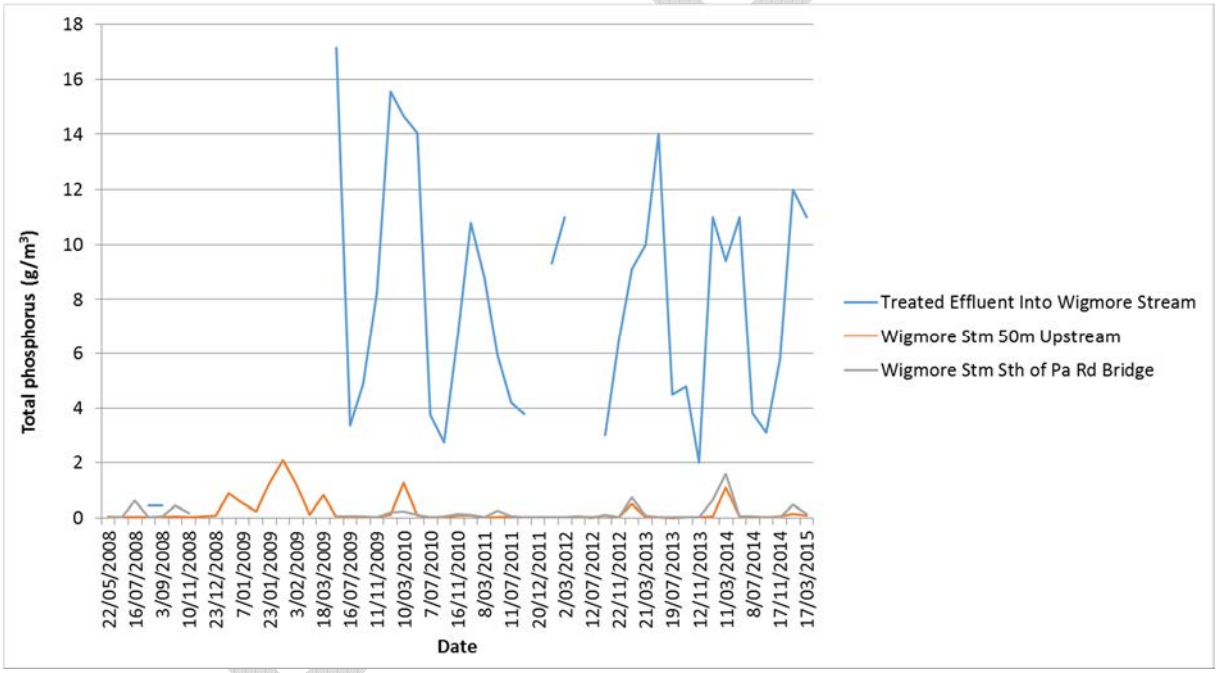

Dissolved reactive phosphorus (g/m³)
16
14
12
10
8
6
4
2
0
22/05/2008
16/07/2008
3/09/2008
10/11/2008
23/12/2008
7/01/2009
23/01/2009
3/02/2009
18/03/2009
16/07/2009
11/11/2009
10/03/2010
7/07/2010
16/11/2010
8/03/2011
11/07/2011
20/12/2011
2/03/2012
12/07/2012
22/11/2012
21/03/2013
19/07/2013
12/11/2013
11/03/2014
8/07/2014
17/11/2014
17/03/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge

