ROTORUA WASTEWATER TREATMENT PLANT

APPLICATIONS FOR RESOURCE CONSENTS AND ASSESSMENT OF ENVIRONMENTAL EFFECTS

APPLICATION EDITION

Prepared for the Rotorua Lakes Council

20 August 2018



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Rotorua Wastewater Treatment Plant Discharges

Application for Resource Consents and Assessment Environmental Effects

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This Assessment of Environmental Effects (AEE) Document is supported by eleven Support Documents and two Companion Documents. Information included in this AEE has been sourced by many of those documents. Accordingly, the authors of the Support Documents have also contributed to this AEE. A full list of the Support Documents is included in the Contents Pages of this document.

Technical information relating to the Proposed Treatment Plant process and the treatment and land application options has been sourced from consultants Mott MacDonald's Design Statement (included as Appendix H to the AEE and Support Documents as set out in Section 9 of this AEE).

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Executive Summary

The Rotorua District Council, operating as the Rotorua Lakes Council (RLC), operates the Rotorua Wastewater Treatment Plant (WWTP) and treated wastewater is currently irrigated to land at a Land Treatment System (LTS) located within the Whakarewarewa Forest. The irrigation is scheduled to cease and the RLC needs to find a viable alternative location to discharge the treated wastewater from the WWTP.

The RLC has undertaken a lengthy process to find a viable alternative and this process has resulted in a Preferred Scheme being selected involving a significant upgrade to the WWTP, resulting in a highly treated wastewater, and that treated wastewater being discharged to an unnamed tributary of Lake Rotorua. The unnamed tributary is referred to as Te Arikiroa Thermal Channel. Various resource consents are required to implement the Preferred Scheme and for the discharge of treated wastewater and contaminants to air from the WWTP over the next 35 years (being the duration of consent being sought for the discharges from the WWTP).

This document is the combined Assessment of Environmental Effects (AEE) filed in support of two applications for resource consents by the RLC associated with the Preferred Scheme. One application is for various resource consents from the Bay of Plenty Regional Council (BOPRC) and the other is an application for various resource consents from the RLC (as consent authority). This AEE has been prepared in accordance with the requirements of section 88 and Schedule 4 of the Resource Management Act 1991 (RMA).

The process which has resulted in selecting the Preferred Scheme has involved a large number of stakeholders and various committees, sub-committees, and advisory groups were also established. A Rotorua Project Steering Committee (RPSC) was formed and established specific project goals. These goals were critical in setting the terms of reference for the project development and decision making in identifying and selecting the Preferred Scheme to replace the existing LTS. These goals included working with the community, key stakeholders, and tāngata whenua to ensure a Best Practicable Option (BPO) wastewater treatment and disposal / discharge solution was selected.

A comprehensive assessment of alternatives in respect of wastewater treatment options, discharge methods, and discharge locations, has been undertaken as part of selecting the Preferred Scheme. A Technical Advisory Group (TAG) was established to consider the technical aspects of the wide range of options available and to evaluate the options not only from a technical and cost perspective, but also from the actual and potential effects of the treated wastewater discharge on the receiving environment.

The RLC has progressed the development of the Preferred Scheme to the point that a concept design has been developed for a proposed upgrade to the WWTP so that treated wastewater can be appropriately discharged to Te Arikiroa Thermal Channel, which in turn discharges to Puarenga Bay (also known as Sulphur Bay), which is part of Lake Rotorua. As part of the WWTP upgrade design, the treated wastewater is proposed to pass through a new land contact bed before being discharged to Te Arikiroa Thermal Channel via a new discharge structure – this component of the design has been included to specifically address Māori cultural concerns associated with direct discharges of human waste to water.

The proposed upgrade to the WWTP will result in a very high quality wastewater which will be able to be beneficially reused by other persons (e.g. for irrigation and/or industrial process water) and the public health risks associated with contact recreation (swimming and boating) within the receiving waters will be acceptable – a ‘double barrier’ treatment system is proposed involving the use of membrane filtration followed by ultra-violet (UV) light disinfection which will remove pathogens and particulate matter to exceptionally low concentrations. Beneficial reuse will reduce the volume of treated wastewater needing to be discharged to Lake Rotorua via Te Arikiroa Thermal Channel.

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The Preferred Scheme will not increase nutrient inputs into Lake Rotorua above those provided for in the BOPRC's 'allocations'. An annual mass load limit for total nitrogen (TN) and total phosphorus (TP) allowed to be discharged is proposed, with the TN limit allowed to be increased as rural land is developed and connected to the WWTP – a transfer of TN allocation from the rural land use to the WWTP is proposed which aligns with the Memorandum of Understanding (MoU) entered into between the BOPRC, the RLC, and Te Arawa Lakes Trust.

The RLC has undertaken a wide range of environmental and technical investigations to inform this AEE. Studies have investigated the water quality, ecology, and mixing of the treated wastewater discharge to Te Arikiroa Thermal Channel and Puarenga Bay (Lake Rotorua). No significant adverse water quality effects are expected within Puarenga Bay outside of the zone of reasonable mixing as a result of the discharge of treated wastewater from the WWTP. In addition, no significant adverse odour effects are predicted to occur beyond the designation boundary of the WWTP. Removal of indigenous geothermal vegetation, modifications of Te Arikiroa Thermal Channel and construction of five small bunds adjacent to the Puarenga Stream are expected to have some unavoidable adverse ecological, natural character, landscape and amenity effects – a minimal intervention approach is proposed to minimise these adverse effects to the greatest extent practicable.

Extensive consultation has been undertaken with tāngata whenua, statutory bodies, key stakeholders, and the wider community to inform this AEE. The consultation activities were undertaken between 2014 and July 2018. Consultation with tāngata whenua has been ongoing and two Cultural Impact Assessments (CIAs) have been prepared, both of which confirm that the Preferred Scheme exhibits a number of positive and significant adverse cultural effects. The Preferred Scheme is innovative and meaningful because it addresses important cultural concerns. Further, it incorporates Māori concepts and values at the forefront in the conceptualisation and design of the proposed land contact bed and discharge structure.

A range of measures are proposed to avoid or mitigate the identified actual and potential adverse effects – these being included in a comprehensive set of volunteered consent conditions which will ensure that acceptable effects result from the ongoing operation of the upgraded WWTP and discharge of treated wastewater to Te Arikiroa Thermal Channel.

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Cross Reference to the Provisions of the Fourth Schedule of the Resource Management Act

6. Information required in assessment of environmental effects	Relevant Section of this AEE for Regional Consents	Relevant Section of this AEE for District Consents
(1) An assessment of the activity's effects on the environment must include the following information:		
(a) If it is likely that the activity will result in any significant adverse effect on the environment, a description of any possible alternative locations or methods for undertaking the activity.	Section 9	Section 9
(b) An assessment of the actual or potential effect on the environment of the activity.	Section 7	Section 7
(c) if the activity includes the use of hazardous installations, an assessment of any risks to the environment that are likely to arise from such use	n/a	n/a
(d) If the activity includes the discharge of any contaminant, a description of— *(i) the nature of the discharge and the sensitivity of the receiving environment to adverse effects; and* *(ii) any possible alternative methods of discharge, including discharge into any other receiving environment:*	Section 6 and 9	n/a
(e) A description of the mitigation measures (including safeguards and contingency plans where relevant) to be undertaken to help prevent or reduce the actual or potential effect.	Section 8	Section 8
(f) Identification of the persons affected by the activity, any consultation undertaken, and any response to the views of any person consulted.	Section 10	Section 10
(g) If the scale and significance of the activity's effects are such that monitoring is required, a description of how and by whom the effects will be monitored if the activity is approved.	Section 11	Section 11
(h) If the activity will, or is likely to, have adverse effects that are more than minor on the exercise of a protected customary right, a description of possible alternative locations or methods for the exercise of the activity (unless written approval for the activity is given by the protected customary rights group).	Section 9	Section 9
7. Matters that must be addressed by assessment of environmental effects	**Relevant Section of this AEE**	
(a) Any effect on those in the neighbourhood and, where relevant, the wider community including any social, economic, or cultural effects	Section 7	Section 7
(b) Any physical effect on the locality, including any landscape and visual effects	n/a	Section 7
(c) Any effect on ecosystems, including effects on plants or animals and any physical disturbance of habitats in the vicinity	Section 7	Section 7
(d) Any effect on natural and physical resources having aesthetic, recreational, scientific, historical, spiritual, or cultural value, or other special value, for present or future generations	Section 7	Section 7

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6. Information required in assessment of environmental effects	Relevant Section of this AEE for Regional Consents	Relevant Section of this AEE for District Consents
(e) any discharge of contaminants into the environment, including any unreasonable emission of noise, and options for the treatment and disposal of contaminants:	Section 7	Section 7
(f) any risk to the neighbourhood, the wider community, or the environment through natural hazards or hazardous installations.	Section 4.6.1	Section 4.6.1

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Resource Consent Application Forms

Resource Management Act – Form 7A

Request for application relating to resource consent to be determined by Environment Court [Section 87D, Resource Management Act 1991]

To Bay of Plenty Regional Council

1 I, the Rotorua District Council, operating as the Rotorua Lakes Council, requests that the Bay of Plenty Regional Council allows the following application lodged by me to be determined by the Environment Court instead of by you:

- an application for a resource consent.

***Note**: Resource consents are also required from the Rotorua District Council and the same request has been made to that consent authority. A joint Assessment of Environmental Effects (AEE) has been prepared covering the activities for which resource consents are required from both consent authorities.*

2 The Rotorua Lakes Council operates the Rotorua Wastewater Treatment Plant (WWTP). Treated wastewater from the WWTP is currently irrigated to land at the Land Treatment System (LTS) in the Whakarewarewa Forest. The irrigation is scheduled to cease and the RLC must find a viable alternative location to discharge the treated wastewater from the WWTP. A Preferred Scheme has been identified which involves upgrading the WWTP and discharging the treated wastewater to an unnamed tributary of Lake Rotorua. The application is for various resource consents required from the Bay of Plenty Regional Council needed to implement the Preferred Scheme and for the ongoing discharges from the upgraded WWTP.

3 The reasons for the request are as follows:

Direct referral is regarded as the optimum and most efficient process for the applicant, the consent authority(ies) and potential submitters given:

- The complexity of the relevant legal and technical issues;
- The anticipated strength of opposition which would have inevitably resulted in appeals to the Environment Court from a first instance hearing; and
- The significance and essentialness of the services provided by the infrastructure which is the subject of the application(s).

DATE: 20 August 2018

Address for service of applicant:
Theresa Le Bas
Tompkins Wake
PO Box 248,
Rotorua 3010

Attention: Theresa Le Bas
Telephone: (07) 349 8702
Email: Theresa.LeBas@tompkinswake.co.nz

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Resource Consent Application Forms

Resource Management Act – Form 7A

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***Note**: Resource consents are also required from the Bay of Plenty Regional Council and the same request has been made to that consent authority. A joint Assessment of Environmental Effects (AEE) has been prepared covering the activities for which resource consents are required from both consent authorities.*

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- The complexity of the relevant legal and technical issues;
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- The significance and essentialness of the services provided by the infrastructure which is the subject of the application(s).

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Resource Consent Application Forms

Resource Management Act – Form 9

Application for resource consents

To Bay of Plenty Regional Council

The Rotorua District Council, operating as the Rotorua Lakes Council (RLC) applies for the following type(s) of resource consents:

Discharge permit:	To discharge treated wastewater to land in a manner that it may enter an unnamed tributary of Lake Rotorua.
Discharge permit:	To discharge treated wastewater to land via reuse.
Discharge permit:	To increase discharges of Nitrogen or Phosphorus from a point source discharge of contaminants to land in circumstances where it may enter surface water in the catchments of Lake Rotorua.
Discharge permit:	To discharge a contaminant (odour) to air.
Water permit:	For temporary damming and diversion of geothermal water.
Land use consent:	For bed disturbance associated with the widening of Te Arikiroa Thermal Channel and construction of the bunds adjacent to the Puarenga Stream.
Discharge permit:	To discharge sediment to water.
Land use consent:	The disturbance of land and soil as a result of earthworks.
Land use consent:	The disturbance of land and soil disturbance as a result of vegetation clearance.
Land use consent:	For interference with the natural geothermal fluid outflow from a geothermal surface feature; For interference with the physical structure of a geothermal surface feature; For destruction of a geothermal surface feature including excavation; For placement or deposition of any substance, including fill or waste material on, into or under any geothermal surface feature.

These activities are associated with the operation of the Rotorua Wastewater Treatment Plant (WWTP).

The sites at which the proposed activity are to occur, and the respective owners, are as follows:

Land owner	Address	Legal Description
Rotorua District Council	60F Te Ngae Road, Rotorua (Including Sanatorium Reserve)	Part Section 3 Blk I Tarawera SD (SO 25860)

The full name and address of each owner or occupier (other than the applicant) of the site to which the application relates are as follows: Refer to table above.

Attached is an assessment of the proposed activity's effects on the environment that—

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a) includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and

b) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and

c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

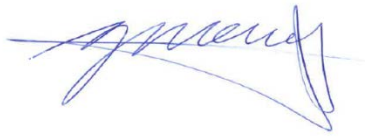
Attached is an assessment of the proposed activity against:

a) the matters set out in Part 2 of the Resource Management Act 1991; and

b) any relevant provisions of the relevant documents referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act; and

c) the resource management matters set out in the Regional Natural Resources Plan.

No further information is required to be included in this application by the district plan, the regional plan, the Resource Management Act 1991, or any regulations made under that Act.



.....

Signature of applicant.

Greg Manzano

Rotorua Lakes Council

DATE: 20 August 2018

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Resource Consent Application Forms

Resource Management Act – Form 9

Application for resource consents

To Rotorua Lakes Council

The Rotorua District Council, operating as the Rotorua Lakes Council (RLC) applies for the following type(s) of resource consents:

Land use consent:	For new Infrastructure being on or within the boundary of an Outstanding Natural Feature or Landscape listed in Appendix 2 – Natural Heritage Inventory or as identified on the 300 and 500 series planning maps.
Land use consent:	For new infrastructure requiring disturbance or removal of indigenous vegetation (other than provided for in Rule 6) within the boundary of a Significant Natural Area (SNA).
Land use consent:	For new infrastructure located within esplanade reserves and strips and requiring earthworks or removal of indigenous vegetation within riparian margins unless otherwise provided for within Appendix 10 – Earthworks.
Land use consent:	For infrastructure above ground for the storage or drainage of water (including geothermal water and steam), stormwater or sewerage.
Land use consent:	For disturbance of soil which fails to meet regulation 8 requirements of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011, but provides a detailed site investigation report stating that the soil contamination does not exceed the applicable standard in regulation 7 of the NESCS, in accordance with regulation 9 of the NESCS.

These activities are associated with the operation of the Rotorua Wastewater Treatment Plant (WWTP).

The sites at which the proposed activity are to occur, and the respective owners, are as follows:

Land owner	Address	Legal Description
Rotorua District Council	60F Te Ngae Road, Rotorua (Including Sanatorium Reserve)	Part Section 3 Blk I Tarawera SD (SO 25860)

The full name and address of each owner or occupier (other than the applicant) of the site to which the application relates are as follows: Refer to table above.

Attached is an assessment of the proposed activity's effects on the environment that—

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a) includes the information required by clause 6 of Schedule 4 of the Resource Management Act 1991; and

b) addresses the matters specified in clause 7 of Schedule 4 of the Resource Management Act 1991; and

c) includes such detail as corresponds with the scale and significance of the effects that the activity may have on the environment.

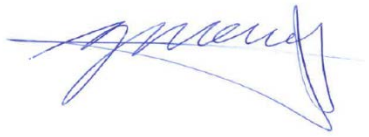
Attached is an assessment of the proposed activity against:

d) the matters set out in Part 2 of the Resource Management Act 1991; and

e) any relevant provisions of the relevant documents referred to in section 104(1)(b) of the Resource Management Act 1991, including the information required by clause 2(2) of Schedule 4 of that Act; and

f) the resource management matters set out in the Rotorua District Plan.

No further information is required to be included in this application by the district plan, the regional plan, the Resource Management Act 1991, or any regulations made under that Act.



.....

Signature of applicant.

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Summary Table: Existing Resource Consents and Resource Consents Applied for

Summary of Existing Resource Consents

Resource Consent	Expiry
To Discharge Treated Effluent from the Rotorua District Council Wastewater Treatment Plant on to Land in the Whakarewarewa State Forest	31 July 2021
To Place, Use and Maintain a Series of Structures in or on the Bed of the Waipa Stream and Associated Tributaries; and	31 July 2021
To Discharge Treated Effluent from the Rotorua District Council Wastewater Treatment Plant into Air in the Whakarewarewa State Forest.	31 July 2021

Summary of Resource Consents Sought from the Bay of Plenty Regional Council

Number	Consent	Duration
1	To discharge treated wastewater to land in a manner that it may enter an unnamed tributary of Lake Rotorua	35 years
2	To discharge treated wastewater to land via reuse	35 years
3	To increase discharges of Nitrogen or Phosphorus from a point source discharge of contaminants to land in circumstances where it may enter surface water in the catchments of Lake Rotorua.	35 years
4	To discharge a contaminant (odour) to air.	35 years
5	For temporary damming and diversion of geothermal water	15 years
6	For bed disturbance associated with the widening of Te Arikiroa Thermal Channel and construction of the bunds adjacent the Puarenga Stream	15 years
7	To discharge sediment to water for associated with the widening and minor deepening of Te Arikiroa Thermal Channel	15 years
8	The disturbance of land and soil as a result of earthworks	Unlimited
9	The disturbance of land and soil by vegetation clearance	Unlimited
10	For interference with the natural geothermal fluid outflow from a geothermal surface feature; For interference with the physical structure of a geothermal surface feature; For destruction of a geothermal surface feature including excavation; For placement	Unlimited

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Number	Consent	Duration
	or deposition of any substance, including fill or waste material on, into or under any geothermal surface feature	

Summary of Resource Consents Sought from the Rotorua District Council

Number	Consent	Duration
11	For new infrastructure being on or within the boundary of an Outstanding Natural Feature or Landscape listed in Appendix 2 – Natural Heritage Inventory or as identified on the 300 and 500 series planning maps	Unlimited
12	For new infrastructure requiring disturbance or removal of indigenous vegetation (other than provided for in Rule 6) within the boundary of a Significant Natural Area (SNA)	Unlimited
13	For new Infrastructure located within esplanade reserves and strips and requiring earthworks or removal of indigenous vegetation within riparian margins unless otherwise provided for within Appendix 10 – Earthworks	Unlimited
14	For infrastructure above ground for the storage or drainage of water (including geothermal water and steam), stormwater or sewerage	Unlimited
15	For disturbance of soil which fails to meet regulation 8 requirements of the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011 but provides a detailed site investigation report stating that the soil contamination does not exceed the applicable standard in regulation 7 of the NESCS, in accordance with regulation 9 of the NESCS.	Unlimited

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Rotorua Lakes Council

Rotorua Wastewater Treatment Plant

Application for Resource Consents and Assessment of Environmental Effects

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APPENDICES

Appendix A Rotorua Lakes Council (RLC): Strategy, Policy and Finance Committee and Full Council Reports and Resolutions

Appendix B Rotorua Project Steering Committee (RPSC) – Terms of Reference, Membership and Meeting Summary Record

Appendix C Rotorua Project Technical Advisory Group (TAG) – Terms of Reference, Membership and Meeting Summary Record

Appendix D Memorandum of Understanding – Nitrogen Accounting Approach for Rotorua Wastewater Treatment Plant Discharge

Appendix E Rotorua Context and Business Growth – APR Consultants Ltd

Appendix E.1 Tourism Wastewater Processing Needs

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Appendix E.3 Selected 2013 Census Metrics

Appendix E.4 Evidence for Continued Fast Tourism Growth

Appendix F Existing Resource Consent 60739

Appendix G Existing Resource Consent 60739 Monitoring – Annual Summary Report to March 2018

Appendix H Mott MacDonald Wastewater Treatment Design Statement December 2017

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Appendix I Relevant Objectives and Policies

Appendix J Rotorua Sustainable Living Strategy

Appendix K Volunteered Consents Conditions

Appendix L Response to Alternative Proposal for Bunds and Outlet Location at Puarenga Bay

COMPANION DOCUMENTS

No. 1 Cultural Impact Assessment of Rotorua Land Treatment System Alternatives April 2017. Prepared by Antoine Coffin of Te Onewa Consultants; and

No.2 Cultural Impact Assessment of a Discharge of Treated Wastewater to Lake Rotorua through a Land Contact Bed at Puarenga Bay, Rotorua April 2018. Prepared by Antoine Coffin of Te Onewa Consultants.

SUPPORT DOCUMENTS

No. 1 Lakes Water Quality Society Project Rotorua Clean Water Proceedings September 2013;

No. 2 Mott MacDonald Four Alternatives Reports:

2A. Mott MacDonald. (2014, December). Detailed Feasibility Study of Alternatives to Land Treatment. Rotorua District Council;

2B. Mott MacDonald. (2015, June). Alternative Land Treatment Sites - Revision Four;

2C. Mott MacDonald. (2015, June). Supplementary Report - Alternative Land Treatment Sites - Version 2;

2D. Mott MacDonald. (2015, June 8). Wastewater Strategy Version 3;

No. 3 University of Waikato - Lake Rotorua Treated Wastewater Discharge: Environmental Effects Study October 2015 ERI Report 80. Prepared by Jonathan Abell, Chris McBride, David Hamilton;

No. 4 University of Waikato - Assessments of Effects of Proposed Treated Wastewater Discharge to the Thermal Channel and Sulphur Bay (Lake Rotorua) June 2018. ERI Report 91. Prepared by A Dada, B Hick, N Ling and D Hamilton;

No. 5 Analysis of Selected Emerging Organic Contaminants in MBR Treated Effluent and at Two Sites Within and Outside the Discharge Point Mixing Zone with Lake Rotorua, November 2017. Prepared by Dr Grant Northcott;

No. 6 Public Health Risk Assessment, Stantec, November 2017 incorporating the Quantitative Microbial risk Assessment for Treated Rotorua Wastewater NIWA March 2017;

No. 7 Te Arikiroa Thermal Channel Effects Assessments and Alternatives Considered (11 Documents)

- Stantec Technical Note, Rotorua Lakes Council Wastewater Resource Consent Project, Te Arikiroa Thermal Channel – Concept Design, (March, 2018)
- Rotorua Wastewater Treatment Plant Upgrade (July, 2018). 1D Modelling of Te Arikiroa Channel, Revision 3, Stantec
- Rotorua Wastewater Treatment Plant Upgrade (July, 2018). 2D Modelling of Te Arikiroa Channel, Stantec

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- Rotorua Wastewater Treatment Plant Upgrade, Discharge Channel, Construction Methodology, (July, 2018). Rotorua Lakes Council, Jacana Consulting
- Thermal Channel Feasibility Options Information (April-May 2018) Jacana Consulting
- Geothermal Assessment of Te Arikiroa Thermal Channel (Sulphur Bay, Rotorua), (May, 2018) GNS
- Rotorua WWTP Consenting Project Te Arikiroa Thermal Channel Contamination Assessment, (July, 2018) Stantec
- Rotorua WWTP Consenting Project Te Arikiroa Thermal Channel Site Management Plan, (July, 2018) Stantec
- Ecological Management Plan for Part of Sanatorium Reserve, Rotorua (May 2017), Wildlands Consultants
- Ecological Assessment of Works Proposed for the Discharge Channel from the Rotorua Wastewater Treatment Plant (August, 2018), Wildlands Consultants
- Rotorua Wastewater Treatment plant Te Arikiroa Thermal Channel – Assessment of Effects on Natural Character, Landscape, and Amenity (August, 2018), Wildlands Consultants

No. 8 Project Consultation Information

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1 Introduction

1.1 Purpose of this Document

The Rotorua District Council, operating as the Rotorua Lakes Council (RLC), operates the Rotorua Wastewater Treatment Plant (WWTP). Treated wastewater from the WWTP is currently irrigated to land at the Land Treatment System (LTS) in the Whakarewarewa Forest. The irrigation is scheduled to cease and the RLC must find a viable alternative location to discharge the treated wastewater from the WWTP.

A number of options and locations have been considered for the discharge of the treated wastewater. Following consultation and technical assessments, the RLC's preferred option is to upgrade the existing WWTP to a full Membrane Bioreactor (MBR) plant with the addition of ultraviolet (UV) light disinfection and additional phosphorus removal (or alternative treatment to achieve an equivalent performance in terms of treated wastewater quality) – hereafter referred to as the 'Preferred Scheme'. Under this arrangement, wastewater would be subjected to biological, chemical and physical treatment processes, and the treated wastewater discharged through a land contact bed, then to an unnamed tributary of Lake Rotorua (hereafter referred to as Te Arikiroa Thermal Channel) which discharges to Sulphur Bay (Lake Rotorua).

Several new resource consents are required from both the Bay of Plenty Regional Council (BOPRC) and the RLC to allow for the discharge of treated wastewater to land, discharge of contaminants to air, and the construction and use of a discharge structure, earth bunds adjacent to the Puarenga Stream and earthworks associated with the land contact bed and Te Arikiroa Thermal Channel.

This Assessment of Environmental Effects (AEE) has been prepared in accordance with section 88 and the Fourth Schedule of the Resource Management Act 1991 (RMA) to support the resource consent applications to the BOPRC and the RLC. This AEE includes:

- A description of Te Arikiroa Thermal Channel and Sulphur Bay (Lake Rotorua);
- A description of the Preferred Scheme;
- A description of the management procedures for the Preferred Scheme;
- A description of the actual and potential effects on the environment;
- Details of measures to avoid, remedy, or mitigate adverse effects;
- An evaluation of alternatives (options); and
- Volunteered resource consent conditions, including monitoring conditions.

Early on in this Project, the RLC formed a Rotorua Project Steering Committee (RPSC), a Technical Advisory Group (TAG), and a Cultural Advisory Sub-committee (CAS) to guide the development of various options. Section 3 of this AEE describes the activities of the RPSC and sets out the Project Objectives. Section 4 of this AEE establishes the rationale for the Preferred Scheme.

The Preferred Scheme has been formulated to accommodate the residential population and industrial growth predicted over the next 35 years and, accordingly, the RLC is requesting that the resource consents be granted for the maximum term allowed for under the RMA (being 35 years). Such terms are commonly granted for consents associated with wastewater treatment plants around New Zealand to provide security and sound financial management for significant and essential infrastructure assets.

A vital element in the process of undertaking this Project has been consultation with statutory bodies, tāngata whenua, and the wider community. Section 10 of this AEE sets out the consultation approach, the parties consulted, and the feedback received.

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1.2 Structure of the Application Documentation

The structure of this AEE is as follows:

- Executive Summary;
- Summary of Resource Consents Sought;
- Cross reference to the Fourth Schedule of the RMA;
- Application Forms;
- Section 1: Introduction;
- Section 2: Background;
- Section 3: Project Structure, Goals and Development;
- Section 4: Preferred Scheme;
- Section 5: Rule Assessment and Activity Status;
- Section 6: Existing Environment;
- Section 7: Assessment of Environmental Effects;
- Section 8: Mitigation Measures;
- Section 9: Consideration of Alternatives;
- Section 10: Consultation;
- Section 11: Monitoring;
- Section 12: Statutory Assessment;
- Section 13: Duration and Lapsing;
- Section 14: Volunteered Consent Conditions;
- Section 15: Conclusions;
- Section 16: He Mihi / Acknowledgements;
- Section 17: Glossary of Terms and Abbreviations; and
- Section 18: References.

Eleven volumes of Support Documents, each covering specific topic areas, support this AEE. The Support Documents should be read in conjunction with this AEE. A list of the eleven volumes of Support Documents is included in the Contents page.

Due to the importance of the two Cultural Impact Assessments (CIAs), these are attached as Companion Documents No. 1 and 2 to this AEE.

In order to keep this AEE reasonably concise, cross referencing is made to the Support and Companion Documents and these provide the detailed information that underpins the development of the Project and this AEE.

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2 Background to the Project

2.1 Purpose and Content

This section of this AEE sets out, in a brief summary format, the history and present situation as it relates to Rotorua's WWTP and its discharges.

This information provides context to the background to this Project and the consents being sought.

2.2 Overall Background

The Whakarewarewa LTS has been in operation since 1991 and is used to discharge treated wastewater from the WWTP. During the early operational years, nutrient leaching was minimal. The soils retained most of the nitrogen (N) and phosphorus (P) applied in the first three years, with around eight tonnes (t) of N and less than 1 t of P leaching to groundwater/streams each year. In the early years the LTS was performing better than anticipated, as the soils held more N than anticipated. Subsequently the efficiency of N removal has declined and the adverse effects of water saturation became increasingly evident in the low lying areas of the LTS. From 1993-2002 the amount of N leaching has steadily increased, rising to around 45 t N/yr in one year, thereby significantly exceeding the 30 t N/yr consent limit. This situation led to the BOPRC issuing an Abatement Notice to the RLC for non-compliance[1].

The RLC appealed the Abatement Notice to the Environment Court. The Environment Court, after a mediation process, issued a Consent Order which required the RLC to:

- Lodge an application to change the existing consents for the WWTP and LTS; and
- Undertake, and complete by 1 June 2013, investigations identifying viable alternative options for disposal of treated wastewater from the WWTP.

The application to change conditions was submitted to the BOPRC after a process of consultation with all stakeholders, including a review of all technical reports supporting the application by the Water Quality Technical Advisory Group of the Rotorua Te Arawa Lakes Programme.

A Scoping Report which summarised the potential alternative options to the Whakarewarewa LTS was submitted to the Rotorua Te Arawa Lakes Strategy Group in 2013. The completion of the Scoping Report was a first step towards the selection, development and implementation of a viable and alternative option for the long term disposal of treated wastewater from the WWTP.

The existing resource consent for the LTS expire on 31 July 2021, however a Deed of Understanding (May 2014) between the RLC and CNI Iwi Holdings Trust (CNI) (the owner of land in the Whakarewarewa Forest) set a revised target of December 2019 for treated wastewater to cease being irrigated at the LTS. While the RLC was anticipating ceasing the use of the LTS by the end of December 2019, the RLC requires additional time to secure the required resource consents and to ensure the WWTP upgrade is optimised in respect of being able to manage and treat the expected peak wet weather flows that arrive at the plant. To ensure this is achieved, the RLC intends on, *inter alia*, investigating sources of infiltration and inflow (I/I) within the reticulation system with the aim of then reducing I/I to levels which the WWTP can optimally manage and treat to ensure that the proposed conditions of consent will always be able to be met. This programme of work is expected to extend beyond December 2019, being the original intended date to cease using the LTS. In the event that the LTS is required to be used beyond the expiry of the current consents, the RLC will apply for new consents for the LTS at least six months prior to the expiry date (i.e. before 31 January 2021).

[1] The RLC was also served with an earlier Abatement Notice which was complied with.

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The RLC has, since the Environment Court Consent Order was issued (and following signing the Deed of Understanding), actively pursued a programme involving extensive consultation, investigation, and decision making to arrive at the position of identifying a Preferred Scheme.

Central to this programme has been the establishment of the RPSC, made up of representatives from iwi groups, community personnel, and elected representatives from both the BOPRC and the RLC. The TAG and specialist wastewater engineering consultants were engaged to assist the RPSC.

The Rotorua Te Arawa Lakes Programme, which has provided a strong starting point for the Project, involves a partnership with the RLC, Te Arawa Lakes Trust, and the BOPRC. The Rotorua Te Arawa Lakes Programme seeks to protect and restore water quality in 12 Rotorua lakes. As an early activity in the Project and prior to the formulation of the RPSC, a symposium was organised jointly by the RLC and the Lakes Water Quality Society. This was held on 30 September and 1 October 2013 and is discussed in more detail in Section 3.5 of this AEE.

The Regional Policy Statement (RPS) requires the annual load of N to Lake Rotorua to be 435 t/yr by 2032. Based on current land uses the load of N to Lake Rotorua is estimated to be 746 t/yr. Figure 2-1 shows the current sources of N entering Lake Rotorua, with the 30 t/yr from urban wastewater contributing around 5% of the overall total.

Background on Lake Rotorua nitrogen issues

"At 30 t/year, treated wastewater contributes around 5% of the nitrogen coming from current sources – an amount similar to the nitrogen in rainfall landing on the lake"

The Regional Policy Statement sets a 435 t/year sustainable load for Lake Rotorua, with actions in place by 2032 to achieve this load

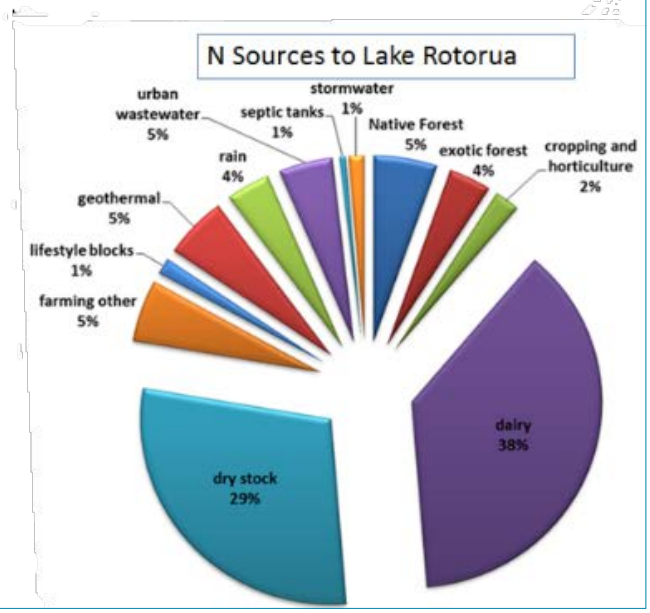


Figure 2-1: Lake Rotorua Total Nitrogen Sources

Since the 1980s the annual load of N from the pastoral sector increased by 300 t, and needs to reduce by 270 t in order to achieve the 435 tN/yr required by the RPS. The sector loads will change over time as land use within the Lake Rotorua catchment changes. An N discharge rate (kg/ha) has been assigned as an upper limit on N losses from rural land.

The wastewater-derived load of N to Lake Rotorua increased over time (as shown in Figure 2-2) as urban land use grew and was around 150 t/yr in the 1980s. A target N load for wastewater derived N was set at 30 t/yr. The N load reduced significantly as a result of the 1991 WWTP upgrade and implementation of the LTS. Further significant upgrades were made to the WWTP to ensure the discharge achieved the 30 t/yr target load (refer to Appendix G).

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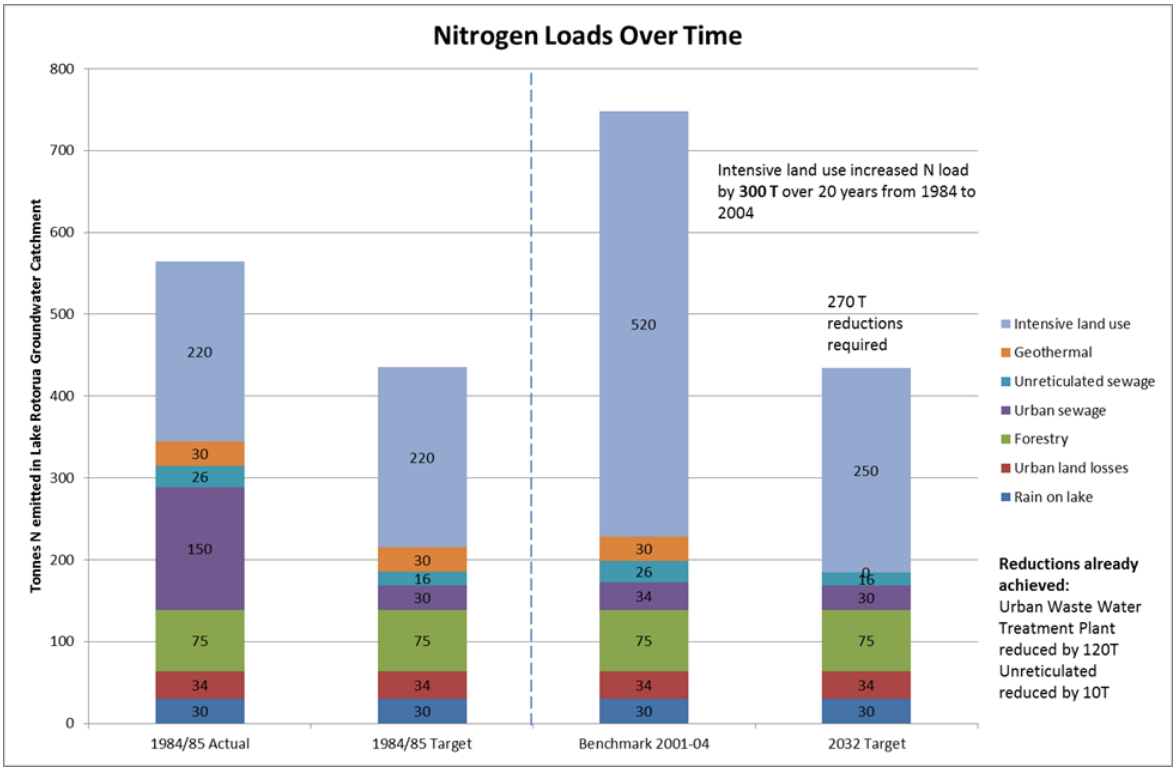


Figure 2-2: Nitrogen Loads to Lake Rotorua Over Time

No further reductions in the wastewater-derived N are required in order to achieve the 435 tN/yr load limit specified by the RPS.

An N accounting mechanism was developed to deal with land use change from rural to urban use in order to account for the change from rural sources of nitrogen to urban sources, including wastewater-derived N. The accounting mechanism was agreed by the RLC, the BOPRC, and the Te Arawa Lakes Trust and recorded in a Memorandum of Understanding (MoU). This MoU is included as Appendix D and discussed in more detail in Section 4.7 of this AEE. The N discharge allocation rate of 30 t for wastewater-derived N applies to the 2001-2004 benchmarked urban area (as identified in Plan Change 10 (PC10) on Map LR1 Lake Rotorua Nutrient Management – Groundwater Catchment Boundary and Rural Land), and the allocation increases from 30 t as the city expands beyond the 2001-04 benchmarked urban area. The load of N discharged from the WWTP can increase as the city and its wastewater reticulation expands into the rural area, by the amount determined in the agreed accounting mechanism recorded in the MoU without impacting the 435 t Sustainable Load of N to Lake Rotorua. Section 4.8 of this AEE elaborates further on this important matter.

2.3 Existing Wastewater Treatment Plant

The WWTP was constructed in 1973 and since its inception has seen many changes with progressive improvements in the removal of nutrients (N and P compounds). The WWTP initially comprised secondary treatment with activated sludge and some chemical removal of P. The treated wastewater was then discharged through sand filters to the Puarenga Stream.

A major upgrade of the WWTP occurred in 1991 when the LTS at the Whakarewarewa Forest was commissioned. This upgrade comprised the addition of the Bardenpho biological nutrient removal system which was designed to improve the removal of N from treated wastewater prior to irrigation at the LTS. Chemical removal of P at the WWTP ceased at this time as the soils at the LTS were identified as having high P retention capacity.

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In 2005 further N removal was achieved at the WWTP through the upgrades to the return activated sludge (RAS) pumps and methanol dosing. Methanol was replaced with ethanol between 2006 and 2008 as the source of carbon for denitrification. Flow balancing was also introduced where a portion of the diurnal peak inflow to the WWTP is stored and fed into the Bardenpho system during periods of low flow to create a more stable (less peaked) flow through it.

In 2012 the WWTP throughput capacity was increased with the installation of a parallel (side-stream) MBR which treats approximately one third of the wastewater. The side-stream MBR system includes a combination of activated sludge biological treatment and membrane filtration. The MBR removes nutrients in a similar process to the Bardenpho system.

The treated wastewater stream currently comprises the two secondary treatment processes in parallel (Bardenpho and MBR) with the streams currently combined prior to balancing storage (in ponds), pumping and conveyance, and irrigation at the LTS. The existing WWTP is designed for a connected population equivalent (on a hydraulic basis) of approximately 75,000.

A schematic diagram of the existing WWTP is shown in Figure 2.3. Figure 2.4 shows an oblique photograph of the existing WWTP and Figure 2-5 shows aerial of the WWTP site and environs.

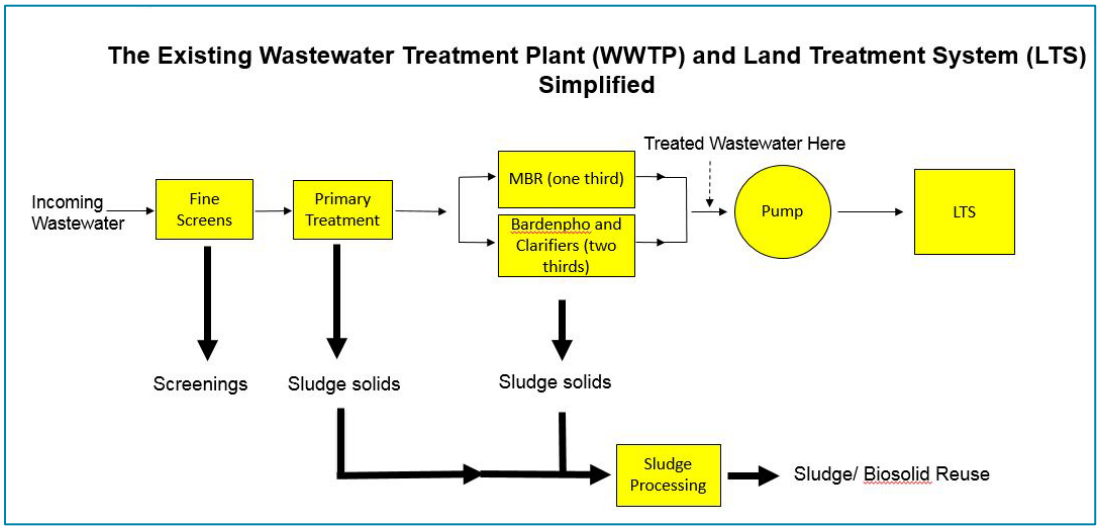


Figure 2-3: Schematic Diagram of the WWTP and Current LTS

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Figure 2-4: Existing Wastewater Treatment Plant

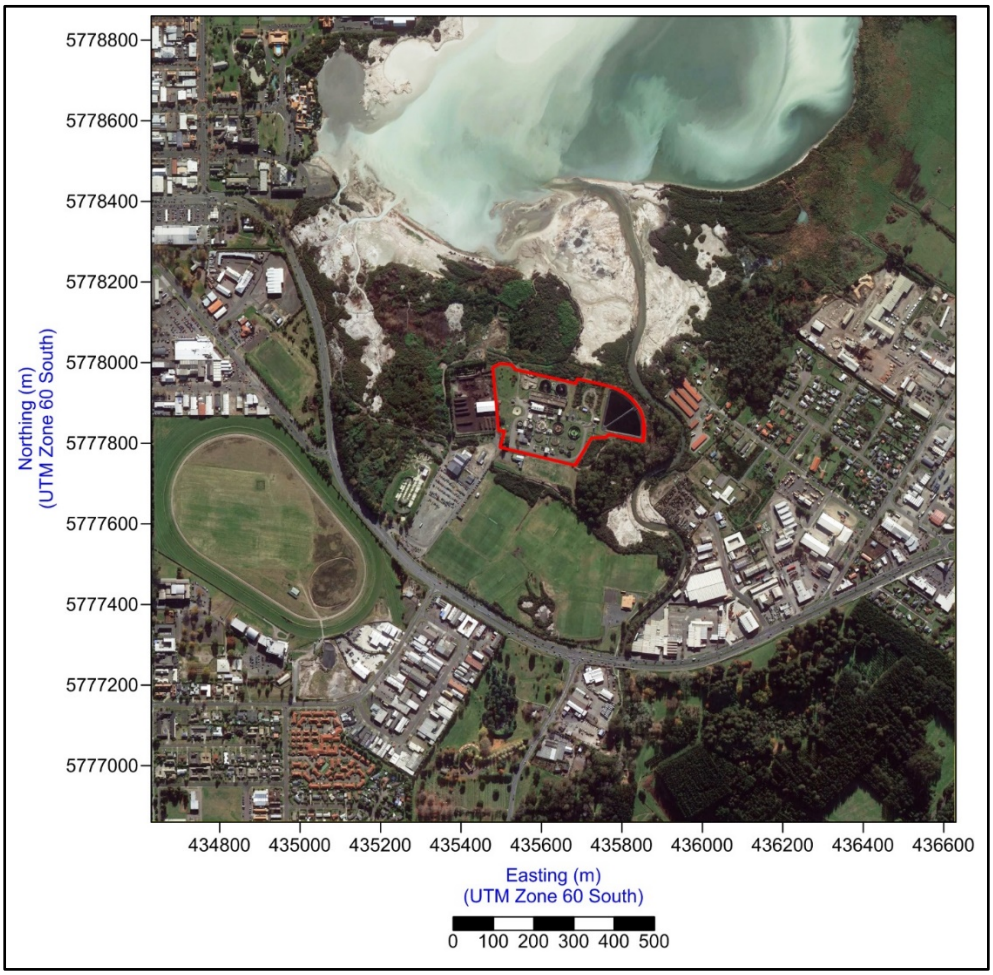


Figure 2-5: Wastewater Treatment Plant Site and Environs

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2.4 Existing Discharge within the Whakarewarewa Forest

The RLC has an easement over 433 hectares within the Whakarewarewa Forest where treated wastewater is irrigated (the LTS). Since the implementation of the LTS the land has been returned from the Crown (through the Forestry Corporation) to CNI as a result of the settlement of a Waitangi Tribunal claim. Cutting rights to the trees is held by Timberlands Ltd. The easement provides for spray irrigation and includes provisions relating to the relationship of the LTS and forestry operations.

Treated wastewater from the WWTP is pumped to two storage ponds in the Whakarewarewa Forest. From there the treated wastewater is pumped to spray irrigation fields spread throughout the forest.

In recent years there has been a trend of rising N loads into the Waipa Stream, a stream located downgradient/downslope of the LTS. A key part of the original LTS design was the expectation that the wetlands in the valley floors of the forest would remove large quantities of N. The irrigation blocks were laid out, in part, to ensure that water draining to ground could pass through a wetland prior to exiting to adjacent watercourses.

Operational experience and research has subsequently shown that denitrification through the wetlands is less than anticipated. It appears that the groundwater is by-passing the riparian zone and there is insufficient contact between the groundwater and the carbon rich soils in the wetland riparian zone.

The LTS has been highly effective at removing P from the applied treated wastewater. The capacity for P to be removed by adsorption onto soil exchange sites was estimated to be sufficient for around 80-120 years, however recent evidence shows that there are low, but increasing, concentrations of dissolved P leaving the LTS (refer Figure 2-9).

2.5 Future Legacy Discharge to the Puarenga Stream from the Land Treatment System

Key parameters including the load of nutrients to the lake from the current LTS will continue to be monitored for some years following the upgrade commissioning and optimisation of the WWTP and new discharge location.

Monitoring relating to the legacy load to the Puarenga Stream is proposed. Details of this are yet to be finalised by the RLC and the BOPRC. The legacy load does not form part of this application.

2.6 Current Scheme Performance and Consent Compliance

Discharge Permit 60739 authorises the discharge of treated wastewater from the WWTP to the LTS in the Whakarewarewa Forest and includes a TN limit, as measured at the outlet of the WWTP, of 51 tonnes in any 12 month period, and a total sewage-derived phosphorus limit in the Waipa Stream (at monitoring site 5) of 4 tonnes in any 12 month period.

The RLC monitors and reports on the discharge to land and the level of pathogens and nutrients in the Waipa Stream that flows to Lake Rotorua. The latest Annual Monitoring Report to the BOPRC (2018) is appended (Appendix G).

Around 7-8 million cubic metres of treated wastewater is applied to land each year. The average daily discharge volume to land for the year to March 2018 was around 22 million litres (ML), greater than the 20 ML average in recent years (Figure 2-6) and ranges from 14-44 ML. 44 ML/dy is the capacity of the LTS and is the consented maximum discharge volume per day. Flows to the WWTP in excess of 44 ML/d were rare until the past 18 months, when the combination of high daily rainfall on occasions, saturated soil conditions and high lake levels resulted in overflows at the WWTP to the Puarenga

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Stream on six occasions within that time.

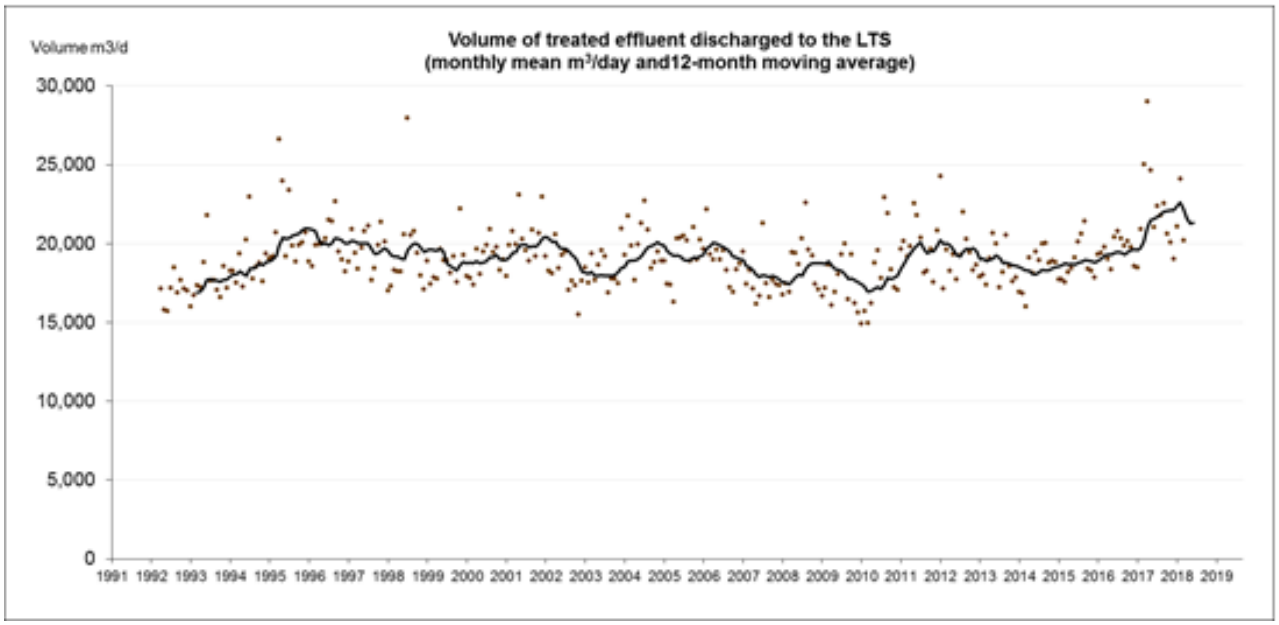


Figure 2-6: Volume of Treated Effluent Discharged to the LTS

The quality of the treated wastewater has been relatively stable since the last upgrade in 2012 (Refer Table 2-1). The 6-year average concentrations of nutrients in the treated wastewater to March 2018 were 2.4 g/m^3 for total phosphorus (TP) and 5.4 g/m^3 total nitrogen (TN).

Table 2-1 Mean Concentration of Constituents in the Discharge Water

	TP g/m^3	DRP g/m^3	TN g/m^3	TOX-N g/m^3	Org-N g/m^3	TKN g/m^3	NH4-N g/m^3	Cl g/m^3	E coli /100ml
1/4/12-31/3/18 (6-yr mean)	2.4	2.1	5.4	3.2	1.8	2.3	0.4	44	5800
1/4/12-31/3/18 (range in annual mean)	1.7 – 3.2	1.6 – 2.7	4.6 – 6.1	2.5 – 3.6	1.4 – 2.7	1.7 – 3.1	0.3 - 0.6	40 - 48	3000 - 7400

Upgrades to the WWTP have reduced the load of TN discharged to land over time. The WWTP has been fully compliant with TN consent conditions since November 2012, discharging less than the 51 t/yr consent limit for the load of TN to the forest and less than 30 t/yr to the lake. The load discharged to land peaked at 49.7 t in the 12 months to March 2018, and the load to the lake recently peaked at 29.2 t in the 12 months to October 2017 following a period of high rainfall (Figure 2-7).

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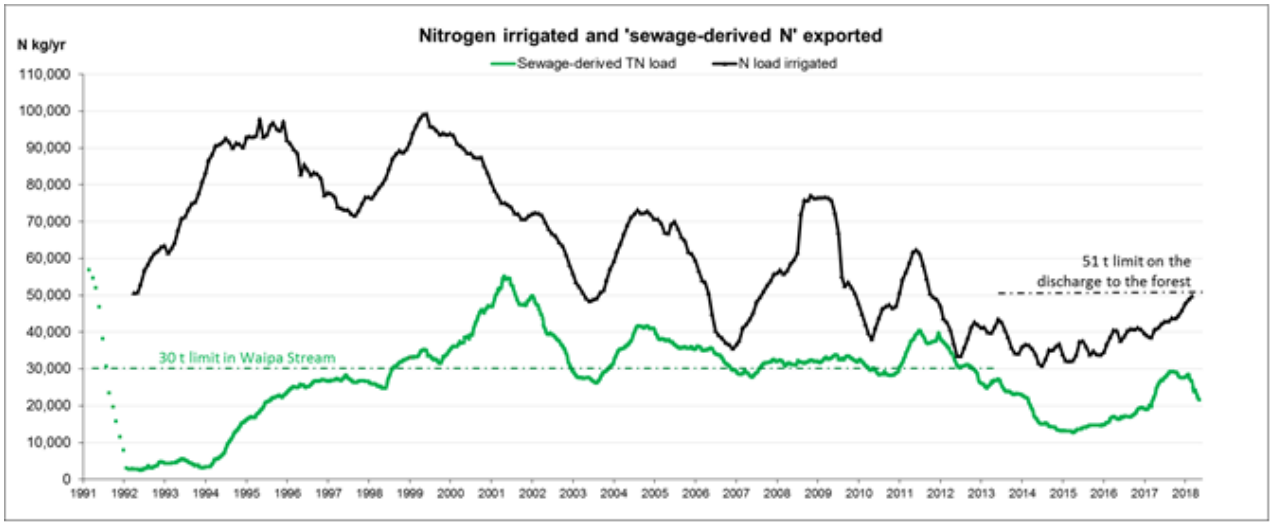


Figure 2-7: Total Nitrogen Irrigated and 'Sewage-derived N' Exported

The WWTP removes around 50% of TP from wastewater. The remaining 15-20 t/yr is discharged to land. The LTS has retained virtually all of the TP discharged to land since 1991 (Figure 2-8). Although the load of soluble P in the Waipa Stream appears to be increasing (Figure 2-9), the load of TP to the lake has remained below the consented limit since 2002.