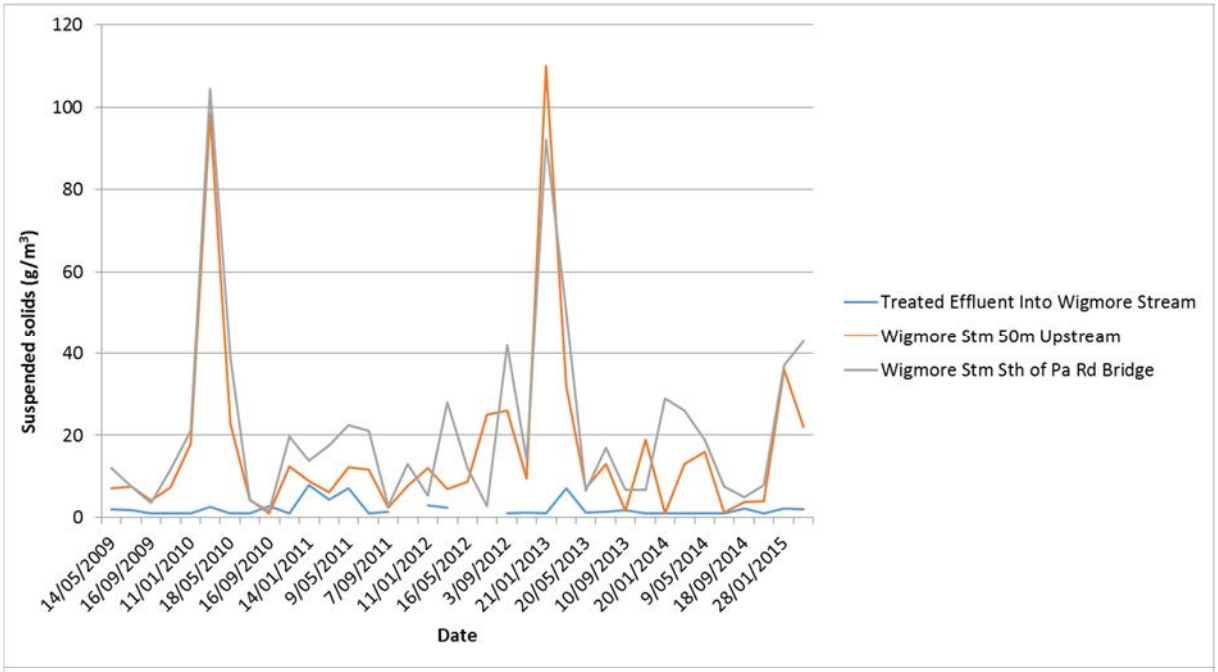

E. coli (cfu/100 ml)
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
22/05/2008
8/10/2008
7/01/2009
12/02/2009
16/09/2009
27/01/2010
19/04/2010
16/09/2010
5/01/2011
8/02/2011
7/06/2011
6/01/2012
9/02/2012
12/07/2012
21/12/2012
21/01/2013
19/04/2013
10/09/2013
30/12/2013
20/01/2014
9/04/2014
18/09/2014
31/12/2014
21/01/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge

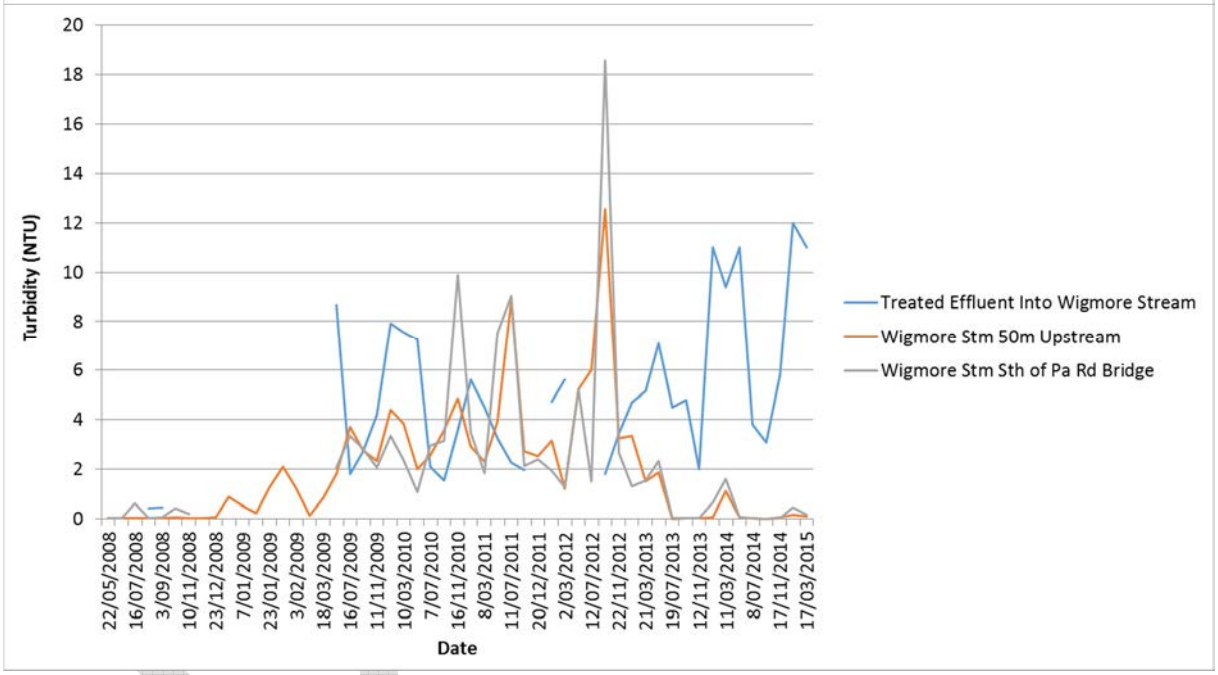

Enterococci (cfu/100 ml)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
22/05/2008
8/10/2008
29/12/2008
3/02/2009
16/07/2009
18/01/2010
10/03/2010
18/08/2010
29/12/2010
3/02/2011
9/05/2011
29/12/2011
1/02/2012
25/06/2012
22/11/2012
17/01/2013
21/03/2013
19/08/2013
27/12/2013
15/01/2014
11/03/2014
7/08/2014
27/12/2014
16/01/2015
17/03/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge