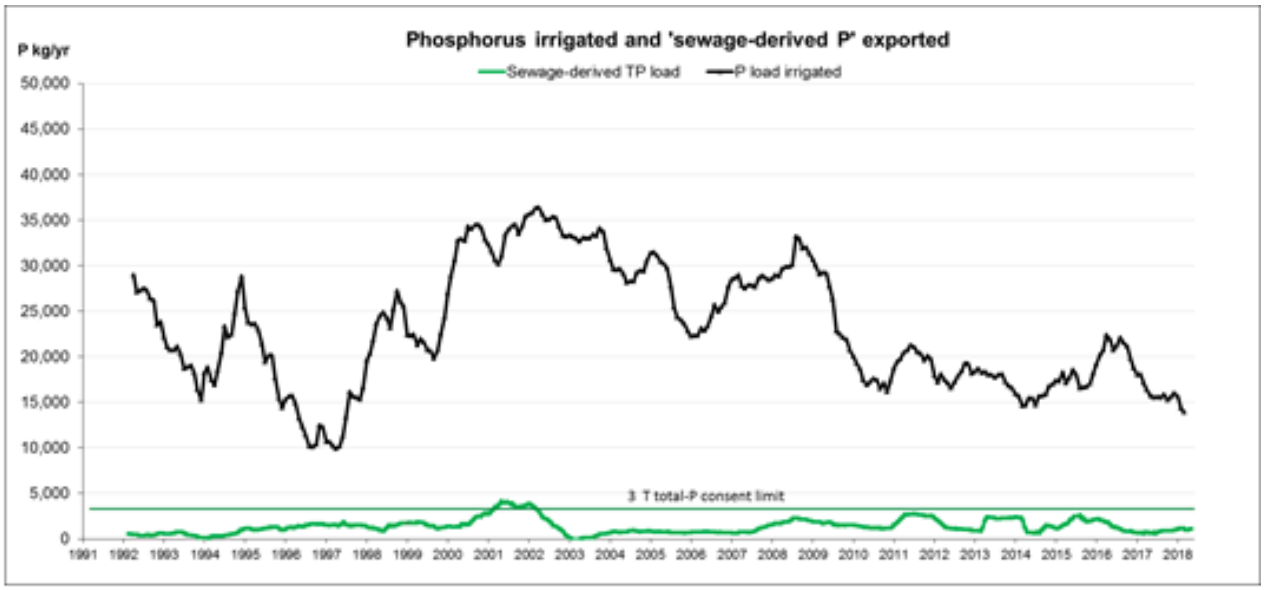


Figure 2-8: Total Phosphorus Irrigated and 'Sewage-derived TP' Exported

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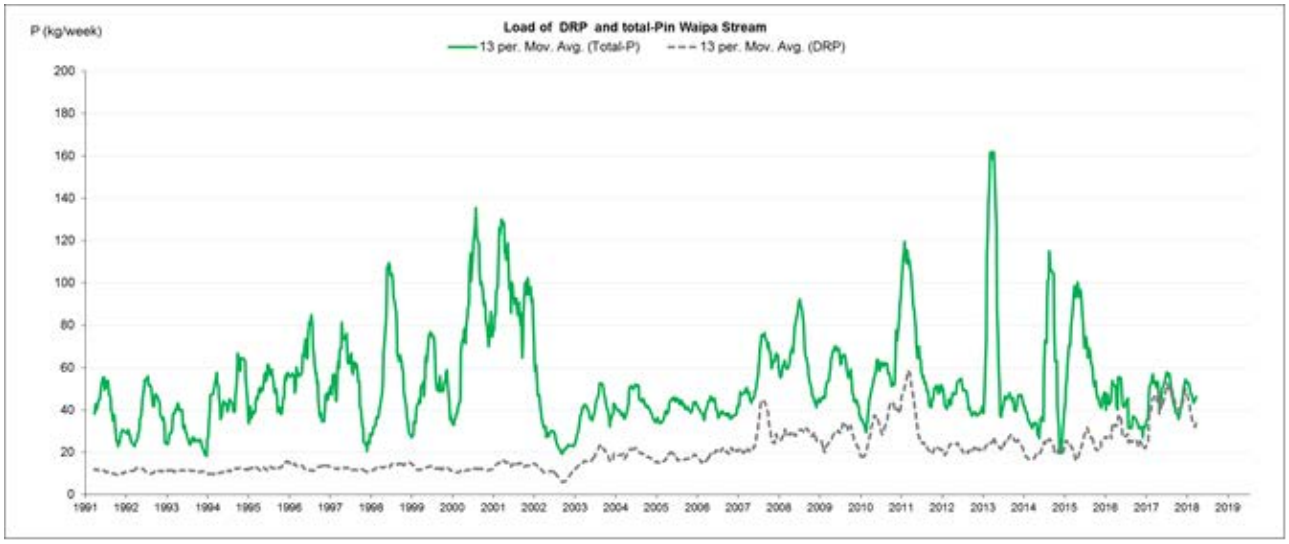


Figure 2-9: Soluble-P and TP in Waipa Stream

The WWTP does not currently disinfect the wastewater prior to discharge and the consent currently does not limit the level of pathogens in the discharge. The wastewater treatment process is very effective at reducing pathogens to relatively low concentrations and the LTS is effective in further reducing concentrations. The concentration of *Escherichia coli* bacteria reduce from around 15 million per 100 mL in the 'raw' wastewater to an average of around 5,800 per 100 mL in the treated wastewater. The irrigated area avoids main roads and tracks. In the past six years the median concentration of *Escherichia coli* bacteria in the Waipa Stream was 62 per 100 ml, with three incidences exceeding the 250 per 100 mL concentration considered 'safe' for recreational purposes (Figure 2-10).

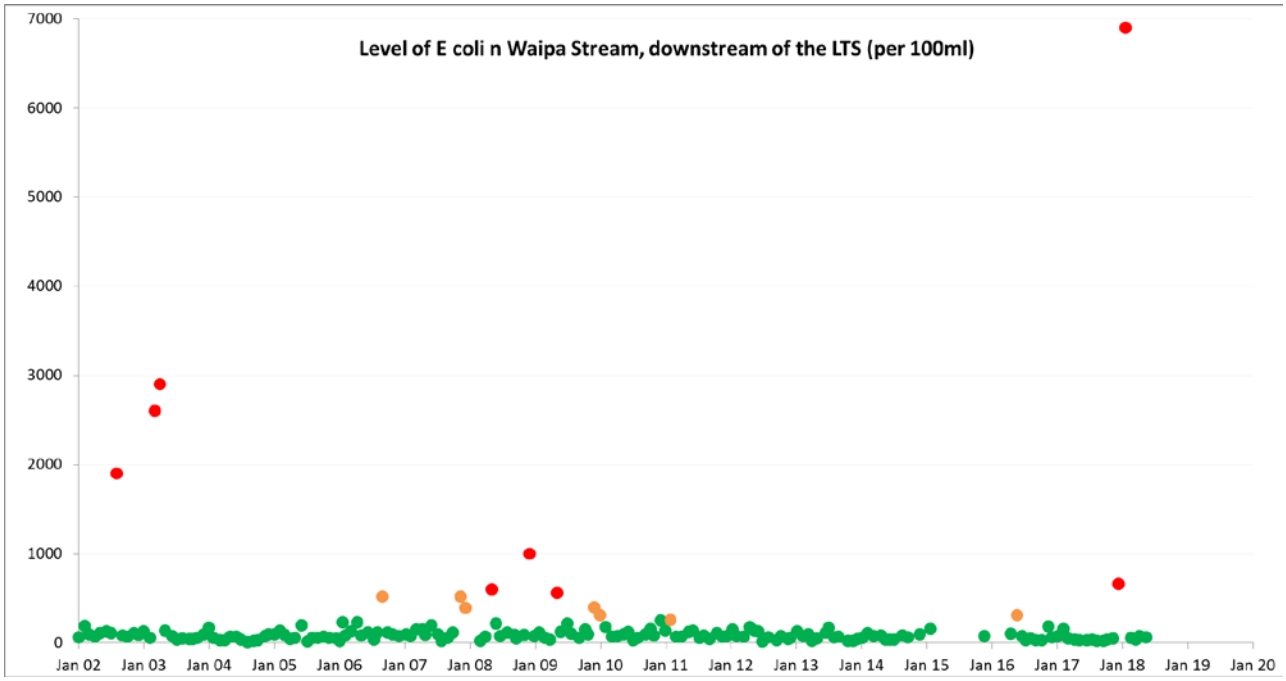


Figure 2-10: The Concentration of Escherichia coli bacteria in Waipa Stream Over Time as Coloured in Relation to the Recreational Guidelines (Green=Low Risk; Orange=Alert; Red=Action)

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3 Project Structure, Goals and Development

3.1 Introduction

This section 'sets the scene' and provides the context of the Project. It identifies the Project Objectives and other drivers, summarises the Project structure and processes followed, records early Project related activities, introduces the RPSC and the TAG, and links the Project to the RLC's Vision, Goals and Priorities and the Rotorua Sustainable Living Strategy. It concludes by setting out the key recommendations of both the RPSC and the RLC that define the Preferred Scheme for which resource consents are sought.

3.2 Project Objectives, Goals and Other Drivers

At the outset of the Project, the RLC set out a number of Project Critical Tasks. These included the establishment of the RPSC. Section 3.3 of this AEE sets out Project Critical Tasks. Based on that early direction, the RPSC was formed and it established its Project Goals. These RPSC Project Goals are set out in Section 3.7 of this AEE and are repeated below for completeness as they are of paramount importance in setting the terms of reference for the Project's development and decision making in identifying a Preferred Scheme.

Additional to the RPSC's Goals are the minimum technical requirements that the TAG identified at the outset of its deliberations. These technical requirements are set out in Section 9.3.2 of this AEE.

RPSC's Goals

> *The Committee (the RPSC) is to select from various options an alternative which is overall the best practicable option, and which:*
>
> - *Contributes to improving the water quality in Lake Rotorua by reducing nutrient and contaminant flows from the Rotorua WWTP;*
> - *Acceptably meets the cultural needs of tāngata whenua;*
> - *Achieves acceptable community environmental outcomes;*
> - *Acceptably safeguards public health;*
> - *Complies with regulatory requirements – national and regional;*
> - *Is an acceptably cost effective option for local ratepayers as well as the RLC; and*
> - *Has acceptable levels of community support.*

Additional and overarching to the RPSC's Goals and the TAG's minimum technical requirements are the RLC's Vision, Goals, Priorities and Commitment and parts of the Rotorua Sustainable Living Strategy, each of which are summarised in Appendix J.

3.3 Project Critical Tasks

Early in the Project development the RLC determined that the critical task for this Project was to get all stakeholders involved in the selection of a preferred alternative option. To achieve this, the following strategies were adopted:

a) Establishment of the RPSC to represent all stakeholders and ensure that their interests and concerns are considered in the selection of the preferred alternative option;

b) Appointment of an independent and external consultant to co-ordinate and manage the consultation and consenting phase of the Project; and

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c) Extensive public consultation to be led by RPSC to a stage where a preferred alternative option is selected.

3.4 Project Structure and Processes Followed

3.4.1 Project Structure and Decision Process

Figure 3-1 shows the project structure used to ensure that pragmatic lines of reporting and communication were established from the outset, noting that some of these structures were in place prior to the Project commencing. Fundamental to the decision making process was the decision by the RLC to form the RPSC (as shown in the grey shaded box) which was set up following the "Project-Rotorua Clean-Water' Symposium" (held on 30 September and 1 October 2013 and discussed in greater detail in Section 3.5 of this AEE). The RPSC was supported by the TAG and other groups and organisations as shown in Figure 3-1.

Figure 3-1 highlights the many parties who were involved in the overall Project development and its integration with the Te Arawa Lakes Trust, the Rotorua Te Arawa Lakes Strategy Group, and the BOPRC in its various roles including, most importantly, as the Consent Authority.

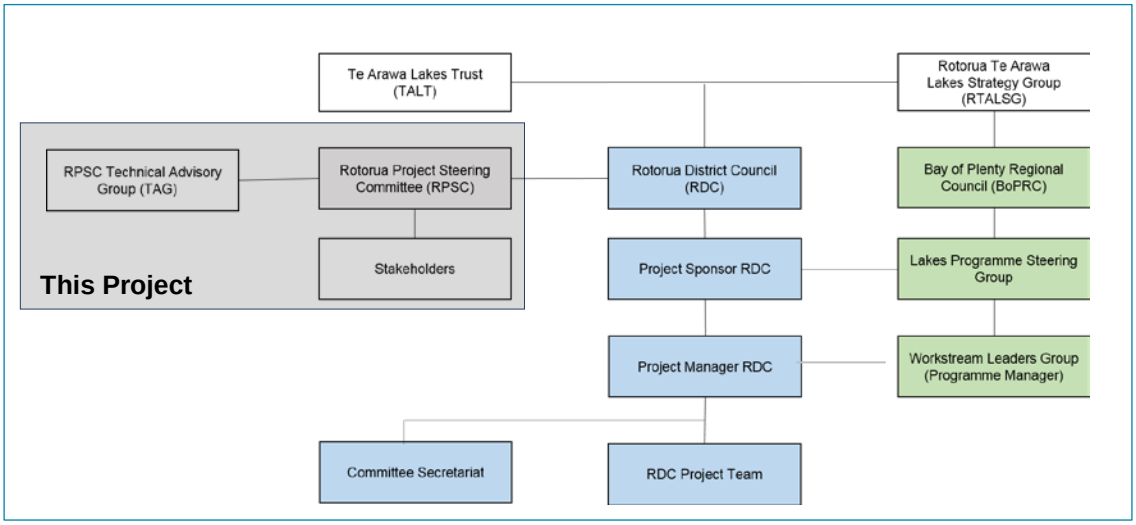


Figure 3-1: Project Structure

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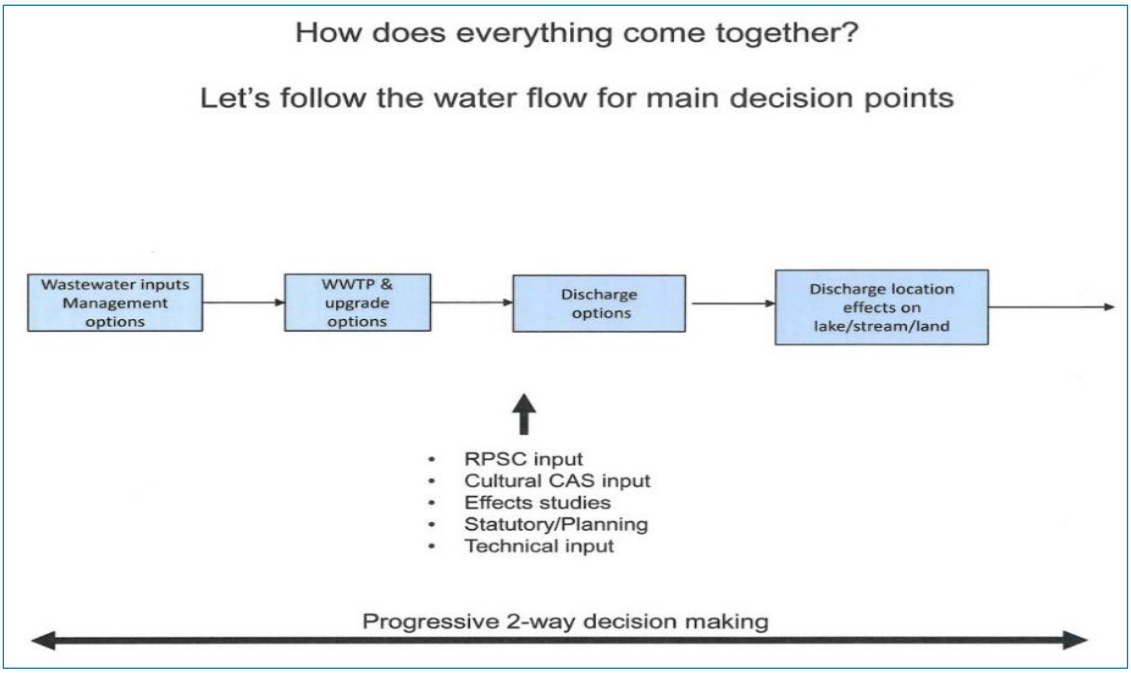


Figure 3-2: Project Development - Simplified Representation

Figure 3-2 presents a very simplified representation of the development of the Project and the main inputs into the Project decision making. This was used for consultation.

Figure 3-3 provides a flow chart to the key inputs into and the decision making in selecting a Preferred Option/Preferred Scheme as an alternative to the LTS and taking it through to lodgement for the resource consents and other approvals needed.

Figure 3-3 also highlights steps that were followed in making the overall decision in respect of the Preferred Scheme as is set out in Section 9 of this AEE.

3.5 'Project-Rotorua Clean-Water' Symposium

As an early activity in the Project and prior to the formulation of the RPSC, a symposium was organised jointly by the RLC and the Lakes Water Quality Society. This was held on 30 September and 1 October 2013. The aim of the symposium was to bring together all stakeholders to understand the issues of the current LTS issues and agree on a way forward. The stakeholders unanimously agreed on a recommendation for dealing with treated wastewater discharge as follows:

- First and foremost, to restore the Mauri of the WWTP's treated wastewater discharge - this would require the restoration of "life giving" properties. This treated wastewater might then be suitable for discharge to the lake or the lower Puarenga Stream; and
- To close the LTS in the Whakarewarewa Forest by 2021 and recommended the formation of the RPSC and associated TAG.

The symposium also identified two options for future treatment and discharge of treated wastewater. These two options are as set out in Section 9.2 of this AEE.

The Lakes Water Quality Society's Report on the symposium is included as Support Document No. 1 to this AEE.

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3.6 Lake Action Plans and the Regulatory Context

Major effort and expenditure has been, and continues to be, undertaken by all levels of central and local government, in collaboration with Te Arawa Lakes Trust, to protect and improve lake water quality.

Action Plans have been produced under the Rotorua Te Arawa Lakes Programme for Lakes Rotomā, Rotorua/Rotoiti, and Rotoehu. These contain lake-water quality targets and actions to achieve these targets.

The Bay of Plenty Region is subject to an operative Regional Policy Statement (RPS), as well as the Operative Regional Water and Land Plan, On Site Effluent Treatment (OSET) Plan and Operative Air Quality Plan. The Operative Regional Water and Land Plan has been renamed the Regional Natural Resources Plan (RNRP). In due course, the BOPRC proposes to amalgamate all other regional plans into the RNRP. These planning instruments are assessed in Sections 5 and 12 of this AEE.

These plans provide important input to the management of the Rotorua Lakes and in Lake Rotorua's achieving the RPS's sustainable TN load. Section 2.2 of this AEE includes Figure 2-1 which presents the TN sources to Lake Rotorua and states that TN to Lake Rotorua is to be reduced to 435 t/yr by 2032. The 435 t/yr TN figure is included in the RPS and as such provides a statutory basis for nutrient planning. It is considered to be the long term future sustainable TN load that Lake Rotorua can assimilate without resulting in undesirable environmental effects. This key figure is used for the environmental effects assessment of the WWTP's discharge of treated wastewater recorded in Section 7 and Support Documents No. 3 and 4 of this AEE.

Works required to construct five small bunds adjacent to the Puarenga Stream and for widening and minor deepening of the Te Arikiroa Thermal Channel have been assessed under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011 (NES-CS) and Rotorua District Plan (RDP) as set out in Section 5 and 12 of this AEE

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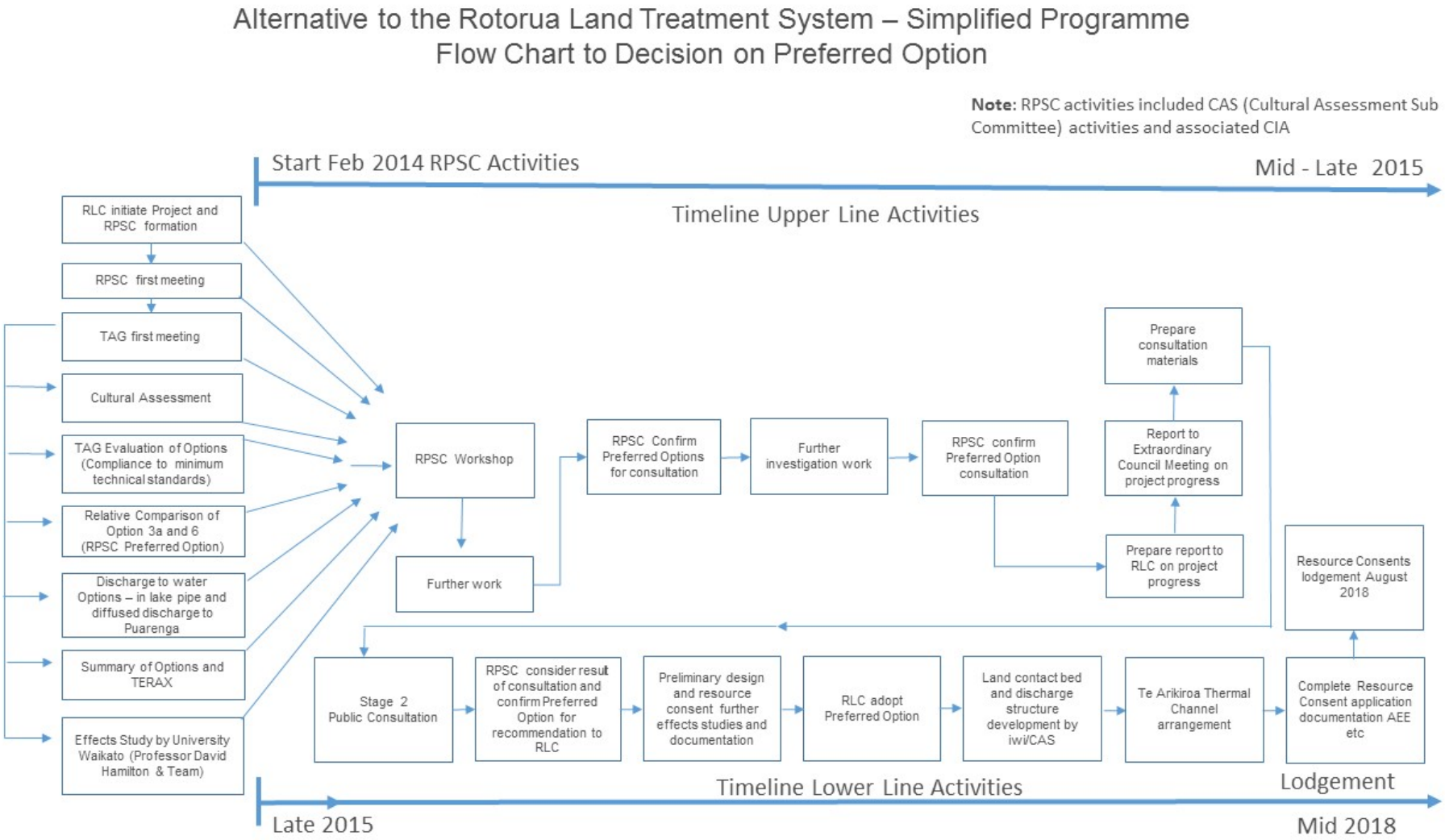


Figure 3-3: Flow Chart - Decision Process to Identify the Preferred Scheme

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3.7 Rotorua Project Steering Committee

Background and Terms of Reference

As set out in Section 3.3 of this AEE, a RLC critical task was the establishment of the RPSC.

The key purpose of the RPSC was to recommend to the RLC a preferred option for treated wastewater disposal/discharge.

The RPSC first met on 16 January 2014 and has met 24 times through to 7 April 2017. Its activities have also included a number of technical workshops, visits to WWTPs in Tauranga City and the Western Bay of Plenty District, as well as to Rotorua's own WWTP.

Key aligned activities of the CAS and the TAG were reported back to the full RPSC.

The RPSC has been independently chaired by Warren Webber (representing the Lakes Water Quality Society) and the CAS chaired by Gina Mohi. Full membership of these two committees is included in Appendix B.

Goals

The RPSC goals, as set out in Section 3.2 above, are repeated here for completeness:

> *RPSC is to select from various options an alternative which is overall the best practicable option, and which:*[2]
>
> - *Contributes to improving the water quality in Lake Rotorua by reducing nutrient and contaminant flows from the Rotorua WWTP;*
> - *Acceptably meets the cultural needs of tāngata whenua;*
> - *Achieves acceptable community environmental outcomes;*
> - *Acceptably safeguards public health;*
> - *Complies with regulatory requirements – national and regional;*
> - *Is an acceptably cost effective option for local rate payers as well as the RLC; and*
> - *Has acceptable levels of community support.*

Fundamental to the activities of the RPSC was the setting of these goals so that options for wastewater treatment, reuse, and discharge could be evaluated against these goals.

RPSC's Activities and Considerations

Throughout its meetings, associated workshops and treatment plant visits, the RPSC traversed an extensive range of topics.

The RPSC's extensive meeting minutes and associated presentation sides and other information are available from the RLC's Project Manager, Greg Manzano, on request. Appendix B includes an overview summary of the key topics discussed at each meeting.

[2] Best Practicable Option (BPO) as defined in the Resource Management Act 1991.

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3.8 Technical Advisory Group

As part of establishing the RPSC, the RLC suggested that the RPSC be supported by the TAG. The RPSC subsequently developed the TAG's terms of reference and selected its membership. The TAG was chaired by Jim Bradley, a specialist wastewater consultant.

The terms of reference and membership of the TAG are set out in Appendix C.

In terms of the TAG's activities, "Technical" was defined to include not only the pure engineering and infrastructure technical information, but also scientific and economic information. The TAG also sought input on cultural matters from the RPSC and CAS.

The TAG met on twelve occasions between 5 June 2014 and 16 August 2016. Each TAG meeting included an update on RPSC's activities and identification work packages necessary to be undertaken to advance the options assessment and environment effects assessments.

Key topics addressed at respective TAG meetings are recorded in the meeting minutes which are available from the RLC's Project Manager, Greg Manzano.

Appendix C includes a summary listing of the key subject matter discussed at each TAG meeting.

3.9 Project Inputs and Supporting Documents

Figure 3-4, used in the Project consultation, shows the key inputs to the Project. These were all important components in the progressive evaluation and decision-making process undertaken by the RPSC to arrive at a "Preferred Option". The RPSC's Preferred Option was then recommended to the RLC for its consideration. Sections 3.11 and 3.12 of this AEE summarise the outcomes and resolutions of RPSC and the RLC on the Preferred Option for which resource consents and other approvals are being sought. It is noted that the "Preferred Option" was later renamed the 'Preferred Scheme' and the two terms are interchangeable.

This AEE document includes information on many of the Project inputs, and how they have informed the Project development as it proceeded. The overall Project and the AEE itself has also been informed by a number of documents recorded in the AEE Appendices, the two Companion Documents and eleven Supporting Documents.

The Companion Documents and Supporting Documents are stand-alone (not bound into the AEE) but are listed in the contents page of this AEE for reference.

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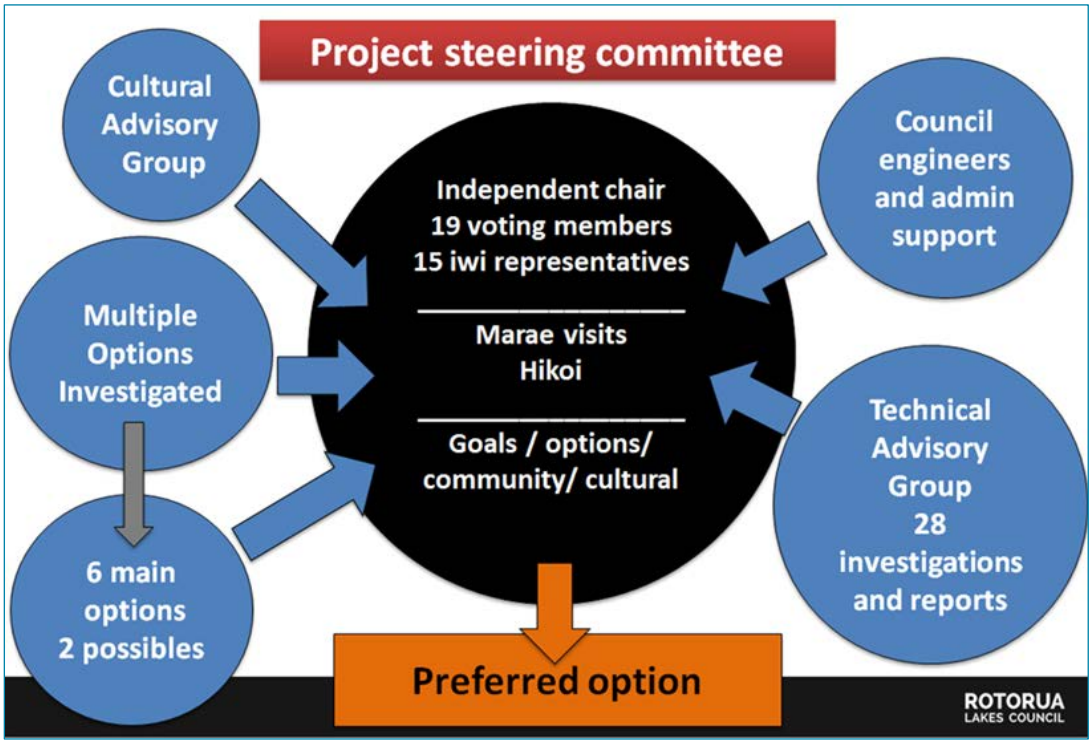


Figure 3-4: Key Inputs to the Project Decision Processes

3.10 Rotorua Lakes Council's Goals, Priorities, Commitment and Sustainable Living Strategy

3.10.1 Vision, Goals, Priorities and Commitments

The RLC has established, as part of its Long Term Plan 2015 - 2025 (LTP), a vision and set of goals, priorities and commitments, many of which provide overarching and important inputs for the overall development and decision making in this Project. Figure 3-5 sets these out.

This vision and these goals, priorities and commitments provided an overarching direction in the development of this Project and determination of the Preferred Scheme.

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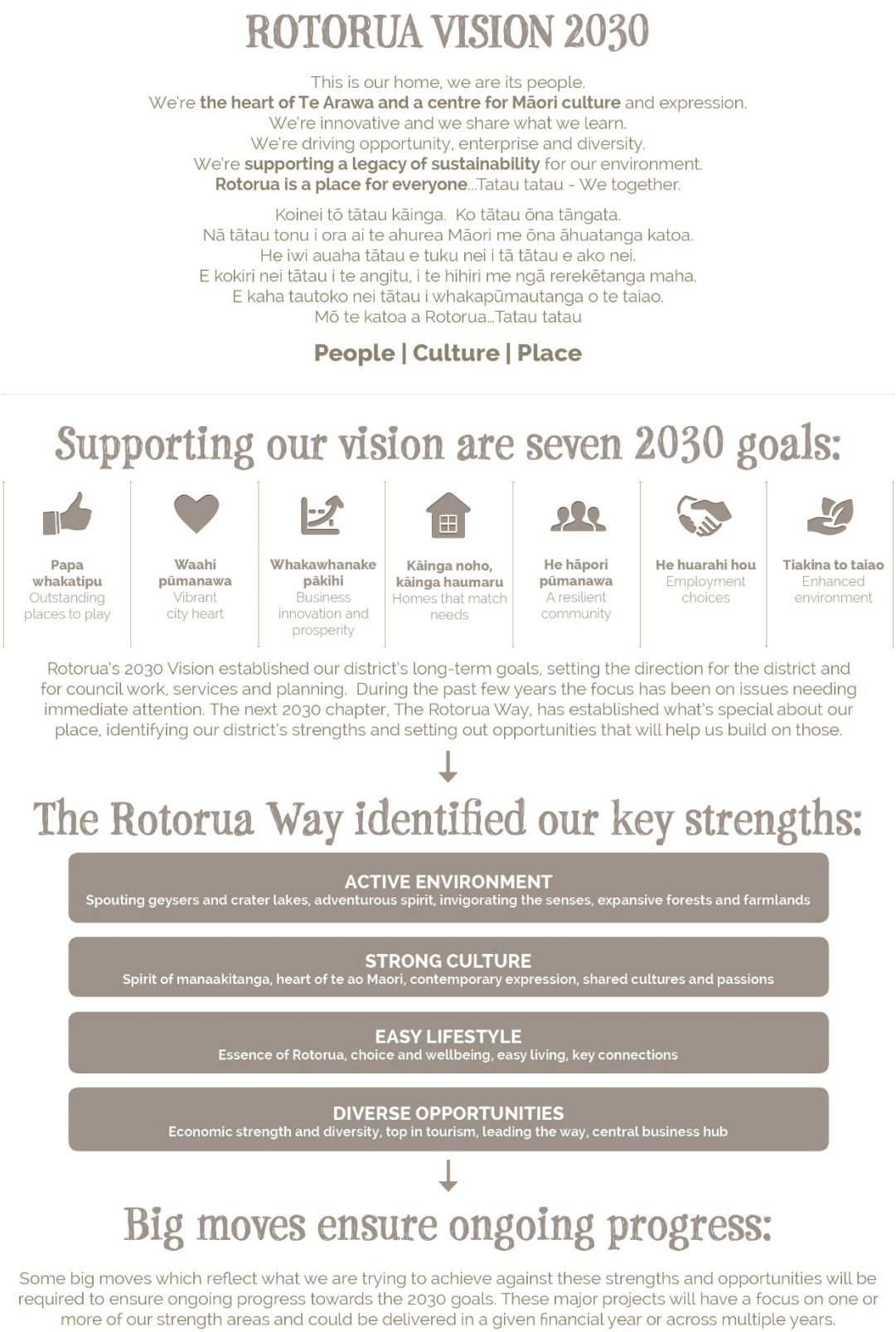


Figure 3-5: Vision, Goals, Priorities and Commitments

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3.10.2 Rotorua Sustainable Living Strategy

Early in 2015 a steering group of community members with interests in a range of topics relating to sustainable living came together with Councillor Janet Wepa and RLC staff to begin the journey to develop a strategy for sustainable living contributing to achieving the goals stated in the "Vision 2030 – The Rotorua Way". This led to the development of the Rotorua Sustainable Living Strategy[3].

The RLC joined the United Nations Global Compact - Cities Programme and the team used the programme's "City Scan" tool to assess a range of attributes contributing to sustainability issues for the Rotorua district. The resulting information was shared and discussed with a wide range of people in the community to get an understanding of what things were of most importance or concern to focus on in the Rotorua Sustainable Living Strategy. The Rotorua Sustainable Living Strategy focuses on six particular objectives and then identifies six sustainable living objectives and sets out how success will be measured. Appendix J of this AEE includes a compilation of those objectives that are considered to have direct relevance to this Project in terms of development and identification of the Preferred Scheme and the implementation and ongoing operation of such a Scheme.

The "Objectives, Strategies and Actions" columns in Appendix J are extracted directly from the Rotorua Sustainable Living Strategy while the "Relevance to this Wastewater Project" column summarises how it is expected the new treatment and discharge scheme will achieve the Objectives, Strategies and Actions. For Objective 4 the Strategy is to "Treat our wastewater to a high standard and discharge safely".

Appendix J also includes (verbatim) those actions and estimated timeframes that are directly relevant to the implementation and ongoing operation of the Preferred Scheme.

3.11 Rotorua Project Steering Committee's (RPSC) Recommendations

The key project recommendations made at the RPSC's meeting on 9 June 2016 and then considered by the RLC were:

> ***Resolved***
>
> ***"That the RPSC recommends to Rotorua Lakes Council proceed to a resource consent application for the Rotorua WWTP upgrade on the basis of the following preferred option:***
>
> - **Treatment – a 100% MBR membrane filtration plant, including extra phosphorus removal and UV treatment"**

Vote - unanimous – 1 abstention

> ***Resolved***
>
> ***"That the RPSC recommends Rotorua Lakes Council proceed to a resource consent application for the Rotorua WWTP discharge, on the basis of the following preferred option:***
>
> 1. ***The identified option to discharge through Puarenga Bay***
>
> ***And***
>
> 2. ***To continue to work with interested parties to investigate alternate discharge options including the reuse of recovered water"***

Vote - carried by majority. For – 8, Against – 4, Abstention - 2

[3] The Rotorua Sustainable Living Strategy is one of the strategies that the RLC has produced to help deliver on the seven goals stated in the "Vision 2030 – The Rotorua Way"

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Appendix B also includes a copy of these resolutions and summarises the topic areas of the RPSC meetings.

3.12 Rotorua Lakes Council's Decision

A staff report summarising the alternative options to the Whakarewarewa LTS was submitted to the RLC's Strategy, Policy and Finance Committee meeting on 14 October 2015. It highlighted that the different options were the result of approximately 18 months of comprehensive options identification, evaluation and stakeholder engagement processes lead by the RPSC.

A further Staff Report was presented to the RLC's Strategy, Policy and Finance Committee on 15 June 2016. This later report is included as Appendix A to this AEE. That Committee report highlighted that while the RPSC was, by the end of its deliberations on 9 June 2016 (refer above), unanimous on the recommended preferred treatment option, it was not unanimous on the recommended type or location of the discharge. The majority of the RPSC members supported a recommended discharge through a cultural land contact bed, a cascade arrangement and then into Te Arikiroa Thermal Channel which flows in to Puarenga Bay (Sulphur Bay).

The resolutions carried at that Committee meeting were further considered and similarly carried at the full Council meeting on 23 June 2016. The resolutions adopted by the RLC were:

1. ***"That Council to proceed to a resource consent application of the preferred upgrade of the Rotorua WWTP, which includes conversion of the existing plant into a full Membrane Bioreactor (MBR) with additional phosphorous removal and the addition of Ultraviolet Disinfection (UV) system."***
2. ***"That the committee recommends to Council to proceed to a resource consent application for the Rotorua WWTP discharge, on the basis of the preferred option:***
    a) ***The identified option to discharge through to Puarenga Bay and;***
    b) ***To continue to work with interested parties including Mana Whenua and Te Tatau o Te Arawa, to investigate alternate discharge options, including the reuse of recovered water."***
3. ***"That the committee recommends to Council to note that the estimated capital cost of the preferred WWTP upgrade and the discharge to Puarenga Bay is $29 million. The budget allocation for this Project in the Long Term Plan Is $18.6 million."***
4. ***"That the committee recommends that Council acknowledge and thank the Rotorua Project Steering Committee and all parties Involved In the process, culminating to this decision."***

Appendix A includes the Committee and full Council Meeting papers that relate to these resolutions.

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4 Preferred Scheme

4.1 Introduction

This Section sets out information relating to the Preferred Scheme for which the new consents are being sought. In terms of the Schedule 4 RMA requirements, this information relates to the description of the activity.

The Preferred Scheme encompasses six main components with treatment and discharge being the key new components in terms of future new built infrastructure. Future beneficial reuse of the very high quality treated wastewater is also a key component (Component 6) of the Preferred Scheme.

The treatment and discharge components have on occasions been separately considered in the course of the Project. Notwithstanding this, it is paramount that these components are considered together as part of the overall Preferred Scheme.

The development journey leading to the Preferred Scheme is traversed in Section 3. The wide-ranging assessment of alternatives/options from which the Preferred Scheme has been identified is summarised in Section 9.

The RLC has progressed the development of the Preferred Scheme to the point where a concept design for the proposed upgraded WWTP has been developed between the RLC's engineering division and its engineering consultants (Mott MacDonald). Appendix H includes Mott MacDonald's Wastewater Treatment Design Statement for the Preferred Scheme.

This Section of the AEE firstly traverses the projected growth and wastewater flows and loads anticipated over the 35 year term sought for the regional discharge resource consents. It then discusses each of the six main components of the Preferred Scheme.

The mechanism for setting the capped total N and total P loads to be consented is outlined.

The RLC's method of procurement is also discussed (section 4.8 of this AEE), indicating that if an alternative treatment system to that promoted in the Preferred Scheme was to be considered, it would need to meet the specified requirements of the resource consents granted (should they be exercised), or seek to have any specific conditions changed or new resource consents obtained.

4.2 Area and Growth to be served by the Scheme

4.2.1 Area Served

The area served by the existing Wastewater Scheme is shown in Figure 4-1 and includes the following wastewater catchments:

- Rotorua Urban Area and Ngongotaha;
- Rotokawa and Brunswick;
- Hamurana and Awahou;
- Okere Falls, Otaramarae, Whangamarino;
- Mourea and Okawa Bay; and
- Okareka and Tikitapu.

Wastewater catchments that are expected to, or could be, connected in the future include Lake Tarawera's township area. Both infill development and urban development of existing rural land is very likely to be part of the growth patterns.

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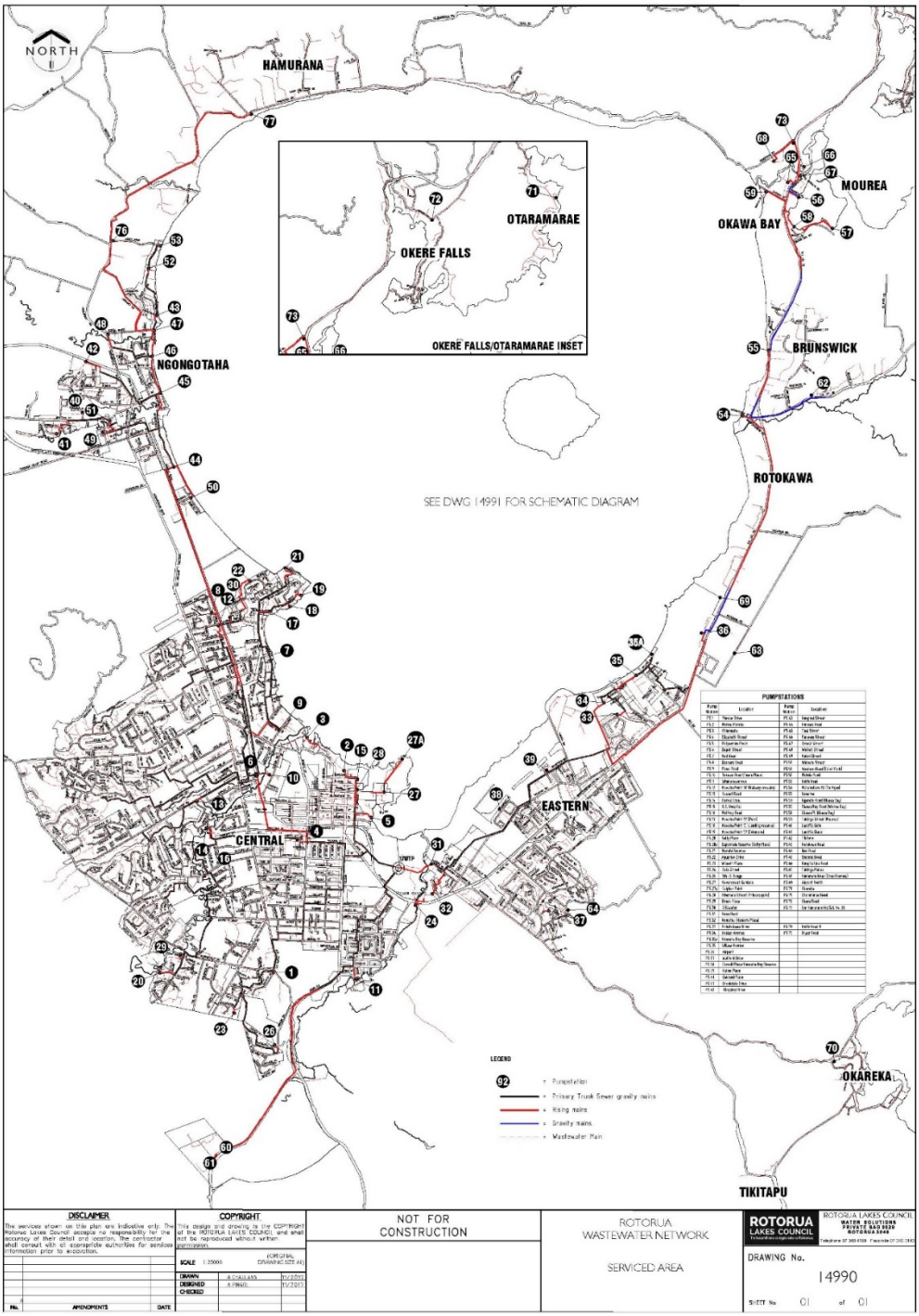


Figure 4-1 Area Currently Served by the Rotorua Wastewater Scheme

4.2.2 Growth Rate

The growth rate for the wastewater catchments served by the WWTP is based upon previous studies[4] and sits between the Berl-Medium and StatsNZ-High population growth scenarios (Figure 4-2).

[4] These studies include the Wastewater Strategy Study and models developed for the TERAX (a sludge processing technology) separate sludge processing investigations where a linear (compound) growth rate of 0.7% p.a was applied to the WWTP influent volume from 2016 to 2051.

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Section 6.2 and Appendix D of this AEE have been prepared by APR Consultants and include in-depth discussion on population, business and tourism growth projections.

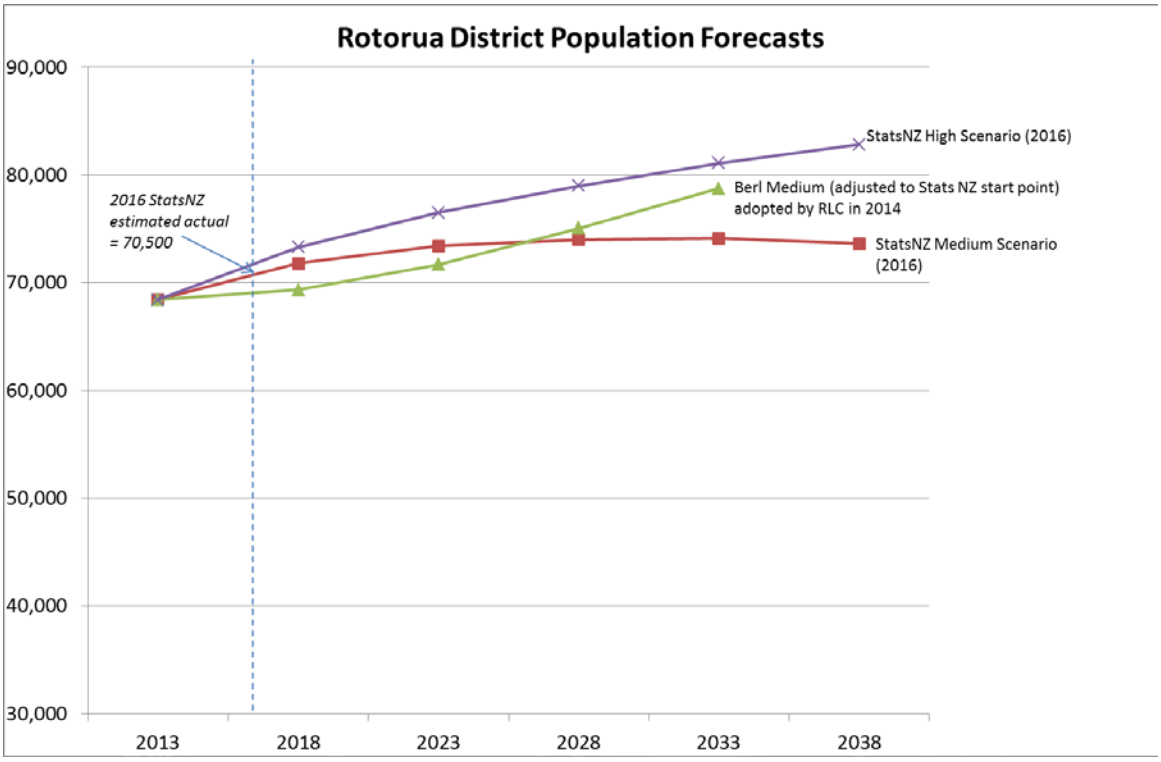


Figure 4-2: Rotorua District Growth Rate

Figure 4-2 highlights different growth scenarios through to 2038. In Section 4.4.3.1 of this AEE the above 0.7% pa growth rate is converted through to the projected average daily wastewater flow up to year 2054. This Projection anticipates 35 year consent terms being granted in line with RLC's applications.

4.3 Development of the Wastewater Strategy

The RLC's Wastewater Strategic Plan is currently under review. The review of the Wastewater Strategic Plan will include subject matter from the following RLC documents, all of which provide key inputs to the RLC's overall wastewater scheme development, implementation, and operation:

- Wastewater Asset Management Plan;
- Water Services and Trade Waste Bylaw 2010;
- Water Conservation and Demand Management Strategy;
- 30 Year Infrastructure Plan; and
- Rotorua Sustainable Living Strategy

Early in its deliberations, the TAG suggested to the RPSC that the Preferred Scheme and its management should be underpinned by some key planks in a new or further updated Wastewater Strategy. This approach was adopted by the RPSC. This is shown diagrammatically in Figure 9.3.

Key considerations the TAG and the RPSC identified for inclusion in the further development of the RLC's Wastewater Strategic Plan, or new Wastewater Strategy included:

- Sustainable management of incoming domestic, business and industrial (trade waste) wastewater by effective use of proven techniques for Wastewater Input Management including:

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  - Water supply conservation and demand management programme (the RLC's Water Operations Manager presented to the RPSC on this matter);
  - Infiltration and inflow management programme;
  - Trade waste management with some emphasis on cleaner technology at industrial premises;
  - Appropriate engineering standards being adopted for new communities and subdivision connections;
- Sustainable measures in terms of design, operation and beneficial reuse of products associated with the WWTP;
- Periodic review of new technologies and processes as outlined in Sections 9.3.3 and included in the RLC's volunteered conditions in Section 14 and Appendix K of this AEE;
- Efficient end use of energy as included in section 7 of the RMA. In this respect the decommissioning of the LTS will result in an energy (electricity) saving of approximately $800,000 pa (ex GST) in pumping and other costs;
- New and existing infrastructure being located and designed to be adaptable to projected climate change; and
- Appropriate best practice use of data including that expected to be developed as part of the NZ Metadata Project being led by the Treasury and the Ministry for Primary Industries.

A number of the above matters are further discussed in Section 4.5 which traverses the RLC's wastewater operation and management procedures.

More recently the RLC has determined that it is to prepare a new "Wastewater Strategy" rather than further develop the above mentioned Strategic Plan.

The above matters will be incorporated into the new Wastewater Strategy together with the following policy and network mitigation matters.

- A Containment Policy whereby the WWTP will be configured and operated to ensure all inflows pass through the full treatment of the MBR and UV disinfection systems. This is outlined in Section 3.8.3 of the Mott MacDonald Wastewater Treatment Design Statement (contained in Appendix H) and also in Section 4.4.3 below.

The future proofing of the network performance is set out in Section 3.8.3.3 of Appendix H (Mott MacDonald Wastewater Treatment Design Statement), and will involve the following mitigation measures in order to minimise the risk of overflows:

- Implementation of an ongoing infiltration and inflow strategy specifically targeted at reducing peak flows and volumes in rainfall events. For example increased peak and/or prolonged rainfall resulting from climate change could result in the need for additional on-site storage capacity
- Considering storage in addition to that already included in the proposed WWTP should this be needed in the future. This could consist of additional onsite storage in some of the disused structures and/or targeted additional storage in the wastewater network
- A program of pipe renewals based on criticality, condition and remaining useful life assessments
- Preventative maintenance on the network including identifying cross connections

The RLC's volunteered conditions (Condition 5 in Appendix K) would require the RLC to provide updated information on the Wastewater Strategy document to the BOPRC every 9 years as part of the Monitoring and Technology Review Report.

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4.4 The Preferred Scheme

The six key components of the Preferred Scheme are as follows:

- Component 1 – Wastewater Inputs Management;
- Component 2 – Wastewater Collection Systems;
- Component 3 – Wastewater Treatment Plant Upgrade;
- Component 4 – Land Contact Bed and Discharge Structure;
- Component 5 – Te Arikiroa Thermal Channel Treated Wastewater Discharge Arrangement;
- Component 6 – Beneficial Reuse of Treated Wastewater.

The RLC wishes to retain flexibility on the final selection of the technology to be used, notwithstanding that the preferred treatment process has been determined as a key part of this Project. The rationale for this approach is set out in Section 4-9 of this AEE.

4.4.1 Component 1 – Wastewater Inputs Management

The following procedures for management of the incoming wastewater all form part of Component 1:

- Water supply conservation and demand management programme;
- Infiltration and inflow management programme;
- Trade waste management with some emphasis on cleaner technologies at industrial and trade waste discharging premises; and
- Engineering standards being adopted for new communities and subdivision connections
- The Containment Policy for the WWTP as introduced in Section 4.3 of this AEE and further outlined in Section 3.8.3 of the Mott MacDonald Wastewater Treatment Design Statement included as Appendix H

Figure 9-3 presents the short-listed options for treatment and discharge and shows how the "Wastewater Inputs Management Options" sit across all the options and form part of the new Wastewater Strategy. In its deliberations the RPSC were mindful of the need to control inputs to the Wastewater Scheme. Accordingly, it supports for inclusion of such measures in a Wastewater Strategy (refer Section 4.3 and Figure 9.3 of this AEE).

4.4.2 Component 2 - Wastewater Collection System

The wastewater collection system forms an integral part of the reticulated Wastewater Scheme. Section 4.2.1 lists the areas served by the WWTP and Figure 4-1 shows the extent of the area reticulated.

The Wastewater Scheme involves a conventional gravity collection sewer system for the main urban area, along with a number of outlying small communities serviced by a low pressure pump and pressure system and conveyance to the main Wastewater Scheme.

Some 2017 statistics that highlight the current size of the Wastewater Scheme are:

- 22,469 household and business connections;
- 1,349 connections on a grinder pump low pressure sewer system;
- 405 km of gravity sewers;
- 77 pumping stations;
- 56 km of rising mains;
- 76 km of low pressure (grinder pump) mains.

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4.4.3 Component 3 - Wastewater Treatment Plant Upgrade (Also referred to as the Preferred Treatment System in this AEE)

4.4.3.1 Wastewater Flows and Loads

Average Daily Flows

Section 4.2.2 records growth projections and refers to Section 6.2 and Appendix E of this AEE.

Due to the very significant tourist population in Rotorua it is very difficult to separate overnight or day visitor flows from flows generated by permanent residents, and therefore difficult to calculate flows and loads based on traditional flow allowances per capita. To simplify this, a number of assumptions have been made:

- Population growth applies to all contributors to the catchment at the same rate (a compounding rate of 0.7% pa);
- Trade waste (industrial wastewater) growth follows the same 0.7% pa growth;
- Base infiltration to the sewerage network is assumed to be a constant proportion of the influent flow and therefore grows at the same rate as the resident and tourist populations;
- Chemical oxygen demand (COD), total Kjeldahl nitrogen (TKN) and total suspended solids (TSS) loads to the WWTP are assumed to grow at the same rate and in the same relative proportions to the current loads, and no distinction is made between contributions from permanent or visitors.

There is currently a significant level of baseline infiltration into the Rotorua wastewater network (night flow) of approximately 100 L/s. Over the next 35 years, based on the assumption of this flow increasing at the same rate as the connected population, it could be expected that this flow would reach 128 L/s. There are, however, some reductions that can be made in the mass of nutrients discharged from the WWTP if the level of base infiltration/inflow is reduced. Section 4.3 and Appendix H (Mott MacDonald Wastewater Treatment Design Statement) further records measures proposed to minimise infiltration and inflow.

Measured and predicted average daily flows to the WWTP (influent flows) over time are presented in Table 4-1.

Table 4-1: Measured and Projected Average Daily Influent Flows

Calendar Year	Measured* Average Daily Flow (ADF) (ML/day)	Projected Average Daily Flow (ADF) at 0.7% growth from 2016 (ML/day)
2006	19.0	
2007	17.7	
2008	18.7	
2009	17.6	
2010	18.0	
2011	19.8	
2012	19.5	
2013	18.6	
2014	18.5	
2015	18.8	

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Calendar Year	Measured* Average Daily Flow (ADF) (ML/day)	Projected Average Daily Flow (ADF) at 0.7% growth from 2016 (ML/day)
2016	19.7	19.6
2017		19.7
2018		19.9
2026		21.0
2036		22.5
2046		24.1
2054		25.0

*Measured discharge for the calendar year – from monthly ADF as reported under Condition 9.2 of Discharge Permit 60739.

Figure 4-3 shows the wastewater inflow to the WWTP from March 2004 to March 2018. This shows the increase over time and the variation within any year.

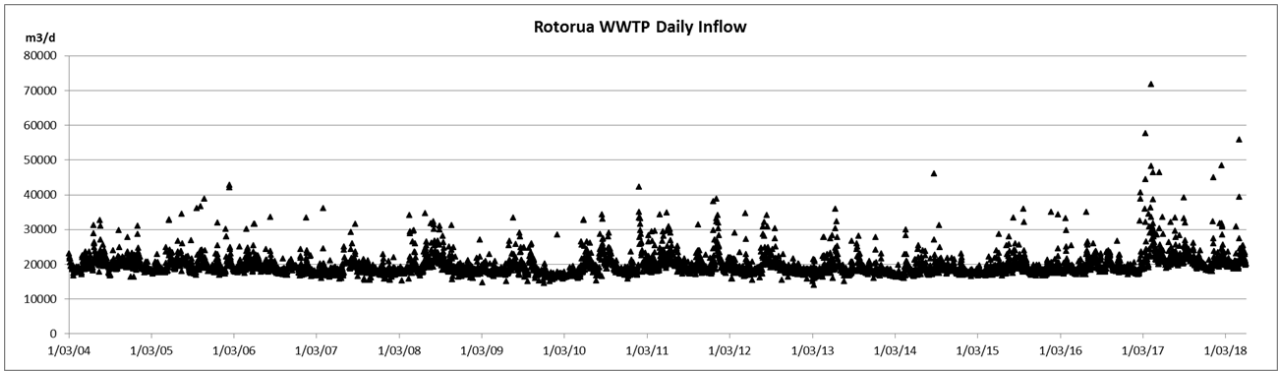


Figure 4-3: Rotorua WWTP Daily Inflow

Peak Wet Weather Flows

The Preferred Scheme's design objective is 100% containment and treatment of all reasonably foreseeable inflows through the MBR and UV disinfection (refer to the Containment Policy discussed in Section 4.3 of this AEE and Sections 3.8.3 and 3.9 of Appendix H – Mott MacDonald Wastewater Treatment Design Statement). An important design consideration for the WWTP upgrade is how the assessed future peak design inflow to the WWTP of 1,130 L/s (Mott MacDonald Design Statement, Appendix H) and its inflow duration are accommodated. These parameters determine the volume of influent that the WWTP infrastructure must reliably accept, convey, store, treat, and discharge during and after a peak wet weather flow event.

This information then further determines the detailed design criteria for the capacity of influent flow reception, preliminary treatment, conveyance, storm flow balancing/storage, storm flow balancing return to treatment and membrane peak design flow (and membrane sizing). This assessment has determined the peak wet weather treated wastewater discharge to the Te Arikiroa Thermal Channel (refer to Section 4.4.5 of this AEE) as being 831 L/sec (equivalent to 71.8 ML/day).

The overall approach outlined above is part of the Containment Policy as outlined in the sections 4.3 and 4.4.1 of this AEE and also in Appendix H Mott MacDonald Design Statement.

Wastewater Characteristics and Influent

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The design criteria used for the concept design are set out in Table 4-2 and the treated wastewater expected quantity and quality in Table 4-3.

The wastewater COD and TKN loads have been assessed assuming the influent concentrations remain constant with the loads to the WWTP increasing over time with the projected increases in flow to the WWPT (0.7% pa).

Table 4-2: Current and Projected Future COD and TKN mass loads

Year	COD load (kg/d)	TKN load (kg/d)
2014 (measured)	10,487	964
2024	11,265	1,006
2034	12,101	1,081
2044	12,999	1,161
2054	14,275	1,275

Table 4-3: Expected Treated Wastewater Quantity and Quality

Parameter	Units	Measures
Projected average daily discharge in 2054	Cubic metres per day (m^3/day) or as a million litres per day (ML/day)	25,000 (average) 25 (average)
Total nitrogen (TN)	Tonnes per year as total cumulative mass load (t/yr)	30 (annual limit)*
Total phosphorus (TP)	Tonnes per year as total cumulative mass load (t/yr)	3 (annual limit)*
Ultra-violet (UV) light disinfection	Validated UV dose rate (milli-Watt seconds per square centimetre)(mWs/cm^2)	35 (as defined in volunteered conditions)

*Plus any increase as urban development takes place (refer to Section 4.7 of this AEE).

As outlined in Section 2.2, TN management is a key consideration in terms of the treatment requirements in order to meet an allowable mass load per annum discharge into Lake Rotorua.

The above treated wastewater nutrient parameters, along with the UV dose specification and a filter or membrane requirement (with a nominal pore size of no greater than 0.04 micrometres (µm) and an absolute pore size of not greater than 0.1 µm) are all key matters that are included in the RLC's volunteered consent conditions as set out in Section 14 and Appendix K.

It is further noted that with a very fine pore size membrane, TSS and other particulate matter will be substantially removed. For example, the existing MBR at the WWTP (treating one third of the flow) results in a mean COD of 28 mg/L and a median of 18 mg/L (for the full 12 months to December 2017). This resulting in part from the substantial removal of TSS through the membranes.

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4.4.3.2 Wastewater Treatment Process

The Preferred Scheme consists of a full MBR with UV disinfection and extra phosphorus removal. This is referred to as Option 6a in the Project documentation.

Mott MacDonald has prepared a Wastewater Treatment Design Statement for the Preferred Treatment System which is included in Appendix H to this AEE. The assessment below is based on the contents of that Design Statement in Appendix H.

Since identifying the Preferred Treatment System, the RLC has determined that it will follow a procurement process for the treatment system and that process may result in an alternative treatment arrangement to that currently proposed. The reasons for this are set out in Section 4.8. Any such alternative approach would still need to comply with all the conditions of consent, however such an alternative would be provided for through volunteered Condition 1 which uses the words *"generally in accordance with the information provided"*. However, in the event that any alternative approach is unable to comply with any of consent conditions then either: 1) an application would be lodged under section 127 of the RMA to change the condition(s); or 2) an application for a new resource consent(s) would be lodged to enable the alternative approach to be considered.

In view of the above position, and to give certainty to the BOPRC as the Consent Authority, it is appropriate that the RLC demonstrates that the Preferred Treatment System is a proven, reliable, resilient, and sustainable treatment approach.

This Preferred Treatment System, originally identified as Option 6, was further developed to include additional P removal (and consequently identified as Option 6a) as set out in Section 9.8.

The design philosophy is based on N removal to achieve an overall efficiency of 93% removal resulting in a treatment process that can achieve a treated wastewater quality where the average TN concentration does not exceed 4.3 mg/L based on a rolling 52 week averaging period. This is achievable with the MBR treatment process using a nominal membrane pore size.

The Mott MacDonald Wastewater Treatment Design Statement includes discussion on the rationale for a MBR system. It states:

> "*A filtration process could be either incorporated into the secondary biological process (such as MBR) or provided as a tertiary stage. Membrane filtration was identified as the most reliable means through its provision of a "physical barrier" to solids and its very low pore size. The experience with the side stream MBR that has been operating since 2012 on the current wastewater treatment plant site, is that the particulate nitrogen and phosphorus levels in the membrane permeate are essentially zero. Further to this the pore size of the membranes (0.04micron) are such that additional nitrogen and phosphorus removal is achieved from removing colloidal solids further enhancing the ability of the process to meet low nitrogen and phosphorus levels"*.

The Wastewater Treatment Design Statement also discusses the alternatives for additional P removal, either by the addition of metal salts and/or Enhanced Biological Phosphorus Removal (EBPR). It is noted that the addition of alum as a metal salt has previously been employed at the WWTP.

Figure 4-4 presents a schematic diagram showing a possible arrangement of proposed new and to-be-decommissioned treatment process infrastructure under a single train arrangement.

The MBR units achieve very fine filtration which, along with UV disinfection, creates what is commonly referred to as a "double barrier" for the removal of pathogenic microorganisms (bacteria, viruses, and protozoa). Coupled with the other biological treatment processes, the Preferred Treatment System will, in fact, provide a "multiple barrier".

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In terms of the arrangement of the MBRs, a single train MBR configuration is proposed rather than an arrangement incorporating the existing MBR handling one third of the flow and new MBRs treating the remainder of the flow. This arrangement as is shown in Figure 4-4.

Such an arrangement would be constructed to treat all flows through the single train treatment plant and the existing MBR equipment will be decommissioned and the tankage potentially made available for an alternative purpose such as for containment in line with the Containment Policy (Section 4.3).

4.4.3.3 Carbon Balance

Ensuring an effective carbon balance is critical for the TN removal process. One of the key reasons for the selection of MBR for this upgrade is to maximise the use of all the COD in the influent wastewater for nitrogen removal, thereby minimising or eliminating the need for supplemental carbon dosing.

The Mott MacDonald Wastewater Treatment Design Statement (Appendix H) further discuses

the carbon balance in terms of the MBR process and possible removal of the existing primary sedimentation tanks.

4.4.3.4 Additional Disinfection

The Mott MacDonald Wastewater Treatment Design Statement (Appendix H) records that:

> *"The MBR, due to its small pore size, effectively removes most larger microorganisms such as bacteria and protozoa. However, the removal of virus through MBR is not as effective. In order to reduce the risk of virus in the effluent, particularly norovirus, the proposed solution includes for membrane filtration and UV disinfection. The installation of UV disinfection will in effect give a "double barrier" pathogenic micro organism removal system."*

The Wastewater Treatment Design Statement sets out the approach of a validated UV light dose as specified in volunteered Condition 25(b), included in Appendix K.

4.4.3.5 Treatment Plant Sustainability and Beneficial Reuse

The RPSC expressed interest in adopting sustainable solutions and, where practical, making beneficial reuse of resources derived from the treatment process possible. As highlighted in both the resolutions of the RPSC and the RLC, beneficial reuse of treated wastewater was an important Project objective.

The Preferred Treatment System achieves the reuse objective by:

- Removing the primary treatment to retain the carbon for the nitrogen removal processes;
- Saving energy (electricity) by not pumping to the LTS;
- Dewatering sludges and taking off site for vermiculture or other beneficial reuse techniques; and
- Implementing beneficial reuse of treated wastewater s included as Component 6 of the Proposed Scheme (refer AEE Section 4.4.6).

4.4.3.6 Air (Odour) Emissions

Following the proposed WWTP upgrade, the principal odour emission sources are likely to include the following:

- Bardenpho tanks;
- Sludge dewatering building;
- Dissolved Air Flotation (DAF) (sludge) tanks;
- Stormflow storage tanks; and
- New MBR, Return Activated Sludge (RAS) tanks, and biofilter (which will provide odour control).

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These potential odour sources and the air (odour) mitigation approaches are described in more detail and assessed further in Section 7.7.

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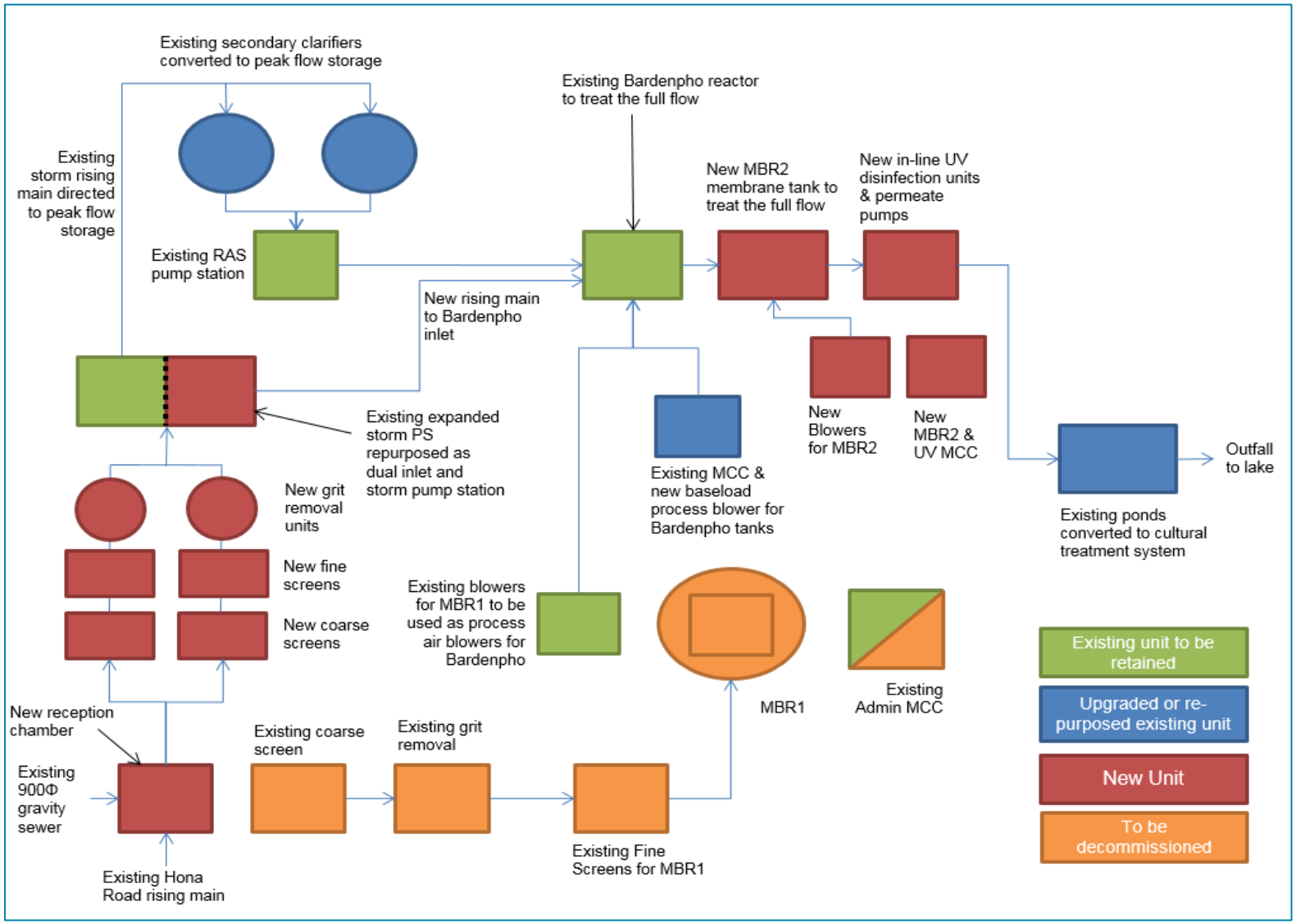


Figure 4-4: Schematic Diagram of a Possible Single Train Treatment Plant Reconfiguration

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4.4.3.7 Summary Features of Proposed Treatment Plant

Figure 4-5 summarises the main features of the Preferred Treatment System.

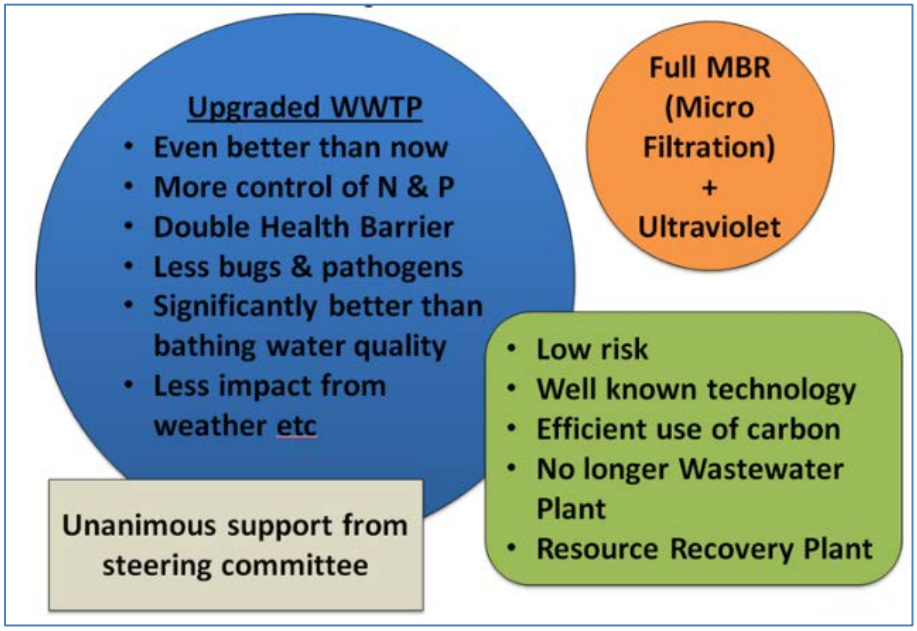


Figure 4-5: Summary of Features of Proposed Treatment Plant Upgrade

4.4.4 Component 4 – Land Contact Bed and Discharge Structure

The land contact bed concept was developed by the RLC's technical personnel and the CAS in consultation with a Mātauranga Māori Experts Group. These activities and the extensive consultation with iwi groups associated with this process is recorded in Companion Document No. 2 being the Cultural Impact Assessment titled "Cultural Impact Assessment of Rotorua Land Treatment System Alternatives", dated April 2018.

This component of the Preferred Scheme involves:

- Constructing a treatment facility that incorporates Mātauranga[5] and Mātāpono[6] Māori. The facility involves a range of aggregate and wetland type sections representing natural and cultural environments;
- The re-purposing of an existing retention pond within the WWTP for the land contact bed concept;
- The treated wastewater is directed to the land contact bed and then discharged to Te Arikiroa Thermal Channel via a water fall/spillway structure; and
- The treated wastewater discharges into Sulphur Bay (also known as Puarenga Bay, being part of Lake Rotorua).

[5] Mātauranga as defined in the Māori Dictionary (http://maoridictionary.co.nz/) is: knowledge, wisdom, understanding, skill -
[6] Mātāpono as defined in the Māori Dictionary (http://maoridictionary.co.nz/) is: principle, maxim

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Figure 4-6: Land Contact Bed Concept from Above

Treated wastewater will traverse a number of segments or elements within the land contact bed. In the concept these segments and elements shown in Figure 4-6 are numbered 1-14. It should be noted that this is only a concept and the details will be finalised following consultation with iwi. A short description of the key elements of the concept follows:

1. Water enters the land contact bed via a causeway from the Sanatorium Reserve;
2. A walking platform provides pedestrian access and observation from the entry point of water to the discharge point;
3. This is where the water springs to the surface (punawai);
4. Gabian baskets filled with local stone;
5. Bands of wetland planting;
6. Sculptural water fountains to create turbulence and aeration;
7. Locally sourced loose rock; placed to create mounds to replicate Rotorua landform;
8. Rills; shallow water channels with carefully designed surfaces which create different water movement and sounds;
9. Calm water; pond containing aquatic life;
10. Weir with stepping stones;

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11. Waterfall;
12. Elevated deck/boardwalk
13. Compacted lime chip path; and
14. Create natural looking stream with planting (watercourse connects into Lake Rotorua).

Figures 4-7 to 4-9 show an artist's impression of the land contact bed and discharge cascade waterfall.

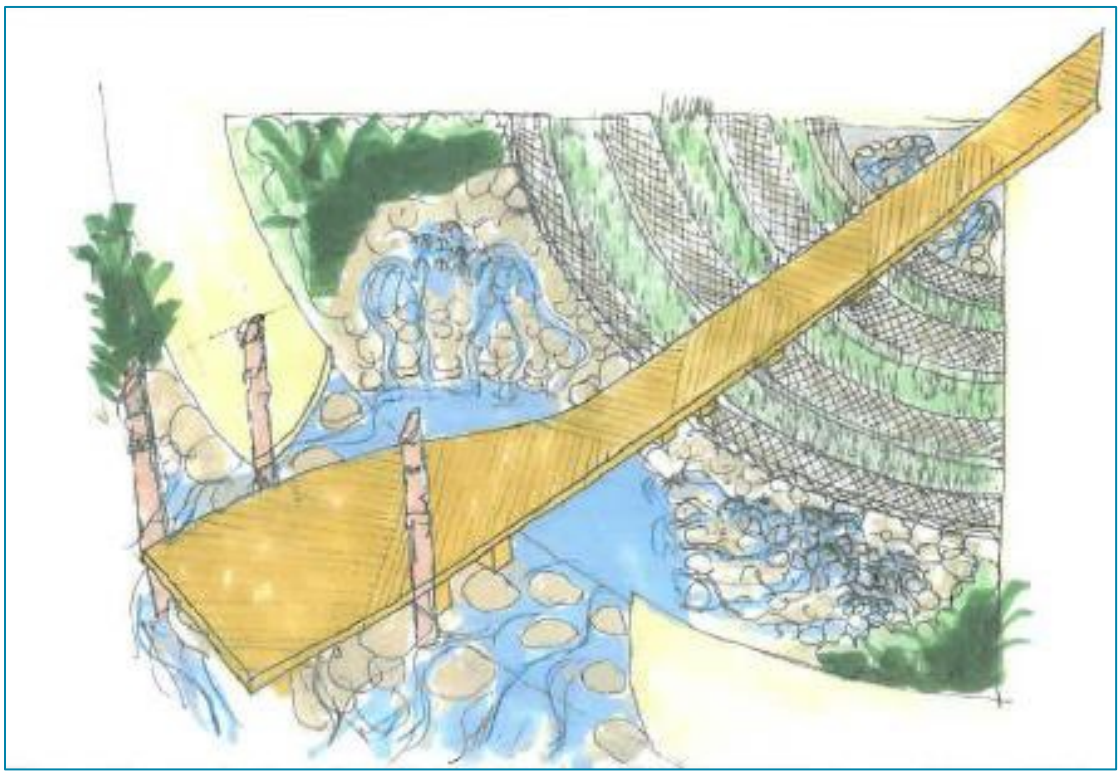


Figure 4-7: Land Contact Bed Concept from the North

The RLC and CAS have prepared a video of the proposed land contact bed system. This video with its commentary discusses the background, cultural considerations, and proposed general arrangement of the bed. The video is available through the RLC's website on the following link:

https://www.youtube.com/watch?v=bpBvSbZmkX8

A key consideration is the safety and health requirements associated with the land contact bed and discharge structure. The final design will ensure all safety and health legislative requirements are satisfied.

Since the above land contact bed concept was developed the investigations into ecology, natural character, landscape and amenity values of the area have identified that an alternative outlet location for the land contact bed would be preferable. This location would be nearer to point 14 on the top left corner of Figure 4-6. The change in this location is discussed and supported by the CIA author Antoine Coffin as is set out in Appendix L to this AEE.

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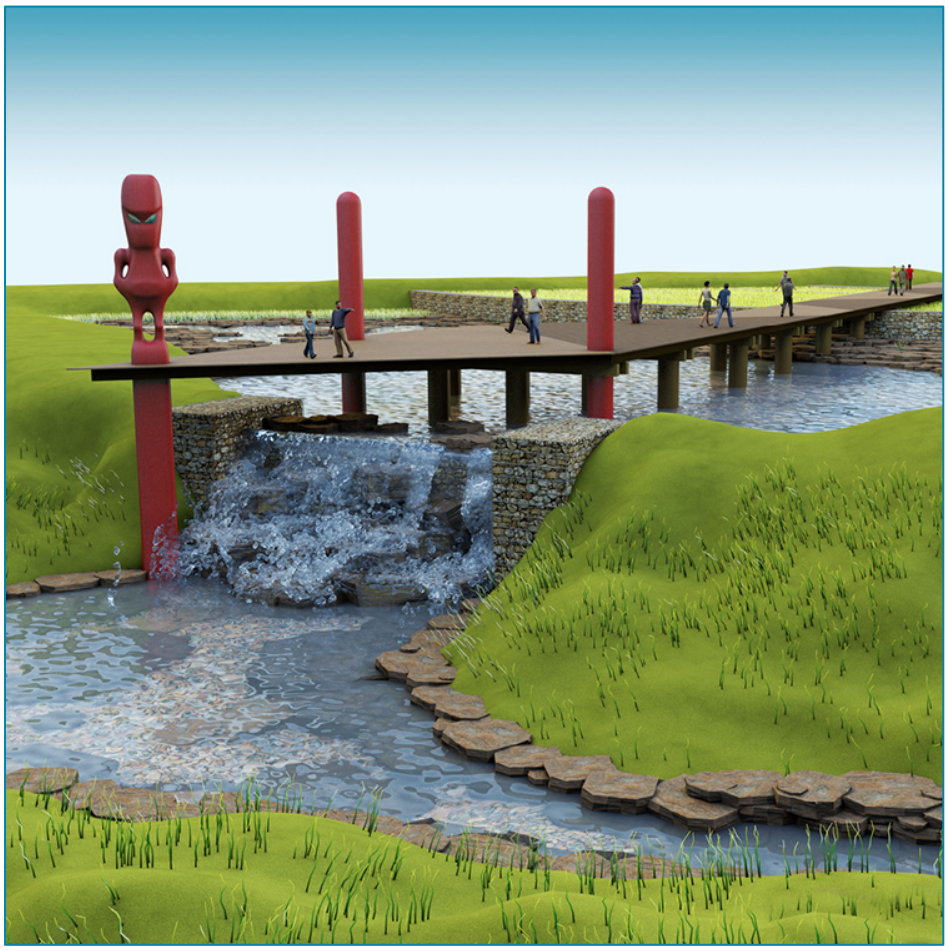


Figure 4-8: Artist Impression – View 1

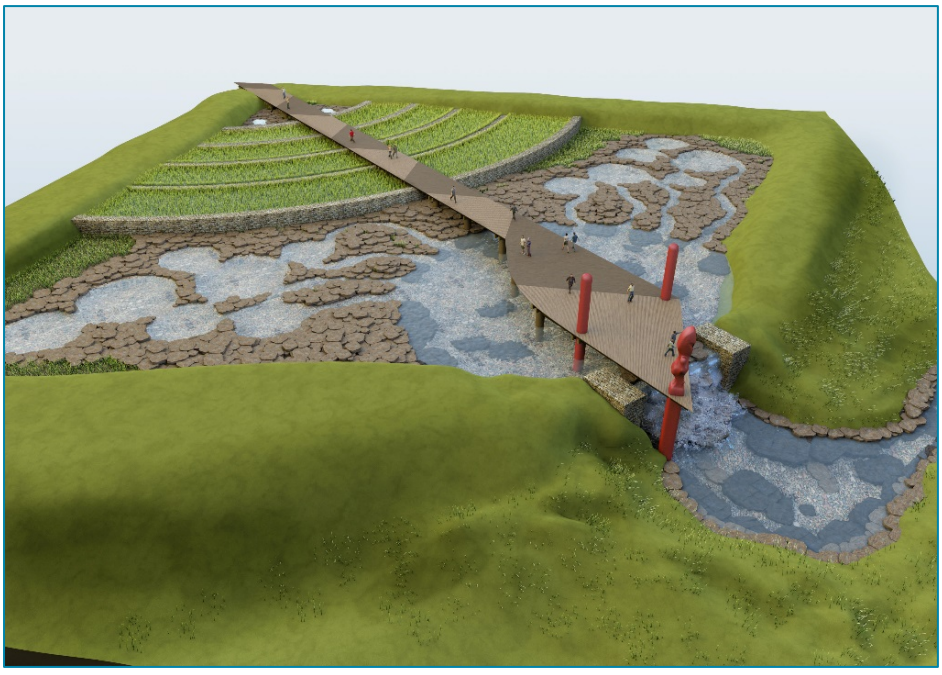


Figure 4-9: Artist Impression – View 2

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Figure 4-10 shows the proposed new channel running from the land contact bed and discharge structure through to Te Arikiroa Thermal Channel which is proposed to be widened and deepened in some places as set out in Section 4.4.5 of this AEE.

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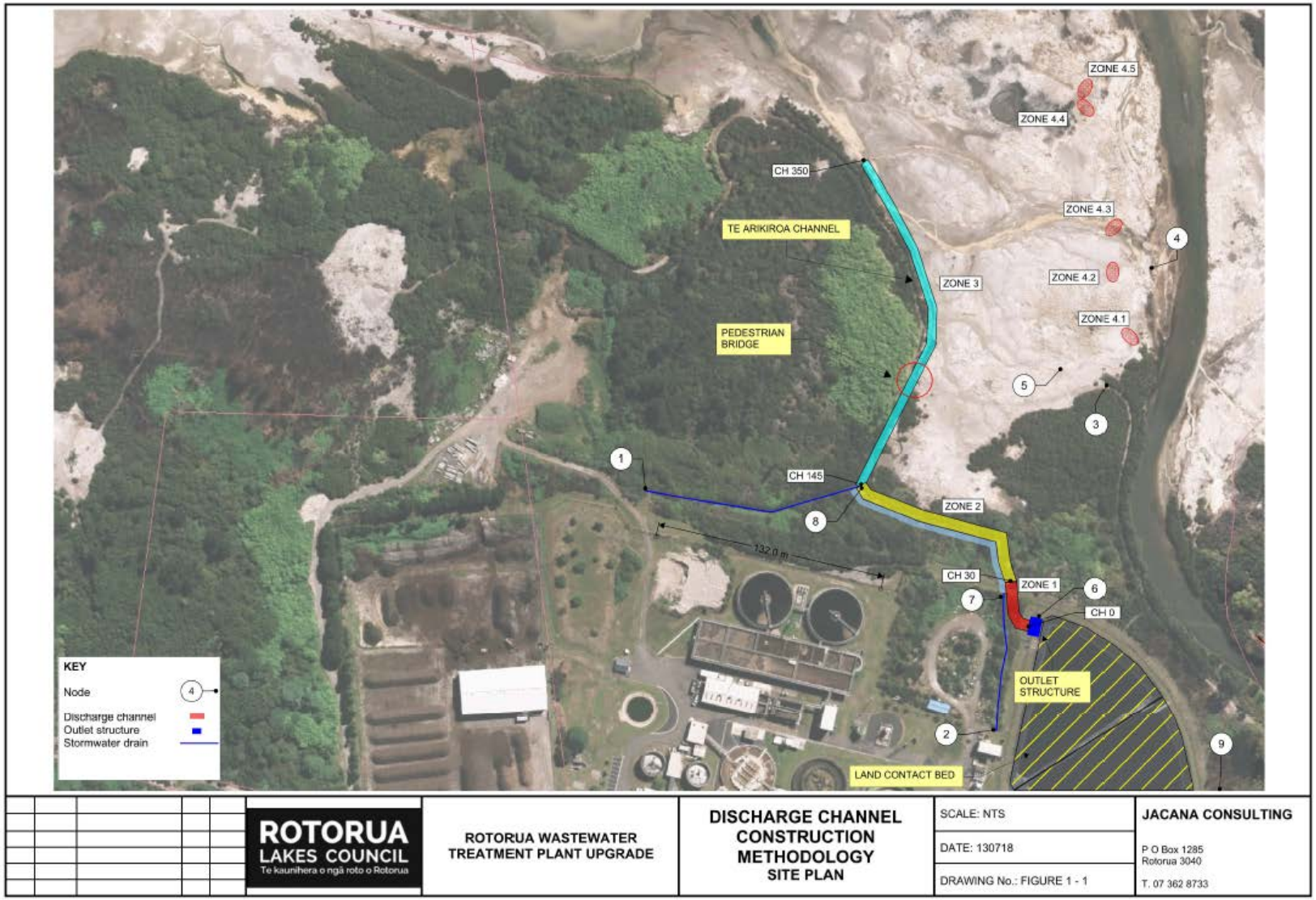


Figure 4-10: Te Arikiroa Thermal Channel Proposed Works

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4.4.5 Component 5 – Te Arikiroa Thermal Channel Treated Wastewater Discharge Arrangement

A number of alternatives (options) have been investigated to determine the preferred channel arrangement. These are outlined in Section 9.12 of this AEE.

The preferred discharge arrangement is generally shown in Figure 4-10. This comprises of the following components:

- A new 30 m section of channel will be constructed northwards from the land contact bed outlet structure and cascade to the east-west drain (Zone 1, node 6-7);
- A 115 m section of existing east-west outlet drain will require widening and deepening as well as clearance of regenerating native vegetation located along its banks (Zone 2, node 7-8);
- A 205 m section of the thermal channel will require some maintenance to remove sediment and localised enlargement (with minor deepening to less than 0.6 m), as well as clearance of regenerating native vegetation located along its banks (Zone 3, node 8 to CH350); and
- A series of flow diversion bunds to prevent mixing of the discharge and Puarenga Stream flows. (Zone 4, 4.1-4.5, total length of the five bund sections is 48 m with maximum bund heights of 0.5 m).

The rationale for constructing the proposed bunds is to address cultural concerns as expressed in the following quotation from the second CIA (Companion Document No. 2):

> *"…there are a number of geothermal expressions on the eastern side of the Puarenga Stream, which should be avoided. If a discharge here was to proceed, a physical structure such as a bund will need to be constructed to direct flow to Lake Rotorua. The sensitivity of this area to Te Arawa Lakes Trust and tangata whenua would suggest that an 'unobtrusive' and 'natural looking' structure would be required…".*

Hydraulic modelling indicates that five small bunds are required to achieve the above when water levels in Lake Rotorua are high. Of the various alternative arrangements investigated, the above arrangement of five small bunds has been assessed as the least intrusive (referred to the Assessment of Effects in Section 7.3 of this AEE and Support Document No. 7).

4.4.5.1 Construction Methodology

An indicative construction methodology has been prepared (by Jacana Consulting) and included in Support Document No. 7. Figure 4-10 shows the various distances and sections of works downstream of the discharge structure (referred to as chainage (CH), with CH 0 m being the exit of the discharge structure). It should be noted that the final construction methodology will be defined by the successful tenderer.

The channel from CH 0 to 350 m is divided into different construction 'zones' to demarcate the extent of the works along each section of the channel. The influence of each construction zone on the environment is linked to the extent of the earthworks footprint and the land required to provide maintenance access.

Zone 1: New Channel

The scope of work for construction zone 1 will involve the excavation of a new channel approximately 2.5 m wide at the base and 6.5 m wide at the embankment level with a maximum water depth of approximately 0.8 m. The concept design allows for a freeboard of 0.5 m between the operating water level and the embankment crest.

The new channel, in terms of the concept design, will be excavated through the existing storage pond embankment. The extent of this excavation will depend on the results of the geotechnical investigation

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to be carried out prior to proceeding with the preliminary design. The intention is for zone 1 of the channel to be concrete lined to reduce the risk of scouring during the peak wastewater flow (PWWF). High density rock will be laid to completely cover the concrete layer while still allowing for the design cross section to be achieved. The natural rock will be laid up the sides of the channel to the embankment crest on both sides.

Zone 2: Existing Open Drain

The scope of work in zone 2 will involve the removal of overhanging vegetation along the sides of the existing open drain (CH 30 to 145 m). The vegetation will need to be cleared along the south (left) bank to create a track for maintenance vehicles. Minor earthworks will be required along the banks of the existing channel to cut back unstable soil. Sediment will need to be removed along the bed of the open drain to ensure that there is a constant grade along the channel. Channel protection in the form of gabions (rock filled baskets) and possibly a Reno mattress (rock filled bed basket) will be required at the bend in the existing stormwater drain downstream of node 7. The rest of the channel will be unlined.

Zone 3: Te Arikiroa Thermal Channel

The existing channel from CH 145 to 360 m at the Rotorua Lake shore, meanders during low flows along the edge of the contact boundary between the thermal flats and the vegetation along the left (west) bank. The work along this channel will primarily involve the removal of sediment and vegetation from within the stream corridor. The removal and replacement of the existing timber pedestrian bridge with a new structure will be required. The new bridge will be set at a higher level and lengthened to allow passage of the design WWTP discharge volumes.

Zone 4: Flow Diversion Bunds

In order to address cultural concerns noted above, five small bunds are proposed to be constructed at a number of locations along the true left bank of the Puarenga Stream (Photographs 10, 11, and 12 in Support Document No. 7). Between the thermal channel and the Puarenga Stream there are a number of shallow ephemeral channels that flow during periods when the Puarenga Stream water level rises above its mean flow regime.

The bunds would be of the order of 3 m wide at the crest and between 0.2 and 0.5 m high above the existing channel bed. The movement of sediment and water across the thermal flats is influenced by the level of the lake and flow in the Puarenga Stream. Historic photographs show the movement and ponding of water across the thermal flats during high rainfall events. Owing to the dynamic nature of the physical environment it is very likely that the bunds will be eroded during above average rainfall events and would need to be reinstated.

4.4.6 Component 6 – Beneficial Reuse of Treated Wastewater

Throughout the Project development beneficial reuse of treated wastewater, also referred to as recovered water, was seen as a desirable objective in order to use at least some of the high quality treated wastewater. A number of possible/potential options were identified. The RLC's Strategy, Policy and Finance Committee and full Council resolved:

> *"to continue to work with interested parties to investigate alternate discharge options, including the reuse of recovered water".*

The RPSC similarly promoted this concept of beneficial reuse.

Subsequent discussions with the BOPRC on beneficial reuse have been very positive. Those discussions have led to the RLC proposing the development of a Beneficial Reuse Management Plan (BRMP) approach whereby potential future reuse options would be detailed in a BRMP which would then be submitted to the BOPRC for certification before such reuse can occur. A suite of conditions are included in Section 14 which provides for such reuse and preparation/certification of BRMPs.

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4.5 Wastewater Operation and Management Procedures

4.5.1 General

The RLC has well established operating and management procedures for its wastewater infrastructure. These are set out in the Wastewater Asset Management Plan, Wastewater Strategic Plan, and Water Services and Trade Waste Bylaw 2017. These procedures, along with implementation of matters in the Wastewater Strategy being developed, will form the basis of the operation and maintenance of the new treatment, land contact bed and discharge infrastructure. The RLC's risk management procedures also form part of the overall management and operating systems which are an important part of providing a reliable wastewater service and network.

4.5.2 Trade Waste Management

The established trade waste management procedures implemented by the RLC through its Water Services and Trade Waste Bylaw 2017 will apply to the WWTP upgrade. Given the importance of managing TN and TP in the treated wastewater discharges, any new trade waste application made under the Bylaw which proposes significant contributions of TN and / or TP will be critically examined before any approvals to discharge into the RLC's Wastewater System are given.

4.5.3 Energy Management

Sections 7(ba) and (j) of the RMA require the Consent Authority to have particular regard to the efficient end use of energy and the benefits to be derived from the use and development of renewable energy.

The Preferred Scheme presents the RLC with a considerable saving in energy (electricity costs) by not having to operate the LTS. This will result in savings in excess of $800,000 per annum. The new WWTP infrastructure will be designed and operated to ensure efficient energy use by incorporating dissolved oxygen control automation and other energy efficient approaches on the main mechanical and electrical equipment such as the air blowers and pumping equipment.

4.5.4 Sustainable Wastewater Management

Rotorua's Sustainable Living Strategy, discussed in Section 3.10.2, sets out the overall direction that has been taken forward into this Project and the identification of the Preferred Scheme. Specific features of the Preferred Scheme that encompass sustainable wastewater management approaches are set out in Section 4.4.3.5 and also in the Wastewater Treatment Design Statement contained in Appendix H.

4.5.5 Climate Change and Natural Hazards

Natural hazard planning is part of the RLC's statutory duties under sections 31(1)(b)(i) and 6(h) of the RMA. Because the wastewater network is a critical and significant infrastructural asset, the RLC's attention to hazard planning is a key focus. Section 7(i) of the RMA also requires the Consent Authority to have particular regard to the effects of climate change.

The likelihood of the increased intensity of rainstorm events, resulting in higher peak wet weather inflows to the WWTP, has been identified as the main climate change factor that the RLC needs to take account of in the wastewater system and particularly the WWTP design and operation. Inflow management and storage, as part of the Containment Policy, are features that have been allowed for in the concept design work to date as are set out in Section 4.3 of this AEE and in the Wastewater Treatment Design Statement included as Appendix H which recommends a number of mitigation measures in this regard. These form part of the RLC's future Wastewater Strategy as outlined in Section 4.3 of this AEE.

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Higher ambient air temperatures are likely to aid the efficiency of biological treatment processes that are temperature dependant. Increased odour production potential could also result from higher temperatures. Odour management procedures are proposed to mitigate such issues.

4.6 Estimated Capital Costs

The forecast capital cost for the Preferred Scheme, at the preliminary design stage, is $41,900,000 (excluding GST). This estimate includes non-works and contingency components estimated at $9,800,000.

The estimate makes no allowance for solids processing beyond the existing Dissolved Air Flotation (DAF) system, the possible TERAX, or any other solids processing system.

4.7 Upper Limits on Nutrients for Consenting Purposes

The RPS specifies the total sustainable load of nutrients to Lake Rotorua in order to achieve the water quality target trophic level index (TLI). The RPS limit for TN of 435 t/pa is to be achieved by 2032. This section describes the background to the nutrient (TN and TP) limits that will ensure the wastewater-derived loads remain below the wastewater-derived target loads.

In terms of TN loads from the WWTP, the RNRP describes how the sustainable loads to the lake will be achieved through targets and reductions. The wastewater-derived TN target load from the WWTP is 30 t/yr and this load is based on the 2001-2004 baseline period of TN loads to Lake Rotorua (from the LTS).

Upper limit on the mass of TN discharged – Dynamic from the PC10 2001-04 baseline period allocation of 30 t/yr

The BOPRC tracks the load of TN discharging into Lake Rotorua from various sources as part of its Lakes Programme and the 2017 Memorandum of Understanding (MoU) between BOPRC, RLC, and Te Arawa Lakes Trust outlines how TN allocations are to be dealt with as rural land is developed and reticulated into the future. The MoU identifies that changes that have already occurred since the baseline 2001-2004 period means that an additional 2.4 t/yr of TN has effectively been transferred from rural land to the WWTP, meaning that the annual load, which equates to 32.4 t/yr, represents “no increase” in the TN load to Lake Rotorua. That is, what appears to be an “increase” (32.4 t/yr cf. 30 t/yr) in TN loads is not actually an increase, but rather it reflects a transfer of TN allocation from the rural land being reticulated to the WWTP (Figure 4-11).

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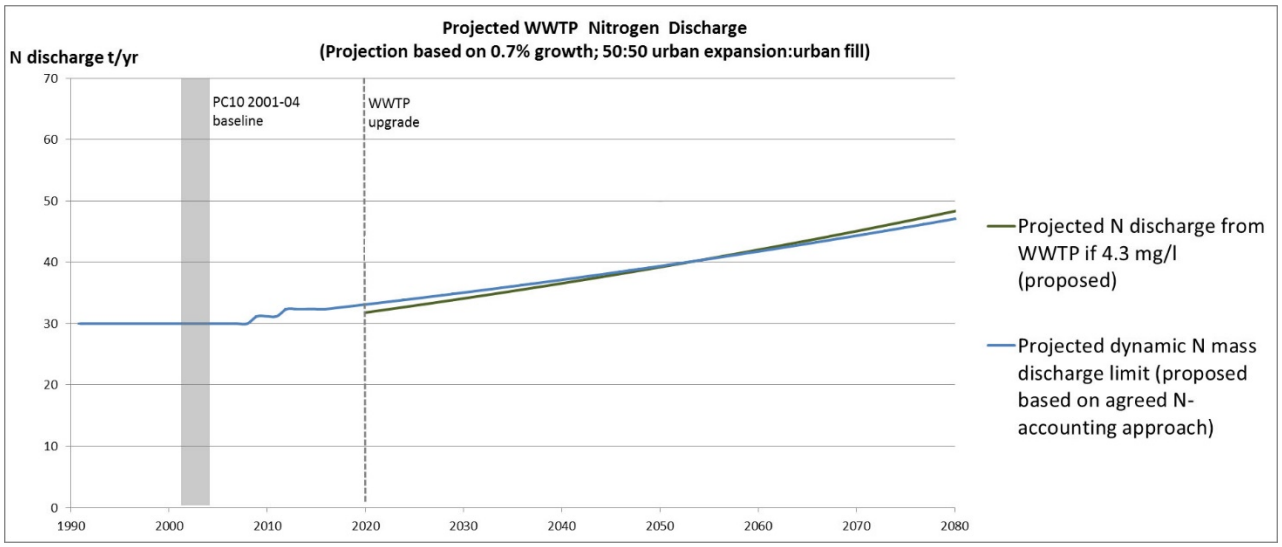


Figure 4-11: Projected Mass of TN in the Discharge at the Proposed Maximum Average Concentration Limit of 4.3 mg/L, and Projected Upper Dynamic Mass Limit, Relative to the Projected Mass of TN in the Discharge at the 2017 Concentration in the Absence of an Upgrade.

It is proposed that the dynamic wastewater-derived target becomes an "upper limit" on the consented annual mass of TN discharged. This is the mass that can be discharged without the sewage-derived load impacting the RPS's 435 t/yr sustainable load of TN to the lake.

A time-proportional weekly composite sample (similar to the current sampling arrangement undertaken in the Waipa Stream) that is representative of the treated wastewater discharged will be collected and analysed every week. The concentration of TN in the weekly sample will then be multiplied by the weekly discharge volume to determine the weekly mass of TN in the discharge. The annual mass of TN discharged will be calculated each week by adding (summing) the most recent 52 weekly results (ie. the annual mass will be based on a rolling 52-week period).

Upper limit on the average concentration of TN – 4.3 mg/L in any 52-week period.

An upper limit on the 52-week rolling average concentration of 4.3 mg/L TN will reflect the best practicable design and operation of the WWTP.

A time-proportional weekly composite sample is proposed to be collected and analysed weekly and reported monthly.

Upper limit on the mass of TP discharged – 3 t/yr (52-week rolling period)

It is proposed that the upper limit on the load of TP discharged annually to the lake remain at 3 t/yr. The current upper limit of 4 t/yr load of TP in the Waipa Stream allows for 3 t of 'sewage-derived' TP as well as TP from other sources given the different sources of TP cannot be separated out for analytical purposes.

A time-proportional weekly composite sample (similar to the current sampling arrangement in the Waipa Stream) that is representative of the discharge water is proposed to be collected and analysed weekly. The concentration of TP in the weekly sample is multiplied by the weekly discharge volume to determine the weekly mass of TP in the discharge. The annual mass of TP discharged will be calculated each week by adding (summing) the most recent 52 weekly results (ie. the annual mass will be based on a rolling 52-week period).

Concentration of TP – not specified but as required for mass limit.

Limits on the concentration of TP are not proposed as the mass load limit achieves the sewage-derived lake target.

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Despite no concentration limit being proposed, a time-proportional weekly composite sample will be collected and analysed weekly for TP (as the results are needed to calculate the mass loads).

4.8 Infrastructure Procurement Procedures

The RLC's intended approach to the procurement of the treatment plant upgrade components of the Preferred Scheme is set out below.

For Component 2: The Upgraded Wastewater Treatment Plant

For the new WWTP, the RLC has decided to leave the final configuration of process selection open until nearer the time of procurement. This allows the RLC to either decide to adopt a 'Design Build' (DB) or a 'Design Build Operate' (DBO), with or without financing provisions or other procurement mechanisms.

The RLC has already decided to take such an approach as it can gain the advantage of the contracting/equipment supply/design markets at the time as well as take advantage of any technology advances following the identification of the Preferred Treatment System in 2016.

In following this approach, the RLC is well aware it will need to demonstrate to the BOPRC, as Consent Authority, that proven treatment technologies can meet treated wastewater and air quality requirements as included in the volunteered conditions or other conditions that maybe imposed.

The RLC considers that through the extensive assessment of treatment alternatives, it has been clearly demonstrated that while Option 6a is the Preferred Treatment System, there may be other treatment processes and configurations that can achieve the same standards of treatment as set out in the RLC's volunteered conditions.

In the event that any alternative treatment approach is unable to comply with any consent conditions then either: 1) an application would be lodged under section 127 of the RMA to change the condition(s); or 2) an application for a new resource consent(s) would be lodged to enable the alternative approach to be considered.

4.9 Rationale for the Preferred Scheme

The RLC's Strategy, Policy and Finance Committee met on 15 June 2016 (refer Appendix A and Section 3.12 of this AEE) and identified the following reasons/rationale for recommending the Preferred Scheme to the RLC's full Council. The RLC's full Council met on 23 June 2016 and subsequently adopted the same reasons/rationale:

> **"*The Preferred Wastewater Treatment Plant Upgrade and Discharge Structure***
>
> *The preferred wastewater treatment plant upgrade will involve converting the existing plant to a full membrane bioreactor plant with additional phosphorous removal and ultraviolet disinfection. The RSPC unanimously agreed that this is the preferred option moving forward. Comments and submissions from the public engagement process also supported the preference for this option.*
>
> *This option was selected as the preferred option because of the key benefits it provides, as follows:*
>
> *a) The resulting treated effluent (recovered water) is very high quality, with both nitrogen and phosphorous levels reduced to as low as practicable. Resource consent compliance would not be an issue;*
>
> *b) The double barrier health protection from the MBR and UV treatment reduce pathogens and virus levels to a very low level where it is safe to return to environment;*

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c) *The technology selected is well proven and the operators are familiar with the operational and maintenance requirements. The existing wastewater treatment plant is part MBR and Rotorua Lakes Council's water supply is treated using UV system;*

d) *The proposed upgrade will enable the treatment process to be streamlined and simplified, which would make it easier to operate and carries fewer risks than other systems."*

The Preferred Land Contact Bed Discharge Option

The preferred, but not unanimously agreed option, is to discharge to earth contact beds within the existing treatment plant site at Sanatorium Reserve. The treated effluent would flow through the beds, cascade into an existing open channel and flow overland into Lake Rotorua at Puarenga Bay.

"Majority of the RSPC members considered this as the preferred discharge option because of the following:

a) *This will enable Rotorua Lakes Council to complete the Project within the December 2019 agreement with CNI.*

b) *The proposed treatment process will bring the pathogen and virus levels to a very low level, that public health risks associated with the proposed discharge type and location is nil. It is expected that pathogen levels from the systems are a lot lower than that at Lake Rotorua, Puarenga Stream, Waipa Stream and Awahou Stream.*

c) *The proposed treatment process will consistently bring the nutrient levels to the same level as the current land treatment system, that there are no environmental risks associated with the proposed discharge type and location.*

d) *The discharge to a properly designed earth contact bed would provide for the cultural treatment requirements."*

There are also a number of positive effects that have been identified in Companion Document No. 2, the CIA on the land contact bed. These are set out in sections 7.2 and 7.8 of this AEE.

The Preferred Scheme also allows the beneficial reuse of treated wastewater as covered in Component 6 of the Scheme (AEE Section 4.4.6).

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5 Rules Assessment and Activity Status

5.1 Introduction

The following sections set out the resource consents requirements for the Preferred Scheme under the NES:SC, RNRP, RAQP, RGRP and the RDP and the relevant rules that apply in determining the status of the activities.

5.2 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health 2011

The resource consents in Table 5-1 are sought under the NES-SC.

Table 5-1: Resource Consents Sought under the NES-CS

Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
s9 Land Use Consent	For disturbance of soil that does not comply with regulations 8(1) to (3) of the NES-CS	s9	Controlled	Unlimited	Disturbance of soil that does not comply with regulations 8(1) to (3) of the NES-CS

5.3 Regional Natural Resources Plan – Land and Water

The resource consents in Table 5-2 are sought under the RNRP.

Plan Change 10 (PC10) to the RNRP was publicly notified on 29 February 2016 and the BOPRC's decision on PC10 was released on 15 August 2017. As of July 2018, one appeal on PC10 has been resolved which settles the final text of Rule RL R7. As the Preferred Scheme results in an increase in the discharge of Nitrogen from a point source, consent is required under Rule RL R7.

Table 5-2: Resource Consents Sought under the RNRP relating to Land, Water and Air

RMA Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
s15 RMA Discharge Permit	To discharge treated wastewater to land	DW R8	Discretionary	35 years	For the proposed discharge treated wastewater to land in a manner that it may enter an unnamed tributary (Te Arikiroa Thermal Channel) of Lake Rotorua
	To discharge treated wastewater to land	DW R8	Discretionary	35 years	For the proposed discharge of treated wastewater to land via reuse
	To discharge sediment to water	DW R8	Discretionary	15 years	For the proposed discharge of sediment through the widening and minor deepening of Te Arikiroa Thermal Channel
	For increases in discharges of Nitrogen or Phosphorus from a point source discharge	RL R7	Restricted Discretionary	35 years	For the increase in the discharge of nitrogen or phosphorus from a point source discharge of

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RMA Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
	of contaminants to land in circumstances where it may enter surface water in the catchments of Lake Rotorua.				contaminants to land in circumstances where the contaminant may enter surface water or groundwater.
	Discharge of a contaminant (odour) to air	AQ 21(x)(i)[7]	Discretionary	35 years	Discharges from municipal sewage treatment plants, excluding sewage pumping stations
s14 of the RMA Water Permit	For temporary damming and diversion of geothermal water	GR R8	Discretionary	15 years	For temporary damming and diversion of geothermal waters potentially required for the widening and deepening of the Te Arikiroa Thermal Channel.
s13 Land Use Consent	For bed disturbance associated with the widening of Te Arikiroa Thermal Channel and construction of the bunds adjacent the Puarenga Stream	BW R36	Discretionary	15 years	For excavation and disturbance of a stream and lake associated with the proposed minor widening and deepening of Te Arikiroa Thermal Channel and construction of the bunds adjacent the Puarenga Stream
s9 Land Use Consent	The disturbance of land and soil as a result of earthworks	LM R4	Discretionary	Unlimited	Earthworks associated with the construction of the bunds and widening and deepening of the connections to the Te Arikiroa Thermal Channel
	For land and soil disturbance by vegetation clearance	LM R10	Discretionary	Unlimited	Vegetation removal associated with the construction of the new section of the Te Arikiroa Thermal Channel, and widening of the existing Te Arikiroa Thermal Channel

5.4 Regional Air Quality Plan

The BOPRC notified Plan Change 13 to the RNRP on 27 February 2018 and submissions closed on 18 April 2018. The summary of decisions requested has been notified and further submissions are being called for until 31 July 2018. The resource consent required for a discharge to air under PC13 has been included in Table 5-2 and the resource consent required under the RAQP is set out in Table 5-3

[7] Plan Change 13 to the RNRP. Refer to Section 5.4 of this AEE for details on the timeframes on Plan Change.

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Table 5-3: Resource Consent Sought under the RAQP

RMA Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
s15 Discharge Permit	Discharge of a contaminant (odour) to air	Rule 19(w)(i)	Discretionary	35 years	Discharges from municipal sewage treatment plants, excluding sewage pumping stations and on-site effluent treatment systems permitted under the On-Site Effluent Treatment Regional Plan. The WWTP is a municipal sewage treatment plant and therefore discharges to air from the WWTP are considered a discretionary activity under the operative RAQP.

The RLC has not previously held a resource consent for a discharge of a contaminant to air from the existing WWTP. The subsequent commencement of Rule 19 of the RAQP and the proposed expansion that will occur through implementation of the Preferred Scheme requires the RLC to now apply for an air discharge permit for the WWTP.

5.4.1 Permitted Activity

The discharge of contaminants to air from the beneficial reuse of the treated wastewater within the Rotorua District is considered a permitted activity under Rule 9 of the RAQP, subject to compliance with the permitted activity standards. In the event that the proposed beneficial reuse of treated wastewater does not comply with the permitted activity standards of Rule 9, resource consent will be sought at that time.

5.5 Rotorua Geothermal Regional Plan 1999

The resource consents in Table 5-4 are sought under the RGRP for works involved in the widening and deepening of Te Arikiroa Thermal Channel and construction of bunds on the geothermal sinter located adjacent to the Puarenga Stream.

Table 5-4: Resource Consent Sought under the RGRP

RMA Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
s9 Land Use Consent	For interference with the natural geothermal fluid outflow from a geothermal surface feature For interference with the physical structure of a geothermal surface feature For destruction of a geothermal surface feature including excavation	13.5.3(b)(i)(a)-(d)	Discretionary	Unlimited	For the Interference with the geothermal sinter required for the deepening and widening of the Te Arikiroa Thermal Channel and the construction of a bund adjacent to the Puarenga

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RMA Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
	For placement or deposition of any substance, including fill or waste material on, into or under any geothermal surface feature				

5.6 Rotorua District Plan

The resource consents in Table 5 5 are sought under the RDP for works involved in the widening and deepening of Te Arikiroa Thermal Channel (including vegetation clearance) and construction of bunds on the geothermal sinter located adjacent to the Puarenga Stream.

The proposed works are located within a Significant Natural Area and Outstanding Natural Feature being Lake Rotorua as shown on Figure 5-1.

Table 5-5: Resource Consent Sought under the RDP

RMA Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
s9 Land Use Consent	For new infrastructure[8] being on or within the boundary of an Outstanding Natural Feature or Landscape listed in Appendix 2 – Natural Heritage Inventory or as identified on the 300 and 500 series planning maps	5 of Part 15	Discretionary	Unlimited	Deepening and widening of the Te Arikiroa Thermal Channel and the construction of a bund within an ONFL.
	For new infrastructure requiring disturbance or removal of indigenous vegetation (other than provided for in Rule 6) within the boundary of Significant Natural Area (SNA)	5 of Part 15	Discretionary	Unlimited	Disturbance or removal of indigenous vegetation for the construction of the new section of the Te Arikiroa Thermal Channel and widening of the existing Te Arikiroa Thermal Channel.
	For new infrastructure located within esplanade reserves and strips and requiring earthworks or removal of indigenous vegetation within riparian margins unless otherwise provided for within	5 of Part 15	Discretionary	Unlimited	For works required for the construction of the new section of the Te Arikiroa Thermal Channel and widening of the existing Te Arikiroa Thermal Channel.