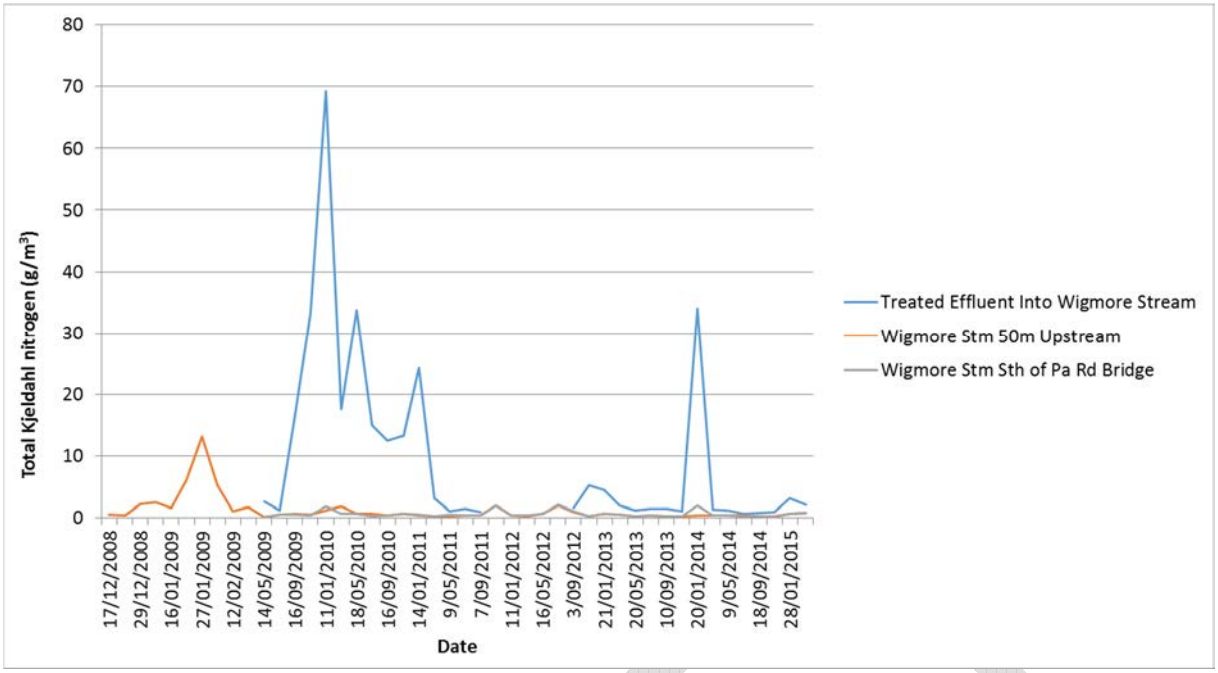

Nitrate - N (g/m³)
12
10
8
6
4
2
0
22/05/2008
16/07/2008
3/09/2008
10/11/2008
23/12/2008
7/01/2009
23/01/2009
3/02/2009
18/03/2009
16/09/2009
11/01/2010
18/05/2010
16/09/2010
14/01/2011
9/05/2011
7/09/2011
11/01/2012
16/05/2012
3/09/2012
21/01/2013
20/05/2013
10/09/2013
20/01/2014
9/05/2014
18/09/2014
28/01/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge


pH
10
9.5
9
8.5
8
7.5
7
6.5
6
22/05/2008
3/09/2008
11/11/2009
27/01/2010
10/03/2010
7/07/2010
16/11/2010
21/01/2011
8/03/2011
11/07/2011
6/01/2012
1/02/2012
16/05/2012
3/09/2012
27/12/2012
7/02/2013
20/05/2013
10/09/2013
27/12/2013
20/01/2014
11/03/2014
8/07/2014
17/11/2014
8/01/2015
3/02/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge


Total phosphorus (g/m³)
18
16
14
12
10
8
6
4
2
0
22/05/2008
16/07/2008
3/09/2008
10/11/2008
23/12/2008
7/01/2009
23/01/2009
3/02/2009
18/03/2009
16/07/2009
11/11/2009
10/03/2010
7/07/2010
16/11/2010
8/03/2011
11/07/2011
20/12/2011
2/03/2012
12/07/2012
22/11/2012
21/03/2013
19/07/2013
12/11/2013
11/03/2014
8/07/2014
17/11/2014
17/03/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge


Suspended solids (g/m³)
120
100
80
60
40
20
0
14/05/2009
16/09/2009
11/01/2010
18/05/2010
16/09/2010
14/01/2011
9/05/2011
7/09/2011
11/01/2012
16/05/2012
3/09/2012
21/01/2013
20/05/2013
10/09/2013
20/01/2014
9/05/2014
18/09/2014
28/01/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge


Turbidity (NTU)
20
18
16
14
12
10
8
6
4
2
0
22/05/2008
16/07/2008
3/09/2008
10/11/2008
23/12/2008
7/01/2009
23/01/2009
3/02/2009
18/03/2009
16/07/2009
11/11/2009
10/03/2010
7/07/2010
16/11/2010
8/03/2011
11/07/2011
20/12/2011
2/03/2012
12/07/2012
22/11/2012
21/03/2013
19/07/2013
12/11/2013
11/03/2014
8/07/2014
17/11/2014
17/03/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge


Total Kjeldahl nitrogen (g/m³)
80
70
60
50
40
30
20
10
0
17/12/2008
29/12/2008
16/01/2009
27/01/2009
12/02/2009
14/05/2009
16/09/2009
11/01/2010
18/05/2010
16/09/2010
14/01/2011
9/05/2011
7/09/2011
11/01/2012
16/05/2012
3/09/2012
21/01/2013
20/05/2013
10/09/2013
20/01/2014
9/05/2014
18/09/2014
28/01/2015
Date
Treated Effluent Into Wigmore Stream
Wigmore Stm 50m Upstream
Wigmore Stm Sth of Pa Rd Bridge

Appendix II

NOF Ammonia Guidelines adjusted to pH in Wigmore Stream

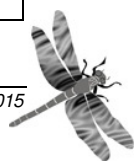
Table 22. NOF ammoniacal-N guidelines adjusted to pH of Wigmore Stream as ammonia is less toxic at low pH levels (median pH = 6.9; 95th percentile pH = 7.6). Values adjusted in accordance with Hickey (2014).

Attribute state	Annual median	Annual median (pH adjusted)	95th percentile	95th percentile (pH adjusted)
A	<0.03	<0.08	<0.05	<0.08
B	0.03-0.24	0.08-0.62	0.05-0.40	0.08-0.65
C	0.24-1.3	0.62-3.37	0.40-2.20	0.65-3.59
D	>1.3	>3.37	>2.20	>3.59

Appendix III

Proposed Criteria for Determining Significance of Indigenous Biodiversity- Proposed Waikato Regional Policy Statement

	Previously assessed site
1.	It is indigenous vegetation or habitat for indigenous fauna that is currently, or is recommended to be, set aside by statute or covenant or by the Nature Heritage Fund, or Nga Whenua Rahui committees, or the Queen Elizabeth the Second National Trust Board of Directors, specifically for the protection of biodiversity, and meets at least one of criteria 3-11.
2	*[Deleted]*
	Ecological values
2A	In the Coastal Marine Area, it is indigenous vegetation or habitat for indigenous fauna that has reduced in extent or degraded due to historic or present anthropogenic activity to a level where the ecological sustainability of the ecosystem is threatened.
3.	It is vegetation or habitat that is currently habitat for indigenous species or associations of indigenous species that are: • classed as threatened or at risk, or • **endemic** to the Waikato region, or • at the limit of their natural range.
4.	It is indigenous vegetation, habitat or ecosystem type that is under-represented (20% or less of its known or likely original extent remaining) in an Ecological District, or Ecological Region, or nationally.
5.	It is indigenous vegetation or habitat that is, and prior to human settlement was, nationally uncommon such as geothermal, chenier plain, or karst ecosystems, hydrothermal vents or cold seeps.
6.	It is wetland habitat for indigenous plant communities and/or indigenous fauna communities (excluding exotic rush/pasture communities) that has not been created and subsequently maintained for or in connection with: • waste treatment; • wastewater renovation; • hydro electric power lakes (excluding Lake Taupō); • water storage for irrigation; or • water supply storage; unless in those instances they meet the criteria in Whaley et al. (1995).
7.	It is an area of indigenous vegetation or naturally occurring habitat that is large relative to other examples in the Waikato region of similar habitat types, and which contains all or almost all indigenous species typical of that habitat type. Note this criterion is not intended to select the largest example only in the Waikato region of any habitat type.
8.	It is aquatic habitat (excluding artificial water bodies, except for those created for the maintenance and enhancement of biodiversity or as mitigation as part of a consented activity) that is within a stream, river, lake, groundwater system, wetland, intertidal mudflat or estuary, or any other part of the coastal marine area and their margins, that is critical to the self sustainability of an indigenous species within a catchment of the Waikato region, or within the coastal marine area. In this context "critical" means essential for a specific component of the life cycle and includes breeding and spawning grounds, juvenile nursery areas, important feeding areas and migratory and dispersal pathways of an indigenous species. This includes areas that maintain connectivity between habitats.
9.	It is an area of indigenous vegetation or habitat that is a healthy and representative example of its type because: • its structure, composition, and ecological processes are largely intact; and • if protected from the adverse effects of plant and animal pests and of adjacent land and water use (e.g. stock, discharges, erosion, sediment disturbance), can maintain its **ecological sustainability** over time.
10.	It is an area of indigenous vegetation or habitat that forms part of an **ecological sequence**, that is either not common in the Waikato region or an ecological district, or is an exceptional, representative example of its type.
	Role in protecting ecologically significant area
11.	It is an area of indigenous vegetation or habitat for indigenous species (which habitat is either naturally occurring or has been established as a mitigation measure) that forms, either on its own or in combination with other similar areas, an ecological buffer, linkage or corridor and which is necessary to protect any site identified as significant under criteria 1-10 from external adverse effects.