[8] The RLC confirmed that the Te Arikiroa Thermal Channel works will be regarded as works on/for infrastructure in accordance with Part 15 of the RDP.

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RMA Consent Type	Activity to be Consented	Rule Reference	Activity Status	Duration Sought	Description
	Appendix 10 - Earthworks				
	For infrastructure above ground for the storage or drainage of water (including geothermal water and steam), stormwater or sewerage, including … • Waste Water Treatment Plant, spray irrigation of treated wastewater and whey and waste-water disposal sites	25 of Part 15	Discretionary	Unlimited	For works required for the construction of the new section of the Te Arikiroa Thermal Channel and widening of the existing Te Arikiroa Thermal Channel.
	For disturbance of soil which fails to meet regulation 8 requirements of the NES-CS for Assessing and Managing Contaminant in Soil to Protect Human Health, but provides a detailed site investigation report stating that the soil contamination does not exceed the applicable standard in regulation 7 of the NESCS, in accordance with regulation 9 of the NESCS	3 of Part 16	Controlled	Unlimited	Disturbance of soil which does not to comply regulation 8 requirements of the NES-CS

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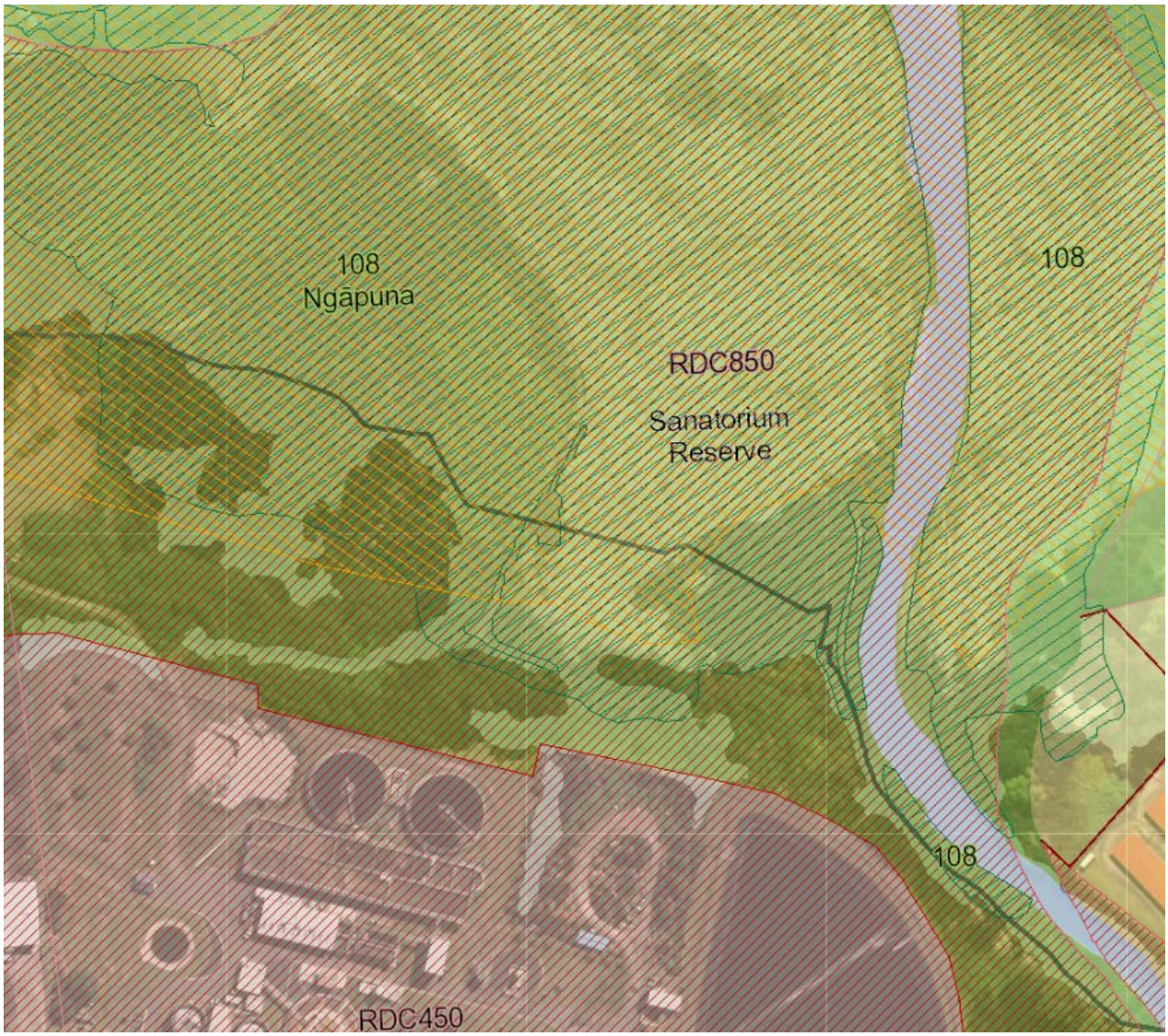


Figure 5-1: RDP Zones and Overlays (RV1 Conservation Zone in Green, WWTP Designation (RDC450) in Red Hatching, Significant Natural Area in Green Hatching and Outstanding Natural Feature (Lake Rotorua) in Orange Hatching.

Designation RDC850 does not apply to this Project.

5.6.1 Designations

The WWTP is designated in the RDP as Designation RDC450 and the RLC is the requiring authority. The extent of the designation is shown in Figure 5-2. The designated land is subject to an underlying zoning of Industrial 1 and Reserve 1 in the RDP.

The purpose of the designation is for a Wastewater Treatment Plant, as set out in Table 5-6. The designation authorises work and activities on the site (consistent with the purpose of the designation), without the need for land use consent from the RLC as the relevant territorial authority (i.e. s9(3) of the RMA does not apply).

An outline plan of work (section 176A of the RMA) will be prepared and submitted to the consent authority prior to commencing work.

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Table 5-6: RDP Designations

Designation Number	Description	Legal Description and Gazette Reference	Purpose and Extent
RDC450	Waste Water Treatment Plant	Pt Sec 3 SO25860	Wastewater Treatment Plant. For the purpose of reception, storage, treatment, processing and reprocessing of wastewater liquids, solids and waste products, including organic waste composting and the recovery / generation of energy from waste products and the extraction and use of geothermal fluids for energy generation



Figure 5-2: Designation 450 Boundary in the RDP

5.7 Activity Status

It is considered that there is significant overlap between the various consents sought and their associated effects. On this basis, it is considered appropriate that the applications for consent should be 'bundled' and considered together, with the most restrictive activity status applying to the entire bundle. This bundling applies both in terms of the various consents being sought from each consent authority and also bundling across the regional and district plans. This results in a discretionary activity status applying to the overall bundle.

5.8 Existing Resources Consents

The RLC holds Discharge Permit 60739, issued by the BOPRC for the discharge of treated wastewater from the WWTP. Discharge Permit 60739 authorises the following activities:

a) Pursuant to section 15(1)(b) of the RMA: to Discharge Treated Effluent from the Rotorua District

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Council Wastewater Treatment Plant on to Land in the Whakarewarewa State Forest;

b) Pursuant to section 13(1)(a) of the RMA: to Place, Use and Maintain a Series of Structures in or on the Bed of the Waipa Stream and Associated Tributaries; and

c) Pursuant to section 15(1)(c) of the RMA to Discharge Treated Effluent from the Rotorua District Council Wastewater Treatment Plant into Air in the Whakarewarewa State Forest.

A copy of Discharge Permit 60739 is attached at Appendix E.

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6 Existing Environment

6.1 Introduction

This section describes the wider environment (in terms of the definition of Environment in the RMA) and the activities located in the vicinity of the WWTP and in and around Lake Rotorua. These provide the social, economic, and cultural context of the Project.

While this Section of the AEE includes the context of the wider environment it does not include discussion on the water environment relating to the existing and future discharge. This is covered in Section 7 – that is, Section 7 also includes information on the existing water quality within the receiving environments.

Sections 6.2 and 6.3, which are supported by Appendix D, have been compiled by APR Consultants Ltd, who have specialist knowledge of the residential, social, and business environment in Rotorua and the Bay of Plenty.

These Sections give a reasonably extensive assessment of these environments in order that a full appreciation can be gained of the importance of the RLC's WWTP to the wellbeing and growth of Rotorua District including its businesses and industries.

6.2 Rotorua District and Environs

6.2.1 Residential Environment

6.2.1.1 Residential Housing Activity

Housing activity is in an expansionary phase as investors and Auckland residents seek more affordable housing options. Investors from outside of Auckland are also seeking alternative investment opportunities.

6.2.1.2 Rotorua Projected Population Growth

Rotorua population projections have been prepared by Statistics New Zealand (SNZ), BERL and National Institute of Demographic and Economic Analysis (NIDEA). Rotorua's resident growth population has been relatively static, but is now experiencing some moderate growth. NIDEA Projects that within the next 20 years Rotorua is likely to enter a period of population decline, however, alternative forecasts by BERL that consider potential economic growth and higher migration show a period of low to moderate growth. Migration is by no means certain and is a significant factor for Rotorua because slight population changes can have a big impact. Overall, Rotorua's future spans a range of possibilities from growth to decline. All of the projections outlined show an initial increase to 2033 and therefore extra wastewater processing costs ahead for the RLC will occur. The issue, however, is the extent of the growth and the longer-term prognosis.

6.2.2 Business Environment

6.2.2.1 Business Confidence

The Rotorua business and public indices calculated as part of APR's Business and Public Confidence Survey for December 2016 showed that Rotorua businesses and households had an optimistic outlook for the 12 months to December 2017. This positive outlook is in line with selected economic indicators that show that Rotorua's economy is in a growth phase.

Local business conditions

The Rotorua business index increased by 11.0 points to 51.0 during the December 2016 Rotorua confidence surveys. The positive index showed that a majority of Rotorua businesses expected local

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general business conditions to improve from December 2016 levels during the 12 months to December 2017. Rotorua business confidence in the quality of business conditions has steadily increased from the level experienced in 2011.

6.2.2.2 Industry Sectors

Table 6-1 shows Rotorua employment counts by main Australian and New Zealand Standard Industrial Classification (2006) (ANZSIC-06) industry sectors, as well as associated metrics. As at February 2015, Rotorua's largest industry in terms of employment was health care and social assistance (12%) followed by accommodation and food services (10.5%), manufacturing (10.5%), retail trade (9.6%), education and training (9.5%), agriculture, forestry and fishing (7.8%), construction (6.1%), professional, scientific and technical (5.3%) and public administration and safety (5.3%).

In terms of industry sectors with significant scale, Rotorua has relatively more employment than New Zealand as a whole in the accommodation and food services sector (attributable to the tourism industry) and the agriculture, forestry and fishing sector (attributable to the forestry and agriculture industries).

Table 6-1: Rotorua employment counts by main ANZSIC-06 industry sectors 2000-15

	2000	2015	Ann. Average growth rate 200-15	% composition	Location quotient	Sector more or less important than for NZ?
Total Industry	**26,610**	**29,580**	0.7%			
Q Health Care and Social Assistance	2,820	3,540	1.5%	12.0%	1.1	greater
H Accommodation and Food Services	3,140	3,410	0.6%	11.5%	1.6	greater
C Manufacturing	3,570	3,100	-0.9%	10.5%	1.0	less
G Retail Trade	2,930	2,840	-0.2%	9.6%	1.0	less
P Education and Training	2,380	2,740	0.9%	9.3%	1.1	greater
A Agriculture, Forestry and Fishing	1,960	2,300	1.1%	7.8%	1.4	greater
E Construction	1,150	1,800	3.0%	6.1%	0.9	less
M Professional, Scientific and Technical Services	1,210	1,570	1.8%	5.3%	0.7	less
O Public Administration and Safety	1,270	1,570	1.4%	5.3%	0.9	less
I Transport, Postal and Warehousing	1,380	1,550	0.8%	5.2%	1.2	greater
F Wholesale Trade	1,270	1,100	-1.0%	3.7%	0.7	less
S Other Services	790	1,100	2.2%	3.7%	1.1	greater
R Arts and Recreation Services	1,030	1,070	0.3%	3.6%	1.9	greater
N Administrative and Support Services	440	670	2.8%	2.3%	0.5	less
K Financial and Insurance Services	380	400	0.3%	1.4%	0.5	less
L Rental, Hiring and Real Estate Services	430	360	-1.2%	1.2%	0.8	less
D Electricity, Gas, Water and Waste Services	110	260	5.9%	0.9%	1.2	greater
J Information Media and Telecommunications	320	220	-2.5%	0.7%	0.4	less
B Mining	..	12	0.0%	0.0%	0.1	less

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Source: APR analysis based on Statistics New Zealand Business Frame data downloaded from NZ.Stats.

Note: (1) A location quotient greater than one indicates that Rotorua is more specialised in a sector than New Zealand as a whole.

Note: (2) Employment counts are a head-count of all salary and wage earners that excludes those who are self-employed and does not distinguish between part and full-time employment.

Although the RLC does not have a significant amount of trade waste (liquid waste from industry discharge into the sewerage scheme), trade waste industries are also an important part of the employment sector.

6.2.2.3 Established Industry Base Comparative Advantage

The Rotorua District has inherent strengths that contribute to its comparative advantage, including the following key aspects:

Forestry and biotech

Rotorua's traditional industries include agriculture, manufacturing, tourism, forestry, wood processing and related sectors such as research and development. There are high levels of human capital clustered around forestry-related businesses including Scion, Red Stag, Tachikawa, Lockwood and other established companies.

The Waipa Valley industrial estate to the south of Rotorua's main urban area provides positive agglomeration and cluster effects. A big reason for the existence of these companies is Rotorua's proximity to the Kaingaroa production forest, which has an ageing stock profile and projected large increase in cut over the next 10-15 years.

Rotorua is also proximate to other industrial and commercial businesses, particularly with a relationship to the forest and wood processing industry, including the Waiariki Institute of Technology wood processing training centre and a number of site-servicing industry professionals and advisors and equipment and maintenance specialists. Scion Ltd in particular has potential for substantial development as an engine room for ideas. There may be scope to further develop processes for commercialising Scion's intellectual property outputs.

Destination tourism

Rotorua is known nationally and internationally as a key tourism destination with its mix of geothermal attractions, Māori culture and a diverse range of other attractions, events, facilities and accommodation.

Existing event and tourist infrastructure includes a major Events Centre, international stadium and conference facilities, as well as natural attractions such as forest tracks for mountain biking. Rotorua has an iconic status as a tourism city. The local industry is well developed and internationally recognised.

As a secondary spin-off, tourism also shows off Rotorua's lifestyle benefits to a large number of potential migrants each year. Emerging sectors within the broader industry mix include adventure, sports and nature tourism, spa or therapeutic/beauty tourism and the conference market. There is scope for further development of an integrated sports, cultural, adventure, environmental and health recreational experience, making use of Rotorua's lakes, geothermal areas and other features. As one of New Zealand's top conference destinations, Rotorua is well-equipped with accommodation and other infrastructure for handling larger conferences.

6.2.2.4 Selected Recent Business Investments/Developments

Selected recent business investments/developments reflect the practical effects of Rotorua tourism growth in terms of attracting external investment, as well as showing the overall the expansionary

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growth phase the local economy is currently experiencing. A list of selected developments is provided in Appendix E.2.

6.2.3 Social Environment

6.2.3.1 Residential Amenity

Many residents of Rotorua have been attracted by its wide range of lifestyle factors including:

- World class natural environment and recreation opportunities, including lakes, forests, parks, reserves and geothermal, offering a diverse range of attractions and activities (many free) within easy access. Rotorua has more than 110 public reserves, gardens and parks with a wide range of amenities, playgrounds and walking tracks to enjoy;
- Lower than national average housing costs with rural, lakeside, suburban and city living options, many with lake, forest and farmland views;
- Excellent community facilities including, Rotorua District Library, Rotorua Aquatic Centre, Rotorua Convention Centre, Civic Theatre, Rotorua International Stadium and the Rotorua Energy Events Centre;
- Strong community spirit and friendly people;
- Quality education opportunities from pre-school through to tertiary;
- Close proximity of services, short travelling times and effective public transport;
- Close proximity to cities of Auckland, Hamilton, Napier, Tauranga and Taupo;
- Easy access to a variety of sports clubs, cultural groups, community events and family activities;
- Rotorua is bicycle friendly – easy and safe to ride to school and work; and
- Free or discounted access to world-class tourist attractions.

A full range of public and private health services is available in Rotorua, with access to 24-hour medical and emergency care. Rotorua Hospital provides quality and modern health facilities. Southern Cross QE is Rotorua's private surgical hospital. QE Rotorua is also New Zealand's only geothermal medical health and spa specialist.

6.2.3.2 2013 Census Data

An outline of selected 2013 Census metrics is provided in Appendix E.3. A Summary of key facts are as follows:

- Rotorua has a significantly greater proportion of Maori compared to New Zealand as a whole. Rotorua maintains a strong Maori cultural heritage and has a growing cosmopolitan feel. It has over 150 different ethnicities represented in the district. The major ethnic groups are European (61.8%), Māori (34.3%), Pacific Islands (4.6%), and Asian (5.8%);
- Home ownership is slightly lower in Rotorua compared to New Zealand as a whole;
- Rotorua's unemployment rate is higher than for New Zealand as a whole; and
- Medium personal income in Rotorua is less than for New Zealand, mostly due to having less individuals who have an annual gross income significantly greater than $50k.

Census data implications for wastewater plant upgrade

Most socio-economic demographic indicators appear to show Rotorua moderately lagging behind New Zealand as a whole in terms of social wellbeing and affluence. The WWTP upgrade provides a key underlying infrastructure to support population and economic growth. This growth will increase

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employment and allow the district ratings base to expand notwithstanding the question of affordability of the community to pay for the upgraded plant.

6.2.4 Maori Cultural Environment

Refer to Section 7.8 of this AEE.

6.2.5 Tourism and Recreational Environment

Rotorua is the hub of international visitor activity in the Bay of Plenty and the Central North Island. Along with Queenstown in the South Island Rotorua is known as one of the New Zealand's prime tourist destinations. Rotorua's holiday tourism sector has been underperforming over recent years, but has experienced an upturn in visitor numbers during the past three years.

6.2.5.1 Recreational Environment

Rotorua contains a diverse natural environment that provides the basis for a wide range of outdoor recreational opportunities. Key features of the scenic environment include:

- The area covered by the RLC is 261,906 hectares. This area includes approximately 107,381 hectares of forests and 17 lakes. Rotorua city is nestled in a huge, ancient caldera 20km across at its widest point and 16km at the narrowest, with Lake Rotorua nearly 300 metres above sea level;
- 18 volcanic lakes - 16 accessible;
- Over 110 reserves, gardens and parks free for public use;
- Three major rivers (Waikato, Kaituna and Rangitaiki);
- Numerous geothermal fields with hot pools and spectacular geysers;
- 100,000 hectares of native and exotic forests (with the largest commercial plantation. forest in the Southern Hemisphere);
- 100,000 hectares of farmland;
- 120 wetlands;
- Stunning volcanic landscapes with Mount Tarawera, Rainbow Mountain, Mount Ngongotaha and Mokoia Island as local icons;
- Hundreds of kilometres of walking, cycling and mountain biking tracks; and
- These all provide an unbeatable living environment and are used for recreation, sporting, healing, spiritual, cultural, commercial and community purposes.

6.2.5.2 Visitor Growth

Expectations for future growth requires an understanding of past and present growth. Table 6-2 shows annual Rotorua visitor nights and their growth rates based on a combination of SNZ Commercial Accommodation Survey data and APR Private Household Visitor Monitor data.

Rotorua's visitor nights' growth over the past few years has been strong. Growth between December 2015 and December 2016 was 5.8% while annual growth in 2015 (8.6%) and 2014 (2.7%) were also strong. Taking a broader perspective, average annual visitor night growth covering the period December 2008 to December 2016 takes into account slow growth during the Global Financial Crisis (GFC) and was relatively slow at 1.1% pa. In the four years subsequent to 2012, Rotorua's average annual visitor nights' growth was relatively fast at 5.0% pa.

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Table 6-2: Annual Rotorua visitor nights' analysis

Year ended December	International	Annual growth	Domestic	Annual growth	Total	Annual growth
2008	1,335,042		2,060,054		3,395,096	
2009	1,182,165	-11.5%	1,977,634	-4.0%	3,159,799	-6.9%
2010	1,214,220	2.7%	1,999,732	1.1%	3,213,952	1.7%
2011	1,227,749	1.1%	1,911,481	-4.4%	3,139,230	-2.3%
2012	1,168,022	-4.9%	1,868,828	-2.2%	3,036,850	-3.3%
2013	1,258,006	7.7%	1,870,834	0.1%	3,128,840	3.0%
2014	1,284,349	2.1%	1,929,622	3.1%	3,213,971	2.7%
2015	1,443,137	12.4%	2,047,213	6.1%	3,490,350	8.6%
2016	1,599,741	10.9%	2,093,919	2.3%	3,693,660	5.8%
Av. Ann. Growth 2012-16	**8.2%**		**2.9%**		**5.0%**	
Av. Ann. Growth 2008-16	**2.3%**		**0.2%**		**1.1%**	

Source: APR analysis using Statistics New Zealand Commercial Accommodation data and APR Rotorua Private Household Monitor

Note: (1) SNZ commercial accommodation data sourced from: http://www.stats.govt.nz/browse_for_stats/industry_sectors/accommodation/AccommodationSurvey_HOTPJun16.aspx/

Note: (2) APR Consultants Private Household Visitor Monitor data was sourced from the APR's Private Homes Survey database.

Note: (3) Visitor nights are the sum of commercial and private accommodation visitor nights.

6.2.5.3 Evidence for Continued Fast Tourism Growth

This section outlines an evidential basis for asserting that Rotorua is capable of achieving average annual visitor night growth of 3% pa. The rate of visitor night growth is significant as it will determine the future wastewater processing capacity needed for visitors and this in turn will influence the overall need for future wastewater processing capacity. The evidential basis is significant in that the RLC, in the interests of investment efficiency, must invest in capacity that covers the potential for maximum growth, even if this level does not manifest.

A list of potential drivers of Rotorua's continued fast tourism growth is provided as bullet points below and outlined in more detailed in Appendix 4:

- Strong projected New Zealand international visitor growth will increase Rotorua's visitor numbers.
- Rotorua's international visitor mix is in alignment with fast-growing international visitors to New Zealand.
- Continued Success of the Rotorua Investment Scheme in attracting domestic visitors to Rotorua.
- Rotorua's diversified visitor product mix.
- Rotorua's diversified visitor market.
- Rotorua's proximity to three fast growing cities (ie, Auckland, Hamilton and Tauranga).
- Accommodation hub - Rotorua's proximity to other key tourism areas (eg, Taupo)
- Success of the Crankworx Festival.

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- Potential development of Rotorua-based “international-ready” golf course.
- Positioning Rotorua as a globally-recognised destination for health and wellness[9]
- Evidence of increasing investment levels in retail and tourism-related infrastructure.

6.2.6 Economic Environment

6.2.6.1 Outlook

Rotorua’s economic activity summary to December 2016 shows that most indicators are improving including traffic flow, both residential and non-residential building consents, house sales, guest nights, retail trade, car and commercial vehicle registrations. According to Infometrics: All indicators of spending, investment, and labour market activity were indicative of an economy that is showing a healthy level of economic growth. Key drivers of growth were Rotorua’s tourism sector and rising real estate and construction activity.

6.2.6.2 Selected Economic Metrics

GDP

GDP in Rotorua District was up 3.9% for the year to December 2016 compared to a year earlier. Growth was higher than in New Zealand (3.2%) and the same as in Bay of Plenty Region (3.9%). GDP was $2,733 million in Rotorua District for the year to December 2016 (2010 prices). Annual GDP growth in Rotorua District peaked at 3.9% in the year to December 2011.

Unemployment

The annual average unemployment rate in Rotorua District was 5.8% in December 2016, down from 7.5% a year earlier. The unemployment rate in Rotorua District was higher than in New Zealand, where the unemployment rate averaged 5.1% over the year to December 2016. Over the last ten years the unemployment rate reached a peak of 8.6% in March 2012.

Retail expenditure

Electronic card retail spending in Rotorua District, as measured by Marketview, increased by 6.2% over the year to December 2016 compared to the previous year. This compares with an increase of 2.9% in New Zealand.

Non-residential building consents

Non-residential building consents to the value of $66 million were issued in Rotorua District during the year to December 2016. The value of consents increased by 42% over the year to December 2016. By comparison the value of consents in New Zealand increased by 1.7% over the same period. Over the last 10 years, consents in Rotorua District reached a peak of $122 million in the year to December 2009.

6.2.6.3 Selected Factors Influencing GDP Ahead

Increased annual tourism growth rate

The growth rate of Rotorua visitor nights has significantly increased over the past four years. During 2015 Rotorua’s annual visitor night growth was 8.6%. Visitor night growth during the year ended December 2016 was 5.8%. As Rotorua increases in popularity, businesses are beginning to ramp up their investment in the area. Non-residential building consents were up 42% pa in the year ended December 2016, a large proportion of which was in commercial investment. The proposed Rotorua Lakefront development, worth $200m, will attract further business to Rotorua, as will the mixed-use commercial development of Lynmore Junction.

[9] Downloaded from: http://www.mpi.govt.nz/document-vault/8656/

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Increased annual international migration to Rotorua

Rotorua District experienced a permanent and long-term net migration gain of 923 persons in the year to December 2016. This compares with a gain of 718 persons a year ago, and a ten-year average of 31 people (gain). If the current level of international migration continues BERL's population projections will likely be exceeded.

Increased annual domestic migration to Rotorua

Given the high cost of living in Auckland from rising housing costs and rates, there is an increasingly significant motivation for Aucklanders to move to provinces to achieve more affordable living and a higher quality of life. It is not improbable that at some point in the future Aucklanders' rate of migration to Rotorua will significantly increase, thereby causing BERL's population projections to be well exceeded. Notably, the economies of Hamilton and the Western Bay of Plenty sub-regions are growing at a steady pace. These coupled with improved transport linkages, will increasingly provide attractive opportunities for New Zealanders to work in these areas and reside in Rotorua.

Pressure is mounting on the existing housing stock and on the city's infrastructure. The cost of housing in Rotorua went up rapidly in 2016, with house prices in December sitting 27% above their 2015 level. Rising house prices put pressure on Rotorua's rental market, with rental inflation in the December quarter reaching 9.6%pa, an all-time high. A number of new subdivisions have been earmarked for residential development, which will ease pressure on the housing stock and consequently prices going forward.

Forestry and wood processing sector growth

The forestry and wood processing sector is one of the largest employment sectors in Rotorua and an important income generator for the District's local economy. The forestry sector is set to continue to grow over the coming decades, creating new jobs. The Asia Pacific Forestry Commission has forecast demand for industrial round wood to increase from 317 million m^3 in 2005 to 550 million m^3 in 2020, with East Asia, especially China, accounting for most of this consumption.

Similar analysis has shown that growth in construction is expected to be strong in China, the United States and India, with a 70% increase in construction output to $15 trillion worldwide by 2025, including the need for 270 million new homes in China and India by 2015. The forestry industry is well-established in Rotorua and has extensive transportation infrastructure and support services surrounding the industry. These transport and logistical services will expand along with the forestry industry to support increased demand for the region's wood.

6.3 Wastewater Treatment Plant and Environs

6.3.1 General Locality

The WWTP is located adjacent to a well-used multi recreational area and also adjacent to some industrial activities. Recreational activities/clubs that make use of the area are: Rotorua Archery Club, Mid Island Gym Sports (MIGS), Puarenga Park Run, Puarenga Sport Field and Puarenga walkway (refer to Table 6-3).

6.3.2 Residential and Industrial

Section 7.7.3 of this AEE discusses land use and the adjacent and nearly industrial, recreational and residential areas from an air quality/odour point of view. Figures 2.4 and 7.10 show these areas.

The following information focusses on the recreational activities.

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6.3.3 Open Space and Reserves

Puarenga Park Run

The Puarenga Park Run (as shown in Figure 6-1) is a free weekly 5 km event for runners of all standards, which takes place every Saturday at 8:00am in Puarenga Park. The run hosts approximately 50 to 60 runners a week. The course starts from behind MIGS gym beside the car park and heads north along the Sulphur Track for several hundred metres before turning right and following the Sulphur Track towards the Puarenga Stream. The track turns right just past the gum trees, runs beside the archery club to complete one 2.5 km lap.

Puarenga Park

Puarenga Park is primarily used for under 12-year old soccer. Details of park usage are provided in the Table 6-3 shown below:

Table 6-3: Puarenga Park Sports Activities

Facilities	Code(s) Using	Winter/Summer	Usage	
			Frequency	Impact
4 full size soccer fields 14 small soccer fields	Junior Soccer	W	H	H
Toilets/Changing sheds	Rugby	W	M	M
2 Rugby Fields	Cricket	S		M
Car park 2 artificial cricket wickets			M	

Notes: (1) Low = <2 hrs p/week (2) Med = 3-6 hrs p/week (3) High = 6 + hrs p/week

Mid Island Gym Sports

MIGs is the only gymnastics and trampoline club in Rotorua. It is affiliated to GymSports New Zealand and caters for children wishing to partake in recreational gymnastics, trampoline and tumbling for fun, as well as having a competitive stream of these sports.

Rotorua BMX Club

The club currently has a clubroom, floodlights and the users of the BMX track currently use the Puarenga Park toilets. However, the RLC has approved the lease of reserve land at Waipa to the Rotorua BMX Club. A $1 million plus facility will be built on the corner of State Highway 5 and Waipa Mill Rd after a 20-year lease was granted to the club.

Puarenga Walkway

The walkway starts at the Redwoods Forest, then crosses an underpass under Te Ngae Road. The walkway goes beside the area in the general vicinity of Puarenga Stream into the Sulphur flats before linking to the carpark of Polynesian Spa. The walkway is used by locals and particularly by visitors to Rotorua in summer as the beginning of the walkway is adjacent to the Sudima Hotel and relatively close by to the Millennium Hotel.

Rotorua Walking Festival

The Rotorua Walking Festival is held annually in early March with some of walks including the Puarenga Walkway.

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Figure 6-1: Locality and Surrounding Recreational Opportunities to the WWTP

Source: Google Maps

Note: (1) The blue line shows the Puarenga Park Run. (2) The green area adjacent to the MIGS parking lot is Puarenga Park.

6.4 Climate and Climate Change

Rotorua is situated inland from the coast and is sheltered by high country to the south and east, resulting in less wind than many other places in New Zealand. Rotorua has a relatively high altitude (290 m above sea level) and enjoys a warm, temperate climate.

Table 6-4 sets out that the greatest mean temperatures are in January (17.7°C) and February (17.9 °C) and the coolest are in June (8.5 °C), July (7.8 °C) and August (8.4 °C).

The driest months are January (92.7 mm), February (93.9 mm), and March (99.2 mm), while the wettest month are June (136.1 mm), July (134.5 mm), and August (131.4 mm).

The months with the greatest sunshine hours are January (242.9 hours) and December (215.8 hours), while the months with the least sunshine hours are June (119.1 hours) and July (130.7 hours).

Climate change considerations and the effect on the WWTP and its discharge are discussed in Section 4.5.5 of this AEE.

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Table 6-4: Rotorua Climate Statistics, 1981-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean temp (Degrees Celsius)	17.7	17.9	16.0	13.3	10.7	8.5	7.8	8.4	10.2	12.0	13.9	16.2	12.7
No. of wet days (>1mm)	8.2	7.4	8.5	8.2	9.5	11.2	11.0	11.6	11.3	10.9	9.4	10.0	117.0
Rain fall (mm)	92.7	93.9	99.2	107.2	116.9	136.1	134.5	131.4	109.3	112.3	93.8	114.2	1,341.8
Sunshine hours	242.9	205.9	199.7	170.5	145.1	119.1	130.7	152.1	155.1	190.8	200.1	215.8	2,127.8

Source: Compiled from data available at: https://www.niwa.co.nz/education-and-training/schools/resources/climate/sunshine

6.5 Lake Rotorua – Nutrient and Other Inputs and Cumulative Effects

Refer to sections 2.2, 7.2 and 7.5 of this AEE inclusive and Support Documents No's. 3 and 4 (the University of Waikato ERI Reports 80 and 91). In particular Section 2 of Support Document No. 4 (the University of Waikato ERI Report 91) gives environmental setting to Lake Rotorua and wastewater and other contaminants discharges into it.

6.6 Maori Cultural Values

Refer to Section 7.8 and Companion Documents No. 1 and 2 of this AEE.

6.7 Te Arikiroa Thermal Channel and Environs

The Ecological Assessment Report prepared by Wildlands Consultants which is included in Support Document No. 7, states that Sanatorium Reserve is 77 hectares and is administered by the RLC. The Sanatorium Reserve includes the Te Arikiroa Thermal Channel and Puarenga Stream and is known as Sulphur Bay and Sulphur Point. The Reserve is bounded by Lake Rotorua to the north, Te Ngae Road to the south, and the Puarenga Stream to the east. The Reserve also includes sports fields (Puarenga Park) and the Polynesian Spa. A Department of Conservation administered reserve - Sulphur Point Wildlife Sanctuary - is situated adjacent to the Sanatorium Reserve. The part of Lake Rotorua bounded by the Reserve is a Wildlife Refuge, administered by the Department of Conservation.

Sanatorium Reserve has been modified considerably by human influence. Two hot pools were used for bathing until they were bulldozed in 1952, being deemed unsafe for further use. There is now no visible evidence of where these pools were. Previous uses of the reserve include rubbish dumping, bathing, sulphur mining (166 tons of crude sulphur was extracted in the first few months of a three year operation, beginning in 1916), wastewater treatment, roading and sports fields development.

Trails through the Reserve, connecting the lakefront with the Redwood trails in the Whakarewarewa Forest, were constructed between 1995 and 1997. This includes Te Ara Ahi trail which starts at Queens Gate and meanders through the Sulphur Bay geothermal landscape, before linking with the Puarenga Stream southwards to Whakarewarewa, Te Puia, and Waipa. The trail avoids the main Puarenga delta which, as well as being too dangerous (due to the level of geothermal activity), would disturb wildlife.

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6.7.1 Rotorua Township Reserves Management Plan 2006

The Rotorua Township Reserves Management Plan 2006 (RTRMP), prepared pursuant to the Reserves Act 1977, was approved following hearings on 10 May 2006 and includes the Sanatorium Reserve. The wider Sanatorium Reserve is classified as "recreation" but some of the land, including the WWTP site and land to the north of it including the Sulphur Flat area, is classified as "no reserve". Section 8.1 of the RTRMP includes a recommendation to reclassify the area north of the WWTP as "recreation", however this has not been formally gazetted and therefore has no legal effect.

The RTRMP clearly includes the WWTP site and the Sulphur Flat area within "Zone B" (shown in Figure 6-2). Section 7.2.10.8.2 of the RTRMP states that this area:

> *comprises all the reserve land north of the highway designation. It includes the bulk of the significant vegetation, geothermal and wild life areas as well as the wastewater treatment plant and sludge composting plant. Its character is wilderness area being a mixture of modified and unmodified landscape. Its main purpose is preservation and conservation of significant natural vegetation, geothermal activity and wildlife habitat. The subsidiary use of part of the area for wastewater treatment and sludge composting is also significant and must be taken into account.*

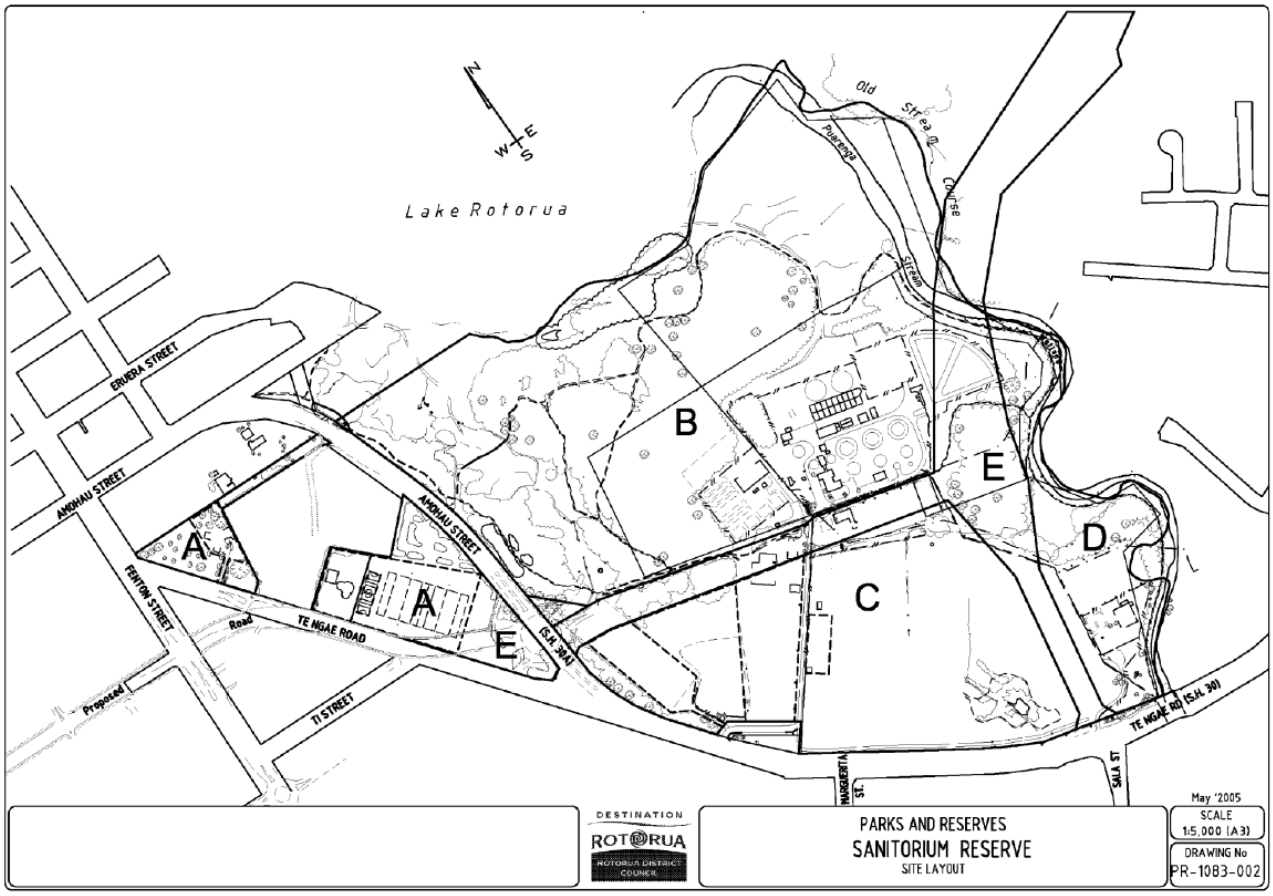


Figure 6-2: Sanatorium Reserve Zones (Sulphur Flat is Zone B)

The RTRMP includes a specific objective for Zone B which states:

> *Objectives for the management of this reserve must recognise that the reserve has a number of features that make it uniquely valuable and significant. These are:*
>
> - *Its high value in terms of wildlife habitat.*

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- *The presence of natural and modified geothermal activity close to a city (a unique situation).*
- *The presence of uncommon native vegetation types.*
- *The presence of historic and traditional sites.*
- *The existing and potential use for recreation.*
- *Its location on the route of the Rotorua walkway.*
- *The motorway designation for the Eastern Arterial Motorway.*
- *The current and potential vistas across the reserve to Lake Rotorua and the Rotorua Museum of Art and History.*
- *The presence of the wastewater treatment plant and sludge composting plant.*

It is noted that specific reference is made to the WWTP. Reference is also made to a motorway designation for the Eastern Arterial Motorway which was withdrawn from the RDP by the RLC as requiring authority in 2016 but notably has not been removed from the RTRMP. Further discussion on the RTRMP is presented in Section 12.2.6.6 of this AEE.

6.7.2 Ecological Management Plan for Sanatorium Reserve

In 2017, the RLC commissioned Wildland Consultants to prepare an Ecological Management Plan that intends to guide the restoration and enhancement of approximately 70 hectares of the Sanatorium Reserve. This Plan is included in Support Document No. 7. The plan includes timings and costs of works to be undertaken, and considers flora, fauna, habitats, and special ecological features, such as the geothermal features and existing bird life on the site. The plan also takes into account the amenity features and sports fields within the site, safety considerations around people's access to the site (such as sight lines on shared cycle/walkways), options for the disused landfill area within the reserve, the cultural significance of the site, and management of ecological issues such as weeds and pest animals.

The Plan includes the following vision:

> *The ecological integrity of Sanatorium Reserve and Sulphur Point is restored so that it can be enjoyed by visitors using a high quality, low impact network of tracks and other facilities.*
>
> *By 2022:*
>
> - *Geothermal vegetation and fauna habitats within Sanatorium Reserve and the Sulphur Point area have been restored as a special Rotorua City gem, linked to other tourist destinations such as Kuirau Park, Government Gardens, and the Redwoods, as an integral part of a unique visitor experience;*
> - *Visitor infrastructure has been installed, such as viewing platforms, providing a safe and enjoyable visitor experience; and*
> - *Areas outside of the restoration areas have been enhanced, including areas around the sports clubs.*

The RLC has made provisions in its budgets to progress this work.

6.7.3 Natural Character, Landscape and Amenity

The Natural Character Landscape and Amenity Assessment Report prepared by Wildlands Consultants which is included in Support Document No. 7, states that Lake Rotorua, including Sulphur Bay, is an Outstanding Natural Feature and Landscape as mapped in the RDP (Maps 336 and 337). Further, the entire locality is within the Rotorua Geothermal System (Map 212), and the geothermal terraces and associated vegetation are a Significant Natural Area (Maps 336 and 337).

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Natural character has not been assessed by the RLC in respect of its District Plan, however Sulphur Bay, the geothermal terraces and associated geothermal vegetation have very high to outstanding natural character according to the Natural Character Landscape and Amenity Assessment Report. The Report notes that the locality itself is highly modified including; the Wastewater Treatment Plant commissioned in 1973, the old landfill site – parts now used as a council store/depot, the composting facility, and associated power lines, drains, and other infrastructure.

The Report states that the viewing audience for Sulphur Bay is quite limited with views only possible from distant elevated sites. Surrounding geothermal vegetation and limited access, plus existing building development, prevent viewing from main roads and more general views. East of the site much of lakeside of Owhata and Ngapuna is undeveloped, or is farmland with no public access to this section of the lake shoreline.

Walkers and cyclists using the Puarenga Walkway and Te Ara Ahi cycleway gain close up views of Sulphur Bay, the sinter terraces and geothermal features, and are an important viewing audience.

6.7.4 Ecology

The Ecological Assessment Report prepared by Wildlands Consultants which is included in Support Document No. 7, states that geothermal habitats in the Sanatorium Reserve, Sulphur Point, and on the eastern side of the Puarenga Stream (Ngapuna), comprise the fourth largest area of geothermal habitat in New Zealand (Wildland Consultants 2009).

The Report notes that much of the vegetation is generally typical of that found in many geothermal habitats, being a mixture of geothermal kānuka (Kunzea tenuicaulis), kānuka (Kunzea robusta), mānuka (Leptospermum scoparium), mingimingi (Leucopogon fasciculatus) and tūrutu (Dianella nigra). Small areas of wetland are dominated by raupō and Carex geminata. The quality of vegetation is generally higher towards the northern end of the Sulphur Bay site, with fewer weeds. Exotic vegetation dominates the area long Te Ngae Road and alongside part of the Puarenga Stream. Scattered woody pest plants are present within the geothermal vegetation, and patches of arrow bamboo (Pseudosasa japonica) are scattered throughout Sulphur Bay the site. Other weeds of ecological concern include pampas (Cortaderia selloana), alder (Alnus glutinosa), broom (Cytisus scoparius), grey willow (Salix cinerea), crack willow (Salix fragilis), yucca (Yucca sp.), gorse (Ulex europaeus), blackberry (Rubus fruticosus agg.), and silver birch (Betula pendula). There are also planted areas of eucalyptus (Eucalyptus sp.) and Tasmanian blackwood (Acacia melanoxylon).

Vegetation and habitat type descriptions and a vegetation map for the Sanatorium Reserve (from Wildland Consultants 2017) are presented in the Ecological Assessment Report included in Support Document No. 7.

The Ecological Assessment Report states that Sulphur Bay provides habitat for various threatened and at risk indigenous bird species, including black-billed gull ('Threatened-Nationally Endangered' in Robertson et al. 2017); Caspian tern, New Zealand dabchick, banded dotterel (all 'Threatened-Nationally Vulnerable'); red-billed gull ('At Risk-Declining'); and black shag, little black shag, and little shag (all 'At Risk-Naturally Uncommon'). Grey duck and white heron (both 'Threatened-Nationally Critical') are known to occasionally utilise the lake and its margins, but this site is not important for their protection.

The Report notes that Sulphur Bay is a particularly important site nationally for red-billed gull, black-billed gull, and New Zealand dabchick. An area of 27 hectares within Sulphur Bay including most of the proposed works site, has been recognised as an important area for New Zealand seabirds: Site on Land (Site NZ028 Forest and Bird 2016), with the two trigger species being black-billed gull and New Zealand dabchick. Frost and Taylor (2018) identified the Rotorua red-billed gull population, and specifically the large colony at and adjacent to Sulphur Bay, as the third largest colony in New Zealand with 2,277 pairs, making up c.8% of the national population of this species.

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6.7.5 Geothermal Features

The Natural Character Landscape and Amenity Assessment Report prepared by Wildlands Consultants which is included in Support Document No. 7, states that there are large areas of sinter adjacent to and beneath Sulphur Bay, with frequent fumaroles, ngawha (springs), bubbling geothermal pools, and ponds. The sinter terraces have been modified, with the Te Arikiroa Thermal Channel being straightened for discharge of water from the Treatment Plant and the old landfill site.

Evaluation of a series of historical aerial photographs in the Natural Character Landscape and Amenity Assessment Report show considerable modifications to Sulphur Bay and the WWTP area over the last 50 years. They show the sinter terraces before and after the Te Arikiroa Thermal Channel was straightened around 1972. A natural alignment was present in 1970 and a straightened alignment was present in 1972, during the construction phase for the WWTP.

The Natural Character Landscape and Amenity Assessment Report states that the sinter terraces at Sulphur Bay are readily seen from Hatupatu Drive, at the southern edge of Rotorua Energy Events Centre, and from Te Ara Ahi - pathway of fire trail between Motutara Point and the Puarenga Stream/Ngapuna area. This includes views from the Government Gardens trails, the golf course, and lake-side of the Events Centre.

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7 Assessment of Environmental Effects

7.1 Introduction

This section has been prepared in accordance with section 88 and the Fourth Schedule of the RMA and should be read in conjunction with the Companion and Support Documents.

In particular, sections 7.3, 7.4 and 7.5 of this AEE are supported by the detailed assessments in the University of Waikato documents prepared for the RLC and titled as follows:

- Support Document No. 3: University of Waikato - Lake Rotorua Treated Wastewater Discharge: Environmental Effects Study October 2015 ERI Report 80. Prepared by Jonathan Abell, Chris McBride, David Hamilton; and
- Support Document No. 4: University of Waikato - Assessments of Effects of Proposed Treated Wastewater Discharge to the Thermal Channel and Sulphur Bay (Lake Rotorua) October 2017 ERI Report 91 Prepared by A Dada, B Hick, N Ling and D Hamilton.

Further, section 7.8 of this AEE should be read in conjunction with:

- Companion Document No.1: Cultural Impact Assessment of Rotorua Land Treatment System Alternatives April 2017. Prepared by Antoine Coffin of Te Onewa Consultants; and
- Companion Document No. 2: Cultural Impact Assessment of a Discharge of Treated Wastewater to Lake Rotorua through a Land Contact Bed at Puarenga Bay, Rotorua November 2017. Prepared by Antoine Coffin of Te Onewa Consultants.

7.2 Positive Effects

7.2.1 General

In accordance with the definition of ‘effect’ in the RMA, positive effects of the Preferred Scheme for which the consents are being sought need to be assessed. The positive effects should be kept to the fore when considering all effects as defined under the RMA and considering the proposal in terms of the purpose of the RMA.

The Preferred Scheme has a significant number of positive effects for the residential, business and industrial areas it serves, further a number of positive cultural effects are set out in Section 7.8.3 of this AEE. These positive effects include the following.

7.2.2 Provision of a Safe Public Health and Sanitation System

The key positive effect of the Preferred Scheme is the continued provision of a safe and reliable public health sanitation system for both existing and planned residential and business/industrial development in Rotorua’s urban area and the connecting outlying smaller communities. Provision of a safe wastewater scheme eliminates the need for onsite or alternative sewage facilities for residential and business use in urban areas should such alternative approaches be permitted and sustainable in terms of protecting public health and the natural built environment.

In short, the Preferred Scheme will provide significant benefits for the well-being of the community in terms of the “health and safety” requirements in Part 2, section 5 of the RMA.

7.2.3 Wider Positive Effects

The WWTP upgrade will achieve a very high standard of wastewater treatment before discharge to the freshwater environment and allows for increased volumes of wastewater from projected residential and business growth over the next 35 years. Future wastewater processing needs will be driven by:

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- Future reticulation projects;
- Infill development;
- Projected resident population growth; and
- Projected tourism activity growth.

The Preferred Scheme will contribute significantly to enabling Rotorua's economic growth by supporting population and tourism activity growth as follows:

Supports future reticulation

There may be opportunities to reduce TN losses from land use within the Lake Rotorua catchment (eg, land use change from rural to lifestyle or residential), that would require a greater output from the WWTP; as well as from outside the catchment that benefits other priority Te Arawa lakes.

Investment in WWTP upgrade to cover for resident population growth demands

The planned WWTP upgrade supports population growth. It is likely that Rotorua will experience moderate population increases during the next 35 years, rather than a decline as predicted by BERL's Reality Check Scenario and SNZ's projections. There is a realistic possibility of BERL's high growth rate scenario being achieved and even this scenario could prove to be relatively conservative. It is possible that BERL's population projections may be exceeded, attributable to faster levels of domestic and international net migration to Rotorua than has historically been experienced and a local economy that is currently in an "expansionary" growth phase.

Enabler of economic growth

BERL's population projections explicitly relate future population levels to the performance of the economy. These projections assume that a growing economy (i.e, business growth) will generate increased employment. As the WWTP upgrade provides infrastructure to support projected residential and business growth, it is therefore a direct enabler of economic growth.

Investment in WWTP upgrade covers tourism growth demands

Reviewing a range of statistical evidence, APR Consultants conclude that Rotorua to 2051 is likely to experience faster visitor growth than experienced on average over the past ten years. An average annual visitor night growth of at least 3% pa is not unrealistic and will create a significant need for additional processing of visitors' wastewater (refer to Appendix 1 of the APR Consultants Report for supporting analysis). According to APR Consultant's research:

- In 35 years' time, Rotorua will need to possess the capacity to handle increased visitors' wastewater treatment demands. In 2051 the load created by all visitors is likely to range between the annual equivalent of 15,629 residents (at an average of 1% visitor growth pa during the period 2016-51) and 32,629 residents (at an average of 3% visitor growth pa during the period 2016-35); and
- In 2051 the additional load (from 2016 levels) created by visitors is likely to range between the equivalent of 4,034 "extra" residents (at an average of 1% visitor growth pa) and 21,033 "extra" residents (at an average of 3% visitor growth pa).

WWTP upgrade covers uncertainty with respect to uncertain population and visitor growth rates

While future levels of visitor and population growth are subject to a high level of uncertainty, they will nevertheless require that Rotorua invest in a more significant WWTP upgrade than might otherwise be the case in order to achieve cost efficiencies of scale and to mitigate any time dependencies given implementation lags if fast growth in these variables should occur. In this regard, because of the high-performance standards necessary to discharge to Lake Rotorua, the RLC is obliged in the interests of

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unhindered, well-planned economic development to make a significant investment in wastewater infrastructure, irrespective of the growth that actually occurs.

WWTP upgrade supports the Ministry of Business, Innovation and the Employment and the Tourism Growth Partnership's investment in Rotorua-based tourism providers and major events[10]***,***

Major events attract significant numbers of visitors. Event funding by central government is primarily focused on attracting new international visitors to New Zealand. Central government funding to Rotorua during the past few years has been significant. Funding from the Tourism Growth Partnership (TGP) was made for the:

- World Spa project ($359,000);
- Skyline Gravity Park ($225,000);
- Te Puia New Zealand Māori Arts and Crafts Institute ($2,457,600); and
- Redwoods' Treewalk Night Lights ($328,445).

Funding from the Ministry of Business, Innovation and Employment's (MBIE) major events has included:

- The RLC 2017;
- Mud Festival ($1.5m);
- Crankworx Festival ($300,000); and
- Tarawera Ultramarathon ($300,000).

An upgraded WWTP will, in part, cover for potential future visitors' wastewater processing needs. The WTTP upgrade therefore indirectly supports MBIE and TGP funding to Rotorua.

WWTP upgrade supports Bay of Plenty outcomes recommended by the Toi Moana Regional Growth Study

The WWTP upgrade will contribute to enabling Rotorua tourism and therefore economic growth in Bay of Plenty that can leverage Rotorua's position as a tourism hub. The MBIE's 2015 Toi Moana Regional Growth Study recommended that the Bay of Plenty (BoP) region would benefit from a consistent and coherent strategy as well as improved coordination and collaboration to package and market visitor activity. The result of this would be the attraction of more free independent travellers (FITs) and an improvement in enticing them to stay longer in the wider BOP region. Such initiatives, by their nature, have a strong potential to benefit not only BOP's main centres, but also the more remote areas like the Eastern Bay of Plenty sub-region.

While the ability to maximise a collaborative opportunity is currently constrained by the separate objectives and funding priorities of BOP regional tourism organisations (RTOs), nevertheless Eastern and Western Bay of Plenty sub regions can significantly benefit if they are able to leverage the opportunity afforded by Rotorua's visitor growth momentum. APR Consultants note that growth in Rotorua's tourism activity will also benefit areas close to Rotorua, but not located in the Bay of Plenty, such as the South Waikato and Waitomo Districts. Rotorua's visitor growth seems likely to add a source of day visitors to the Timber Trail and the Waikato River Trails, both of which have received MBIE funding.

[10] Information was extracted from MBIE Tourism Growth Partnership successful projects at http://www.mbie.govt.nz/info-services/sectors-industries/tourism/tourism-growth-partnership/successful-projects/ and MBIE New Zealand Major Event's funding recipients at http://www.majorevents.govt.nz/investment-process/major-events/major-events-development-fund-recipients/

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WWTP upgrade is a productive investment in New Zealand tourism

The WWTP upgrade provides the capacity for Rotorua to cope with tourism growth. This in turn enables Rotorua to make a significant contribution to New Zealand's tourism offering given that it possesses the following key characteristics:

- Significant alignment in terms of composition with the largest and/or fastest growing New Zealand international visitor markets;
- Attracts significant annual number of international visitors;
- Brings international visitors to New Zealand for events;
- Contributes to extending international visitors' overall length of stay in New Zealand because of events or "must-see" iconic attractions;
- Possesses a significant level of product diversification thereby catering to the needs of a range of segments within domestic and visitor markets;
- Attracts significant annual numbers of domestic and international visitors to make the destination more economically sustainable;
- Significantly contributes to retaining visitors within a region, thereby contributing to surrounding district economies;
- Makes a significant contribution to retaining domestic expenditure in New Zealand, by preventing leakage made on short-haul outbound holidays, especially to Australia and various Pacific islands;
- Strongly contributes to key elements of New Zealand's clean green outdoor adventure brand by possessing a range of activities and attractions that include lake, forest, mountain, sea and geothermal scenic opportunities, cultural opportunities and action adventure opportunities. Rotorua's contribution to the brand is strengthened by the fact that the proposed WWTP will achieve the highest treatment standard in New Zealand for total nitrogen and pathogenic microorganism removal. This will protect the freshwater environment into which it discharges;
- Provides best practice cultural and environment infrastructure investment and tourism methods that show cases New Zealand to international visitors and provides an exemplar to other New Zealand tourism areas;
- Possesses an RTO, council and/or economic development agency that possesses a high level of competence and good track record in implementing tourism strategies and undertaking successful marketing to grow tourism; and
- Possesses a productive tourism environment with a high level of tourism operator collaboration and participation in the tourism sector

7.2.4 Maori Culture Effects

Refer to section 7.8.3 of this AEE.

7.3 Te Arikiroa Thermal Channel

7.3.1 Catchment Characteristics

Te Arikiroa Thermal Channel is a locally and geothermally influenced stream channel that flows into the southern end of Sulphur Bay, Lake Rotorua.

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7.3.2 Stream Flows

The mean baseline discharge (flow rate) of the Te Arikiroa Thermal Channel is 0.01 $m^3 s^{-1}$ (BOPRC 2015).

7.3.3 Water Quality

7.3.3.1 Mixing of WWTP Discharge

Dada et al. (2017) undertook mass balance dilution calculations (as set out in Support Document No. 4: University of Waikato ERI Report 91) to predict the water quality of Te Arikiroa Thermal Channel following implementation of the Preferred Scheme. No mixing zone was considered for the channel in these calculations due to the high projected rate of treated wastewater discharge relative to baseline flows in the thermal channel. For mass balance dilution calculations, it was assumed that the mean baseline discharge (flow rate) of the thermal channel is 0.01 $m^3 s^{-1}$ and the mean daily discharge of treated wastewater is 0.2756 $m^3 s^{-1}$. Thus, following implementation of the Preferred Scheme, the flow in the thermal channel would comprise 27.56 parts treated wastewater to 1 part baseline thermal channel water. Modelling results were compared with Attribute States in the National Policy Statement for Freshwater 2014, updated in August 2017 (NPS-FM 2014; New Zealand Government 2017) and the ANZECC and ARMCANZ (2000) guidelines (metals).

7.3.3.1 Nutrients

7.3.3.2.1 Ammoniacal-Nitrogen

P projected ammoniacal nitrogen concentrations in the treated wastewater are lower than measured concentrations in the Te Arikiroa Thermal Channel and for comparison Sulphur Bay (refer Table 7-1). Mass balance modelling therefore predicts that the discharge will cause ammoniacal nitrogen concentrations to decrease in the Te Arikiroa Thermal Channel. The proposed discharge is predicted to improve the NPS-FM 2014 Attribute State from D to C in Te Arikiroa Thermal Channel.

Table 7-1: Baseline and Projected Ammoniacal Nitrogen Concentrations. Comparisons are Made to Attribute States Defined in the National Policy Statement for Freshwater Management 2017 for Protection of Ecosystem Health in Lakes and Rivers (Based on Toxicity).

Site	NH_4-N (mg L^{-1})	Details	Attribute State (median concentration)
Te Arikiroa Thermal Channel baseline	5.60	One sampling date (November 2016)	D
Sulphur Bay (Lake Rotorua) baseline	0.04	One sampling date (November 2016)	B
Treated wastewater (projected)	2.00	Projected	-
Te Arikiroa Thermal Channel modelled	1.16		C
Sulphur Bay (Lake Rotorua) modelled	0.07		B

7.3.3.2 Nitrate-Nitrogen

Projected nitrate-nitrogen concentrations in the treated wastewater are higher than measured concentrations in the Te Arikiroa Thermal Channel. The modelling therefore predicts that the discharge will cause nitrate-nitrogen concentrations to increase in the Te Arikiroa Thermal Channel (refer Table 7-2).

Comparison with Attribute States defined in the NPS-FM 2014 for protection of ecosystem health in rivers (in relation to toxicity) shows that the Attribute State (based on estimated median concentrations) in the Te Arikiroa Thermal Channel is A under baseline conditions and B following the projected discharge (refer Table 7-2). Attribute State B corresponds to conditions associated with adverse growth effects on up to 5% of species.

This modelling result should be considered in the context of the negligible to low ecological value of the Te Arikiroa Thermal Channel, and the contribution that other baseline factors (e.g., low pH) make to

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limiting growth. Nitrate-nitrogen is also likely to be reduced by dissimilatory nitrate reduction to ammonium and by denitrification in the stream, thus reducing concentrations relative to the model predictions, which assume conservation of mass.

Table 7-2: Baseline and Projected Nitrate-Nitrogen Concentrations. Comparisons are Made to Attribute States Defined in the National Policy Statement for Freshwater Management 2017 for Protection of Ecosystem Health in Rivers (Based on Toxicity).

Site	NO_3-N (mg L^{-1})	Details	Attribute State (median concentration)
Te Arikiroa Thermal Channel baseline	<0.01	One sampling date (November 2016)	A
Treated wastewater (projected)	2.00	Projected	-
Te Arikiroa Thermal Channel modelled	1.93		B

7.3.3.3 pH and Metals

Projected metal concentrations in treated wastewater are higher than baseline concentrations of nine metals in the Te Arikiroa Thermal Channel (refer Table 7-3). In the Te Arikiroa Thermal Channel, projected metal concentrations in treated wastewater are higher than baseline concentrations of antimony, bismuth, cadmium, molybdenum, nickel, selenium, sodium, tin and silver. The modelled concentrations of cadmium, nickel, selenium and silver in the thermal channel are less than the 99% ANZECC and ARMCANZ (2000) trigger values. No trigger values are defined for the remaining five metals listed in Table 7-3.

The projected mean pH of the treated wastewater (6.94) is higher than the baseline pH of Te Arikiroa Thermal Channel (~5.60). Therefore, the proposed discharge will increase the pH in the thermal channel; modelled pH was 6.89.

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Table 7-3: Baseline and Modelled Metal Concentration, with Comparisons to ANZECC and ARMCANZ (2000) Guidelines

Metal	Baseline conc. in Te Arikiroa Thermal Channel (mg/L)	Baseline conc. in Sulphur Bay (Site 4; mg/L)	Projected conc. in treated wastewater (mg/L)	Modelled conc. in Te Arikiroa Thermal Channel (mg/L)	Modelled conc. in Sulphur Bay (Site 4; mg/L)	ANZECC and ARMCANZ (2000) trigger values for freshwater (mg/L)			Projected conc. In treated wastewater > thermal channel baseline?	Projected conc. In treated wastewater > lake baseline?
						99%	95%	90%		
Aluminium	10.3000	0.6500	0.0440	0.4031	0.6318	0.027	0.055	0.08	No	No
Antimony	0.0003	0.0012	0.0045	0.0044	0.0013	ID	ID	ID	Yes	Yes
Arsenic	0.0079	0.0320	0.0039	0.0040	0.0312	0.0008	0.013	0.042	No	No
Barium	0.2000	0.0390	0.0150	0.0215	0.0383	N/A	N/A	N/A	No	No
Bismuth	BDL	BDL	0.0001	0.0001	0.0000	ID	ID	ID	Yes	Yes
Boron	0.4700	0.5700	0.2500	0.2577	0.5604	0.09	0.370[c]	0.680[c]	No	No
Cadmium	0.0000	BDL	0.0001	0.00005	0.00000	0.00006	0.0002	0.0004	Yes	Yes
Caesium	0.0320	0.0330	0.0100	0.0108	0.0323	N/A	N/A	N/A	No	No
Calcium	101.0000	4.0000	9.7000	12.8968	4.1710	N/A	N/A	N/A	No	Yes
Chromium	0.0070	BDL	0.0023	0.0025	0.0001	0.00001	0.001[c]	0.006[a]	No	Yes
Cobalt	0.0006	BDL	0.0003	0.0003	0.0000	ID	ID	ID	No	Yes
Copper	0.0125	BDL	0.0093	0.0094	0.0003	0.001	0.0014	0.0018[c]	No	Yes
Iron	3.2000	0.4200	0.0500	0.1603	0.4089	ID	ID	ID	No	No
Lanthanum	0.0055	0.0003	0.0001	0.0003	0.0003	ID	ID	ID	No	No
Lead	0.0044	0.0002	0.0019	0.0020	0.0002	0.001	0.0034	0.0056	No	Yes
Lithium	0.1320	0.2200	0.0850	0.0866	0.2160	N/A	N/A	N/A	No	No
Magnesium	9.5000	1.6700	2.1000	2.3591	1.6829	N/A	N/A	N/A	No	Yes
Manganese	1.8700	0.0950	0.0570	0.1205	0.0939	1.2	1.90[c]	2.50[c]	No	No
Molybdenum	0.0004	0.0003	0.0009	0.0009	0.0003	ID	ID	ID	Yes	Yes
Nickel	0.0020	BDL	0.0077	0.0075	0.0002	0.008	0.011	0.013	Yes	Yes
Potassium	17.6000	7.5000	16.0000	16.0560	7.7550	N/A	N/A	N/A	No	Yes
Rubidium	0.0730	0.0510	0.0370	0.0383	0.0506	N/A	N/A	N/A	No	No
Selenium	BDL	BDL	0.0011	0.0011	0.0000	0.005	0.011	0.018	Yes	Yes
Sodium	53.0000	55.0000	65.0000	64.5798	55.3000	N/A	N/A	N/A	Yes	Yes
Strontium	0.4600	0.0300	0.0460	0.0605	0.0305	N/A	N/A	N/A	No	Yes
Thallium	0.0001	0.0001	0.0001	0.0001	0.0001	ID	ID	ID	No	No
Tin	BDL	BDL	0.0006	0.0005	0.0000	ID	ID	ID	Yes	Yes
Uranium	0.0001	BDL	0.0000	0.0000	0.0000	ID	ID	ID	No	Yes
Vanadium	0.0041	BDL	0.0011	0.0012	0.0000	ID	ID	0.05	No	Yes
Zinc	0.3700	0.0046	0.0550	0.0660	0.0061	0.0024	0.008[c]	0.015[c]	No	Yes
Silver	BDL	BDL	0.0001	0.00010	0.00000	0.00002	0.00005	0.0001	Yes	Yes

[a] at ph >6.5, at pH<6.5, there are insufficient data to derive trigger value

[c] Figure may not protect key test species from chronic toxicity

BDL- Below detection limit

Key	Metal concentration in relation to ANZECC and ARMCANZ (2000) freshwater trigger levels (mg/L)
	≤ 99% trigger value
	> 99% and ≤ 95% trigger value
	> 95% and ≤ 90% trigger value
	> 90% trigger value
	Not applicable or insufficient data to derive a reliable trigger value

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7.3.3.4 Pathogens

Projected *E. coli* concentrations in the treated wastewater are very low, reflecting the high level of proposed treatment. Projected concentrations are lower than background concentrations in the Te Arikiroa Thermal Channel and for comparison Sulphur Bay (Table 7-4).

Comparisons were made with Attribute States defined in the NPS-FM 2014 for protection of human health for recreation in lakes and rivers. Baseline Attribute State (based on estimated median concentrations) is D in the Te Arikiroa Thermal Channel and the proposed discharge is predicted to improve the Attribute State to A in Te Arikiroa Thermal Channel.

Further assessment of microbial risk has been provided in a separate Microbial Risk Assessment conducted by MWH/NIWA that involved modelling the fate of pathogenic micro-organisms.

Table 7-4: Baseline and Projected E.coli Concentrations. Comparisons are made to Attribute States defined in the National Policy Statement for Freshwater Management 2017 for Protection of Human Health for Recreation in Lakes and Rivers.

Site	*E. coli* (CFU 100 mL^{-1})	Details	Attribute State (median concentration)
Te Arikiroa Thermal Channel baseline	400	One sampling date, November 2016)	D
Sulphur Bay (Lake Rotorua) baseline	7	Median value (n = 5)	A
Treated wastewater (projected)	2	Median (and maximum) value (n = 3)	-
Te Arikiroa Thermal Channel projected	16		A
Sulphur Bay (Lake Rotorua) projected	7		A

7.3.3.5 Fauna and Flora

As set out in Support Document No. 4: University of Waikato ERI Report 91, tāonga species (fish, kōura and kākahi) are expected to be currently absent from Te Arikiroa Thermal Channel. The large geothermal-influence is assessed to eliminate the potential for tāonga species to colonise the channel. Accordingly, there is assessed to be no effect of the proposed wastewater discharge on these taxa in the Te Arikiroa Thermal Channel.

7.3.3.6 Sediment and Erosion Control

As set out in the Construction Methodology Report prepared by Jacana Consulting (included in Support Document No. 7) sediment control measures will be put in place to mitigate the effects of sediment being transported to down Te Arikiroa Thermal Channel in Sulphur Bay (Lake Rotorua). This will involve effective sediment control measures being installed progressively across Te Arikiroa Thermal Channel at a practical distance downstream of excavator activities. The precise nature of these measures and the onsite monitoring during construction to assess their effectiveness and the reporting to the consent authority will be set out the Construction and Environmental Management Plan (Condition 69(b)) as included in the suite of volunteered consent conditions in Appendix K.

7.3.4 Natural Character, Landscape and Amenity

A Natural Character, Landscape and Amenity Assessment Report has been prepared by Wildlands Consultants (Support Document No. 7). This Report assesses the Natural Character, Landscape and Amenity effects of the Preferred Discharge Solution on the Sanatorium Reserve the area of the Sulphur Flats and a summary is provided in the subsequent sections.

7.3.4.1 Natural Character

The Wildlands Natural Character, Landscape and Amenity Assessment Report states that the proposal to modify the Te Arikiroa Thermal Channel and associated drains and vegetation will have adverse effects on natural character because:

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- The naturalised Te Arikiroa Thermal Channel will be modified with removal of sediment as described in the Discharge Channel Construction Methodology prepared by Jacana Consultants and included in Support Document No. 7;
- Flow diversion bunds will be constructed to prevent connectivity flows between the Puarenga Stream and Te Arikiroa Thermal Channel. This Construction will affect the area under bunds, the channel itself where any straightening or widening occurs, plus any affected sinter and vegetation needed for machinery access;
- Water flows will increase, with resultant loss of the still water and the black mirror effect;
- Water colour may change if the black sediment is removed or as a result of dilution.

Historically there has been reasonably large scale human-made interventions and changes to the landscape. These changes are evident in the historical aerial photographs and also recent Google Earth images that show more recent change and variation from 2003 onwards. These show that this locality has been subject to considerable change, and human modification over the last half century or so, and that the landscape has recovered, at least to some extent, from quite severe modifications, such as:

- Sulphur mining (west of the old landfill);
- Landfill for town rubbish/ waste (west of Te Arikiroa Thermal Channel);
- WWTP construction, including excavation of Te Arikiroa Thermal Channel circa 1972;
- Fire, vegetation removal, exotic planting and weed invasion; and
- Construction of public structures including paths, bridges, and interpretation features.

The Wildlands Natural Character, Landscape and Amenity Assessment Report notes that even with all these interventions the area still has exceptional natural character. Further, the area has proven to be resilient with ongoing geothermal activity, natural regeneration of indigenous vegetation, and the lake and river flows re-naturalising parts of the sulphur mine, the landfill site and lake and river edges. This naturalising is prevented where ongoing disturbance from mowing, vehicle movements, and temporary storage occurs, or where weed invasion from dumping has spread.

7.3.4.2 Outstanding Natural Features and Landscapes

The Wildlands Natural Character, Landscape and Amenity Assessment Report (Support Document No.7) states that any proposal to alter the Te Arikiroa Thermal Channel may have adverse effects on the Outstanding Natural Feature and Landscape. The significance of the adverse effect is partly dependent on how it is developed. Alternative alignments and/or multiple discharge points may result in lesser effects.

7.3.4.3 Amenity and Visual Effects

The Wildlands Natural Character, Landscape and Amenity Assessment Report states that the effect on amenity of altering the Te Arikiroa Thermal Channel and construction of the bunds will be to diminish the experience for visitors/users, and the magnitude of this effect depends on the extent of works. Change hidden from the Te Ara Ahi trail views will have inconsequential adverse effects on views and amenity.

The reflective mirror qualities of the Te Arikiroa Thermal Channel are likely to be lost due to an increase in the flow rate due to the WWTP discharge. The mirror effect requires a still water surface and this will be affected due to the proposed increased flow rate. An increase in water surface area will also result from the increased flow in Te Arikiroa Thermal Channel, with water extending up into the arms of the Puarenga connecting channels. These may become still under normal flows, and if black sediment is deposited, as it was in the existing channel, similar mirror qualities may develop in these areas of still water.

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The apparent black colour of the water, resulting from its black sediment base, contributes to the mirror effect and the black sediments provides a stark contrast to the light sinter terrace colours (whites, creams, browns and yellows). The black water surface colour of the Te Arikiroa Thermal Channel may also change through dilution from the WWTP discharge, and removal of the black sediment during deepening and widening construction.

Overall, the experience for Sulphur Bay visitors will remain equivalent with only a short section of trail being affected, and the black mirror effect will change or be lost. From the Sudima Hotel carpark, where the gravel trail starts, to near the outlet of the WWTP land contact bed is about 1.5 kilometres. The section of trail where the effects of the channel modifications may be experienced is 100-200 metres, or 6-12%, of the Sulphur Bay section of trail.

7.3.5 Ecology

An Ecological Assessment Report has been prepared by Wildlands Consultants (Support Document No. 7). This Report considers the effects on the vegetation/indigenous biodiversity and aquatic habitats in/and adjacent to the Te Arikiroa Thermal Channel and its outlet to Sulphur Bay, Lake Rotorua. This Report also recommends mitigation measures to avoid or minimise possible adverse effects of such works.

Subject to the final engineering assessments, the Report considers that the proposed works have the potential to result in adverse ecological effects through the loss of habitat by construction of a drain and bunds in a regionally and nationally significant area, resulting in the loss of part of a nationally rare vegetation and habitat type, so loss should be avoided or kept to an absolute minimum.

The proposed works could involve widening and deepening the thermal channel to accommodate increased flows. A strip of significant indigenous geothermal vegetation could also be removed by the subject works, for access to the site, and to widen and deepen the channel. A few plants may also be killed by inundation by higher water levels.

Sediment loss may occur as a result of the proposed works and could potentially cover geothermal features and vegetation. Banks alongside the channel may become unstable following the subject works and increased water flows.

Construction of short sections of bunds, either along the thermal channel or adjacent to the Puarenga Stream, would result in adverse effects due to modification and burial of significant geothermal habitats. Bunds will also provide sites for weed establishment and for enhanced predator access onto the sinter flats (into very high value avifauna habitat).

7.3.6 Geothermal

A Geothermal Assessment Report has been prepared by GNS Science (Support Document No. 7). This Report assesses the effects on the geothermal features located adjacent to the Te Arikiroa Thermal Channel and its outlet to Sulphur Bay, Lake Rotorua.

7.3.6.1 Evaluation of Significance

The Geothermal Assessment Report states that an evaluation method for significance ranking of geothermal features in the Taupo Volcanic Zone was initially proposed in Bromley (2011). In the Bay of Plenty region, significance assessment is required to consider the policy framework of the RPS. Nine criteria relating to natural science factors and aesthetic values are listed in the RPS.

The Sulphur Flats thermal area has been evaluated by four observers (experienced geothermal scientists). On average the area is found to have a degree of significance that is just above average (3.1 on a scale of 1 to 5, with 5 being highest). Its relative strengths are naturalness of setting, diversity of features, aesthetic appeal and viewer memorability. Its relative weaknesses are vulnerability (steam-heated ground water not chloride liquid dominated), rarity (relatively common feature types), and low resilience (affected by natural variables such as lake level changes and rainfall). As such it would be an

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areas of thermal features that may deserve protecting from significant threats, but not necessarily require absolute preservation.

The Geothermal Assessment Report concludes that some minor thermal features (weakly degassing vents and warm to hot acid sulphate seeps) are located within or adjacent to the Te Arikiroa Thermal Channel, but these, on their own, are not considered of sufficient significance to warrant specific protection. However, measures to minimise adverse effects and enhance their aesthetic appeal are advisable.

7.3.6.2 Assessment of Vulnerability to Potential Adverse Effects or Benefits

The Geothermal Assessment Report states that the observation of a hard pan (presumably silica sinter) at less than 1 m depth within parts of the channel, and near boiling temperatures at this depth, create a real risk of hydrothermal eruption being triggered by rapid excavation to deepen or widen the channel. Similar risks have been managed before in major excavations (e.g. Tokaanu trailrace, Hochstein and Prebble 2006) and Lihir Goldmine, Papa Guinea (Rodriguez et al. 2008). Keeping temperatures cool by removing overburden gradually and flooding the area overnight are technical options to mitigate the risk, but the hazard remains.

7.3.7 Hydraulic Modelling

Hydraulic modelling has been undertaken by Stantec for the Te Arikiroa Thermal Channel and the Sulphur Flats. Three reports are included in Support Document No. 7, they include contour maps showing the flow across the Sulphur Flat under various lake level and WWTP discharge conditions. They conclude that bunding is needed to ensure no flow from Te Arikiroa Thermal Channel flows across Sulphur Flat into Puarenga Stream at high lake water levels. This conclusion is made on the assumption that there is not a positive hydraulic driving force from the Puarenga Stream when it is a high level (in flood) across Sulphur Flat to Te Arikiroa Thermal Channel at times of high lake level. Further hydraulic modelling is to be carried out in respect to this issue.

7.3.8 Contaminated Land

A Contaminated Land Assessment Report has been prepared by Stantec and is included in Support Document No. 7.

The Report found that there were no exceedances of the relevant NES human health soil contaminant standards (for the ‘Parks / recreational’ land use category) in any of the soil/sediment samples analysed, indicating that the risk posed to human health from the disturbance of soil and sediment associated with the upgrade of the Te Arikiroa Thermal Channel is low.

However, the ANZECC ISQG-Low trigger values at all sites were exceeded for a number of heavy metals. Additionally, the ANZECC ISQG-High value for zinc was exceeded at the two sites draining the historic landfill. This indicates that there may be an environmental risk if the excavated soil/sediment material is not appropriately managed. A Site Management Plan has been prepared which outlines how the material will be managed – this document is included in Support Document No. 7 and referenced in the volunteered conditions in Appendix K.

7.4 Puarenga Bay (Sulphur Bay)

7.4.1 Catchment Characteristics

Puarenga Bay is at the southern end of Lake Rotorua – this bay is also known as Sulphur Bay and both names are used interchangeably throughout this AEE. The high sulphur content gives the bay a yellowish-green hue. The bay is an example of Rotorua's famous geothermal environment, with characteristic silica flats, rocky terraces, and sulphur ledges that lie alongside active boiling mud pools

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and steam vents. The bay receives water from the Puarenga Stream, in addition to minor geothermal streams that include the Te Arikiroa Thermal Channel.

7.4.2 Water Quality

7.4.2.1.1 Introduction

Water quality in Sulphur Bay is strongly influenced by geothermal discharges (including Te Arikiroa Thermal Channel) and Puarenga Stream. The geothermal discharges have relatively low pH and elevated concentrations of nutrients (TN and TP concentrations) and many metals. The water quality of Puarenga Stream is influenced by its catchment characteristics, including geological weathering, geothermal inputs and human activities associated with different land uses (e.g., urban, pastoral, the current wastewater land treatment system) and industry. The effects of Puarenga Stream and the geothermal discharges are progressively attenuated with increasing distance from their entry to Sulphur Bay but are also affected by wind and lake circulation (Abell 2015, Abell et al. 2015). Alum dosing takes place in Puarenga Stream adjacent to the Rotorua WWTP and has been used by the BOPRC since 2010, together with alum dosing of Utuhina Stream since 2006, to flocculate and sediment out phosphorus in the stream inflows. Smith et al. (2016) show that alum dosing has been responsible for a marked improvement in water quality of Lake Rotorua since it was first initiated.

7.4.2.1.2 Zone of Reasonable Mixing

Support Document No. 4: University of Waikato ERI Report 91, Dada et al. (2017) assumes that the mixing zone where discharge from the Te Arikiroa Thermal Channel mixes with Sulphur Bay comprised the area within a 250 m radius from where the channel enters Sulphur Bay (refer to Figures 7-1 and 7-2). This area is considered the “zone of reasonable mixing” for the proposed discharge of treated wastewater from the WWTP. This zone has been based on:

1. Analysis of the 3-D modelling results presented by Abell et al. (2015) and Abell (2015);
2. Water quality data collected along a transect in Sulphur Bay, with consideration of the dispersion/dilution of analytes of geothermal origin, and;
3. Expert opinion, with consideration of the projected discharge and the morphology of the receiving bay.



Figure 7-1: Locations Sampled Along a Transect from the Estimated Mixing Zone (sites 5 and 6) to Sites that Represent Increased Influence from the Wider Lake (sites 1–4). A Control Sample was Collected at Site 7.

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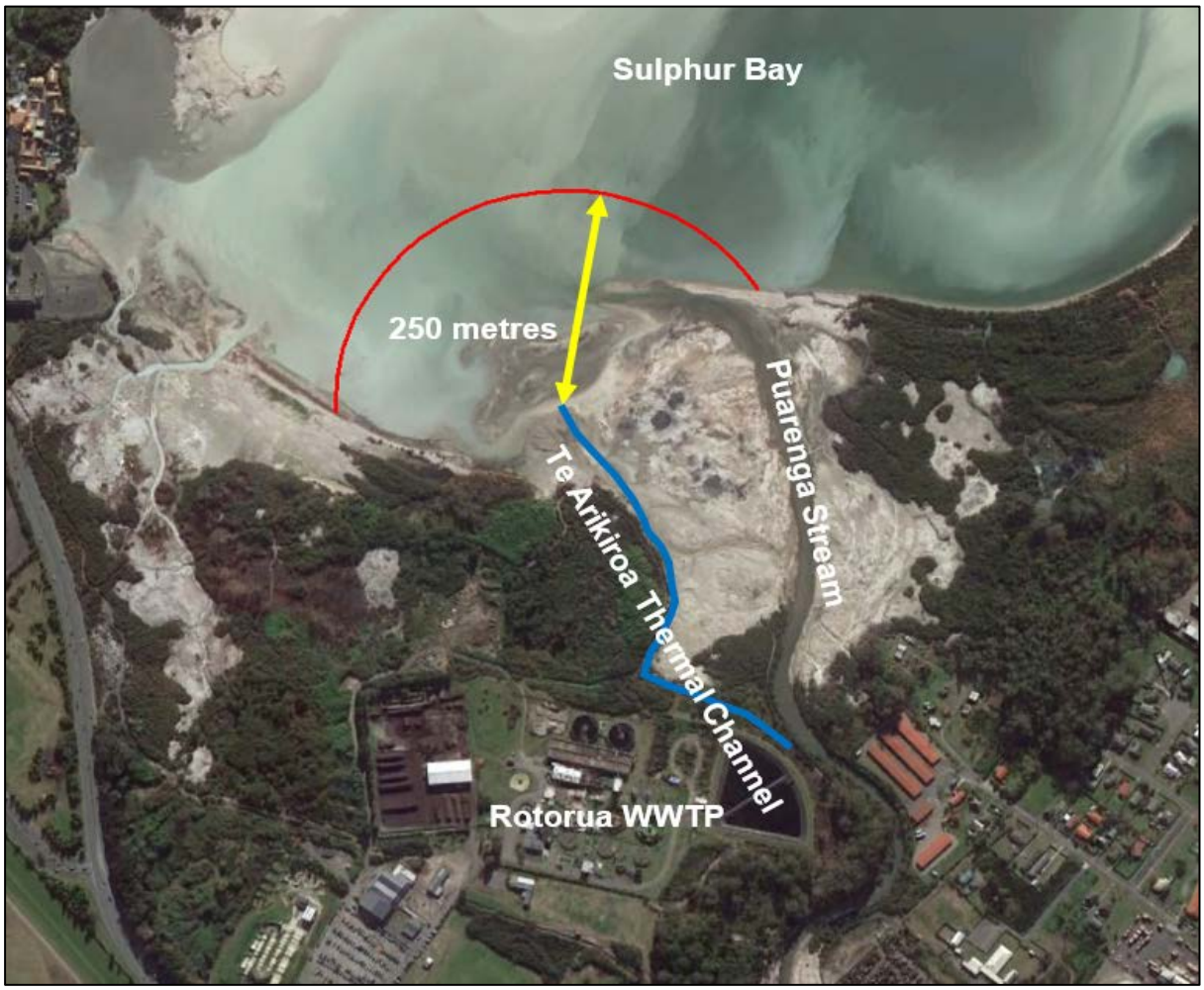


Figure 7-2: Zone of reasonable mixing (red line) within Sulphur Bay.

A mass balance dilution calculation exercise was undertaken to predict water quality within Sulphur Bay at a site ('Site 4', shown in Figure 7-1) 250–300 m north of the Puarenga Stream mouth, outside of the assumed mixing zone. To estimate the extent that lake water will dilute the treated wastewater, results were analysed from a previous study that used a three-dimensional hydrodynamic model (ELCOM) to simulate the mixing and dilution of treated wastewater from a shoreline site to the west of the Puarenga Stream mouth, in the vicinity of the mouth of the Te Arikiroa Thermal Channel (Abell et al. 2015, Abell 2015).

Assessing the potential effects on water quality within Sulphur Bay focussed on Site 4 as this was the closest site outside of edge of the zone of reasonable mixing. It should be noted that water levels in Lake Rotorua are maintained through the Ohau Channel weir according to a consented maximum level of RL 280.076 m and minimum of RL 279.466 m (i.e. a range of 0.61 m) – the varying lake levels creates small variations (a few metres horizontally) in the actual location of where the Te Arikiroa Thermal Channel enters the lake, and therefore also affects the actual location of the edge of the zone of reasonable mixing to a small degree.

Results for two representative one-month modelling periods in winter and summer showed that the proportion of treated wastewater present at the surface (0–2 m depth) ranged from 0.1–4.0% (median = 0.7%) at Site 4, with a 95th percentile value of 3.0%. Consistent with a precautionary approach, the 95th percentile value (3.0%) was used for mass balance dilution calculations to predict lake water quality, i.e., the treated wastewater was assumed to mix in the lake to yield a mixture that comprises three parts wastewater to 97 parts ambient lake water. This approach is conservative because it is based on the 95th percentile (i.e., the modelling predicted that the proportion of treated wastewater would be lower

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than 3% for 95% of the time) and the concentration of treated wastewater is expected to be considerably lower in the main body of the lake, relative to conditions at Site 4, which is outside the mixing zone. Estimation of baseline water quality at Site 4 in Lake Rotorua was based on the results of monthly sampling during July 2011 to June 2016 conducted as part of an Alum Dosing Monitoring Survey, supplemented with the results of additional sampling undertaken in November 2016 to inform this assessment (to measure nutrients, metals, faecal indicator bacteria, and water column chlorophyll *a*).

7.4.2.2 Nutrients

7.4.2.2.1 Ammoniacal-Nitrogen

Projected ammoniacal nitrogen concentrations in the treated wastewater are higher than measured concentrations in Sulphur Bay at Site 4. The modelling therefore predicted that the discharge will cause ammoniacal nitrogen concentrations to increase slightly at the edge of the mixing zone in Sulphur Bay.

Comparisons were made with Attribute States defined in the National Policy Statement for Freshwater Management 2017 for protection of ecosystem health in lakes and rivers (in relation to toxicity). Baseline Attribute State (based on estimated median concentrations) is B in Sulphur Bay (Lake Rotorua). The proposed discharge is predicted to cause no change to the Attribute State in Lake Rotorua. The modelled concentration for Lake Rotorua is at the low end of the range for Attribute State B, which corresponds to conditions associated with occasional impacts on the most sensitive species. The proposed discharge is therefore not predicted to substantively increase ecological risks associated with ammonia toxicity.

7.4.2.2.2 Nitrate-Nitrogen

Baseline and modelled NPS-FM 2014 nitrate toxicity Attribute States were not calculated for Lake Rotorua because the Attribute States relate to rivers. However, based on consideration of the projected nitrate-nitrogen concentrations in the treated wastewater, and the expected dilution in the lake, the proposed discharge is not expected to increase ecological risk in the lake due to nitrate toxicity.

7.4.2.3 pH and Metals

Projected concentrations in treated wastewater are higher than baseline concentrations of 20 metals in the lake, as measured at Site 4 in Sulphur Bay outside of the assumed mixing zone. In Sulphur Bay, projected metal concentrations in treated wastewater are higher than baseline concentrations of antimony, bismuth, cadmium, calcium, chromium, cobalt, copper, lead, magnesium, molybdenum, nickel, potassium, selenium, sodium, strontium, tin, uranium, vanadium, zinc and silver. The modelled concentrations of cadmium, lead, copper, nickel, selenium and sulphur in Sulphur Bay are less than the 99% ANZECC and ARMCANZ (2000) trigger values. The modelled concentrations of chromium and zinc in the thermal channel are less than the 95% ANZECC and ARMCANZ (2000) trigger values but greater than the 99% values. No trigger values are defined for the remaining 12 metals.

The projected mean pH of the treated wastewater (6.94) is higher than the baseline pH Sulphur Bay (4.16 at Site 4). Therefore the proposed discharge was assessed to cause a small localised increase in pH in Sulphur Bay; modelled pH was 4.24 in Sulphur Bay.

7.4.2.4 Pathogens

Projected *E. coli* concentrations in the treated wastewater are very low, reflecting the high level of proposed treatment. Projected concentrations are lower than background concentrations in Sulphur Bay.

Comparisons were made with Attribute States defined in the National Policy Statement for Freshwater Management 2017 for protection of human health for recreation in lakes and rivers. Baseline Attribute State (based on estimated median concentrations) is A in Sulphur Bay and this is expected to be unchanged with implementation of the Preferred Scheme.

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Further assessment of microbial risk was provided in a separate Microbial Risk Assessment conducted by Stantec/NIWA that involved modelling the fate of faecal bacteria. Section 7.5 of this AEE summarises this work which is included in full in Support Document No. 6.

7.4.2.5 Fauna and Flora

Previous biological monitoring of Sulphur Bay suggests that, apart from wildfowl (considered separately), chironomids (family: Chironomidae) are the only aquatic organisms present. Based on evaluation of the water quality modelling results, tāonga species are not expected to colonize Sulphur Bay following implementation of the proposed discharge. Accordingly, there is also assessed to be no effect of the proposed wastewater discharge on tāonga species in Lake Rotorua.

7.5 Lake Rotorua

7.5.1 Catchment Characteristics

Lake Rotorua is eutrophic (highly productive). This is caused by excessive inputs of TN and TP, which have impaired water quality relative to pre-1960s conditions. Since 2010, the water quality of Lake Rotorua has improved relative to the previous two decades, reflecting a range of environmental management actions (Smith et al. 2016). The effects of the proposed option on eutrophication in Lake Rotorua were considered in detail by Abell et al. (2015) by applying a one-dimensional lake ecosystem model (DYRESM-CAEDYM).

7.5.2 Water Quality

Relative to the current operation and consent limits of the LTS, the Preferred Scheme will discharge more TN and TP loads to Lake Rotorua in absolute terms. Projected TN and TP loads from the WWTP in the year 2054 are 40 t/yr for TN (refer to Figure 4-11) and 3.0 t/yr for TP whereas the actual discharges from the LTS are currently in the order of 30 t/yr for TN and around 1.7 t/yr for TP. However, it should be noted that the projected increases in TN into the future will be as a result of, *inter alia*, development rural land which will then be reticulated to the WWTP with the TN allocation being transferred to the WWTP. So, what appears to be an “increase” in TN loads over the next 35 years is not actually an increase in the overall load of N to the lake, but rather it reflects a transfer of TN allocation from the rural land being reticulated to the WWTP (Figure 4-11).

The modelling results of Abell et al. (2015) show that the mean 8-year TLI would be 0.02 units higher than the modelled baseline scenario (no discharge). This difference is small relative to model error, and is negligible to low from an ecological perspective and the model did not account for any reductions in the load of TN to the lake from the rural sector as rural land is urbanised. The model predictions showed no change to the baseline Attribute States for chlorophyll *a* (B), total nitrogen (B) and total phosphorus (C) that are defined in the NPS-FM 2014.

Although the predicted long term effects on take trophic status are minor (negative), there is potential for more pronounced localised effects on productivity. These could include local increases in phytoplankton biomass in the southern area of the lake during periods when background nutrient concentrations in the lake are at limiting concentrations, e.g., during stratified periods in the summer. Such conditions could also occur some distance from the outfall, in areas where dominant mixing processes cause slow dilution of the discharged treated wastewater by lake water. Three-dimensional modelling showed that discharge to Sulphur Bay could result in accumulation of treated wastewater in the vicinity of Rotorua lakefront following prolonged NE winds (Abell et al. 2015, Abell 2015). Thus, there is potential for localised and temporary increases in phytoplankton biomass in this area during specific weather conditions.

Potential impacts to periphyton and macrophytes were scoped out from consideration in the assessment due to the geothermal characteristics of the thermal channel and Sulphur Bay (unsuitable habitats).

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7.5.3 Emerging Organic Contaminants

Northcott Research Consultants Limited (NRC Ltd) prepared a report entitled Analysis of Selected Emerging Organic Contaminants in MBR Treated Effluent and at Two Sites Within and Outside the Discharge Point Mixing Zone with Lake Rotorua (Support Document No. 5). The following provides a summary of this report.

There is global concern that the presence of Emerging Organic Contaminants (EOCs) in the environment may lead to adverse effects on human and ecological health. EOCs include a vast number of chemicals used in industrial and domestic cleaning products, paints, inks and surface treatments, kitchen and laundry detergents, personal care products, cosmetics, pharmaceuticals and medicines. Products containing EOCs are used daily by human population and enter domestic wastewater from bathing, laundry and toileting activities.

Some EOCs enter the environment directly during recreational activities, e.g. from sunscreens and insect repellents. The main loads are from treated wastewater, stormwater, landfill leachate and some specific industrial activities.

New Zealand had no national strategy on EOCs and the ANZECC water quality guidelines provide indicative concentrations for some endocrine disrupting hormones but not for others with different modes of action. NRC Ltd also considered microplastics (MPs). National and international legislation and guidelines, and NZ strategies and research on EOCs was reviewed and recommendations were provided for future monitoring of EOCs in the urban environment in Auckland Council Technical Report 2016/006 “An Update on Emerging Organic Contaminants of Concern for New Zealand with Guidance on Monitoring Approaches for Councils” (Stewart, Northcott, Gaw and Tremblay 2016).

NRC Ltd undertook an initial full suite of tests as baseline monitoring to determine the level of risk to aquatic organisms from EOCs in the proposed WWTP discharge. NRC Ltd tested daily composite samples of treated MBR-permeate representing the proposed discharge, and grab samples of water from Lake Rotorua, one from within and one from outside the WWTP discharge point mixing zone (refer to Support Document No. 4).

NRC Ltd recommended a suite of 78 EOCs, representing nine different classes of EOCs, be analysed. These included:

- Alkylphosphate flame retardants (11 compounds);
- Industrial alkylphenols (7 compounds);
- Insect repellents (3 compounds);
- Nitro- and polycyclic musk fragrances (11 compounds);
- Paraben preservatives (5 compounds);
- Pharmaceuticals (10 compounds);
- Phenolic antimicrobials (6 compounds);
- Phthalate esters and plasticisers (13 compounds); and
- Steroid hormones (12 compounds).

To assess the potential effect of the chemicals in the proposed discharge on exposed organisms, including the long-term effect on populations, a precautionary approach was taken to estimate the concentrations of chemicals in the lake water, and this concentration was compared to published ‘no-observable effect concentrations’ (NOECs) and ‘predicted no-effect concentration’ (PNECs).

Of the 78 EOCs that were analysed - thirty-seven were not detected in the WWTP discharge water, there will be no change in the concentration beyond the zone of reasonable mixing for twelve EOCs, and

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the concentration of twenty-one EOCs was 1 to 9 orders of magnitude below the level considered a risk to aquatic organisms (Northcott, 2017).

NRC Ltd concluded that, overall, EOCs entering Lake Rotorua in treated wastewater discharged from the RLC WWTP following the proposed upgrade and change in discharge location, represents no discernible risk to aquatic organisms (Northcott 2017).

Northcott recommended ongoing monitoring of a suite of 12 EOCs (refer Table 7-5) and a periodic review of the latest information to ensure aquatic organisms in Lake Rotorua are not adversely affected by EOCs in treated wastewater discharged from the WWTP.

Table 7-5: Representative Model EOCs in MBR Permeate

Emerging Organic Chemical	Class	MBR Mean
TBP	Alkylphosphate Flame Retardant	135
TDCP	Alkylphosphate Flame Retardant	287
TBEP	Alkylphosphate Flame Retardant	1529
Methyl-triclosan	Phenolic Antimicrobial	66.2
Triclosan	Phenolic Antimicrobial	98.6
Technical-NP equivalents	Industrial alkylphenol	541
Galaxolide (HHCB)	Polycyclic musks	341
Tonalide (AHTN)	Polycyclic musks	137
Carbamazepine	Acidic Pharmaceutical	383
Diclofenac	Acidic Pharmaceutical	304
Bisphenol-A	Plasticiser	33.7
Estrone	Steroid hormone	55.4

Analyte key

TBP = Tributyl-phosphate

TDCP = Tris [2-chloro-1-(chloromethyl)ethyl] phosphate

TBEP = Tris-(2-butoxyethyl) phosphate

7.5.4 Micro-plastics

NRC Ltd states that the application of membrane technologies with small sub-micron pore size provides the best state of the art technology to remove plastic microfibers and the upper size range of nanoparticles. Ultrafiltration at 0.04 microns will remove all MPs and a significant proportion of nano-sized plastic and other residues from the treated wastewater. Northcott concluded that introduction of ultrafiltration at 0.04 microns for the proposed treatment of wastewater will result in the WWTP achieving the most efficient and highest level of reduction of MPs and nanoplastics in New Zealand.

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7.6 Public Health Risk Assessment of the Treated Wastewater Discharge

7.6.1 Background

A Public Health Risk Assessment Report has been undertaken by consultants Stantec New Zealand for this proposed discharge which includes a Quantitative Microbial Risk Assessment (QMRA) report prepared by NIWA. The Stantec and the NIWA Report are included as Support Document No. 6 to this AEE.

In addition to the overall objectives of the Project, the RLC's aim, with respect to public health and the ability to reuse treated wastewater, is to be an 'industry leader' by treating the wastewater to a sufficient level that it:

1. Could theoretically be used directly (i.e. without dilution) for contact recreational purposes such as swimming; and
2. Could meet the unrestricted reuse standard in relevant international guidelines[11].

7.6.2 Expected MBR Performance

Stantec carried out a literature review to determine the likely range of expected virus reduction through the proposed MBR treatment process with a membrane nominal pore size of 0.04 micron. It is expected that the proposed MBR treatment process will effectively remove larger pathogenic micro-organisms (protozoa and bacteria), which are orders of magnitude larger than the membrane pore size.

The average log reduction values (LRV) expected under "typical" influent concentrations is 5.0 to 5.5 for adenovirus and 4.5 to 5.0 for enterovirus and norovirus. A higher average log reduction is expected under "outbreak" (i.e. higher) influent concentrations.

7.6.3 Suitability for Contact Recreation

A QMRA was carried out by NIWA on a range of scenarios to determine the individual's illness risk associated with the direct use of treated wastewater discharged for primary contact recreation. The QMRA is included as Appendix A to the Stantec Report contained in Support Document No 6.

7.6.4 Public Health Risk Assessment

The individual's illness risk associated with **gastrointestinal illness** resulting from direct use of the treated wastewater discharge for contact recreation:

- is less than 1% for enterovirus with 2.1 log reduction through the Preferred Scheme and for norovirus (disaggregated) with 4 log reduction through the Preferred Scheme for '**typical'** influent virus concentrations; and
- is less than 1% for enterovirus with 4.1 log reduction through the Preferred Scheme and for norovirus (disaggregated) with 5 log reduction for '**outbreak'** influent virus concentrations.

The individual's illness risk associated with **respiratory illness** (i.e. adenovirus) resulting from the direct use of the treated wastewater discharge for contact recreation:

- Is less than 0.3% with 3.1 log reduction through the Preferred Scheme for 'typical' influent virus concentrations
- Is less than 0.3% with 5 log reduction through the Preferred Scheme for 'outbreak' influent virus concentrations.

[11] Unrestricted reuse does not extend to use as a potable water supply. International guidelines have been used as there is not currently a New Zealand guideline that specifies unrestricted reuse wastewater quality for viruses.

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Based on the expected virus LRV through the proposed MBR treatment process and the QMRA results, the treated wastewater from the proposed MBR treatment process alone is expected to meet the RLC's first desired outcome that the treated discharge water is safe and can be used directly for contact recreation without any additional virus reduction that may be provided by the UV disinfection of the Preferred Scheme.

The proposed MBR treatment process with UV disinfection is expected to satisfy the RLC's second desired outcome that the treated wastewater meets the unrestricted reuse standard

7.6.5 Suitability for Unrestricted Use

The expected median treated wastewater quality from the proposed MBR treatment process was estimated from the expected average log reduction through MBR and the median influent virus concentrations used for the QMRA. The expected median treated wastewater concentration (5 enterovirus per 50 L) was then compared against the unrestricted reuse standard in international guidelines (≤2 enterovirus per 50 L).

Based on this analysis, the proposed MBR treatment process alone would not provide a sufficient level of treatment for unrestricted reuse of the treated wastewater. Additional removal through the utilisation of UV irradiation would be required to meet RLC's desired outcome. The proposed UV dose requirements for the UV irradiation facility (i.e. a validated system) are as set out in the volunteered conditions in Section 14 and Appendix K of this AEE.

7.6.6 Summary

- The proposed MBR treatment process alone is expected to satisfy the RLC's first desired outcome that the treated discharge water is safe and can be used directly for primary contact recreation.
- The proposed MBR treatment process with UV disinfection is expected to satisfy the RLC's second desired outcome that the treated wastewater meets the unrestricted reuse standard.

7.7 Air Quality

7.7.1 Scope of Assessment and Methodology

The purpose of this air quality assessment is to determine the actual and potential effects associated with the discharge of contaminants to air at the WWTP, which predominantly comprise odour emissions. The air quality assessment has been undertaken on a semi-quantitative basis in accordance with the Ministry for the Environment's *Good Practice Guide for Assessing and Managing Odour* (MfE, 2016)[12]; this approach was agreed by the BOPRC in December 2016.[13]

7.7.2 Odour Nuisance Effects

MfE (2016) has defined odour as follows:

> *"Odour is perceived by our brains in response to chemicals present in the air we breathe – it is the effect those chemicals have on us. The effect arises from a two stage process where the brain first senses the chemical stimulus and then interprets it based on previous life experiences; we often give meaning to odour. Natural variation in sensitivity and life experiences can result in individuals having different sensations and emotional responses to the same odour compounds.*

[12] MfE (2016). Good Practice Guide for Assessing and Managing Odour, Ministry for the Environment, November 2016.
[13] Email from Mr Shane Iremonger to MWH dated 7 December 2016.

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Because the response to odour is processed in our brains, other senses such as sight and taste, and even our upbringing, can influence our perception of odour and whether we find it acceptable, or offensive and objectionable. For example, odours that are widely perceived as offensive may be acceptable to those working in the 'industry'.

Unlike other sensory information, olfactory stimulation is the only sense that reaches the cerebral cortex without first passing through the thalamus. This can lead to intense emotional and behavioural responses to certain odours.

Humans have a sensitive sense of smell and can detect odour even when chemicals are present in very, very low concentrations."

The difficulty when assessing odours is the fact that the same odour has the potential to cause an effect that may be considered "acceptable", "objectionable", "offensive" or "noxious" depending on the context, the sensitivity of the receiving environment and the person carrying out the assessment. An "objectionable" or "offensive" effect may occur where an odorous compound is present in a sample of air in very low concentrations, usually far less than the concentration that could cause adverse effects on the physical health of humans or impacts on any other part of the environment.

Typical odour effects reported by people include the following: nausea; headaches; retching; difficulty breathing; frustration; annoyance; depression, stress; tearfulness; reduced appetite; sleep deprivation; and embarrassment in front of visitors. Odour effects, such as those described above, contribute to a reduced quality of life for the individuals who are exposed to the odour.

The odour assessment contained in this report has been carried out regarding the potential for the activities and processes at the WWTP to cause odour effects at sensitive receptors (e.g. residential properties, medical centres, hospitals and schools) located in close proximity to the site boundary.

The sensory perception of odour has four major dimensions: detectability, intensity, character, and hedonic tone. These are explained in greater detail below:

- ***Odour detectability***: this is otherwise known as the odour threshold. It is the concentration of a compound necessary for detection by 50% of the population;
- ***Odour intensity***: this refers to the perceived strength of the odour sensation. Generally, intensity increases exponentially with the concentration of the compound. As the relationship between odour intensity and concentration is logarithmic, an increase or decrease in concentration will not always produce a corresponding proportional change in odour strength as perceived by the human nose. For example, increasing the concentration of an odorous compound or mixture by a factor of 10 may only increase its perceived intensity by a factor of 2. Conversely, an odour control plant or facility may only need to reduce odour concentrations at sensitive receptors by 90% in order to halve the intensity of odours they perceive;
- ***Odour character***: this is what the substance smells like. A standard list of descriptors is commonly used, which includes "fishy, hay, nutty, creosote, turpentine, rancid, sewer, and ammonia"; and
- ***Hedonic tone***: this is the judgement of the relative pleasantness or unpleasantness of the odour. It is this aspect that primarily dictates whether an odour nuisance occurs. A person's perception of odour may vary significantly from individual to individual. For example, some individuals may consider some odours as pleasant, such as petrol, paint and creosote.

Complaints are likely to occur when odours become detectable and recognisable. However, there are many situations when the release of a potentially odorous compound does not result in an odour nuisance effect. It is the subjective judgement of an odour's hedonic tone that enables the decision to be made as to whether it is a nuisance or not.

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The factors that contribute to an odour nuisance effect include the frequency (F) of odour impact, the intensity (I), the duration of exposure (D), the offensiveness (O) and the location (L), together referred to as the FIDOL factors. These factors are consistent with MfE (2016), the BOPRC's operative Regional Air Plan dated 15 December 2003, and the BOPRC's draft Regional Air Plan dated 26 April 2016.

The FIDOL factors are explained in greater detail below:

- ***Frequency***: relates to how often an individual is exposed to odour. Factors determining this include the frequency that the source releases odour (including its source type, characteristics and the rate of emission of the compound or compounds); prevailing meteorological conditions; and topography;
- ***Intensity***: is the perceived strength of the odour or the odour detection capacity of individuals to the various compound(s) on a scale of 1 to 6 (1 = 'very weak'; 6 = 'extremely strong'). An increase in intensity of odour will increase the potential for odour complaints;
- ***Duration***: is the amount of time that an individual is exposed to odour. Combined with frequency, this indicates the exposure to odour. The duration of an odour, like its frequency, is related to the source type and discharge characteristics, meteorology and location. The longer the odour detection persists in an individual location, the greater the level of complaints that may be expected, particularly if the odours are unpleasant or obnoxious;
- ***Offensiveness or odour character***: is a subjective rating of an odour's pleasantness and relates closely to hedonic tone. Offensiveness is related to the sensitivity of the 'receptors' to the odour emission (i.e. whether the odorous compound is more likely to cause nuisance, such as the sick or elderly, who may be more sensitive); and,
- ***Location***: is the type of land use and the nature of human activities in the vicinity of an odour source. The same process in a different location may produce more or less odour depending on local topography and meteorological conditions. It is also important to note that in some locations certain odours may be more acceptable than in others (e.g. the expectation that rural smells will occur as part of the rural environment and industrial smells will occur in industrial areas).

Odour assessments should consider whether the odour discharge is of low-intensity odour occurring frequently over a long period, or high-intensity odour occurring infrequently, or both. In fact, the FIDOL principle demonstrates that there are several factors that may be 'influenced' in order to mitigate odour impacts at a particular site. Employing one or more methods to influence these factors, where appropriate, may significantly decrease the likelihood of causing a serious odour event.

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, but are generally not intended to achieve "no odour".

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the odour threshold and defines one odour unit per cubic metre (OU/m^3).

In practice, the character of a particular odour can only be judged by the receiver's reaction to it, and preferably only when compared to another odour under similar social and regional conditions.

Based on the literature available, the level at which an odour is perceived to be a nuisance can range significantly depending on a combination of the following factors:

- ***Odour quality***: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds;

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- ***Population sensitivity***: any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it may contain;
- ***Background level***: whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour;
- ***Public expectation***: whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility;
- ***Source characteristics***: whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment. Point sources tend to be located in urban areas, while diffuse sources are more often located in rural locations; and,
- ***Health effects***: whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

7.7.3 Land Use, Existing Odour Sources and Sensitive Receptors

The centre of the WWTP is located at approximately Universal Transverse Mercator (UTM) Zone 60 South 435630 m East, 5777860 m North (or latitude 38.144836 ºSouth, longitude 176.265392 ºEast). Rotorua Airport and Lake Rotorua are situated approximately 4.8 km north-east and 510 m north of the WWTP, respectively.

The location of the WWTP is shown in Figure 7-3. The site boundary is shown by a solid red line. The figure was produced for a 2 km by 2 km basemap centred on the WWTP using OpenStreetMap (OSM) under the Open Database License. OSM has been used throughout this section and Stantec has acknowledged OSM and its contributors, where relevant. The Open Database License can be read in full on the OSM website (http://opendatacommons.org/licenses/odbl/1.0/). The designated site boundary includes the WWTP site included within the red line along with the adjacent compost plant that was formerly used by the RLC for compositing of sludge from the WWTP. Figure 5-1 in Section 5 shows the full designated site.

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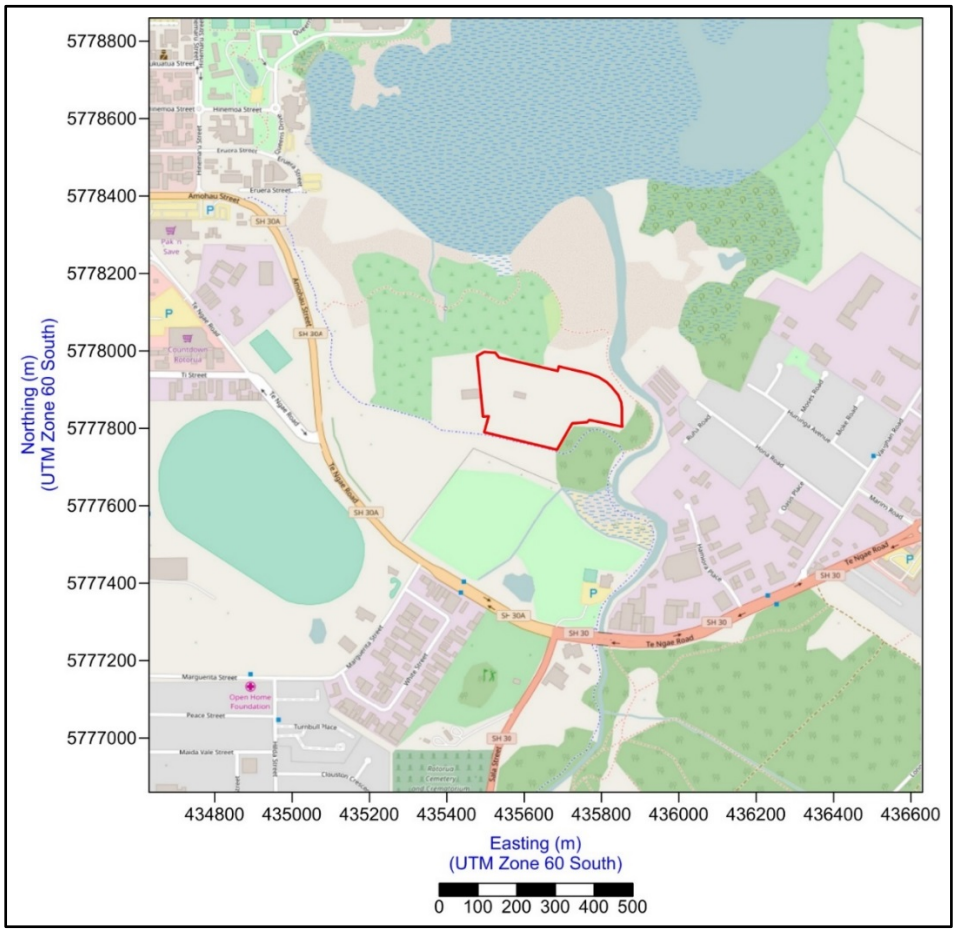


Figure 7-3: Site Location Plan

The land use in the vicinity of the WWTP is shown on the Google Earth basemap (aerial) in Figure 7-4. The figure was produced for the same area shown in Figure 7-3. The terrain surrounding the WWTP is relatively flat.