Appendix IV
Standards for Contact Recreation and Surface Water Classes, Waikato Regional Plan

3.2.4.2. Waikato Region Surface Water Class Standards
For resource consent applications Method 3.2.4.1 sets out how the classes will be had regard to. The standards listed must be met where referred to in relevant permitted activity rules.

The standards shall apply:

a) after reasonable mixing of any contaminant or water with the receiving water and disregard the effect of any natural perturbations that may affect the water
b) to all surface water irrespective of whether the waters may also be subject to other water classification standards.

Standards

a) The following shall not be allowed if they have any significant adverse effects on existing aquatic ecosystems:
    i) changes in dissolved oxygen
    ii) changes in flow regimes due to instream structures
    iii) changes in pH
    iv) increases in deposition of bed sediments
    v) increases in undesirable biological growths
    vi) discharge of a contaminant.
b) As a result of added heat, the water temperature shall not be changed by more than three degrees Celsius.
c) All water intake structures shall be screened with a mesh aperture size not exceeding three millimetres in diameter at locations less than 100 metres above mean sea level, or five millimetres in diameter at locations greater than 100 metres above mean sea level.
d) The maximum intake velocity for any water intake structures shall not exceed 0.3 metres per second.
e) Any discharge into, or utilisation of, the water resource shall not cause a conspicuous change in visual colour or clarity.
f) The discharge of suspended solids shall comply with the standards in Section 3.2.4.5.
g) The water shall not be tainted or contaminated so as to make it unpalatable or unsuitable for consumption by humans after treatment (equivalent to coagulation, filtration and disinfection).
h) The water shall not be tainted or contaminated so as to make it unsuitable for irrigation.

3.2.4.4 Contact Recreation Water Class
For resource consent applications Method 3.2.4.1 sets out how the classes will be had regard to. The standards listed must be met where referred to in relevant permitted activity rules.

The standards shall apply:
a) after reasonable mixing of any contaminant or water with the receiving water and disregard the effect of any natural perturbations that may affect the water
b) to all surface water mapped as Contact Recreation Class on the Water Management Class Maps.

Standards

a) Visual Clarity:
    i) The black disk horizontal visibility* of the waters shall be greater than 1.6 metres.
b) Contaminants:
    i) The median concentration of E. coli of at least seven samples taken throughout the bathing season (1 December to 1 March) in dry weather conditions shall not exceed 126 E.

coli per 100 millilitres. Sampling is to be undertaken between 9 am and 6 pm, at a depth of 300 millimetres. Single- sample maximum shall not exceed 235 E. coli per 100 millilitres.
ii) The waters shall not be rendered unsuitable for contact recreation activities by the presence of contaminants.

c) Undesirable Biological Growths:

i) Bacterial and/or fungal slime growth shall not be visible to the naked eye as plumose growths or mats.
ii) The seasonal maximum cover of stream or river beds by periphyton as filamentous growths or mats (> 3 millimetres thick) shall not exceed 40 percent and the biomass on the bed shall not exceed 100 milligrams chlorophyll a per square metre over a representative reach.