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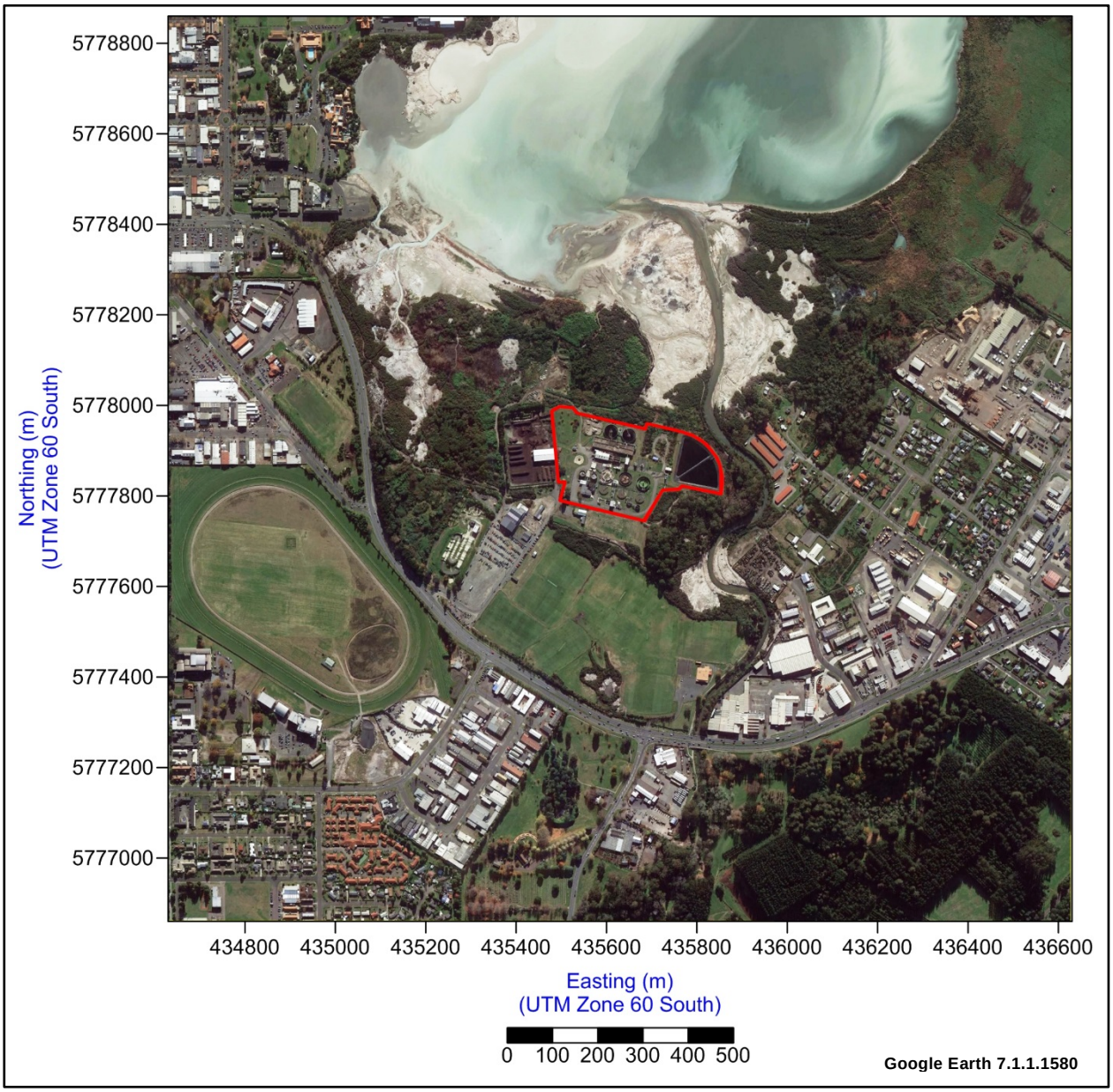


Figure 7-4: Aerial Basemap Showing the Wastewater Treatment Plant Site and Wider Environment

The site is located surrounded by areas zoned 'sanatorium reserve' and 'light industrial' ('ID1') in the RDP dated June 2016, and the WWTP is designated ('RDC450') for the purpose of wastewater treatment. The light industrial zone is described in the RDP as:

> *"Provides for a mix of light industrial activities including food processing, mechanical servicing, selling of farm machinery, car sale yards, building depots and lunch bars. The features that distinguish this zone from others include larger bulky buildings, high levels of noise, odour, signage and heavy vehicle and car movements. High levels of lighting and use and storage of hazardous substances are also common features of this environment."*

Policy 4.3.3.3 of the RDP states:

> *"Avoid adverse effects of noise, vibration, light, smoke, fumes, odours, or other sources of disturbance that are detrimental to the amenity of the residential zones."*

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The sensitivity of the receiving environment must be considered in an air quality and odour impact assessment. The degree of sensitivity in a particular location is based on characteristics of the land use, including the time of day and the reason why people are at the particular location (e.g. for work or recreation). Furthermore, different locations have different sensitivities to odour and can be classified as having 'high', 'medium' or 'low' sensitivity. Typical locations for sensitive receptors include:

- Residential properties;
- Retirement villages;
- Hospitals or medical centres;
- Schools;
- Marae;
- Libraries; and,
- Public outdoor locations (e.g. parks, reserves and sports fields).

A desk-study was undertaken to identify discrete receptors deemed sensitive to changes in the baseline air quality and odour as a result of discharges to air at the WWTP.

The nearest potentially affected sensitive receptors include residential properties, a marae, sports grounds, a BMX park, a gym, a crematorium and cemetery and a racecourse. The residential properties, the marae and the crematorium and cemetery represent locations where people of high sensitivity to odour have the potential to be located, while the remaining receptors (mostly public outdoor locations) represent locations where people of moderate sensitivity to odour have the potential to be located.

Twelve sensitive receptors (referred to herein as receptors R1 to R12) were identified and are shown in Table 7-6. These locations represent the closest sensitive receptors to the WWTP site boundary and are therefore considered to be indicative of the 'worst-case' locations for the purposes of this air quality and odour assessment. The table does not include a definitive list of all the sensitive receptors situated in close proximity to the WWTP.

Table 7-6: Sensitive Receptor Locations

Ref.	Type	Address	Location		Distance (m) and direction from WWTP boundary	Elevation above mean sea level (m)
			Easting (m)	Northing (m)		
R1	Residential	44 Hona Rd	435945	5778025	170 / NE	280
R2	Residential	44 Hona Rd	435983	5777956	160 / ENE	280
R3	Residential	37 Hona Rd	436000	5777870	150 / E	280
R4	Residential	5 Ruha Rd	436014	5777770	170 / ESE	280
R5	Marae	23 Hona Rd	436024	5777690	200 / SE	281
R6	Sports Club	202 Te Ngae Rd	435804	5777424	340 / SSE	283
R7	Park	Puarenga Park	435610	5777650	110 / S	282
R8	Gym	Te Ngae Rd	435420	5777760	80 / WSW	283
R9	BMX Park	Te Ngae Rd	435320	5777730	190 / WSW	283
R10	Residential	39 Marguerita St	435090	5777136	770 / SSW	289
R11	Racecourse	Park St	435150	5777566	400 / SW	286
R12	Cemetery	160 Sala St	435590	5777270	490 / S	284

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The 12 sensitive receptor locations identified in this assessment are shown in Figure 7-5. The closest identified sensitive receptor location to the WWTP site boundary is Puarenga Park (receptor R7) which is a public outdoor location (rugby field) situated approximately 110 m south of the WWTP. The closest residential properties include receptors R1 to R4, which are situated between 150 m and 170 m to the north-east, east-north-east and east of the WWTP on Hona Road and Ruha Road. The Hinemihi Marae (receptor R5) is located at 23 Hona Road, which is approximately 200 m south-east of the site boundary. Receptor R11 is the Arawa Park Racecourse (Racing Rotorua). The Rotorua Archery Club (situated immediately to the south of the WWTP) appears to have closed down and, therefore, this location was not considered to be a sensitive receptor in this assessment.

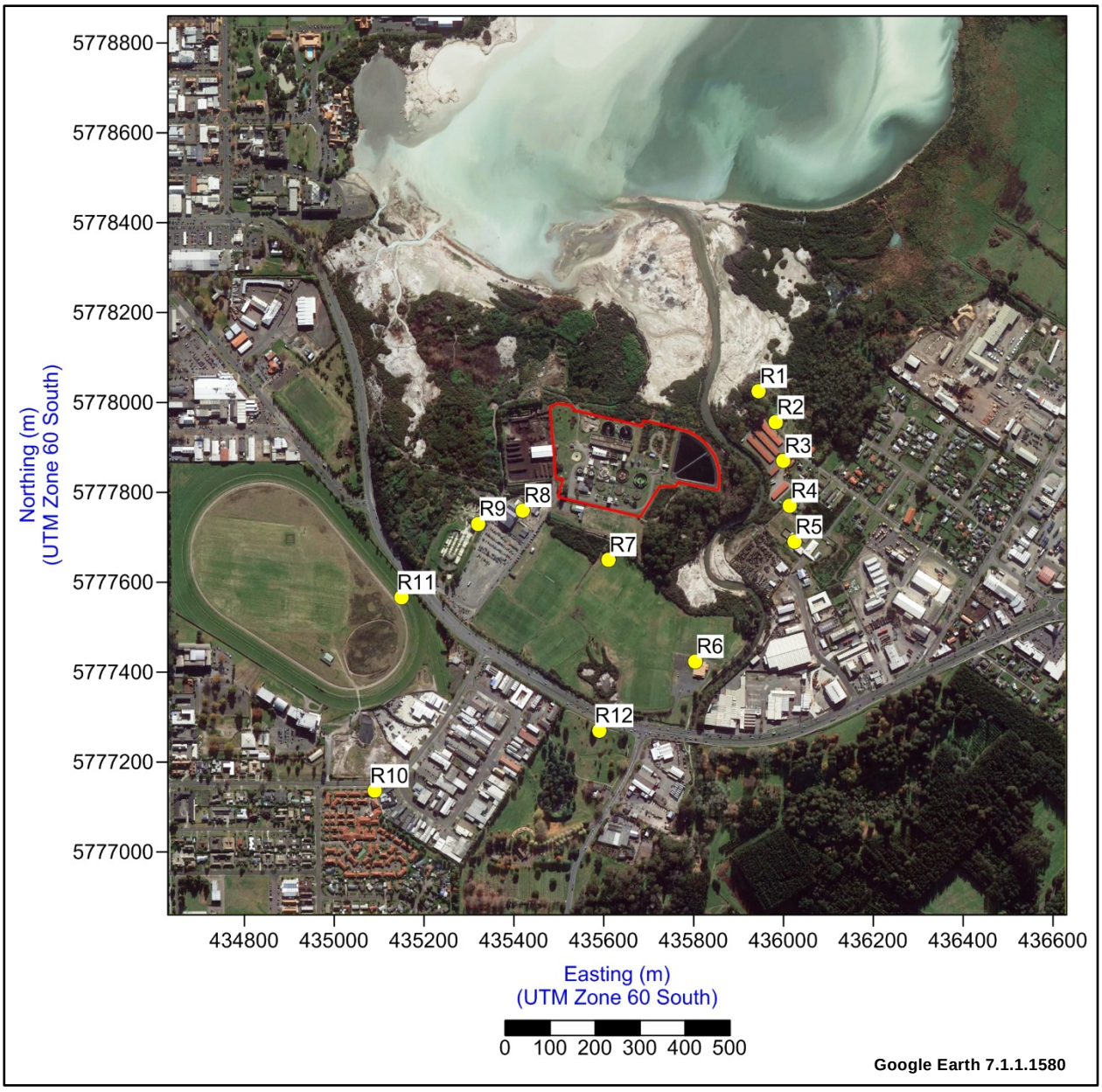


Figure 7-5: Aerial Basemap Showing the Sensitive Receptor Locations

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A field odour investigation was undertaken at the WWTP on 1 November 2016 by an experienced MWH odour scout who had recently been 'calibrated' in accordance with AS/NZS 4323.3:2001, Section 9.7.2 (screening assessment for an olfactometry panellist). The field odour investigation was undertaken in accordance with MfE (2016)[14] and was based on modified German Standard VDI 3940-2:2006.[15]

Based on the field odour investigation, the existing principal odour emission sources located at the site at that time include fugitive (uncontrolled) odour emissions from the inlet works (which is currently uncovered), grit removal and bins, primary clarifiers, existing MBR, filter belt press (sludge dewatering) building, DAF tanks, Bardenpho tank, secondary clarifiers and the treated wastewater storage ponds. The locations of the principal existing odour emission sources at the WWTP are shown in Figure 7-6. The figure also shows the location of the existing green waste composting facility situated beyond the western boundary of the WWTP.



Figure 7-6: Principal Existing Odour Emission Source Locations

Existing odour emissions from the Rotorua geothermal field (e.g. hydrogen sulphide (H_2S) which has a characteristic 'rotten eggs' odour) contribute to the background odours within the local community and there is the potential that people situated at the twelve sensitive receptor locations shown in Figure 7-5 (or at other sensitive receptor locations) may have developed a tolerance to odour (or H_2S) concentrations, compared with other members of the population. It is also possible that some of these people may not be aware of there being any background odours at all (or even existing odours from the WWTP) due to normal "habituation".

At one extreme, residents who have been brought up in Rotorua, or who have lived in an area close to significant odour sources, such as a large sewage treatment works similar to the Project site, may be so

[14] MfE (2016). Good Practice Guide for Assessing and Managing Odour, Ministry for the Environment, November 2016.
[15] VDI 3940-2:2006, Measurement of Odour Impact by Field Inspection - Measurement of the Impact Frequency of Recognizable Odours - Plume Measurement.

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used to, and tolerant of, relatively strong background odours that they do not experience sufficient annoyance or impact to complain for most of the time. An established community will typically tolerate odour for many years with no more than an occasional complaint, but this complaint pattern can quickly be interrupted if new and less tolerant residents move into the area, especially if the new residents move in to new housing in the same area. Odour complaints can suddenly assume a much higher profile in such circumstances. For this reason, the residential properties (receptors R1 to R4 and R10) were assumed to be of high sensitivity to odour emissions from the WWTP, despite the presence of a relatively high level of background odours which are of a similar character and nature (hedonic tone) to the WWTP.

It is also noted that the composting facility, which is located immediately to the west of the WWTP, is another source of existing background odours which may be detected at nearby sensitive receptor locations. In fact, MWH understands that there is a history of odour complaints due to activities undertaken at the composting facility, including when it co-composted digested sludge from the WWTP. Odours from composting facilities (e.g. un-aerated compost piles) are very distinctive, are likely to be distinguishable from any odours released at the WWTP, and may include, for example, dimethyl disulphide (garlic-like odour), dimethyl sulphide (cabbage-like odour), ammonia (characteristic sharp or pungent odour) and, to a lesser extent, H_2S.

7.7.4 Semi-Quantitative Assessment for Odour

7.7.4.1 Local Meteorology

The nearest automatic weather station (AWS) on the National Climate Database (CliFlo)[16] is the Rotorua Electronic Weather Station (EWS; Agent Number 41077) located at approximately 434905 m E 5777695 m N (UTM Zone 60 S) or latitude 38.14635 ºS, 176.2578 ºE. The EWS is operated by NIWA and is situated in the middle of the Arawa Park Racecourse, approximately 600 m west-south-west (WSW) of the WWTP at an elevation of 288 m above mean sea level.

The 1-hour mean wind speed and direction data measured at the Rotorua EWS for the period 25 September 2015 (1:00 am) to 1 January 2017 (0:00 am) inclusive, were analysed.

There was a low percentage of missing hours (0.03%) over this period (3 hours out of a total of 11,136 hours). There was also a low percentage of calm hours or wind speeds less than or equal to 0.45 m/s (0.3% or 37 hours).

The minimum and maximum 1-hour mean wind speeds measured at the site were 0 m/s and 12.7 m/s, respectively. The mean wind speed over the period was 3.1 m/s. The minimum and maximum 1-hour mean wind directions measured at the site were 0 ºN and 360 ºN, respectively.

The 1-hour mean wind speed and directions measured at the Rotorua EWS for the period 25 September 2015 (1:00 am) to 1 January 2017 (0:00 am) inclusive are shown in the wind rose in Figure 7-7, while the wind speed frequency distribution for this 1-year period is shown in Figure 7-8.

[16] CliFlo – NIWA (the National Institute of Water and Atmospheric Research): https://cliflo.niwa.co.nz/

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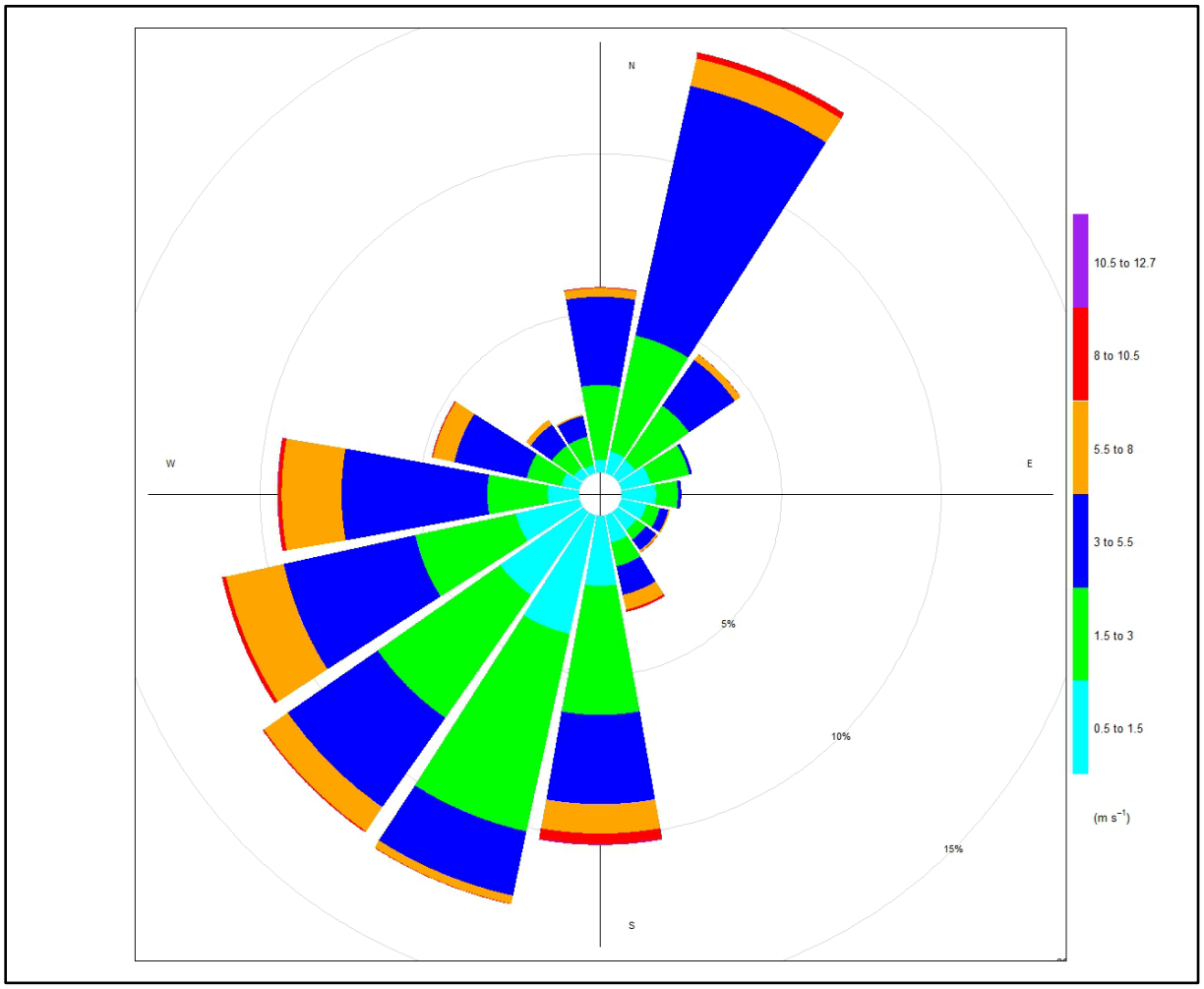


Figure 7-7: Wind Rose for the Rotorua EWS for 25 September 2015 to 31 December 2016

The wind rose shown in Figure 7-7 indicates that the predominant wind directions were:

- North-north-east (NNE) 13.5%;
- South-south-west (SSW) 12.6%;
- South-west (SW) 12.4%;
- West-south-west (WSW) 11.6%; and,
- South (S) 10.4%;

The figure also indicates that the highest 1-hour mean wind speeds (above 8 m/s) occurred during winds from the S and NNE.

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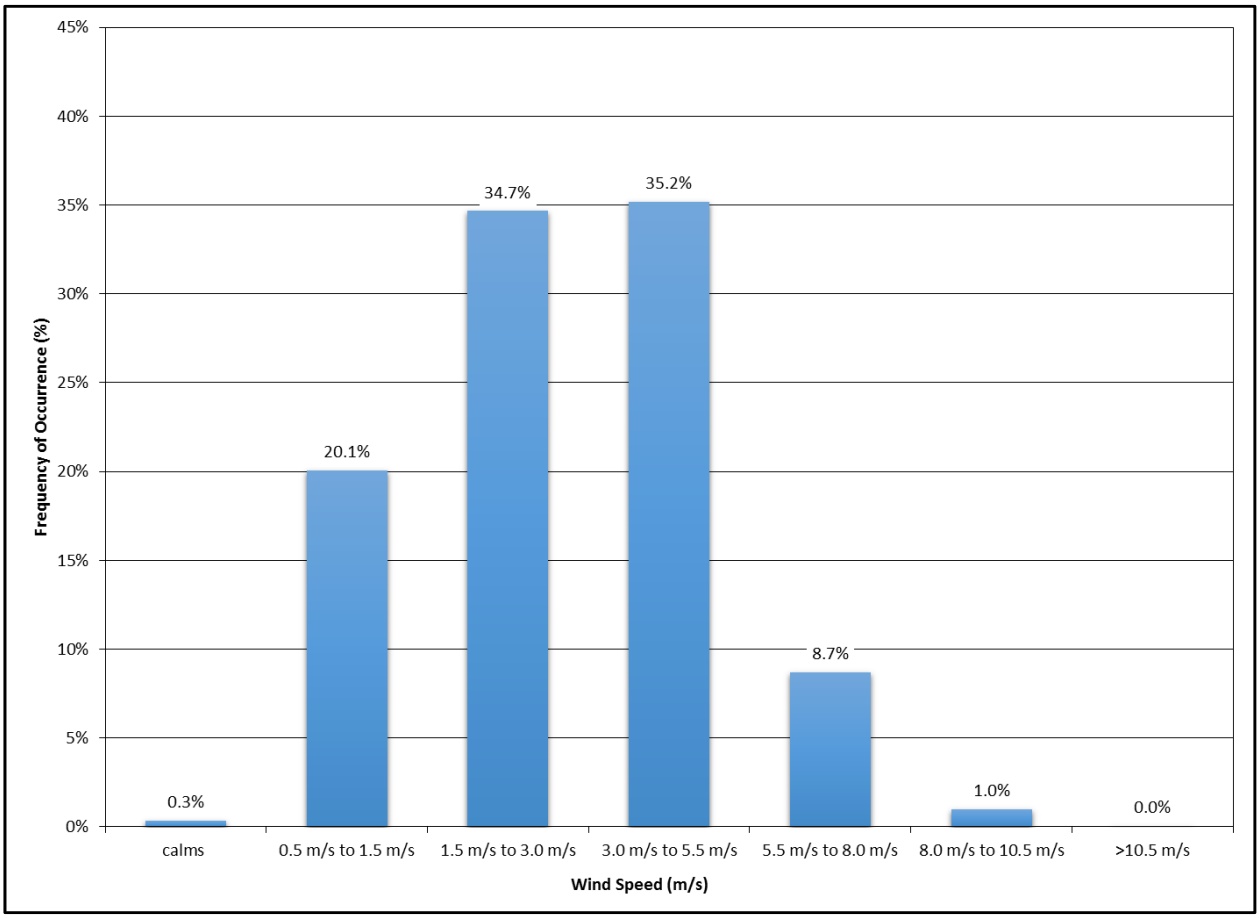


Figure 7-8: Wind Speed Frequency Distribution for the Rotorua EWS

The following wind speed categories are shown in Figure 7-8:

- Wind speeds less than 0.45 m/s ‘Calm’ or Beaufort 0;
- Wind speeds between 0.5 m/s and 1.5 m/s ‘Light Air’ or Beaufort 1;
- Wind speeds between 1.5 m/s and 3 m/s ‘Light Breeze’ or Beaufort 2;
- Wind speeds between 3 m/s and 5.5 m/s ‘Gentle Breeze’ or Beaufort 3;
- Wind speeds between 5.5 m/s and 8 m/s ‘Moderate Breeze’ or Beaufort 4;
- Wind speeds between 8 m/s and 10.5 m/s ‘Fresh Breeze’ or Beaufort 5; and,
- Wind speeds greater than or equal to 10.5 m/s ‘Strong Breeze’ or Beaufort 6.

Figure 7-8 indicates that the majority of the 1-hour mean wind speeds (90% of the total) were between 0.5 m/s and 5.5 m/s (i.e. ‘light air’ to ‘gentle breeze’ conditions). Only 8.7% of the wind speeds were between 5.5 m/s and 8 m/s, and there were only 1% above 8 m/s. There were five occasions when the 1-hour mean wind speed was above 10.5 m/s (or 0.04% of the total). The frequency of low wind speed conditions (below 3 m/s) was fairly high at 55%, which is potentially significant as these conditions are most often associated with odour nuisance effects due to a reduction in the dispersion and dilution potential of an odour plume.

The seasonal wind roses for the Rotorua EWS for the period 25 September 2015 to 31 December 2016 are shown in Figure 7-9 and indicate that:

- In spring (September, October and November or ‘SON’), the winds were predominately from the WSW, W, SW and NNE;

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- In summer (December, January and February or 'DJF'), the winds were predominately from the NNE and to a lesser extent the SW. The higher frequency of winds from the NNE is indicative of 'lake breeze' conditions which are likely to occur at this time of the year;
- In autumn (March, April and May or 'MAM'), the winds were predominately from the SSW, SW and S; and
- In winter (June, July and August or 'JJA'), the winds were predominately from the SSW, S and SW.

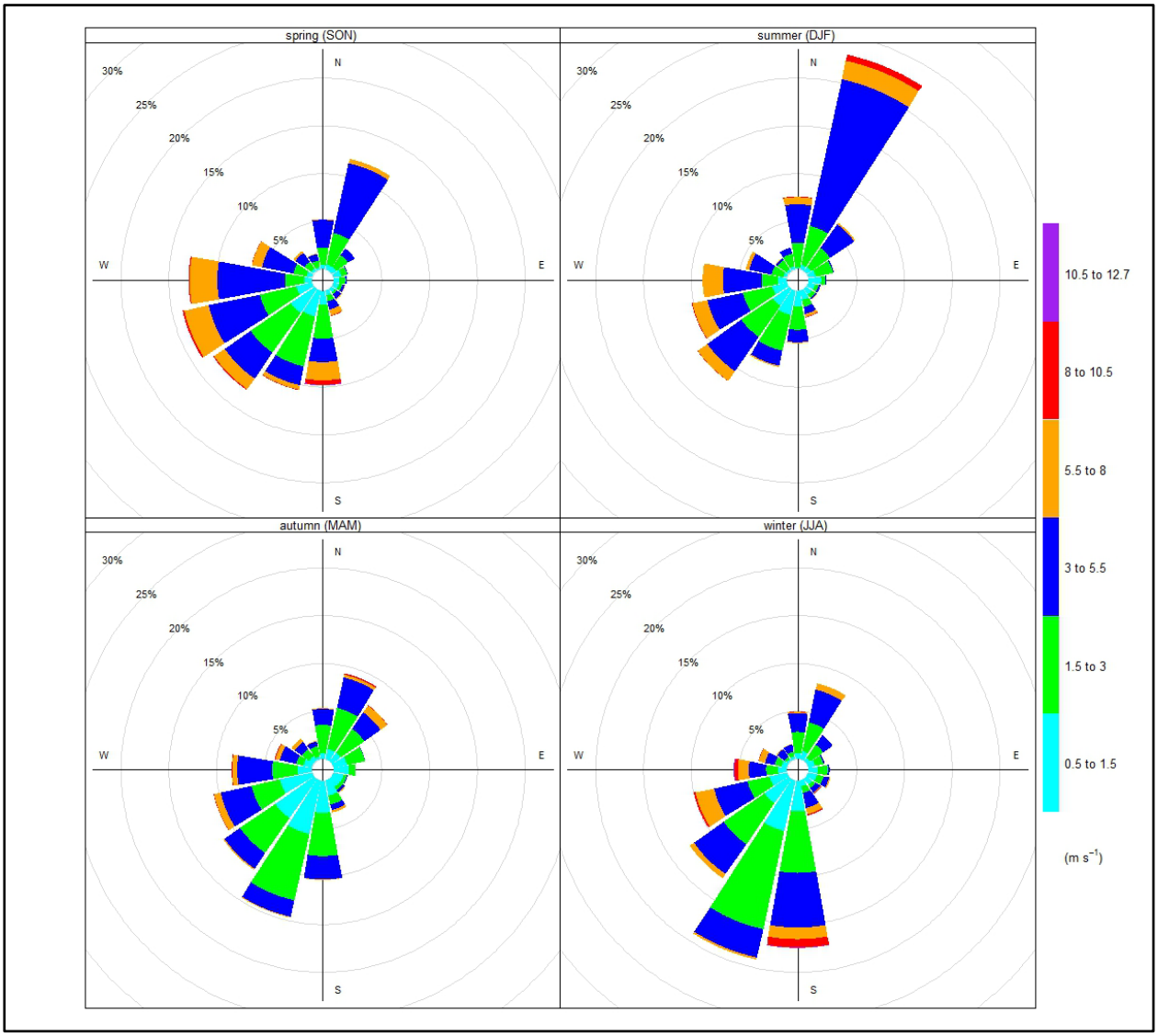


Figure 7-9: Seasonal Wind Roses for the Rotorua EWS

The day-time and night-time wind roses for Rotorua EWS are shown in Figure 7-10 and indicate that:

- During the day-time, the winds were predominately from the NNE, which is likely to be due to lake breeze conditions during spring and summer; and,
- During the night-time, the winds were predominately from the SSW, SW and WSW.

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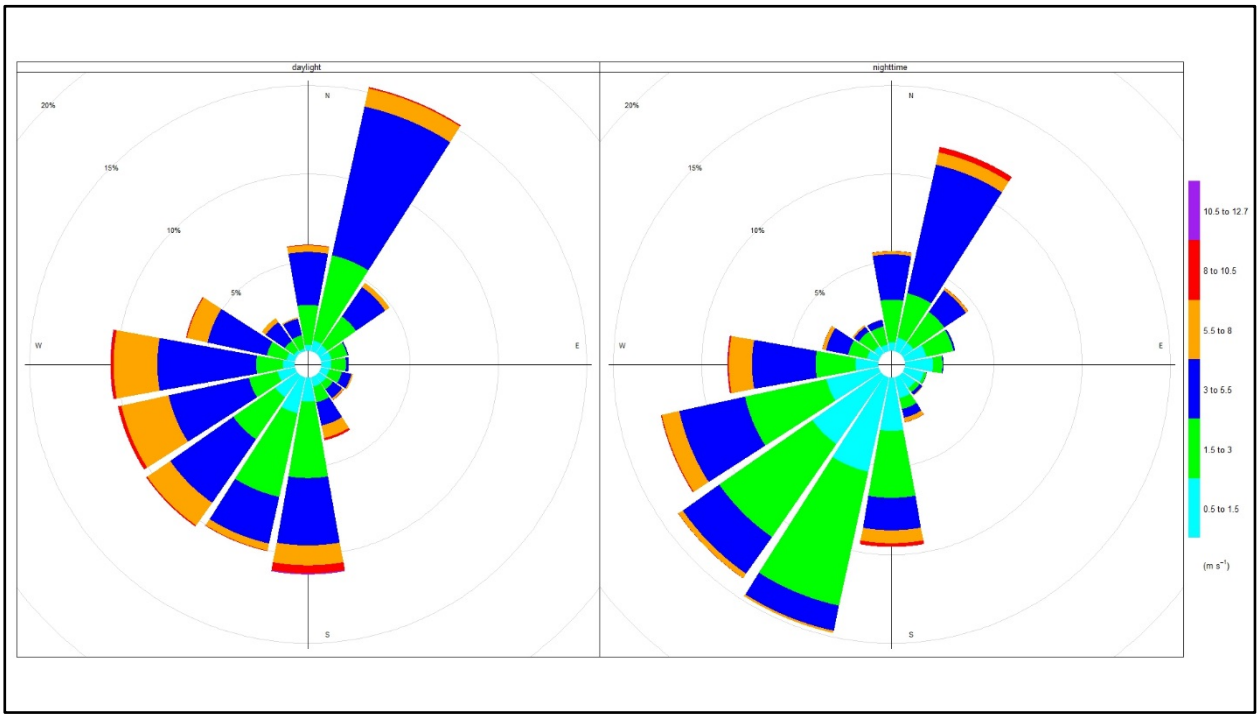


Figure 7-10: Day-time and Night-time Wind Roses for the Rotorua EWS

In fact, the hour-of-the-day wind roses for Rotorua EWS are shown in Figure 7-11 and indicate that there was a gradual shift in the wind directions from 8:00 am and 9:00 am (when the winds were predominantly from the S, WSW and SW, as they were during the early hours of the day). At 11:00 am, the winds were predominantly from the NNE where they remained dominant until 4:00 pm, which is indicative of lake breeze conditions. The predominant wind direction at 9:00 pm was WSW, suggesting the cessation of the lake breeze for the day.

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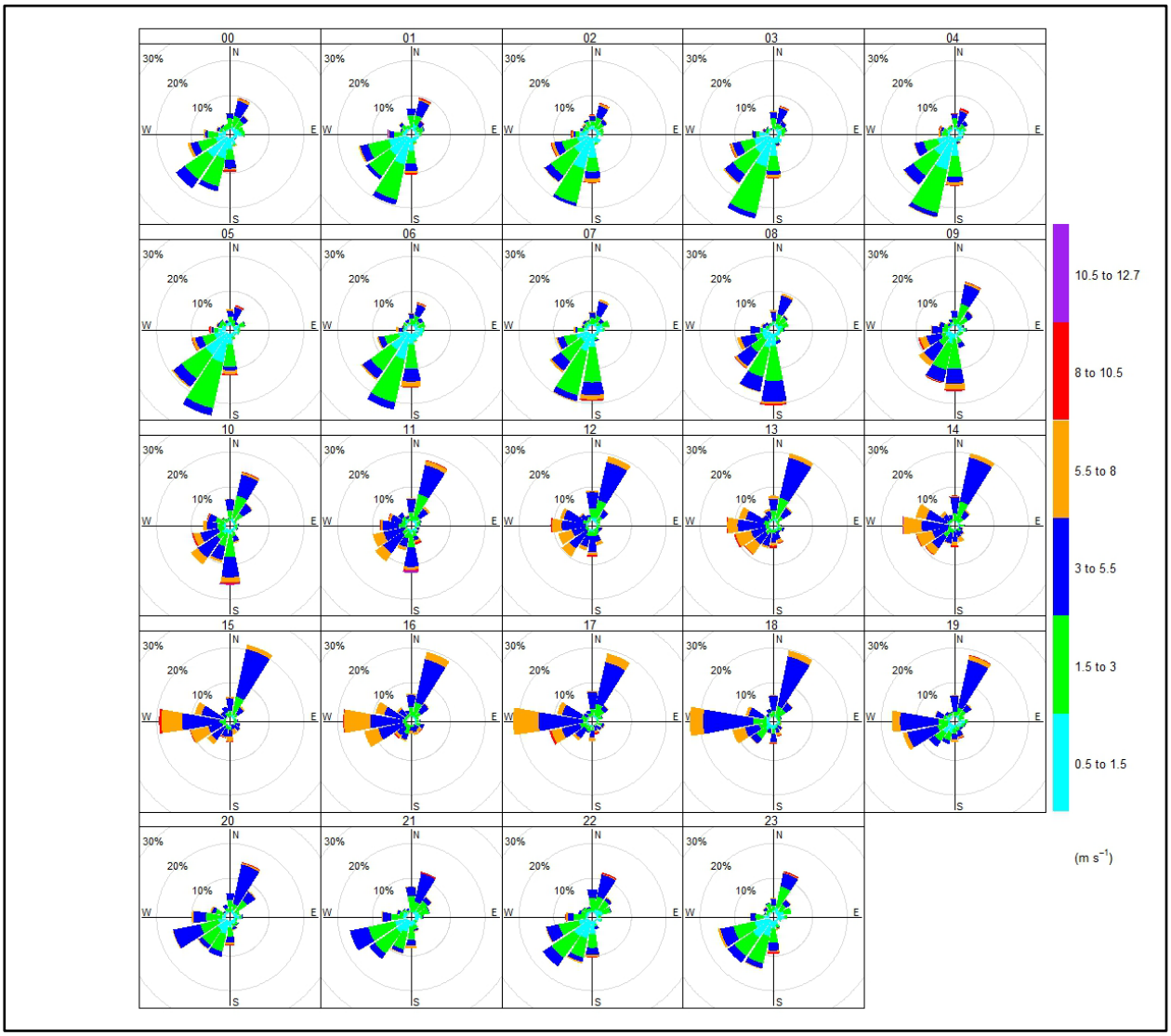


Figure 7-11: Hour-of-the-day Wind Roses for the Rotorua EWS

7.7.4.2 Existing Odour Emissions

Stantec visited the WWTP on 1 November 2016 between 10.30 am and 1.30 pm during which time all treatment processes and activities were operating as normal. A site walkover was undertaken by an MWH odour scout between 10.35 am and 11.40 am in order to gain a better understanding of the activities undertaken onsite and to identify the principal emission sources of odour. A field odour investigation was undertaken at the site between 11.40 am and 1.03 pm.

The weather conditions between 10.30 am and 1.30 pm on 1 November were sunny and warm (between 13 °C and 17 °C) with scattered clouds and 'light air' to 'moderate breeze' winds from the north-north-west (NNW). The wind speed was estimated on-site using the Beaufort wind force scale, and the data were compared against the instantaneous wind speeds measured at the nearest personal automatic weather station (AWS) on the Weather Underground (WU) database,[17] which was located approximately 6 km north-east of the WWTP at the Rotorua Airport (WU reference 'IROTORUA4; latitude 38.106 ºS, longitude 176.315 ºE). The wind speeds measured at the personal AWS ranged between 1.3 m/s and

[17] Weather Underground: https://www.wunderground.com

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6.1 m/s and the wind directions were predominantly north (N), north-north-west (NNW) and north-west (NW).

At each field odour monitoring investigation (sniff test) location, the meteorological conditions (e.g. approximate wind speed and wind direction) were recorded, along with any notable odour-generating activity being undertaken on-site at the time.

The odour intensity, odour character, hedonic tone and a description of the odour were recorded every 10 seconds (i.e. for each sniff) for 10 minutes at each location. Odour intensity was scored on a 7-point scale ranging from 0 for 'no odour' to 6 for an 'extremely strong' odour (see Table 7-7). It was also noted whether the odour was 'objectionable' or 'offensive' (i.e. there was the potential to cause nuisance effects or annoyance in the surrounding community).

Upon completion of each 10-minute sniff test, the odour persistence (or percentage time that odour was detected) was recorded for each sniff over a 1-minute period (i.e. minute 11). This persistence value was then compared against the persistence value determined from the 10-minute assessment.

Table 7-7: Odour Intensity Scale

Odour Intensity	Description
0	No odour
1	Very weak
2	Weak
3	Distinct
4	Strong
5	Very strong
6	Extremely strong

The Stantec odour scout undertook a field odour monitoring investigation (sniff test) at six locations situated downwind of the principal odour emission sources located at the WWTP and at a single upwind monitoring location. The monitoring locations are referred to as sites 'S_1' to 'S_7' and are shown in Figure 7-12.

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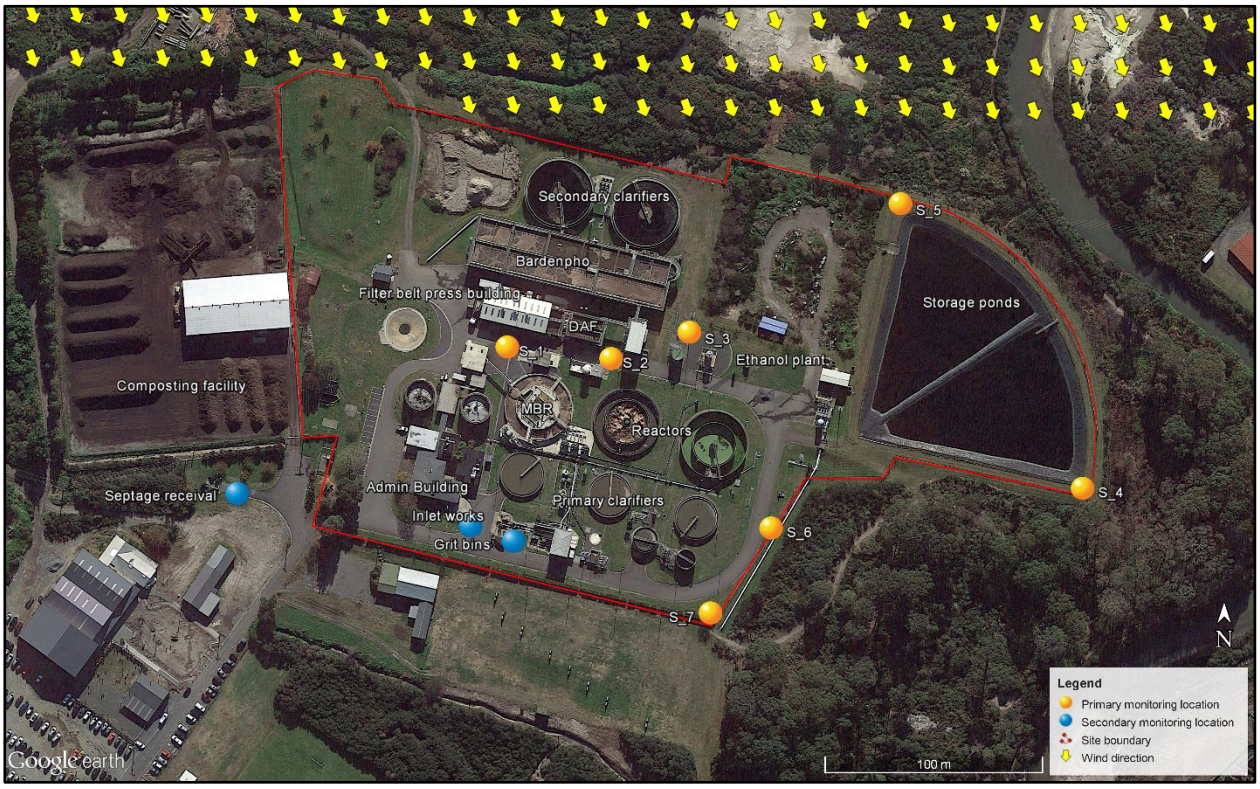


Figure 7-12: Aerial Basemap Showing the Field Odour Monitoring Site Locations

Site 'S_1' was situated downwind of the filter belt press (or sludge dewatering) building, while site 'S_2' was downwind of the DAF tanks. Site 'S_3' was situated downwind of the Bardenpho tank, while site 'S_4' was situated on the site boundary and downwind of the storage ponds. Site 'S_5' was situated on the site boundary and upwind of the principal odour emission sources located onsite and downwind of the geothermal (background) odour emission sources located to the north of the WWTP. Sites 'S_6' and 'S_7' were situated on the site boundary and downwind of the primary clarifiers.

In addition to the primary monitoring locations (S_1 to S_7), the odour intensity was assessed at the inlet works, grit bins and septage receival point (secondary monitoring locations), which are also shown in Figure 7-12.

The field odour investigation commenced at site S_1 at 11.40 am and was completed at 11.50 am, after undertaking a walk through the building. The investigation then continued at site S_2 (11.52 am to 12.02 pm), then at S_3 (12.07 pm to 12.17 pm) and then at S_4 (12.24 pm to 12.34 pm). To check for potential olfactory fatigue[18], the investigation was undertaken at the upwind monitoring location at S_5 (12.40 pm to 12.50 pm), before odour was assessed at S_6 (12.52 pm to 1.02 pm) and finally at S_7 (1.03 pm to 1.13 pm).

The field odour investigation at the inlet works, grit bins and septage receival point was undertaken between 1.15 pm and 1.30 pm.

The results of the field odour investigation are summarised in Table 7-8.

[18] Olfactory fatigue results from a normal but temporary inability to detect (sense) a particular smell after being exposed to it for a long time. Once you are no longer exposed to the smell, the ability to detect that particular smell returns.

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Table 7-8: Summary of the Odour Intensity Scores at Each Sniff Test Location

Site	Start Time	End Time	Wind Speed (m/s)	Wind Dir.	Avg. Intensity	Modal Intensity	Min. Intensity	Max. Intensity	Persistence (%)
S_1	11.40 am	11.50 am	1.8	NNW	4	4	2	6	100
S_2	11.52 am	12.02 pm	2.4	NNW	3	2	1	5	100
S_3	12.07 pm	12.17 pm	3.0	NNW	3	3	2	5	100
S_4	12.24 pm	12.34 pm	6.1	NNW	1	1	0	3	75
S_5	12.40 pm	12.50 pm	5.4	NNW	2	2	1	5	100
S_6	12.52 pm	1.02 pm	5.6	NNW	4	3	2	5	100
S_7	1.03 pm	1.13 pm	5.9	NNW	2	2	0	4	93

The highest odour intensities were observed at sites S_1, S_2, S_3, S_5 and S_6 where scores of '5' and '6' were recorded. The persistence ranged between 75% (i.e. odour was transient but was detected for the majority of the time) and 100% (i.e. odour was present all the time or every sniff). The highest average odour intensity of '4' was recorded at sites S_1 and S_6. The highest modal and maximum intensities of '4' and '6' were recorded at site S_1. A more detailed analysis of the results is provided below.

At site S_1 (approximately 10 m downwind of the filter belt press building) the odour intensities were '4' (or 'strong') for the majority of the time (42% of the total). Intensities of '2' (or 'weak'), '3' (or 'distinct'), '5' (or 'very strong') and '6' (or 'extremely strong') occurred at this location for 10%, 27%, 20% and 2% of the time, respectively. There were no odour intensities below '2'. The odour at this location was mostly described as being 'sewer', 'earthy', 'pungent' and 'sickly'. These odours were considered to be 'moderately unpleasant' and 'extremely unpleasant' and objectionable or offensive at the time of the site visit. The persistence was 100%, indicating that odours were detected every sniff.

At site S_2 (approximately 8 m downwind of the DAF tanks) the odour intensities were '2' (or 'weak') for the majority of the time (52% of the total). Intensities of '1' (or 'very weak'), '3' (or 'distinct'), '4' (or 'strong') or '5' (or 'very strong') occurred at this location for 5%, 25%, 12% and 7% of the time, respectively. There were no odour intensities below '1' or above '5'. The odour at this location was mostly described as being 'sewer', 'H_2S' and 'treatment plant'. These odours were considered to be 'moderately unpleasant' but not objectionable or offensive at the time of the site visit. The persistence was 100%, indicating that odours were detected every sniff.

At site S_3 (approximately 16 m downwind of the Bardenpho tank) the odour intensities were '3' (or 'distinct') for the majority of the time (48% of the total). Intensities of '2' (or 'weak'), '4' (or 'strong') or '5' (or 'very strong') occurred at this location for 20%, 28%, and 3% of the time, respectively. There were no odour intensities below '2' or above '5'. The odour at this location was mostly described as being 'sewer', 'H_2S', 'treatment plant' and 'soapy'. These odours were considered to be 'moderately unpleasant' but not objectionable or offensive at the time of the site visit. The persistence was 100%, indicating that odours were detected every sniff.

At site S_4 (on the site boundary and approximately 4 m downwind of the shoreline of the southern storage pond) the odour intensities were '1' (or 'very weak') for the majority of the time (48% of the total). Intensities of '0' (or 'no odour'), '2' (or 'weak') or '3' (or 'distinct') occurred at this location for 25%, 23%, and 3% of the time, respectively. There were no odour intensities above '3'. The odour at this location was mostly described as being 'H_2S', however, occasionally odours from nearby vegetation

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could be detected (e.g. eucalyptus, gorse). The H_2S odours were considered to be 'slightly unpleasant' but not objectionable or offensive at the time of the site visit. The persistence was 75%, indicating that odours were not detected every sniff but were present for the majority of the time (i.e. odour was transient).

At site S_5 (at the northern site boundary and upwind of the WWTP odour emission sources, but downwind of the background geothermal odour emission sources) the odour intensities were '2' (or 'weak') for the majority of the time (38% of the total). Intensities of '1' (or 'very weak'), '3' (or 'distinct'), '4' (or 'strong') or '5' (or 'very strong') occurred at this location for 18%, 30%, 10% and 3% of the time, respectively. There were no odour intensities below '1' or above '5'. The odour at this location was mostly described as being 'H_2S'. These odours were considered to be 'moderately unpleasant' but not objectionable or offensive at the time of the site visit. The persistence was 100%, indicating that odours were detected every sniff.

At site S_6 (on the site boundary and approximately 30 m downwind of the reactor tank) the odour intensities were '3' (or 'distinct') for the majority of the time (47% of the total). Intensities of '2' (or 'weak'), '4' (or 'strong') or '5' (or 'very strong') occurred at this location for 3%, 37%, and 13% of the time, respectively. There were no odour intensities below '2' or above '5'. The odour at this location was mostly described as being 'H_2S' and 'treatment plant'. These odours were considered to be 'moderately unpleasant' but not objectionable or offensive at the time of the site visit. The persistence was 100%, indicating that odours were detected every sniff.

At site S_7 (on the site boundary and approximately 33 m downwind of the primary clarifiers) the odour intensities were '2' (or 'weak') for the majority of the time (37% of the total). Intensities of '0' (or 'no odour'), '1' (or 'very weak'), '3' (or 'distinct') or '4' (or 'strong') occurred at this location for 7%, 32%, 22% and 3% of the time, respectively. There were no odour intensities above '4'. The odour at this location was mostly described as being 'H_2S', 'organic' and 'musty'. These odours were considered to be 'moderately unpleasant' but not objectionable or offensive at the time of the site visit. The persistence was 93%, indicating that odours were detected almost every sniff.

During a walk around the site, 'distinct' H_2S or sewer-type odours were detected immediately downwind of the grit bins, while 'strong' H_2S or sewer-type odours were detected immediately downwind of the inlet works. The odour intensity decreased with distance downwind from the inlet works, and the intensity was mostly 'distinct' at the southern boundary of the site (approximately 15 m downwind of the inlet works). The odours at the southern boundary were considered to be 'moderately unpleasant', but not objectionable or offensive, at the time of the site visit.

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The odour intensity frequencies recorded at the WWTP (at sites S_1 to S_7) on 1 November are shown in Figure 7-13.

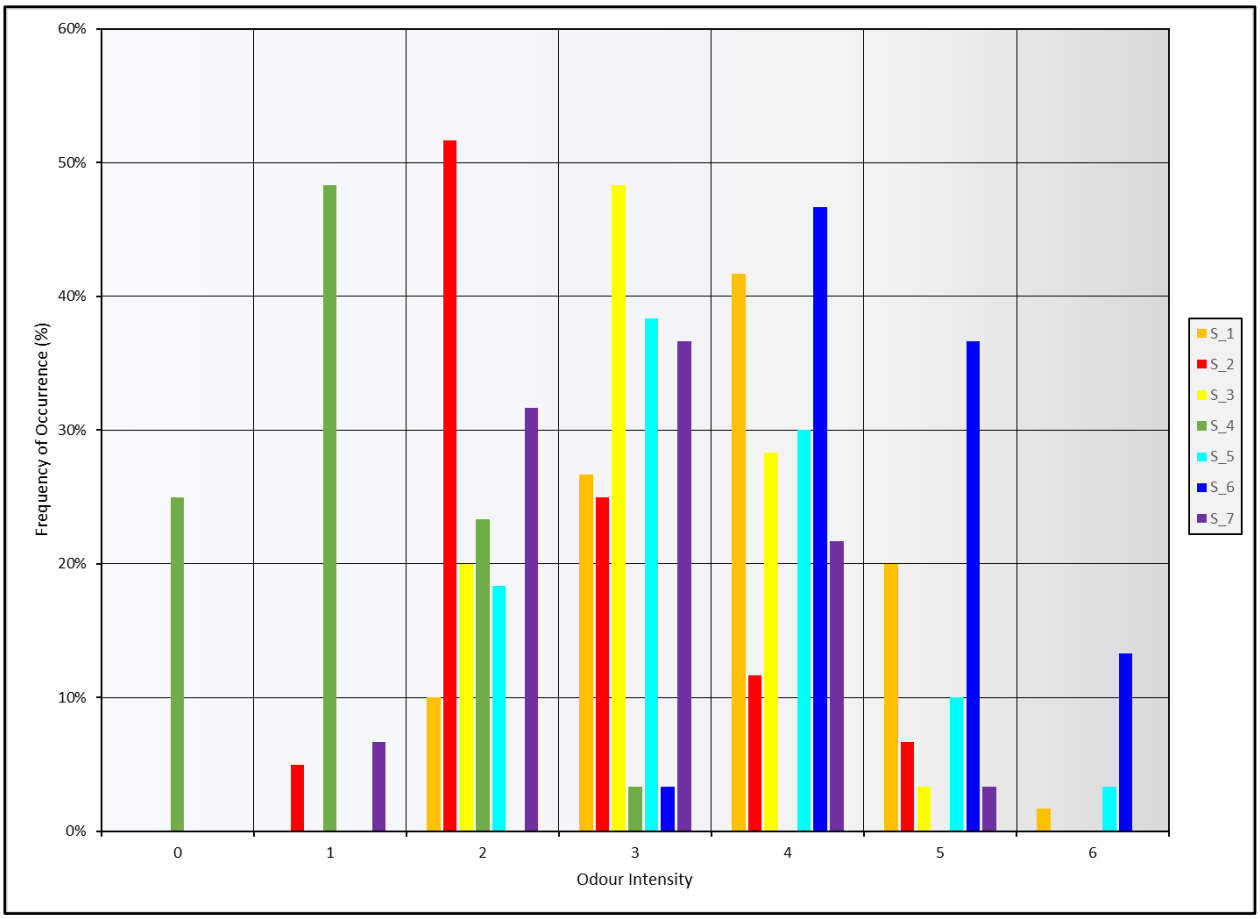


Figure 7-13: Odour Intensity Frequencies Recorded at the WWTP on 1 November 2016

The field odour investigation determined that high-intensity, extremely unpleasant odours occur within and downwind of the sludge dewatering building, while high-intensity, moderately unpleasant odours occur at the inlet works, grit bins, Bardenpho and DAF tanks. Odour intensity was found to decrease with distance downwind from the principal odour emission sources, and moderate-intensity ('distinct' or 'intensity 3') odours were mostly detected at the site boundary monitoring locations.

The existing odour emissions at the WWTP, particularly from the inlet works, sludge dewatering building, Bardenpho and DAF tanks, are likely to comprise of moderate-intensity, moderately unpleasant odours, which have the potential to be frequently detected at the boundary of the site. However, in consideration of the local meteorological conditions and the FIDOL factors (including the distance and direction downwind of the principal odour emission sources relative to the prevailing wind directions and the sensitivity of discrete sensitive receptor locations R1 to R12), it is considered that there is a low risk of odour nuisance effects (offensive and objectionable odour effects or adverse effects) at the sensitive receptors located beyond the boundary of the WWTP.

7.7.4.3 Proposed Odour Emissions

The proposed WWTP upgrade to a full MBR plus UV treatment plant is set out in Section 4 of this AEE. A number of the existing WWTP items will be decommissioned (e.g. the existing MBR, two doughnut reactor tanks, three primary clarifiers, the volatile fatty acid (VFA) mixer tank and thickener tank). This will remove the contribution of odour emissions from these sources. Furthermore, the new inlet works, which will comprise coarse and fine screens and a grit removal system, will be covered and the foul air will be extracted and vented to a biofilter for treatment. In other words, the odour emissions at the inlet

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works will significantly reduce following the completion of the proposed upgrade, providing the seal around the cover is airtight (i.e. the capture efficiency is at least 95%) and the biofilter is designed, operated and maintained in accordance with best practice. A possible overall site layout following the WWTP upgrade is shown in Figure 7-14, based on the Preferred Scheme.

The existing secondary clarifier tanks will be converted to provide storage for stormflows, while the conventional activated sludge Bardenpho plant will be converted to a full Bardenpho-configured membrane bioreactor, involving a new MBR tank, a new RAS tank, a new scum tank, and a new UV system. The odour emissions from the new MBR, RAS and scum tanks will depend on the aerobic condition of the wastewater (i.e. that there is an adequate level of dissolved oxygen) and the sludge and scum removal facilities are adequate. If the wastewater is kept in an aerobic condition and sludge and scum is regularly removed, the potential for the release of high-intensity odours from the new MBR, RAS and scum tanks will be reduced.

The two existing treated wastewater storage ponds will be converted to a new cultural treatment land contact bed with weir and rock cascade outfall structures to the lake. This structure will feature as a small waterfall. The treated wastewater from the upgraded plant will be discharged to the northern and southern contact beds. With the very high quality of the treated wastewater entering the land contact bed, and the design of the flows through it, it is considered that the odour generation potential from the contact beds and its discharge will be very low.

Therefore, following the proposed WWTP upgrade, the principal odour emission sources are likely to be limited to the Bardenpho, sludge dewatering building, DAF tanks, stormflow storage tanks, the new MBR and RAS tanks, and the new biofilter which will provide odour control at the new inlet works. Stantec considers that the odour intensities at these emission sources have the potential to be of moderate-intensity (‘distinct’ or ‘intensity 3’). In consideration of the local meteorological conditions and the FIDOL factors (including the distance and direction downwind of the principal odour emission sources relative to the prevailing wind directions and the sensitivity of discrete sensitive receptor locations R1 to R12), it is considered that there is a low risk of odour nuisance effects (offensive and objectionable odour effects or adverse effects) at the sensitive receptors located beyond the boundary of the WWTP following the proposed plant upgrade. In fact, it is possible that there will be a reduction in the total odour emissions at the WWTP following the upgrade.

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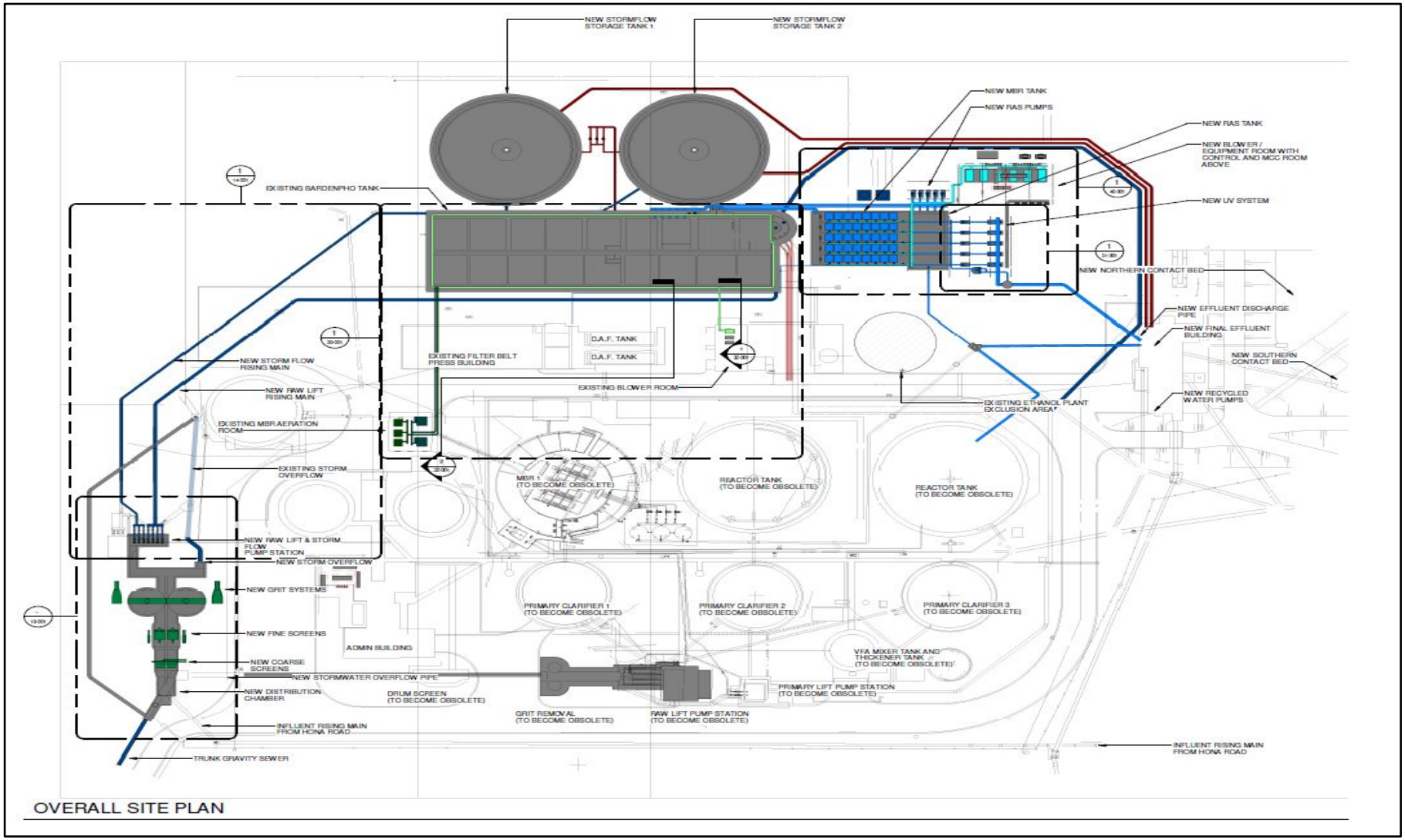


Figure 7-14: Overall Site Layout for the Proposed Upgraded WWTP

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7.7.5 Odour Management Plan

An Odour Management Plan (OMP) is proposed to be prepared for the WWTP and will show how the activities undertaken on-site will comply with the conditions of the resource consent (where relevant) and how the discharge of contaminants to air, including any adverse effects (e.g. odour complaints), will be managed and controlled. The OMP will be a 'live' document and will be regularly updated by the RLC to incorporate any operational activities which have the potential to release and/or control odour at the site. It will also assign managerial or operational responsibilities for maintaining the OMP, implementing the OMP and responding to odour-related incidents (complaints), including providing feedback to complainants, the BOPRC, and/or the local community.

The OMP will address the management of odours at each stage of the source-pathway-receptor (SPR) model and include, but not be limited to, the following aspects:

- Identification of all sources of odour on the site and their locations. The RLC should provide a site layout plan identifying each odour emission source location;
- Odour control measures employed on the site including odour abatement systems and techniques;
- Management procedures, including Descriptions of the roles and responsibilities of personnel on-site and the procedures for materials handling (including sludge), storage, use of equipment etc.;
- Repair and maintenance of plant and equipment should be undertaken in accordance with manufacturer's recommendations. The availability of equipment and spares should be documented in the OMP;
- Monitoring should be systematically planned and should address what, where, when and how such monitoring should be undertaken. Monitoring could include source sampling of odour emissions, site inspections and surveys (e.g. field odour investigations), reviewing the complaints log and analysing the local meteorological conditions;
- Communication with relevant interested parties, including methods used, content and frequency of communication with complainants, the BOPRC and the local community;
- Emergency and incident response procedures, including the scenarios that could occur and the measures to be employed to reduce their impact. Scenarios may include: breakdown of abatement equipment, spillages and "worst-case" meteorological conditions (such as certain wind directions or temperature inversions during which the dispersion of odour may be limited);
- Staff training required to be undertaken by site personnel, including any particular monitoring requirements;
- Identification of sensitive receptors in order to understand the local receiving environment and the locations where receptors may be impacted. A site layout plan should be provided, identifying each sensitive receptor location; and,
- Accurate and thorough record-keeping is an essential part of an OMP. Records should include maintenance of plant, monitoring results, communications carried out, incidents (e.g. complaints), training etc.

7.7.6 Odour Assessment Summary

7.7.6.1 Existing Odour Emissions

The field odour investigation has determined that the principal existing sources of odour emissions at the WWTP include the inlet works, grit bins, sludge dewatering building, Bardenpho and DAF tanks,

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which comprise of moderate-intensity, moderately unpleasant odours and which have the potential to be frequently detected at the boundary of the site. However, taking into account the local meteorological conditions and the FIDOL factors (including the distance and direction downwind of the principal odour emission sources relative to the prevailing wind directions and the sensitivity of discrete sensitive receptor locations R1 to R12), it is considered that there is a low risk of odour nuisance effects (offensive and objectionable odour effects or adverse effects) at the sensitive receptors located beyond the boundary of the WWTP.

Therefore, the field odour investigation and associated FIDOL assessment has determined that there are unlikely to be any odour nuisance effects at any sensitive receptor locations, providing that the odour mitigation measures recommended above are implemented at the WWTP.

7.7.6.2 Future Potential Odour Emissions

The odour assessment has determined that the principal future sources of odour emissions at the WWTP following the plant upgrade are likely to include the sludge dewatering building, Bardenpho, DAF tanks and the new MBR (including RAS and scum tanks). The resulting odour emissions may be of moderate-intensity and be moderately unpleasant and thus may have the potential to be frequently detected at the boundary of the site. However, taking into account the local meteorological conditions and the FIDOL factors (including the distance and direction downwind of the principal odour emission sources relative to the prevailing wind directions and the sensitivity of discrete sensitive receptor locations R1 to R12), it is considered that there is a low risk of odour nuisance effects (offensive and objectionable odour effects or adverse effects) at the sensitive receptors located beyond the boundary of the WWTP.

Therefore, the odour assessment has determined that there are unlikely to be any odour nuisance effects at any sensitive receptor locations, providing that the odour mitigation measures recommended above are implemented at the WWTP.

7.8 Maori Cultural Effects

7.8.1 Historical Background

In the 1980s the Bay of Plenty Catchment Commission, along with the Rotorua District Council and the Ministry of Works, had gained approval to implement the “Kaituna River major scheme” which aimed, *inter alia*, to improve the water pollution problem within Lake Rotorua and it included building a pipeline so that wastewater from the Rotorua WWTP would be piped directly into the Kaituna River instead of the lake. In 1984 Waitangi Tribunal issued its report on the Kaituna River Claim (Wai 4) which included recommendations to the Crown that, *inter alia*:

- *the policy of the Crown by which a pipeline is to be constructed to discharge effluent from the Rotorua District Council Waste Water Treatment Plant into the Kaituna River be abandoned as being contrary to the principles of the Treaty of Waitangi*; and
- *research be undertaken into the possibility of disposing of such effluent by discharging the same on the land in a suitable and practical manner instead of discharging the same into Lake Rotorua.*

The Crown’s response was to abandon all financial support for the pipeline and it announced its support for a combined treatment plant and land-disposal option for Rotorua's wastewater – something that the progressed by setting up the LTS in the Whakarewarewa Forest.

The Waitangi Tribunal’s report further stated:

- *To mingle the effluent with the waters of Lake Rotorua is offensive to Maori spiritual and cultural values. But to find a practical solution we note and emphasise that the waters of Sulphur Bay*

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are not used for any purpose (see para. 7.16) and this is the most practical course we can recommend in the absence of land disposal which is the preferred alternative, but which is not currently available.

And para 7.16 states:

- *At present the treated effluent from the City's Waste Water Treatment Plant is discharged to the Puarenga Stream and enters the lake at the bay a short distance away. He noted the acid conditions of the bay and that the phosphorus discharge from the plant appeared to be largely removed as the stream water flowed across it. A reduction in coliform bacteria was also attributed to a die-off in Sulphur Bay waters. In brief, the potential of the treatment plant effluent in terms of its nutrient concentration to lake waters is reduced by the passage of the effluent through that bay. We noted also that for those same reasons Sulphur Bay does not support fish or plant life. It is associated with thermal activity, has a visibly cloudy appearance and is not used by the Maori people or the general public for recreational or food-gathering purposes. Dr Donovan considered that if there were to be any discharge to the lake a discharge to Sulphur Bay would be an appropriate point both for its unusual chemical properties and for the lack of public use.*

7.8.2 Sites of Significance

Two Cultural Impact Assessments (CIAs) have been prepared and included as Companion Documents No. 1 and 2. The CIAs identified a number of discrete sites of significance in the lower reaches of the Puarenga Stream and Puarenga Bay. The proposal will avoid many of these sites, either as a result of distance or no material effect. There are a small number of sites of particular significance that may be affected by the discharge of treated wastewater to Puarenga Bay. These include Te Mapou and Te Arikiroa. Lake Rotorua and the Rotorua geothermal resource are considered to be taonga. It is expected that the 'taonga' status gives weight to the requirement to 'avoid and protect' these resources from adverse effects.

The sites and areas affected by the proposal to discharge to Puarenga Bay include:

- The proposed wastewater discharge will enter Puarenga Bay and may contact geothermal surface expressions (ngawha). The Rotorua geothermal area is recognised as a taonga to Te Arawa. Ngawha should be protected and avoided;
- The proposed wastewater discharge may overflow to the Puarenga Stream (without bunds) due to the low gradient and/or because of circulation within Puarenga Bay. The Puarenga Stream is of high significance to Ngāti Hurunga Te Rangi and Ngāti Te Kahu. A discharge to the stream would be offensive to the tāngata whenua where it may come into contact with food preparation areas;
- The proposed wastewater discharge will enter Lake Rotorua via Puarenga Bay. Lake Rotorua is recognised as a taonga to Te Arawa;
- The current WWTP and proposed discharge location at Puarenga Bay is within close proximity to or located on the former bird harvesting area Te Mapou and a wāhi tapu Te Waiwhitiinanga, an area associated with a battle. The battle site appears to be buried under the former landfill and Te Mapou is part of the existing wastewater treatment lands where the existing retention ponds and facilities are located.
- The foreshore in this area is known as Te Arikiroa an area associated with the tradition of Ngatoroirangi bringing the 'fire' from Hawaiki to Tongariro.
- There are places to the east of the Puarenga Stream used for cooking and healing. The association of wastewater and the lake as a food basket is anathema to having a kitchen in the

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toilet/bathroom. This affects the perception of Te Arawa whanau, in particular local resident hapū members to discontinue harvesting of kai and cooking in the lake in proximity to the discharge area (Puarenga). The abundance and physical health of these species is not affected, but gathering at this site for kai purposes will not likely occur due to the association and proximity to the treated wastewater discharge.

- The Puarenga Bay is a hostile and dangerous environment toxic to most terrestrial and aquatic life. It is however a natural environment. Introduction of some 20 ML of treated wastewater a day represents a significant change to the natural environment. This change is likely to be reflected in a steady stream of water entering the Puarenga Bay and meandering across the Puarenga Bay flats towards the lake.

7.8.3 Statutory Acknowledgements

There are two relevant Statutory Acknowledgements. These are the Statutory Acknowledgements for the bed of Lake Rotorua and the Rotorua Region Geothermal System.

The Lake Rotorua Statutory Acknowledgement is included in section 65 of the Te Arawa Lakes Settlement Act 2006. The Statutory Acknowledgement sets out the nature of the traditional relationships Te Arawa people have with the lake.

The Statutory Acknowledgement requires the relevant consent authorities, the Environment Court, and the Historic Places Trust to have regard to the statutory acknowledgement, as provided for in sections 62 to 64 of Te Arawa Lakes Settlement Act 2006; and to require the relevant consent authorities to forward summaries of all applications for resource consents to the Trustees of the Te Arawa Lakes Trust, as provided for in section 66 of Te Arawa Lakes Settlement Act 2006; and to enable the Trustees and members of Te Arawa to cite the statutory acknowledgement as evidence of the association of Te Arawa with the Statutory Area.

The Statutory Acknowledgement for the Rotorua Region Geothermal System is included in section 32 of the Affiliate Te Arawa Iwi and Hapū Claims Settlement Act 2008. The Statutory Acknowledgement for eleven iwi and hapū acknowledges the geothermal resource as a taonga. This resource includes ngawha, puia and waiariki used for cooking, bathing, medicinal properties, paints, dyes and wāhi tapu.

The eleven iwi and hapū are:

- Ngāti Ngararanui (including Ngāti Tamahika and Ngāti Tuteaiti);
- Ngāti Kearoa Ngāti Tuara;
- Ngāti Tura – Ngāti Te Ngakau;
- Ngāti Te Roro o Te Rangi;
- Ngāti Tuteniu;
- Ngāti Uenukukopako;
- Tuhourangi Ngāti Wāhiao;
- Ngāti Tahu – Ngāti Whaoa;
- Ngāti Pikiao (excluding Ngāti Makino);
- Ngāti Rongomai; and
- Ngāti Tarawhai

Similar to the Lake Rotorua Statutory Acknowledgment it requires consent authorities and the Environment Court to have regard to the geothermal statutory acknowledgement, as provided for in

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sections 38 and 39 of the Affiliate Te Arawa Iwi and Hapū Claims Settlement Act 2008; require relevant consent authorities to forward summaries of certain kinds of resource consent applications to the trustees, as provided for in section 41 of the Affiliate Te Arawa Iwi and Hapū Claims Settlement Act 2008; and enable the trustees and a member of the Affiliate to cite the geothermal statutory acknowledgement as evidence of the association of the Affiliate with the relevant geothermal resource.

7.8.4 Maori Cultural Impact Assessment

The proposed discharge of treated wastewater to Lake Rotorua is controversial. This is reflected in the amount of time the Preferred Scheme has taken to be developed, consulted on, and now included in an application for consent. Whilst the proposals to upgrade the Rotorua WWTP received unanimous support among iwi and hapū, community and the RLC representatives, there was no consensus among Te Arawa iwi, hapū and whanau regarding the discharge proposal. It has received both broad support and local condemnation.

This Waitangi Tribunal report was a watershed case and it set the scene nationally for the preference of Māori for the discharge of wastewater to land (Papatuanuku). Ironically, the Tribunal recommended as a second option, Puarenga Bay as a discharge point. More than 30 years has passed since that decision. The land resource around Lake Rotorua is a finite resource which Māori land owners derive significant economic returns from. The Whakarewarewa Forest owners and managers have rejected the continuation of treated wastewater discharge to land there. Some land based treatment systems in New Zealand and overseas are now failing to deliver community and indigenous expectations in terms of treatment. Wastewater treatment plants have improved with significant technological improvements in water supply treatment now common in wastewater treatment. Several countries in Asia and the Pacific now recycle wastewater, some even use and sell it as drinking water. Whilst it is within living memory of most New Zealanders that systems only involved primary screening, those are now considered unacceptable. But perceptions associated with discharges of wastewater prevail and are not easily changed.

The overall assessment of cultural effects of this proposal do not sit nicely on one side or the other. The proposal cannot be neatly described as having effects less than minor or having significant adverse effects. That would be simplistic and convenient. The proposal exhibits a number of positive and negative cultural effects, the weighing of these by decision-makers will be a difficult task. Nevertheless, a decision must be made and the assessment here has endeavoured to articulate accurately the concerns of tāngata whenua and provide an assessment of the cultural effects within the context of the RMA.

The proposal to construct a land contact bed with a range of segmented wetland and aggregate environments for treated wastewater to flow through is not new in New Zealand. However, this proposal is considered to be innovative and meaningful due to the primacy of cultural concerns and incorporation of Māori concepts and values into the conceptualisation and design.

As mentioned earlier, there is both broad support and local condemnation for the discharge proposal. Among those who support the proposal are significant entities with important roles in the well-being of Lake Rotorua and its people. These include the Te Arawa Lakes Trust[19], Te Tatau o Te Arawa, Te Pukenga Koeke o Te Arawa[20] and Pukeroa-Oruawhata Trust. Wider iwi and hapū groups are either neutral, supportive or opposed to the proposal. It is understood that the support or neutrality of most parties is based on the effort to find a 'innovative cultural' solution for the proposed discharge. There is however, strong opposition to the proposal from hapū who have what could be considered primary or close relationships with the land on which the WWTP is located and the areas proposed for the discharge. This opposition is not unanimous, but nevertheless should not be discounted. The

[19] Hui with Te Arawa Lakes Trust. Friday 25 August 2017.
[20] Hui with Te Pukenga Koeke o Te Arawa. 25 August 2017

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opposition of these groups to any discharge proposal to water has been consistent and well recorded. The group in opposition includes Ngāti Hurunga Te Rangi, Ngāti Uenukukopako, Ngāti Te Roro-o-Te-Rangi and Ngāti Te Rangiteaorere. These hapū have marae and resident communities at Ngapuna, Puarenga and Ohinemutu, areas within close proximity to the proposal area.

This assessment concludes that the proposal to discharge treated wastewater to Lake Rotorua will have some significant adverse effects. Those effects are deemed to be:

- A loss of mana among local hapū who are strongly opposed to the discharge to the Rotorua-nui-a-Kahumatamomoe as a matter of principle. This loss of mana could be described as a belittling of Rangātiratanga (authority of chiefs) by perpetuating an unacceptable activity;
- A loss of mana resulting from the discharge of a wastewater regardless of the quality of treatment to an ancestral icon, Rotorua-nui-a-Kahumatamomoe. The lake is synonymous with Te Arawa ancestors. The association of the lake with wastewater is perceived as an offence;
- Effects on the relationship between local resident hapū members and the lake expressed through the activities of fishing and harvesting, cooking and healing. The association of wastewater and the lake as a food basket is anathema to having a kitchen in the toilet/bathroom. This affects the perception of Te Arawa whanau, in particular local resident hapū members to discontinue harvesting of kai and cooking in the lake in proximity to the discharge area (Puarenga). This effect does not extend to the abundance of kai or the quality of the kaimoana.

There are also some adverse effects of a low to moderate nature that are likely. These include:

- Effects on the natural character of the Puarenga environment. The introduction of some 20 ML of treated wastewater a day represents a significant change to the natural environment.

This assessment also concludes that the proposal to discharge treated wastewater to Lake Rotorua will have some significant positive effects. These are deemed to be:

- Positive effects on the mauri of the treated wastewater. This will involve the spiritual cleansing of the treated wastewater as it passes through the various experiences and contexts within the land contact bed and be in a state of ‘mauri tau’.
- Positive effects on water quality at the point of discharge, Puarenga Bay. The water and environment is toxic to most aquatic life and hazardous to humans. The water being discharged is a higher quality than the receiving environment.
- Positive effects on the quality of the amenity of the local area. The contact bed and the discharge point will be a high quality landscaped area that will improve public access, education and visual attractiveness.
- Positive effects on the Whakarewarewa Forest through reductions in water inundation and nutrient saturation resulting in improved growth of trees. This will provide increased economic returns to Māori landowners.
- Positive effects on the mana of Te Puarenga Stream, through the cessation of discharge to the tributaries of the Puarenga Stream.

The proposal will allow for alternative uses of the treated wastewater and future sites should they be practical and feasible. This is provided for through the construction and maintenance of a valve that can be accessed by heavy vehicles such as tankers and fire trucks.

7.9 Beneficial Reuse of Treated Wastewater

Component 6 of the Preferred Scheme is the implementation of beneficial reuse of treated wastewater (discussed in Section 4.4.6 of this AEE). A Beneficial Reuse Management Plan (BRMP) approach is

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proposed and provided for in the volunteered conditions in Appendix K. Discussions with BOPRC staff have been supportive of this approach. The alternatives assessments along with the Public Health Risk Assessment (Section 7.6 of this AEE) has addressed the potential effects that relate to the application to land of high quality treated wastewater as produced from the preferred treatment scheme.

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8 Mitigation Measures

8.1 Discharge of Treated Wastewater

The preferred treatment system will produce a very high quality of treated wastewater. This system has been developed to address the following:

- That TN mass load discharge limits discharged to Sulphur Bay (Lake Rotorua) will not exceed the sustainable long term limits that have been determined to be consistent with the provisions of wastewater allocation of the RPS;
- That the TP mass loads will similarly ensure sustainable discharge in terms of the phosphorus and the phosphorus nitrogen ratios relating to Sulphur Bay (Lake Rotorua);
- Providing a very high level of public health protection through the provision of the proposed membrane and UV disinfection system (double barrier); and
- Ensuring high level removal of other contaminants including suspended solids – organic material, micro-pollutants, such that the effects and receiving environment are less than minor.

8.2 Discharge of Contaminants (Odour) to Air

The mitigation measures that will be implemented to minimise odour emissions at the WWTP following the plant upgrade include, but are not limited to, the following:

(a) General

- Sufficient competent personnel will be available 24 hours per day, 7 days per week to respond to plant malfunctions and odour complaints, should they arise;
- Good housekeeping practices by keeping the plant and the surrounding areas clean;
- All mechanical equipment (including aerators and the inlet works blower, ductwork and biofilter) will be well maintained and operated in accordance with best practice, such that odour emissions are kept to a practicable minimum;
- An OMP will be developed and implemented for the WWTP (this is discussed in more detail in section 7.7.5);

(b) Inlet Screen, Screenings and Grit Removal

- The screenings will be removed from the bar screens on a daily basis and the units will be regularly cleaned and flushed such that odour emissions are kept to a practicable minimum. Screenings will be removed from the WWTP as soon as possible after skips are filled, and on at least a weekly basis;
- The seal around the inlet works cover is airtight and the foul air extracted and vented to the odour control facility (e.g. biofilter);

(c) Bardenpho reactor

- Wastewater entering the Bardenpho is aerobic and is maintained in a sufficiently aerated condition. The RLC will monitor the Bardenpho for dissolved oxygen on at least a monthly basis. Care will be taken not to disturb any sludge or organic material that may have accumulated at the bottom of the tank during aeration as this has the potential to release odour;

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- The build-up of algae, scum or foam on the sides and surface of the Bardenpho will be avoided;

(d) New MBR, RAS and Scum Tanks

- Aeration will be maintained throughout the whole MBR-RAS system. The RLC will monitor for dissolved oxygen on at least a monthly basis;
- Care will be taken not to disturb any sludge or organic material that may have accumulated at the bottom of the tanks during aeration as this has the potential to release odour.
- The build-up of algae, scum or foam on the sides and surface of the new MBR tank will be avoided;

(e) Land Contact Bed and Rock Cascade Outfall Waterfall Structures

- Wastewater entering the new contact beds will be aerobic;
- The build-up of algae, scum or foam on the sides and surface of the contact beds will be avoided;
- Significant changes in the wastewater level in the contact beds will be avoided;
- The new rock cascade and outfall structures will be regularly cleaned and maintained;

(f) Sludge Management and Sludge Dewatering Building

- Where possible and practicable, all doors to the sludge dewatering building will be kept closed at all times, to reduce the release of fugitive (uncontrolled) odours from the building;
- Dewatered stabilised sludge will be disposed of appropriately.

8.3 Beneficial Reuse of Treated Wastewater

The use of high quality treated wastewater for beneficial reuse will reduce the volume of wastewater being discharged to the Te Arikiroa Thermal Channel and then Sulphur Bay (Lake Rotorua) – this will also reduce mass loads of nutrients discharged to the lake. The extent of this reduction will depend on the volume used for beneficial reuse. For the beneficial reuse procedures, the mitigation measures adopted will relate to the actual type of reuse. As these are not known at this time, they have not been identified other than to record that such mitigation measures must be consistent when the BRMPs are prepared as outlined in volunteered conditions in Section 14 and Appendix K of this AEE.

8.4 Cultural Values

The cultural impact assessments (CIAs) have recommended a range of measures to avoid, mitigate or remedy effects on cultural values. This section sets out the recommendations and the corresponding responses of Rotorua Lakes Council (RLC) including the volunteered conditions contained in Appendix K.

The CIAs recommend a formal relationship between the RLC and Iwi of Lake Rotorua should be established to oversee and manage the implementation of the proposal once it has achieved necessary consents. The condition will require the establishment of a forum that could regularly monitor and periodically review the performance of the WWTP, review the results of monitoring and assessments of monitoring, receive and comment on a range of plans that support the implementation of the consent conditions, receive reports on alternative discharge locations and methods, the adoption of new technology, advise on cultural interpretation, suggest opportunities to conduct rituals, ceremonies and activities associated with the establishment, completion of works and start of operations and consider issues of concern. A similar forum was established for the Tauranga Wastewater Treatment Plant and

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continues to monitor the consents and administer a research and restoration fund. This assessment recommends that the forum have strong local representation, that is iwi and hapū with close association with the Ngapuna/Puarenga area. The RLC accepts this recommendation and it is reflected in Condition 6 that establishes the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group.

The CIA for the discharge of treated wastewater to Lake Rotorua recommended establishing a reference group of Māori cultural experts. The condition will require this reference group to provide Mātauranga Māori advice and direction regarding the delivery of a land contact bed and monitor the performance of the Land Contact Bed and the mauri of the receiving water in Puarenga Bay. RLC accepts this recommendation and has volunteered Condition 13 that establishes and maintains a Te Hunga Mātauranga Māori made up of Te Arawa cultural experts who will have a number of roles including preparing a cultural monitoring plan that will monitor the performance of the Land Contact Bed and the mauri of the receiving water in Puarenga Bay.

The CIA has recommended having an expert available to local tāngata whenua during the term of consents. This would provide capability resource to members of the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group. The Group can receive unbiased advice and have the expert explain the meaning of the technical language and results of monitoring. The RLC has accepted this recommendation and volunteered condition 10 that an independent expert be available to support the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group to fulfil its functions.

The CIAs have recommended that the RLC should look to establishing and maintaining relationship agreements with hapū that share manawhenua with the site of the WWTP, either collectively or individually. These relationship agreements could address mana whenua concerns with the ongoing operations of the treatment plant but also wider concerns that may not be able to be addressed in consent conditions. The RLC has accepted this recommendation and is engaging with relevant manawhenua groups to establish formal relationships with Council. This recommendation goes beyond the 'effects' of the treatment plant proposals and as such, sits outside any consents granted so conditions have not been proferred for this initiative.

The CIAs have recommended the preparation of a cultural monitoring plan and the results of monitoring be presented at regular intervals to the forum of iwi and hapū representatives. The cultural monitoring plan should set out results and any key issues with the performance of the land contact bed. RLC has accepted this recommendation and volunteered Condition 16 that requires a cultural monitoring plan to be prepared by the Consent Holder in consultation with Te Hunga Mātauranga Māori. Conditions 4 and 18 will require the Consent Holder (RLC) to report the results of the cultural monitoring to the Consent Authority and the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group annually within an Annual Report.

The CIAs have recommended a range of cultural mitigation and environmental enhancement measures to recognise the significant adverse effects of the proposal. Conditions of consent will require the Consent Holder in consultation with a forum to prepare and resource a cultural mitigation and environmental enhancement plan. The plan will include a range of activities such as riparian planting and landscaping of areas adjacent to the WWTP, local conservation projects, local community water infrastructure projects, and cultural and environmental enhancements projects identified by the forum. RLC has accepted this recommendation and volunteered Condition 19 that requires the preparation and resourcing of a Cultural Mitigation and Environmental Enhancement Plan (CMEEP). The CMEEP includes activities such as revegetation of areas adjacent to the WWTP with native species endemic to the area, riparian planting at the mouth of Puarenga Stream, Lake Rotorua edge and areas adjacent to the discharge channel, landscaping of areas immediately adjacent to the WWTP, local water conservation projects, local community water infrastructure projects and programmes, and environmental and cultural enhancement projects identified by the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group.

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The CIA for the discharge of treated wastewater to Lake Rotorua has recommended that detailed drawings and plans are produced for the land contact bed that reflect the consultation conceptual images. This recommendation also requires establishing performance standards for the land contact bed and a cultural monitoring programme being established to monitor the performance of the land contact bed. This monitoring programme should include relevant Mātauranga Māori indicators and involve the participation of kaitiaki. RLC has accepted this recommendation and has volunteered a range of conditions, including Conditions 14 and 16, that incorporate the guidance and advice of the Te Hunga Mātauranga Māori in the detailed design, construction, operation and performance of a Land Contact Bed, preparation of a Cultural Monitoring Plan to monitor the performance of the Land Contact Bed and the mauri of the receiving water in Puarenga Bay, confirming location and design components including detailed design drawings, inspection and maintenance of the land contact bed, and periodic performance reviews of the land contact bed. The location of the outlet from the land contact bed is a matter that is discussed by Antoine Coffin (author of the two CIA's) in Appendix L of this AEE.

The CIAs have recommended the communication of key results of monitoring be provided to local hapū to provide confidence that the proposed upgrades and discharges are meeting expected performance standards. The RLC will need to be careful that the language used, and the form of reporting is appropriate and understandable for lay people. The CIAs recommend that the periodic communication of monitoring results to tāngata whenua is a condition of consent. This would go some way to recognise the kaitiaki role of tāngata whenua. The RLC has accepted these recommendations in part by volunteering Conditions 4, 8, 18 and 21 that require annual reporting of monitoring results to the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group.

The CIAs noted that current proposals to upgrade the WWTP have been selected to facilitate the addition of future wastewater and water treatment technologies. There is an expectation that conditions of consent will reflect this in periodic reviews and flexibility of the consent to consider significant technological changes and advances in relation to wastewater management, treatment, discharge, and beneficial reuse technologies. The RLC has agreed to volunteer Condition 5 that requires the Consent Holder to prepare and submit a comprehensive Monitoring and Technology Review Report on the 9th, 18th, and 27th anniversaries of the consent. This condition includes an outline of significant technological changes and advances in relation to wastewater management, treatment, discharge, and beneficial reuse technologies that could be of relevance for possible future use in the Rotorua wastewater treatment and discharge facilities.

The CIAs have recommended the decommissioning and/or removal of unnecessary infrastructure such as pipes, ponds, tanks, and plant at the wastewater water treatment plant, over time. The RLC has accepted this recommendation and volunteered Condition 22 that requires within five years of the date of commencement of the consents, the Consent Holder shall take all practicable steps to decommission redundant infrastructure including pipes, ponds, tanks and plant at the WWTP.

The CIAs have recommended the provision of infrastructure to facilitate the beneficial re-use of the treated wastewater. The RLC has incorporated this recommendation into the design of the WWTP upgrade, specifically the provision of a valve that can be accessed by tanker. The RLC is required to seek a discharge permit for Discharge Treated Wastewater to Land via Reuse. The RLC has proffered a volunteered condition that requires a Beneficial Reuse Management Plan (Condition 57) and periodic review of advances in beneficial reuse technologies.

The CIAs have recommended management plan(s) for addressing odour during operation and noise and dust during construction. The RLC has accepted this recommendation for odour by volunteering Condition 61 that shall ensure that the operation of the WWTP does not give rise to any discharge of contaminants (including odour) at or beyond the property boundary of the WWTP, that is deemed by a suitably trained and experienced Enforcement Officer of the Council to be noxious, dangerous, offensive, or objectionable to such an extent that it has, or is likely to have, an adverse effect on the environment. The conditions related to odour include the preparation and implementation of an Odour

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Management Plan under Condition 62. Construction noise, dust and nuisance effects will be managed through any required consents and/or managed within existing bylaws, policies and guidelines.

The CIA for the discharge of treated wastewater to Lake Rotorua has recommended construction of a natural looking bund(s) to prevent the mixing of treated wastewater being discharged from the land contact bed to Lake Rotorua with the waters of the Puarenga Stream. The RLC has accepted this recommendation and sought consent on this basis.

A number of bunding options have been investigated as set out in sections 9.12.7 to 9.12.9 of this AEE. The preferred arrangement of five small short bunds is supported by Antoine Coffin the author of the two CIA's (refer Companion Documents No. 1 and 2) as is set out in his response to the preferred arrangement included in Appendix L of this AEE.

The CIAs have recommended that the conditions of consent should include or refer to accidental discovery protocols. These would require a process for management should koiwi or taonga be accidentally uncovered as a result of the construction of the wastewater treatment upgrades and the discharge infrastructure. The RLC has accepted the recommendation by volunteering Condition 73 that in the event of archaeological sites or koiwi being uncovered, activities in the vicinity of the discovery shall cease and the Consent Holder shall contact Heritage New Zealand. Work shall not recommence in the area of the discovery until the relevant Heritage New Zealand approval has been obtained.

The CIAs recommend a number of research and monitoring programmes and opportunities in the wider Puarenga stream catchment to increase cultural and environmental knowledge that may inform future management. These are largely outside the scope of the consents and their conditions. The RLC has accepted cultural and environmental monitoring programmes for the Puarenga Bay and local cultural mitigation and environmental enhancement measures.

8.5 Wastewater Inputs

Section 4.4.1 of this AEE outlines what is included in Component 1 Wastewater Inputs Management, of the Preferred Scheme. This included the development and periodic review of a Wastewater Strategy. These measures, which relate to management and reductions of untreated of untreated wastewater inputs (on a per person or per industry basis), are each in their own right mitigation measures in terms of the flows, volumes and contaminant concentrations and mass loads occurring at the WWTP and subsequently needing treatment and discharge.

8.6 Te Arikiroa Thermal Channel

The following measures are outputs from the Technical Reports included in Support Document No. 7 with regard to the construction of small bunds adjacent to the Puarenga Stream.

8.6.1 Natural Character, Landscape and Amenity

The following measures are suggested in the Assessment of Effects on Natural Character, Landscape and Amenity Report by Wildlands Consultants (Support Document No.7):

- Careful assessment of the discharge channel design concept is warranted with the aim to avoid or remedy, and minimise adverse effects on Natural Character, the Outstanding Natural Feature and Landscape, and visual amenity of Te Ara Ahi trail users through the detailed design phase;
- Implement a minimum intervention approach, with incremental adjustments over time on an as required basis. That is implement a monitoring process prior to installing flow diversion bunds to prove they are necessary;
- • Similarly implement a minimum intervention approach to Thermal Channel works. Retain vegetation to screen channel modifications. The methodology to include methods for creating a

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natural feature of the channel that contributes positively to this special landscape. Further works should react to actual outcomes rather than be overdesigned to a high confidence level;

- Vegetation management. Indigenous vegetation pruning to be carried out by a qualified arborist briefed on the sensitive site and be supervised by an independent ecologist or equivalent;
- Maintain visual separation of the Te Ara Ahi trail and the Wastewater Treatment Plant compound and the Zone 2 drain. The design should screen the Land Contact Bed from the Te Ara Ahi trail;
- Offset mitigation is being implemented through ecological improvements to Sanatorium Reserve. Positive benefits will occur through the removal of bamboo and other exotic weeds, and the management of these weed areas into representative indigenous geothermal vegetation. This will enhance natural character; and
- Offset mitigation should also include positive benefits through improvements to public access to the lake and stream margins, specifically by reviewing Te Ara Ahi trail through Sulphur Bay. Identify enhancements to trail junctions, minor alignment improvements or board walks if needed, safety, directional signage, and interpretation features.

8.6.2 Ecology

As noted in the Ecological Assessment Report prepared by Wildlands Consultants and included in Support Document No. 7, in ecological terms, the best approach would be to leave the existing channel in its current state, and to utilise alternative approaches for additional discharges to the lake. Ecologically-appropriate alternatives for disposal of increased discharges could include the following:

- Discharge to the Puarenga Stream (culturally unacceptable);
- Discharge into the Whakarewarewa Forest;
- Discharge into a constructed wetland, e.g. between Vaughan Road and Lake Rotorua; or
- Use of an additional discharge point(s), west of Te Arikiroa Thermal Channel.

Further engineering evaluation is being undertaken to determine whether flows down the Puarenga, at various levels, provide a hydraulic barrier to discharges into the thermal channel entering the Puarenga Stream at high lake levels.

Measures to address potential adverse effects include minimising the removal of geothermal vegetation and loss of geothermal habitats.

If the works proceed as proposed, the following will need to be addressed:

- Immediately prior to any works, an ecologist familiar with the ecological values at the site, particularly geothermal habitat, should walk through the site with the crew about to undertake the works and identify the areas to be used to access and undertake the works in a manner to keep any damage to a minimum;
- The works site should be monitored and advice provided (by an ecologist) on management of any effects of the works at immediately following the works;
- Follow-up works (e.g. planting control of weeds) will be required after the works are complete. The site should be monitored to assess ongoing requirements.

There are also other ecological restoration opportunities in the Sanatorium Reserve, as set out in Wildland Consultants (2017) summarised in Section 6.7.2 of this AEE and included in Support Document No. 7.

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8.6.3 Geothermal

As noted in the Geothermal Assessment Report included in Support Document No. 7, there is risk of a hydrothermal eruption being triggered by rapid excavation to deepen or widen the Te Arikiroa Thermal Channel.

Options to mitigate the risk of hydrothermal eruption risk include:

- Moving the channel westward to avoid these areas of high (near boiling) temperature at shallow depth; or
- Reducing the depth of the channel excavation to 0.6 m or less, and expanding its width, to accommodate the same design flowrate. The channel excavation depth constraint would apply where the shallow subsurface temperatures are close to boiling (~99 ^{o}C) and where there exists a hard sinter surface at shallow depth (~0.6 m). The purpose would mitigate the risk of triggering hydrothermal eruptions by avoiding penetration into, or removal of, the hard sinter layer, particularly where such high temperatures exist.

8.6.4 Contaminated Land

The requirement for a Site Management Plan (SMP) for the Te Arikiroa Thermal Channel works and the construction of five small bunds has been completed. The SMP is included in Support Document No. 7 and is referenced in the suite of volunteered conditions in Appendix K.

8.7 Other Mitigation Measures

In addition to the above measures, other mitigation measures are included in the suite of volunteered consent condition set out in Section 14 of this AEE and Appendix K.

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9 Consideration of Alternatives/Options

9.1 Background and Approach

Clause 6(1)(a) of Schedule 4 of the RMA requires an AEE to describe any alternative locations or methods for undertaking the activity to be presented if the activity will result in any significant adverse effects on the environment.

Section 7 of this AEE concludes that no significant adverse water quality effects are expected within Puarenga Bay outside of the zone of reasonable mixing as a result of the discharge of treated wastewater from the WWTP and no significant adverse odour effects are predicted to occur beyond the designation boundary of the WWTP. However, removal of indigenous geothermal vegetation, modifications of Te Arikiroa Thermal Channel and construction of five small bunds adjacent to the Puarenga Stream are expected to have some unavoidable significant adverse ecological, natural character, landscape and amenity effects – noting that a minimal intervention approach is proposed to minimise these adverse effects to the greatest extent practicable. As such, a consideration of alternatives under clause 6(1)(a) of Schedule 4 is required to be presented for those activities for which significant effects are predicted occur (i.e. the indigenous geothermal vegetation, modifications of Te Arikiroa Thermal Channel and construction of five small bunds adjacent to the Puarenga Stream).

In addition, clause 6(1)(d) of Schedule 4 states that, where the activity includes the discharge of a contaminant, the AEE must include a description of any possible alternative methods of discharge including discharge into any other receiving environment. Further, section 105(1)(c) of the RMA requires that the consent authority, when considering any application for a discharge permit that would contravene section 15 of the RMA, must have regard to, in addition to matters in section 104(1), “any possible alternative methods of discharge, including discharge into any other receiving environments”.

The remainder of this section presents the consideration of alternatives required by clauses 6(1)(a) and (1)(d) of Schedule 4 of the RMA. In this Project the RMA term “alternatives” is taken to have the same meaning as the often more commonly used term “options”. These two terms are therefore used interchangeably in this AEE.

An extensive and wide ranging approach was undertaken for the identification and evaluation of options and the subsequent determination of the Preferred Option by the RPSC which was then further developed by the RLC as the Preferred Scheme for which these resource consents are being sought.

Figure 9-1 shows how the alternatives assessment progressed from a “long list” of options to the Preferred Scheme. This approach involved the following parties who all provided valuable input into the options considerations:

- Attendees at the Rotorua Clean Water Symposium in 2013;
- Rotorua Te Arawa Lakes Strategy Group;
- The Rotorua District Council/Lakes Council Councillors and Staff;
- CNI Holdings Trust;
- The RPSC and the CAS;
- The Mātauranga Māori Experts Group in the development of the Land Contact Bed (this Group was formed later in the Project once a land contact system was identified as the preferred option for discharge);
- The TAG; and

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- Other stakeholders and wider iwi and hapu groups and the community at large who were involved in hui, public meetings and making submissions to the RLC.

The structure of this Section of the AEE generally follows the sequence of activities followed in evaluating the alternatives:

- Sections 9.1 and 9.2 ‘set the scene’ including the earlier Clean Water Symposium’s Options;
- Sections 9.3 sets out the TAG’s approach and outputs;
- Sections 9.4 and 9.5 traverse the wastewater strategy and source control options;
- Section 9.6 introduces the shortlisted options for treatment and discharge;
- Section 9.7 summarises the four separate technical studies undertaken by Mott MacDonald;
- Sections 9.8 to 9.11 evaluates the shortlisted treatment options;
- Sections 9.12 to 9.13 traverses the discharge options;
- Section 9.14 identifies the beneficial reuse options;
- Sections 9.15 covers the comparative effects assessment alternatives.

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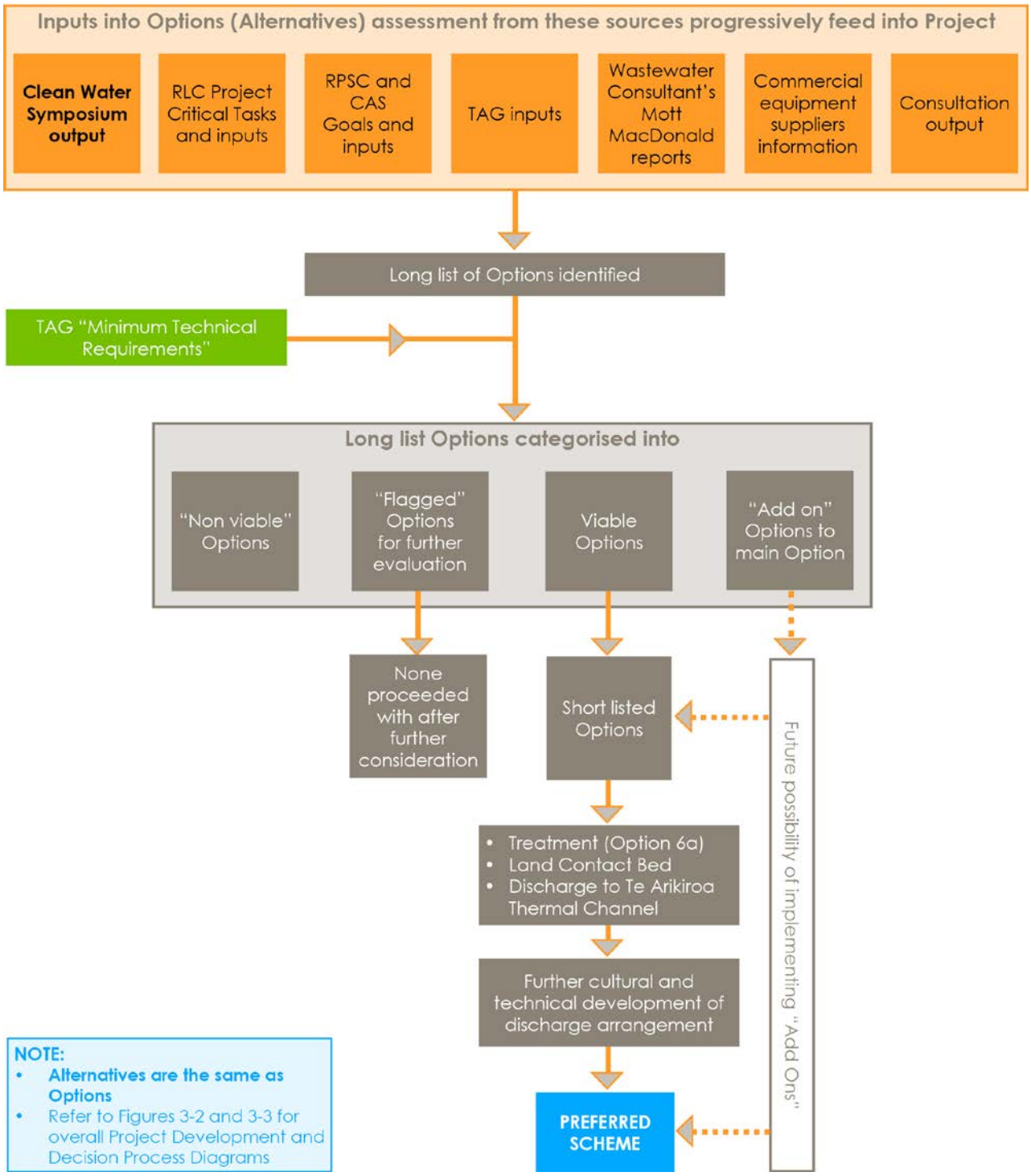


Figure 9-1: Schematic Overview of Input Categories and Progressive Evaluation of Options

9.2 Project – Rotorua Clean Water Symposium Options

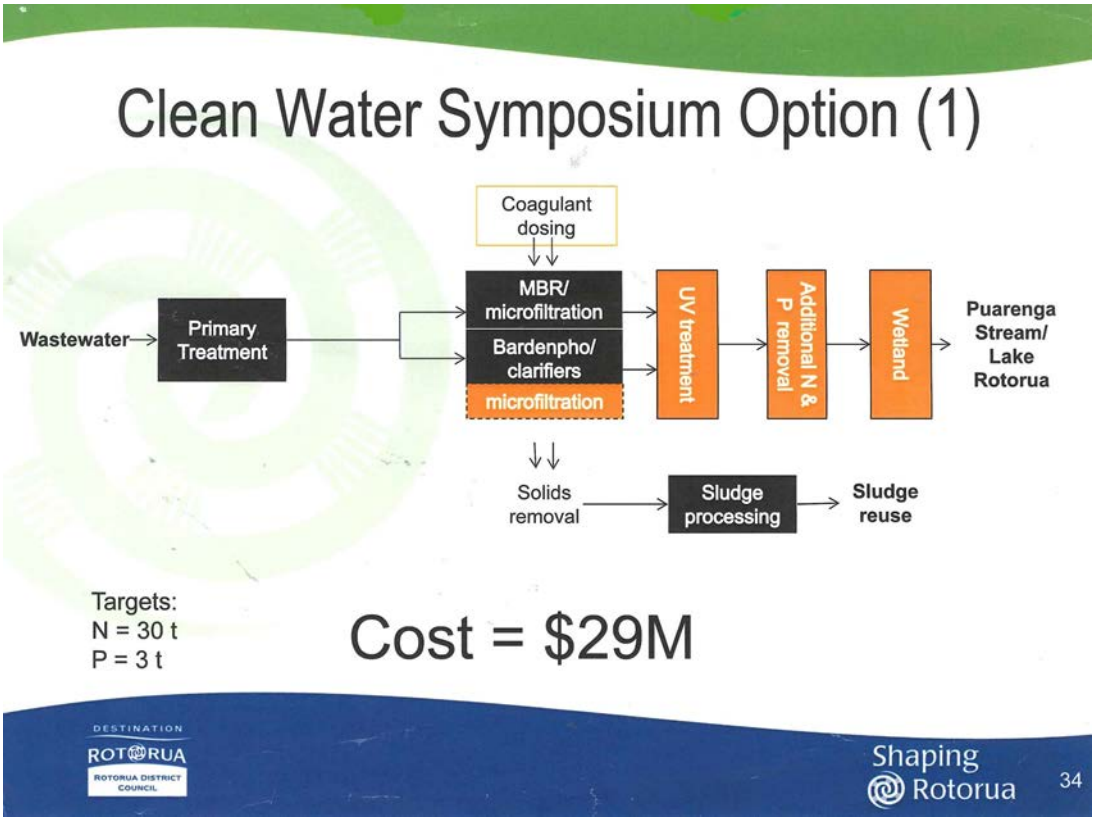
The Rotorua Clean Water Symposium was held in October 2013 and is summarised in Section 3.5 of this AEE. Support Document No. 1 includes the Symposium's proceedings.

At the Symposium two options for nutrient removal (TN and TP) were identified for further consideration as shown in Figure 9-2. Both options also included UV disinfection. Option 1 included the use of a

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wetland before discharge to the Puarenga Stream (which discharges to Lake Rotorua) while Option 2 included a rock passage before also discharging to the Puarenga Stream. The treatment and discharge components associated with these two options were all included in the long list of options.

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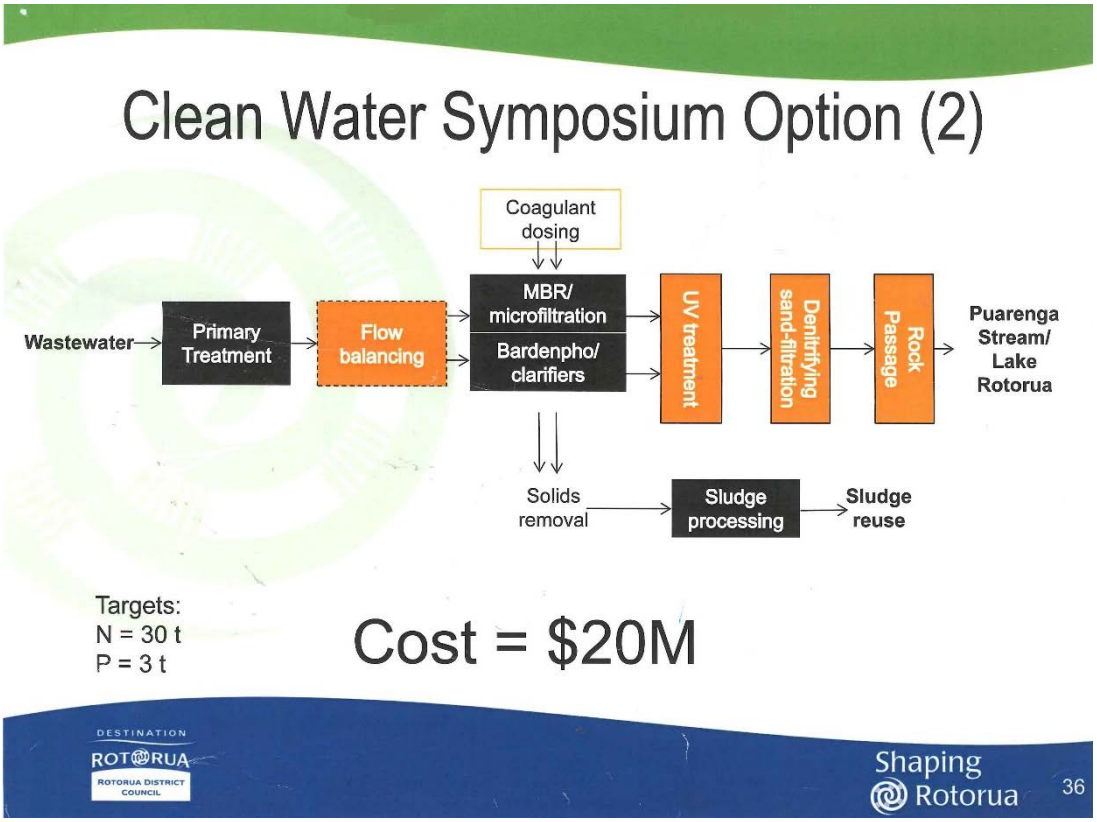


Figure 9-2: Rotorua Clean Water Symposium Options

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9.3 Technical Advisory Group's Approach and Output

9.3.1 Approach

While the TAG's primary focus was to consider the technical and cost aspects of the wide range of options, it also provided advice in respect of the effects of the treated wastewater discharge within the receiving environment. Section 3.8 of this AEE provides a summary of the TAG's activities in servicing the RPSC.

9.3.2 Long List Options

As the Project advanced, the TAG, together with the input from the parties shown in Figure 9-1, developed a 'long list of options for treatment and discharge. The long list options are presented in Table 9-1. The long list options were reported to the RPSC (16 July 2014).

Table 9-1: TAG Long List Options

Long List Options Compiled by the TAG from Inputs as shown in Figure 9-1
New LTS in-catchment
New LTS out of catchment
Base WWTP Upgrade (DRP + UV)
Base-upgrade + Cleanwater 1 (Additional N and P + wetland)
Base-upgrade + Filtration (particulate)
Base-upgrade + Cleanwater 2 (Additional N and P + Rock Passage)
"Best for Lake" – discharge to lower end of catchment e.g. towards Ohau Channel or Kaituna River
Continue LTS
Dual discharge: Lake and LTS
Dual discharge: Domestic reuse (MBR discharge) and LTS
Dual / Triple Collection System and third (purple) pipe reuse system
Algae System
Geothermal aquifer / aquifer injection
Zeolite
Indigitech Enhancement
Other Black Boxes Enhancements
Struvite (Phosphorus recovery)
MicroV

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Long List Options Compiled by the TAG from Inputs as shown in Figure 9-1
Amminox
Direct and indirect discharge options to water
*Flow balancing and TERAX are a committed part of base case upgrade
Identified after 16 July 2014
Full MBR Treatment Plant
Rapid Infiltration Beds (RIB) discharge
Ultra Filtration/Reverse Osmosis (UF/RO)
Beneficial Reuse Options
Additional “Add-On” Options as included in Table 9.6

The RPSC agreed with the TAG’s suggestion that the term “ecosystem re-entry” also be used in the Project to emphasise the discharge of appropriately treated wastewater into the receiving environment ecosystem. The concepts investigated are set out in Table 9-2.

Table 9-2: Ecosystem Re-Entry Concepts Investigated

Water Discharge Options	
Direct discharge to water • Open Pipe • Rock passage to direct discharge	Discharge to water via ecosystem • Wetland • Rapid Infiltration Beds (RIB’s) • Riparian / Gabions • Natural Monitoring Pond • Riparian Strip

The TAG developed a list of minimum technical requirements that it considered necessary to evaluate the long list against. Table 9-3 sets out the TAG’s minimum technical requirements.

Table 9-3: Technical Advisory Group (TAG) – Minimum Technical Requirements[21]

TAG Minimum Technical Requirements	Criteria
Economically viable	• Total cost and specify $/kg TN removed
Meets the purpose of the Local Government Act 2002	• Infrastructure that meets current and future needs in a way that is most cost-effective for households and business

[21] Technical = engineering, environmental, economic

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TAG Minimum Technical Requirements	Criteria
Technically viable	• Integrates with existing WWTP • Complete solution, technically possible, proven robust, reliable, flexible • Engineering resilience (natural hazards and climate change)
Legally viable and contestable from a technical perspective	• Meets key planning and statutory requirements • Appropriate available land access and long term use
Meets Environment Court Consent Order (following abatement notice March 2012)	• To select and pursue a "viable alternative", "the objective being to minimise, as far as practicable, the discharge of nutrients entering Lake Rotorua and its tributaries"
Meets previously agreed upon principles from the Rotorua Clean Water Symposium (Sept 2013)	• If discharging to water, is pure enough to support life • Discharge in Rotorua Catchment (unless agreed by those outside catchment) • Pathogen kill e.g. UV light disinfection
Meets previously agreed upon conditions in principle relating to LTS use of CNI land	• Does not discharge to CNI land • Could potentially be commissioned by 2019
Protects public health and avoids nuisance	• Protects public health and avoids nuisance • Protects water supplies, food sources, recreation
TAG also to seek advice from RPSC on culturally acceptable solutions	
Consider cultural acceptability	• Cultural goal is nil transfer of para (human waste) from one catchment to another and if that cannot be achieved as a goal then a compromise may be needed.

Each of the long list options were evaluated by the TAG against these minimum technical requirements. As part of this this evaluation each of the long list options were categorised as either non-viable, flagged for future consideration, parked for possible further evaluation, or shortlisted for detailed evaluation. The following sections cover this sequence of evaluation.

9.3.2.1 Non-Viable and Flagged Options

The options which were assessed as being non-viable options are presented in Table 9-4.

Table 9-4: Non-Viable Options

Option	Main Issues
New LTS outside catchment	High capex: $40M excl land and piping/transfer, high opex ($1.2M/yr); out of catchment not acceptable to RPSC

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Option	Main Issues
Dual discharge: lake and existing LTS	Agreement to cease existing irrigation on CNI land
Dual discharge with domestic reuse or separate treatment of greywater	Excessive capex to retrofit, potential public health issues
Algae	Trial showed insufficient algae growth so not viable
Zeolite	Negligible Ammonia to remove
Struvite	Viable but not with TERAX
MicroV	Appropriateness of application?
Amminox	Incomplete, does not integrate well with WWTP

The TAG further identified options on the long list that were worthy of further consideration in terms of whether they may make the 'short list – these were referred to as the 'flagged options'. Table 9-5 presents the flagged options together with a summary of what further work/investigation was then recommended to be undertaken by the TAG.

Table 9-5: TAG's Flagged Options

Options	Main Issues / Further Investigation
'Best for Lake' - discharge to lower end of Lake Rotorua catchment (near Ohau channel or Kaituna River?)	Water Quality TAG advised that this is not best for Rotoiti if near channel TAG advises feasible from an engineering perspective but asked RPSC about cultural considerations Not considered further due to the earlier Waitangi Tribunal recommendations and the Crown's (then) decision to abandon such an option
Geothermal aquifer / aquifer injection	Flagged by TAG for further consideration, specialist advice being sought and TAG asks RPSC about cultural considerations
Enhanced Treatment Plant: earth filters, Indigitech, Activated Carbon, other?	TAG will investigate for additional treatment or enhancement as the prototypes and proven processes as they are available or may become available for testing or full scale implementation
Soil Enhancement – Biochar, other?	Questionable economics and practicality for large LTS areas

The "Best for Lake" option and the geothermal aquifer injection option were subsequently determined to not be acceptable to iwi and hapu groups and were therefore not considered further.

9.3.3 "Add-On" Options

During the Project a number of "Add-On" options were considered – these being options that could be added to the WWTP's basic treatment processes to enhance parts of the treatment process and/or to a land application area to also enhance performance.

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Table 9-6 lists the "Add-On" options that were with considered and identifies which party proposed the add-on and its respective function(s).

Table 9-6: "Add-On" Options Considered

"Add-On" Technology	Party that Proposed the "Add-On" be considered	Key Function of "Add-On"
Indigitech	Indigitech	Polish and filtering techniques
Zeolite	RPSC/TAG – Various suppliers	Cationic exchange micro pollutant removal
Activated Caron and Biochar	RPSC/TAG	Improved trace organics, micro pollutants, colour, taste and odour improvement
MicroV	MicroV Technology	Nitrogen and phosphorus removal by optimising enzymatic processes
Ammionx	Proprietary treatment process	Ammonia and Nitrogen removal
Algae Systems	RPSC/TAG	Uptake of nutrients
Everse	Everse	Silica rich material that absorbs nutrients and other ions
Liquid Media	Liquid Media Operations	Use of natural materials to absorb contaminants
Adya Clarity	Water Liberty	Involves black mica and other compounds to achieve chemical absorption of pollutants
Ultra Filtration/Reverse Osmosis UF/RO	RPSC	Very high level of treatment producing reclaimed/recovered water for beneficial reuse
And later in the evaluation Electro Coagulation was promoted	Renewal Energy Group	TN and TP and Micro pollutants removal

The Ultra Filtration/Reverse Osmosis (UF/RO) option was identified by the RPSC as a technology that gave the best possible treatment. A very preliminary estimate of around $100M capital was calculated for a suitably sized UF/RO treatment system for adding onto the WWTP. One of the significant difficulties in the Rotorua situation with such a treatment process would be the disposal of the salty by-product water from such a treatment system which would account for 20-25% of the volume treated.

After consideration of the various "Add-On" options, the TAG advised the RPSC that the "Add-On" technologies be 'parked' as they may not achieve the outcomes required. The TAG further advised the RPSC that these options be reconsidered once they had been developed to a stage where they are in full scale commercial use and have a proven performance track record.

The TAG further recommended to RPSC that periodic technology reviews be included in the RLC's suggested resource conditions so that these may be introduced at a later date. The RLC's volunteered consent conditions (Section 14 and Appendix K of this AEE) includes such a commitment and provides a

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mechanism when these and other possible future "Add-On" type technologies to be further investigated at a later date and, if any are found to be appropriate, incorporate them into the treatment and/or treated wastewater disposal/discharge procedure.

9.4 Development of the Wastewater Strategy

The TAG recommended to the RPSC that the consent application for Preferred Scheme should be under pinned by a Wastewater Strategy and the RPSC adopted this recommendation.

The Wastewater Strategy would set out the RLC's strategic and sustainable approaches that would be adopted to underpin the consents and other approvals being sought and to ensure appropriate scheme operations and compliance with the consent conditions throughout their duration.

Figure 9-3 shows the Short Listed Treatment and Discharge Options presented in a high level format. This figure was extensively used by the RPSC in their consideration of options. The box on the right hand side of Figure 9-3 represents how the Wastewater Strategy would incorporate both the wastewater management inputs and the key features of the Preferred Scheme and the associated (suggested) resource consent conditions.

Section 4.3 of this AEE sets out a number of the key components that are to be included in the Wastewater Strategy. Subsequent to the TAG's and the RPSC's recommendation for such an approach it became evident that the RLC already had a Wastewater Strategic Plan in place that is in the process of being reviewed. Accordingly, the approach now to be followed is to incorporate into a new Wastewater Strategy the matters included in Section 4.3 and any others that may come out of the statutory consenting process. These include the containment policy and matters relating to the wastewater collection network as outlined in Appendix H the Wastewater Treatment Design Statement.

9.5 Wastewater Source Control Options

Early on in the options evaluation process, the TAG, RLC's engineering staff and RPSC highlighted the importance of prudent and cost effective management and control of the amount (volume) and quality of the raw wastewater (influent) entering the WWTP. Figure 9-3 highlights this by showing the box overlaying all shortlisted options titled "Wastewater Inputs Management". Within this box are listed the management options of:

- Water conservation;
- Wet weather flow and infiltration management;
- Trade waste management and pre-treatment; and
- New infrastructure types and standards.

Appropriate measures to achieve effective WWTP influent controls as part of sustainable wastewater management were presented to the RPSC by the RLC's three waters operational personnel. This included the RLC's Water Supply Conservation Strategy.

The output of the decision making was that appropriate influent quantity (volume) and quality management and control measures should be incorporated into the RLC's Wastewater Strategy. This includes the containment policy as referred to in Section 9.4 of this AEE and Appendix H. This Strategy being Component 1 of the Preferred Scheme (as also covered in Section 4.3 and 9.4 of this AEE) will, in part, underpin the consents being applied for and the ongoing operation of the WWTP and discharge infrastructure throughout the life of the consents.

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9.6 Short Listed Options for Treatment and Discharge

Following the TAG's evaluation of the long list options, a short list of treatment and disposal/discharge options was developed for further evaluation. The four Mott MacDonald reports provide a wide range of technical and estimated costing information that the RPSC, the TAG and the RLC's engineering personal used in the options evaluation. Key options from these four reports are summarised in Section 9.7 of this AEE as below. The full reports are included in Support Document No. 2.

The short list options are shown in Figure 9-3 and shows six core treatment options (denoted Options 1 to 6) and the possible combinations of these with two 'ecosystem re-entry' options, being to land and to water.

The identification of the six options for treatment and disposal/discharge options then provided the RLC with the range of options which it sought specialist wastewater treatment consultants Mott MacDonald to undertake concept development, possible treatment plant configurations, siting, and cost estimating.

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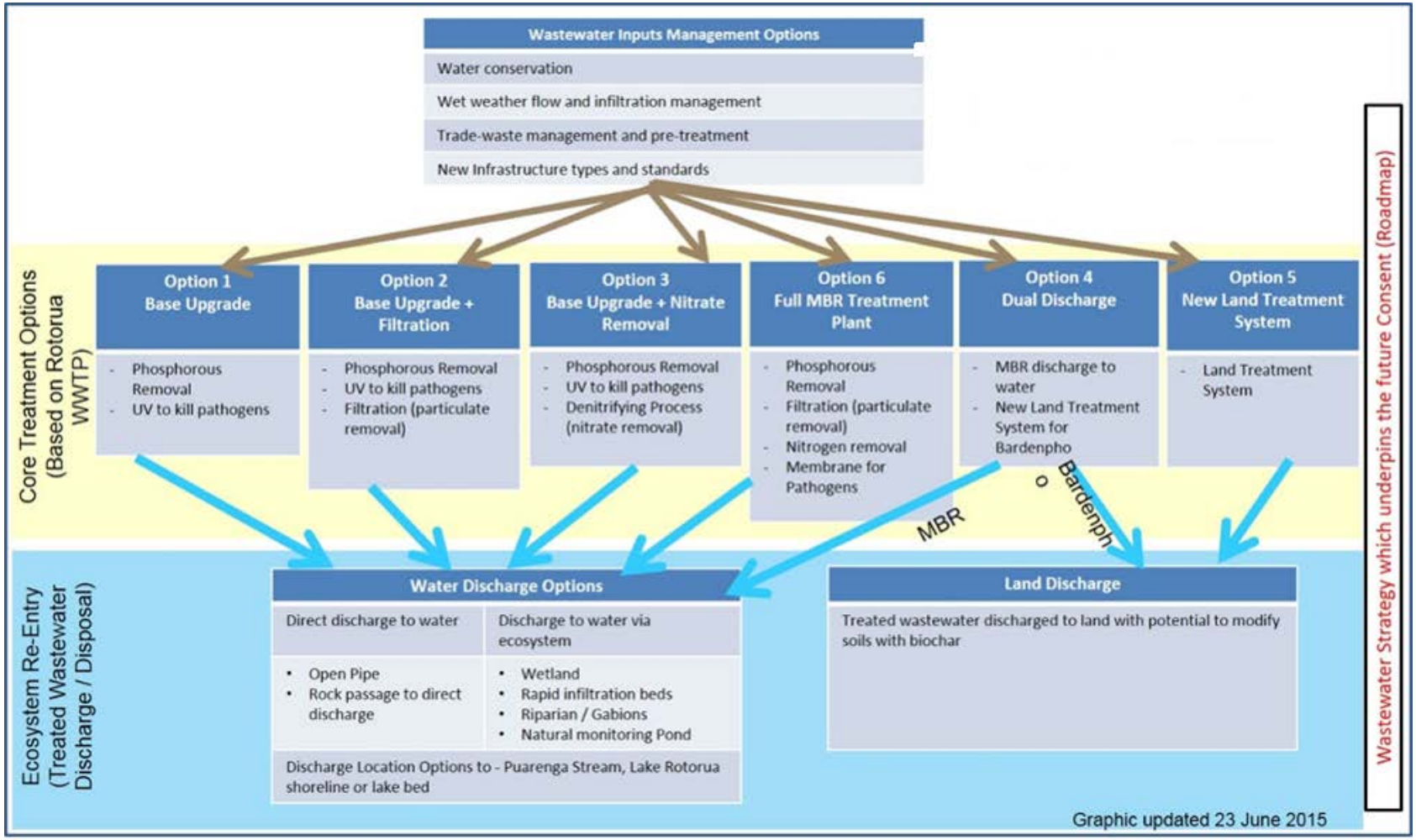


Figure 9-3: Short-Listed Options for Treatment and Discharge

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9.7 Technical Studies and Reports by Mott MacDonald

To advance the understanding of the short listed treatment and discharge options, including a range of land treatment and land contact options, the RLC engaged Wastewater Engineering Consultants Mott MacDonald to prepare a number of reports as part of the RPSC process leading up to the identification of a Preferred Option.

The four reports which make up Support Document No. 2 are:

Report 1 Mott MacDonald. (2014, December). Detailed Feasibility Study of Alternatives to Land Treatment. Rotorua District Council – denoted Support Document 2A;

Report 2 Mott MacDonald. (2015, June). Alternative Land Treatment Sites - Revision Four – denoted Support Document 2B;

Report 3 Mott MacDonald. (2015, June). Supplementary Report - Alternative Land Treatment Sites - Version 2 - denoted Support Document 2C; and

Report 4 Mott MacDonald. (2015, June 8). Wastewater Strategy Version 3 - denoted Support Document 2D.

Reports 2 and 3 relate to discharge options in that they cover land treatment sites and methods. They therefore should be read in conjunction Section 9.12.1 of this AEE. The following subsections briefly summarises each of these reports.

9.7.1 Report 1 - Mott MacDonald. (December, 2014). Detailed Feasibility Study of Alternatives to Land Treatment. Rotorua District Council (denoted Support Document No. 2A)

The purpose of Report 1 was to present the results of the detailed feasibility investigation undertaken on the short listed options. The detailed assessment of the WWTP upgrade and disposal options provided information for the TAG, the RPSC and the RLC for their deliberations and also for community consultation.

The options subject to this detailed feasibility study are presented in Table 9-7.

Table 9-7: Shortlisted Options Evaluated

Treatment Plant Upgrade Options		
Option	**Upgrade**	**Description**
1	Base Option	Addition of flow balancing, phosphorus removal by chemical addition and UV disinfection before discharge to water
2	Base Option + basic filtration	Base Option with the addition of basic filtration by either: • Option 2a Disc filters; • Option 2b Sand filters; • Option 2c Membrane filters.
3	Base Option + denitrifying filtration	Base option with the addition of denitrifying filtration by either: • Option 3a Denitrifying sand filters; • Option 3b Carbon beds.
Discharge Arrangement Options		
• Pipe to direct discharge with or without a diffuser; • Rock passage to direct discharge; • Wetland;		

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Treatment Plant Upgrade Options		
Option	**Upgrade**	**Description**
		• Rapid Infiltration Beds (RIB); • Riparian/gabions; • Natural monitoring pond.

Options 4 and 5 presented in Figure 9-3 incorporated treatment components of Options 1, 2 and 3.

Option 6 (being the full scale MBR and UV upgrade option) was not included in the short list at the time of this report and was introduced into Mott MacDonald's Wastewater Strategy Report (Support Document 2D) discussed in Section 9.7.4 of this AEE.

Report 1 covered many technical aspects relating to these options including detailed option descriptions, operating requirements, performance (especially in terms of nutrient removal), concept design assumptions, risk assessments and estimated capital, operating and Net Present Value (NPV) costs. Table 9-8 (extracted from this report) presents the estimated cost summary. These costs are on a December 2014 basis and exclude GST and were prepared for comparative purposes between options. The LTS's operating costs were, at that time, approximately $800,000 pa.

Table 9-8: Summary of Capital Costs, Operation Costs and NPV for Treatment Plant Upgrade Options

CAPEX Summary	Option 1	Option 2a	Option 2b	Option 2c	Option 3a	Option 3b
	Base + UV + Alum	Disc Filter	Disc Filter	Membrane Filter	Denitrifying Filter	Denitrifying Filter
Total Capex	$14,408,000	$19,793,000	$19,486,000	$22,354,000	$22,018,000	$28,793,000
OpenX Summary						
Opex (average annual)	$467,000	$581,000	$590,000	$653,000	$715,000	$597,000
Opex (average per day)	$1,280	$1,591	$1,617	$1,790	$1,960	$1,636
Cost per m3 treated	$0.05	$0.07	$0.07	$0.08	$0.08	$0.07
NPV Summary						
Total NPV (including contingency over 35 years)	$24,295,000	$46,487,000	$46,383,000	$50,586,000	$51,562,000	$60,225,000

The capital, operating and Net Present Value (NPV) (20 year basis) cost estimates for wastewater discharge/disposal options are shown in Table 9.9.

Table 9-9: Water Discharge Options

CAPEX Summary	CAPEX ($)	OPEX (pa) ($)	NPV ($)
Direct Pipe	$502,000	$1,920	$462,000

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Pipe with Diffuser	$602,000	$2,480	$558,000
Rock Passage	$747,000	$2,320	$647,000
Wetland 0.5 ha (conveyance)	$793,000	$10,255	$1,076,000
Wetland 38ha	$25,008,000	$11,680	$29,135,000
Rapid Infiltration Beds (RIB's)	$40,749,000	$19,720	$34,594,000
Gabion / Riparian	$278,000	$2,480	$286,000
Monitoring Pond	$217,000	$6,790	$284,000

9.7.2 Report 2 - Mott MacDonald. (June, 2015). Alternative Land Treatment Sites - Revision Four (denoted Support Document 2B)

Report 2 presents a detailed feasibility study of alternative sites to the LTS for land treatment of wastewater from the WWTP. Two discharge options were investigated in accordance with the short listed options as set out in Figure 9-3, namely:

- Option 4 - Dual Discharge – Discharge to water of one third of the total treated wastewater from the MBR with the remaining volume to be discharged to land; and
- Option 5 – Total Discharge – Discharge of the entire treated wastewater volume to a new alternative site within the catchment.

The study identified three potential areas – denoted Areas A, B, and C as shown in Figure 9-4 and discussed in more detail in the Report 2. The report discusses site specific factors including soil type, slopes angles, application rates, land use and land area required including buffer zones, nutrient removal performance, risk and estimated costs. The report did not investigate land ownership matters.

Table 9-10 summarises the findings of Report 2 and key risks.

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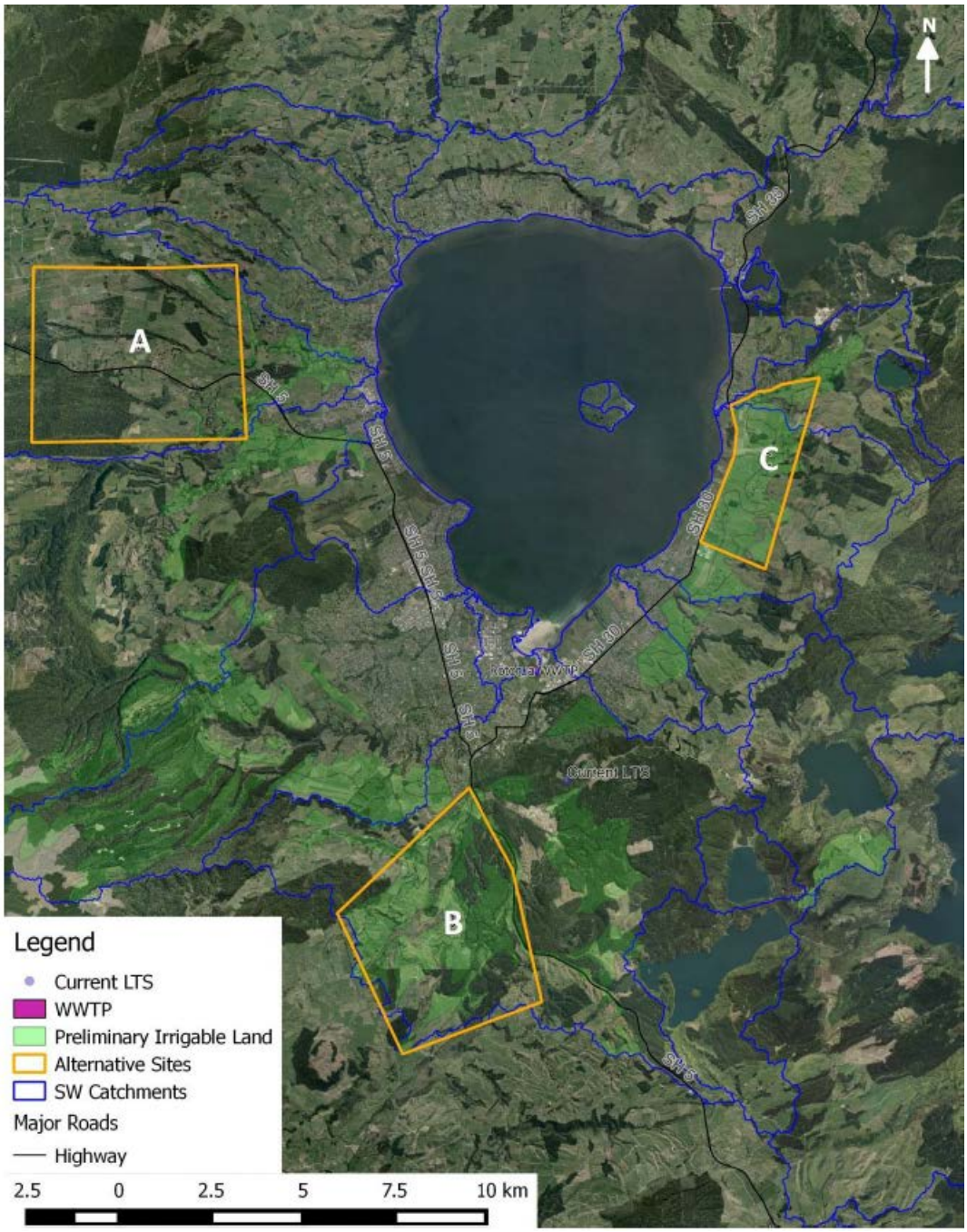


Figure 9-4: Selected Land Options - Areas A, B and C

Table 9-10: Land Treatment Sites Summary of Findings

Area and Option	Loading Rate (mm/day)	Land Area Required, Including Buffer Zones (ha)	CAPEX ($M)	OPEX ($M/Yr)	NPV ($M)	Key Risks
	5	420	86.16	33	100.37	

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Area A (Option 4)	20	105	53.27	1.99	69.73	Geotechnically challenging and ability to consent the activity
Area A (Option 5)	5	600	106.90	3.11	127.38	
	20	150	59.91	2.62	83.62	
Area B (Option 4)	5	420	55.81	1.83	69.86	High number of streams, hilly, complex irrigation arrangement and ability to consent the activity
	20	105	33.16	1.51	47.10	
Area B (Option 5)	5	600	70.44	2.45	89.73	
	20	150	38.08	1.96	57.22	
Area C (Option 4)	5	420	60.06	1.13	63.08	Sandy soils, proximity to Lake Rotorua, likely to have relatively high land value and ability to consent the activity
	20	105	31.85	0.85	36.57	
Area C (Option 5)	5	600	77.83	1.42	80.96	
	20	150	37.52	0.97	43.10	

9.7.3 Report 3 - Mott MacDonald. (June 2015). Supplementary Report - Alternative Land Treatment Sites - Version 2 and Rapid Infiltration Basins (denoted Support Document 2C)

Report 3 was prepared in response to a further request by the RLC following the TAG and RPSC consideration of Report 2. Report 3 was prepared in two parts, namely:

- Part 1 covered the infrastructure required for both Options 4 and 5 on Area B based on using the existing LTS pumping station and pumping main; and
- Part 2 covered requirements associated with the use of Rapid Infiltration Beds (RIBs) for both Options 4 and 5. Assessment of this option was instigated by both the RPSC and the TAG as a means to further consider a land contact option that may be acceptable. Based on a hydraulic loading rate of applying 150 mm/day of treated wastewater on the RIBs, an area (including buffer areas) of 11 and 16 hectares was calculated as being required for Options 4 and 5, respectively.

  More detailed investigations of RIBs were undertaken by the RLC's engineering department. Five general site locations were identified, and cost estimates worked up that included conveyance to, as well as construction and operation of, the RIB's.

  The sites included three on the Peak Block, one down gradient of the Katore Ponds (of the existing LTS) and the fifth on the Whakapoungakau aggregated farm area. Reference should be made to Report 3 for further details of these land areas. Capital cost estimates were all similar at around $27 M (ex GST and November 2015 costs).

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9.7.4 Report 4 - Mott MacDonald. (June 8, 2015). Wastewater Strategy Version 3 (denoted Support Document 2D)

Report 4 further investigated the treatment options to meet target mass load nutrient limits of 30 t TN/yr and 3 t TP/yr in the discharge.

The treatment process selection included chemical phosphorus removal using alum or other metal salt dosing, fine filtration and the opportunity to by-pass the primary sedimentation clarifiers to enhance the use of carbon available in the wastewater and thereby minimise ethanol dosing. Bypassing the primary sedimentation clarifiers increases the solids inventory and this, in part, lead to the selection of a process configuration that incorporates fine filtration into the secondary biological treatment process by using MBR technology. The MBR technology also provides a high level of disinfection of the treated wastewater which, when followed by UV disinfection, provides a 'double barrier' pathogen removal system.

This arrangement is referenced as Option 6 (then Option 6a with the inclusion of extra phosphorus removal) in the short listed options.

The estimated capital costs at that time varied from $32.8 M to $50.3 M to (ex GST) depending on whether the existing clarifiers are used or new tankage is constructed. Annual operating costs were estimated at $1.75 M which includes sludge and biosolids handling and disposal. Based on these estimated costs a figure of $0.24 per cubic metre of treated wastewater was arrived at.

9.8 Short List – Treatment Options

Initially treatment Options 1 to 5 were included in the short list, however a full MBR treatment plant together with UV disinfection treating the entire wastewater volume was subsequently added as Option 6, which in turn was further developed into Option 6a (which included additional phosphorus removal).

Table 9-11 summarises the short listed options identified, including alternative sub-options for Options 2 and 3. Grey shading indicates the two options selected for further evaluation, namely Option 3a and Option 6a. The process followed in arriving at these two options is shown in Figure 9-8.

Table 9-11 Shortlisted Treatment Options

Option No.	Option Description	Comments
1	Base Option Flow balancing + P removal = UV Sludge disposal through TERAX.	Does not comply with current consent limit of 30 TN and 3 TP.
2a	Base Option + Disc Filtration.	Does not comply with current consent limit of 30 TN and 3 TP.
2b	Base Option + Sand Filtration (RGF) Sludge disposal through TERAX.	Does not comply with current consent limit of 30 TN and 3 TP.
2c	Base Option + In-line Membrane Filtration Sludge disposal through TERAX.	Does not comply with current consent limit of 30 TN and 3 TP.
3a	Base Option + Denitrifying Sand Filtration Sludge disposal through TERAX.	Complies with 30 TN and 3 TP limits.
3b	Base Option + Carbon Beds Sludge disposal through TERAX	Carbon bed performance unknown at low effluent nitrogen levels.
4	Current plant with MBR (1/3 flow) flow Discharge to water and Bardenpho (2/3 flow)	Complies with 30 TN and 3 TP limits

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	Flow discharge to land at 5mm/day or 20mm/day loading rates. Sludge disposal through TERAX	
5	Current plan with all flows discharged to land at 5mm/day or 20mm/day loading rates. Sludge disposal through TERAX	Complies with 30 TN and 3 TP limits.
6 further developed to 6a	Full MBR Option - Bypass primary tanks with MBR after the Bardenpho additional Phosphorous removal. - Sludge dewatering + offsite disposal	Complies with 30 TN and 3TP limits

Options 3a is shown in Figure 9-5, and Option 6a is shown in Figure 9-6. Table 9-11 compares these two options and suggests that Option 6a is the preferred treatment option.

The two shortlisted options were further considered by the RPSC and after consideration of all relevant matters it concluded that the preferred option for treatment (based on discharge to water) was Option 6a.

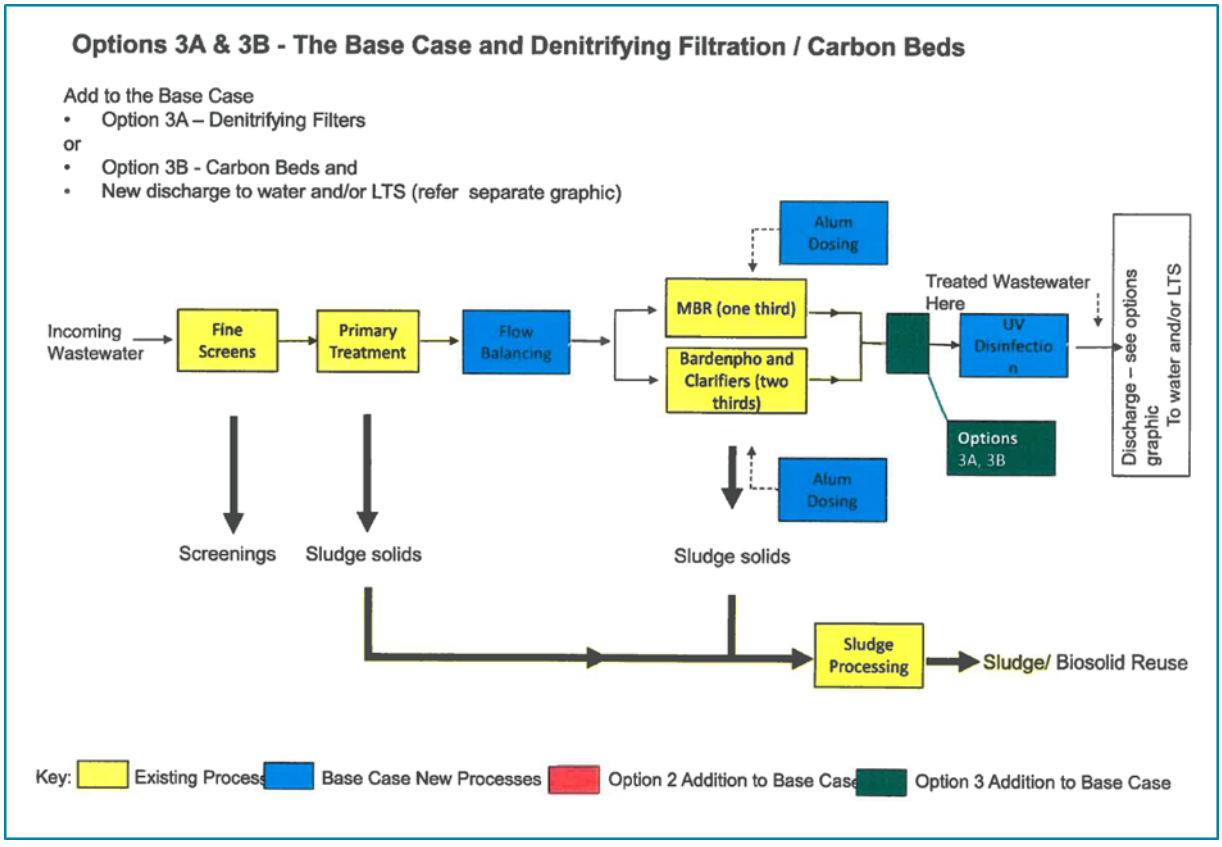


Figure 9-5: Option 3a Denitrifying Beds and UV disinfection

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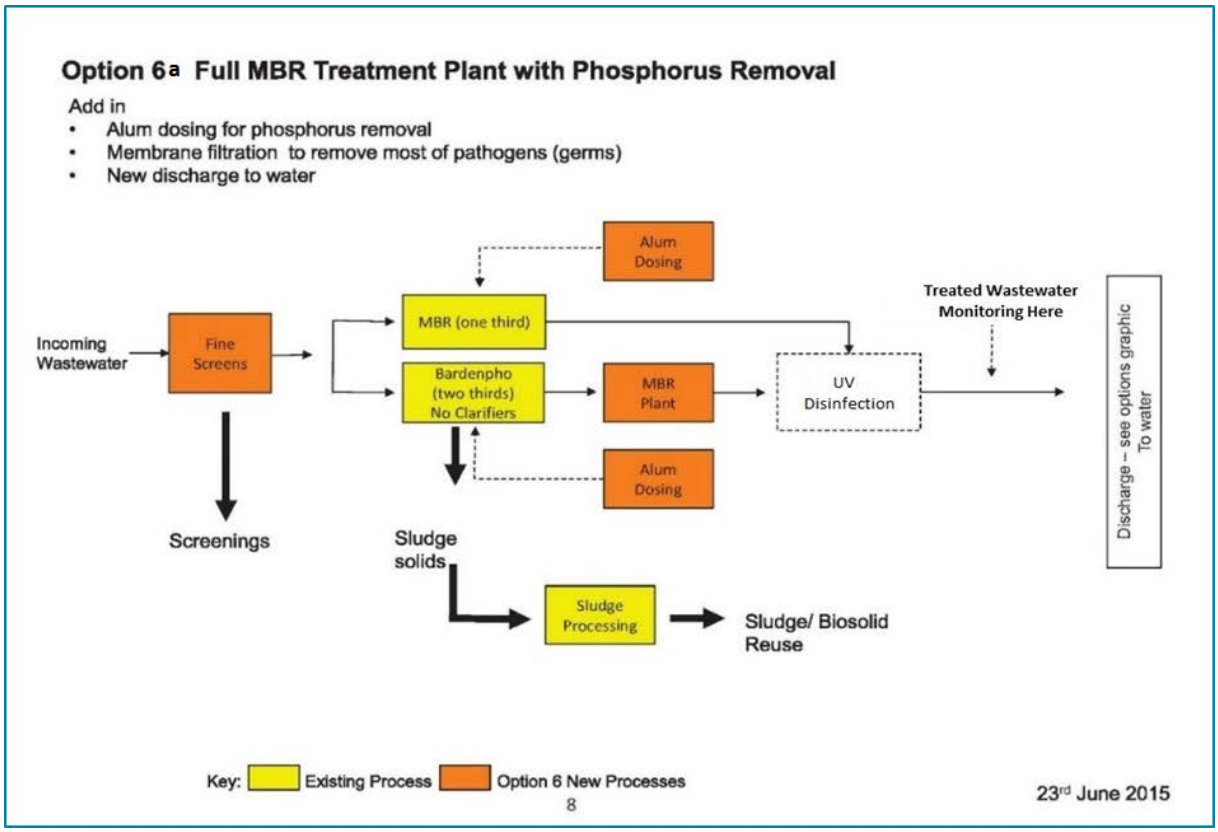


Figure 9-6: Option 6a – Full MBR and UV disinfection with extra Phosphorus Removal

Table 9-12 Comparison of Short-Shortlisted Treatment Options 3a and 6* and 6a

Item No.	Attribute / Description	Option 3a (Base Option + Denitrifying Filter)	Option 6 (Full MBR + UV)*	Best Fit Option
1.	Proven technology	No wastewater reference sites in New Zealand. Many in use in Australia and around the world, particularly USA {Florida etc.) UV disinfection totally proven.	Current WWTP has MBR as major component (largest MBR in New Zealand.) UV disinfection totally proven.	6
2. Operation and Maintenance				
2.1	Operator requirement	Additional operator skill and attention needed for denitrifying sand filter and UV. {More training required.)	Current operator skills sufficient for MBR. (Training for UV required.)	Unsure

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Item No.	Attribute / Description	Option 3a (Base Option + Denitrifying Filter)	Option 6 (Full MBR + UV)*	Best Fit Option
2.2	Complexity of operation	Denitrifying sand filter has carbon dosing that needs to be monitored and controlled as an additional tertiary process. Being at the end of the treatment process, any overdose of ethanol is likely to have immediate effect on the wastewater COD and BOD concentrations. This situation gives more complexity to plant operation and more risk to meeting requirements.	Denitrification by Bardenpho and filtration by MBR, within current secondary processes. Similar operational complexity as existing.	6
2.3	Operational risks	Excess solids from clarifier could "blind" the sand filter requiring constant backwash which could impact on nutrient removal performance.	Risk of filter clogging minimal. Membrane cleaning happens continuously through pulsed system. {Current operation provides evidence of requirements.)	6
2.4	Energy (electricity cost)	Medium	High	3a
2.5	Additional {supplementary) chemical costs e.g. ethanol carbon source	Denitrification depends on additional ethanol carbon source.	"Free" carbon from by-passing primaries reduces ethanol carbon dosing from current requirements.	Without TERAX 6 With TERAX 3a
3. Reliability/Flexibility				
3.1	Risk of non-compliance to consent conditions.	Period to recover from backwash process could result in periods of non-compliance.	Stable process. Membrane filtration could provide buffer for upset biological process.	6
3.2	Ability to handle wet weather flows.	Solids carry over from clarifier due to stormflow, resulting in solids in excess of 50 mg/l will cause continuous backwash at the sand filter resulting in decreased hydraulic through flow.	Has higher level of flexibility in terms of solids carry-over.	6
3.3	Future flexibility or potential to increase treatment capacity	Reasonable flexibility but need to design this initially for cost efficient expansion	Good flexibility by adding additional treatment modules.	6

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Item No.	Attribute / Description	Option 3a (Base Option + Denitrifying Filter)	Option 6 (Full MBR + UV)*	Best Fit Option
4.	Sludge Production	32 m^3/day @ 17% dry solids	21 m^3/day @ 18% dry solids (i.e. 32% less sludge that 3a)	Without TERAX 6 With TERAX 3a
5. Predicted Performance				
5.1	TN	< 30 t/yr) - Potentially more N removal but also more variability risks	<30 t/yr N	Similar
5.2	TP (with Alum)	<3 t/yr P	<3 t/yr P	Similar
5.3	Bacteria removal by filtration down to	100 Ecoli	<1 Ecoli	6
5.4	Virus removal by filtration	Norovirus removed	Norovirus removed	Similar
5.5	Pathogen removal by UV	Relatively more variable UV requirements to achieve high pathogen destruction due to higher SS and variability than MBR. Single Barrier Removal (UV)	Consistently very high pathogen destruction due to consistently low SS. Double barrier removal (MBR + UV)	6
6* then developed to 6a.	Ability for upgrade to be staged but still stay within the consent limit requirements.	Possible	Possible	Similar
7. Costs (ex GST)				
7.	Costs			
7.1	Capex	$ 24.40 M	$ 30.55 M	3a
7.2	Opex	$ 2.56 M	$ 1.92 M	6
7.3	Net Present Value (NPV)	$ 75.79 M	$ 68.05 M	6

* Option 6 was expanded to Option 6a to include the addition of extra phosphorus removal. Which are included in the above estimated costs.

9.9 Pathogenic Microrganism Treatment Considerations

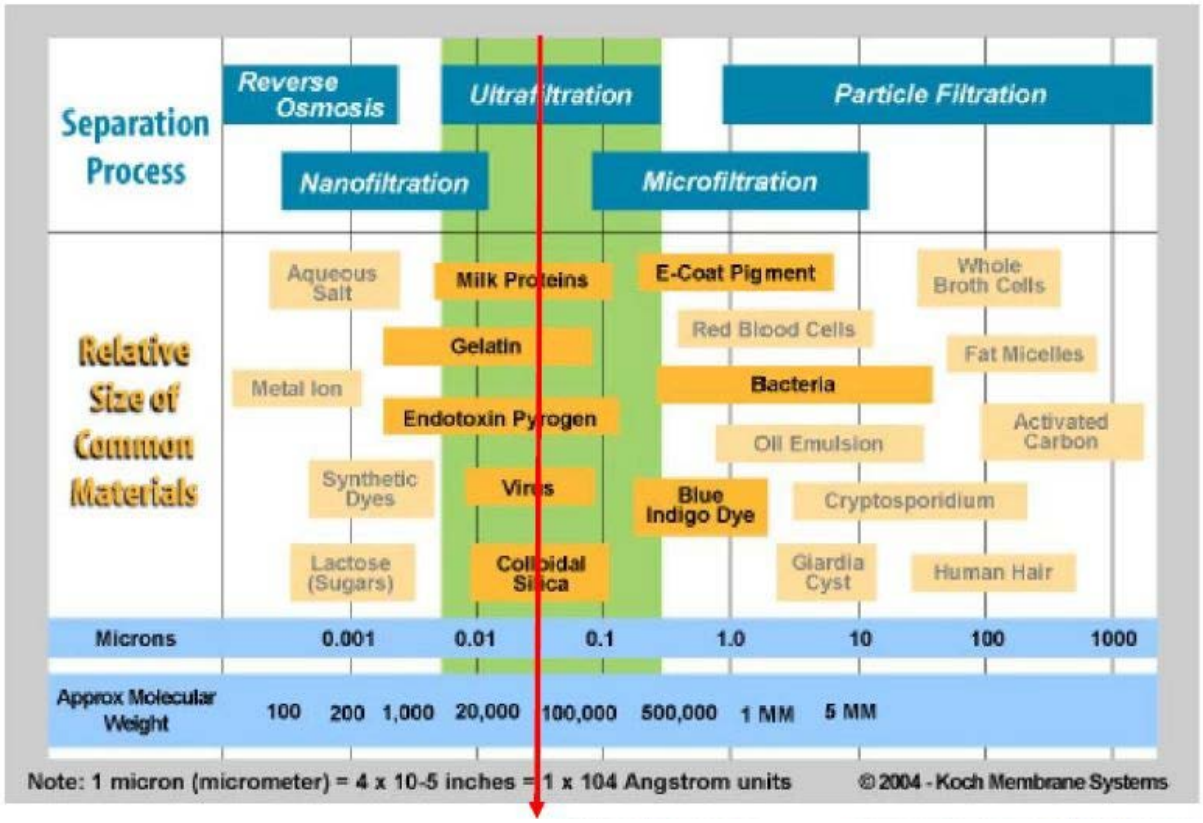
A key matter to the RPSC, the TAG, the RLC, and stakeholder parties involved in the wider consultation was to ensure the wastewater was treated to a very high level so as to ensure public health was

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protected from a recreation and wild food collection viewpoint. Toi Te Ora Public Health Service (Ms Annaka Davis) provided valuable input into this key matter.

There was a clear preference for the double barrier (plus) pathogenic microorganism removal system to be incorporated in Option 6 through both the MBR (fine membrane) plus UV disinfection. Additionally, the discharge of the treated wastewater to the Te Arikiroa Thermal Channel (as outlined in Section 9.12 of this AEE), which typically has a low pH, provides additional pathogen removal/inactivation.

Figure 9-7 shows the relationship between the size of different pathogenic microorganisms and the proposed MBR nominal pore size of 0.04 microns, being the same pore size as the existing MBR units at the WWTP. Section 7.6 of this AEE summaries the public health risk assessment undertaken as part of this Project.



Note: Existing MBR 0.04 Micron Pore Size (Zeeweed 500D module) on which concept design of full MBR plant is based

Figure 9-7: Relationship of Particle Size and MBR Pore Size

9.10 Design Statement for Preferred Treatment Arrangement

Mott MacDonald has prepared a design statement for Option 6a, the preferred treatment option and is included as Appendix H to this AEE. This statement brings together, in summary format, key design considerations and concepts for the MBR, UV, plus extra phosphorus treatment as included in Option 6a (refer to Figure 9-6 and Table 9-12).

This Design Statement provides information used in Section 4.4.3.1 covering the treatment component (Component 3) of the Preferred Scheme.

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9.11 Summary of Treatment Options Assessment Sequence

Figure 9-8 summarises the treatment options considered and shows the process of identification and assessment of the various options that was followed in arriving at the preferred treatment solution which is the subject of these resource consent applications.

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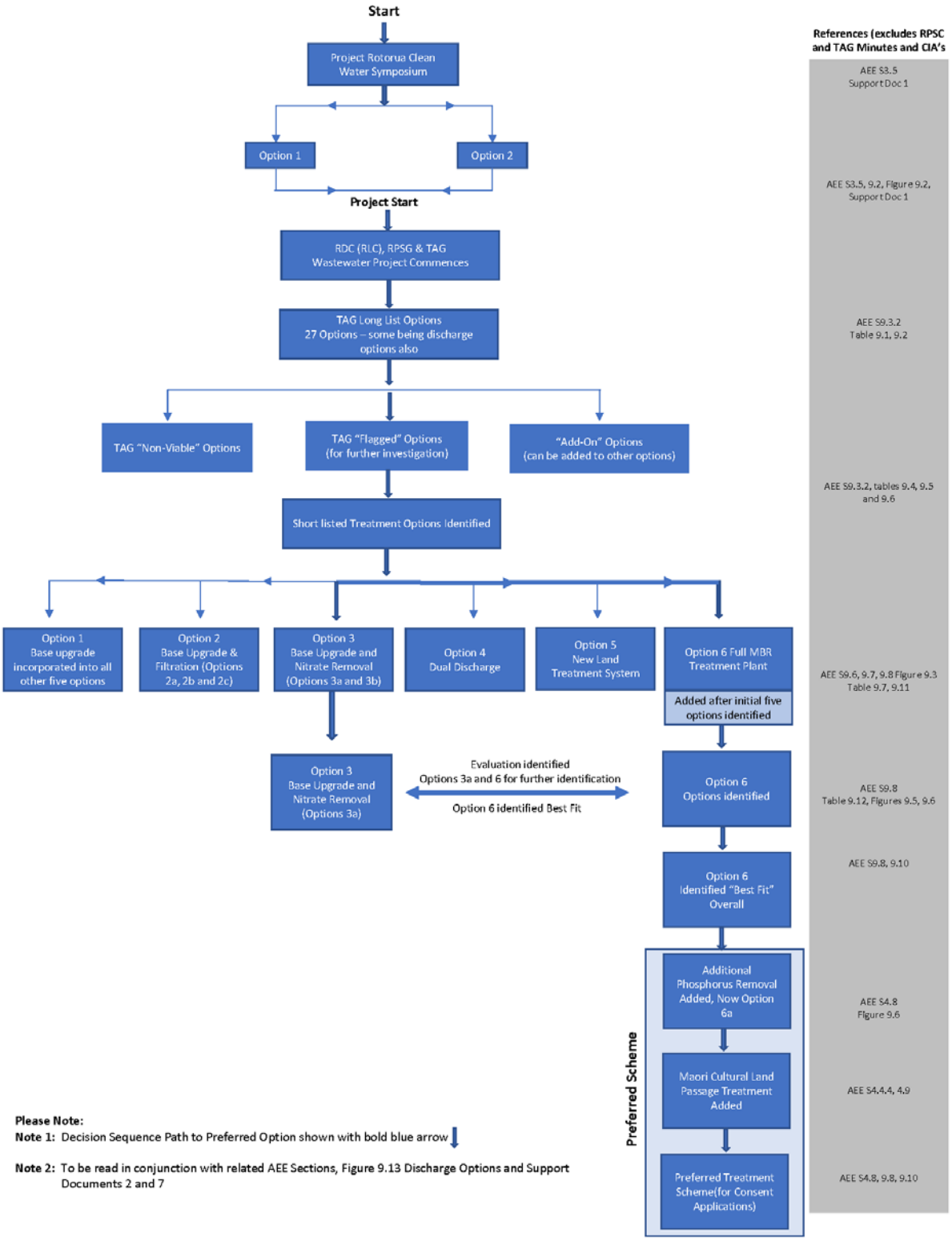


Figure 9-8: Summary of Treatment Options Assessment Sequence

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9.12 Discharge Options

As part of the Project a number of treated wastewater discharge and beneficial reuse options were assessed. Figure 9-13 summaries the discharge options considered and shows the assessment sequence to arrive at the Preferred Discharge Option. The following sections outline the options considered (generally in the order this occurred).

9.12.1 Land Treatment Options

The Mott MacDonald's Alternative Land Treatment Sites Revision Four Report, discussed in Section 9.7.2, investigated three different land treatment areas and five difference options within these sites.

Further land treatment options were included in Mott MacDonald's Report No. 3 – A Supplementary Repot titled "Alternative Land Treatment Sites – Version 2" and RIBs included as Support Document 2C and summarised in Section 9.7.3 of this AEE.

These options were determined as not likely for a range of reasons, including land availability, technical and locational issues and for the Rapid Infiltration Beds upwelling and discharge of the applied treated wastewater.

9.12.2 Discharge "Out of the Lake Rotorua Catchment" Options

The RPSC initially considered the concepts of both land treatment and water discharge options outside of the Lake Rotorua catchment. These would require conveyance of treated wastewater relatively long distances.

Options considered included discharge into Lake Rotoiti, Lake Tarawera and land application out of the catchment south of Rotorua.

The RPSC determined such options were unlikely to be acceptable and accordingly "out of catchment" options were removed from short list considerations.

9.12.3 Kaituna River Discharge and Lake Rotorua Outlet

The RPSC considered a piped discharge from the WWTP to the Kaituna River at a point at or near the Lake outlet. This option was dismissed because an earlier proposal involved this approach and the Waitangi Tribunal's recommended, in its 1984 Kaituna Claim Report (on claim Wai 4), that the Crown abandon its proposal as it was not acceptable, including to iwi downstream as far as Maketu in addition other river users and water quality matters (refer to Section 7.8.1 of this AEE).

9.12.4 Puarenga Stream Discharge

A discharge to the adjacent Puarenga Stream was considered as part of the Project. A discharge to the Puarenga Stream had been previously consented to cover "emergency" situations. Figure 9-9 shows a possible location and long section with the discharge passing through gabion baskets located on the bank of the Puarenga Stream. Subsequent consideration by the CAS and the RPSC arrived at the decision that a discharge direct to the Puarenga Stream would not be acceptable from a cultural perspective and instead a discharge to Lake Rotorua either directly (piped) or via Te Arikiroa Thermal Channel should be further considered instead.

The Puarenga Stream discharge option was not proceeded with as it has been highlighted as having cultural significance to local iwi. This is covered in the two CIAs (Companion Documents No. 1 and No. 2). In respect to the above, subsequent considerations by the CAS group who developed the land contact bed concept identified the need for bunding of the Te Arikiroa Thermal Channel in order to ensure there is no flow of treated wastewater into the Puarenga Stream via flowing across the Sulphur Flats from the Te Arikiroa Thermal Channel.

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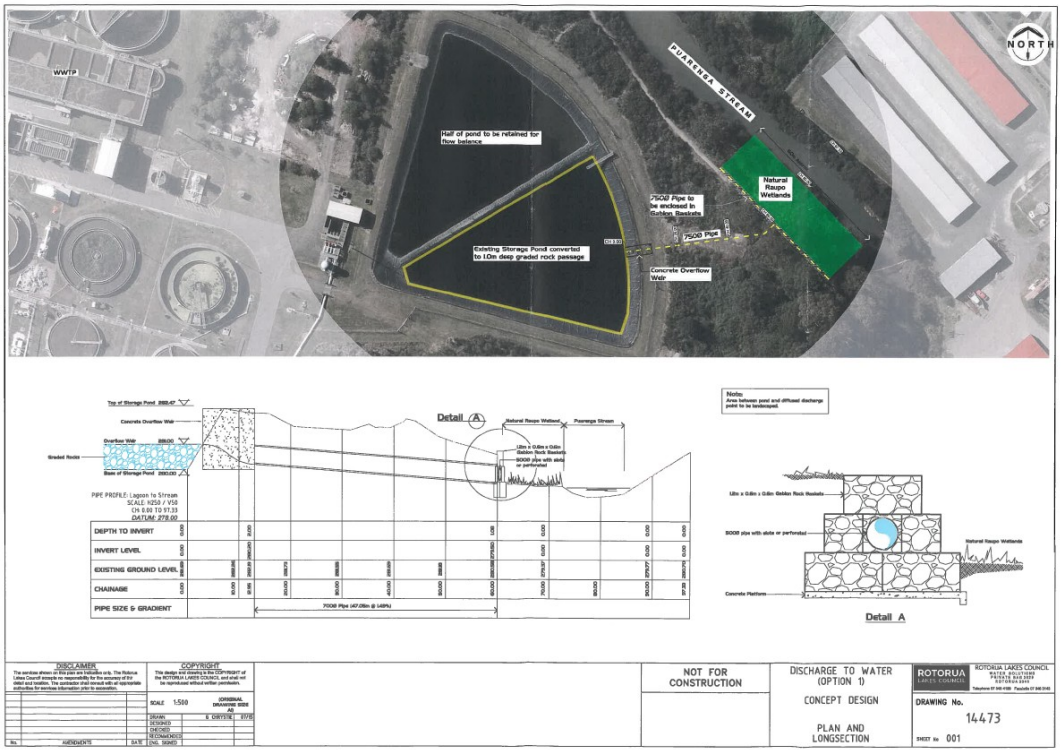


Figure 9-9: Puarenga Stream Discharge Concept

9.12.5 Lake Rotorua Offshore Outfall

These options involved discharging well out into the deeper waters of Lake Rotorua. Two options denoted 2A and2B were evaluated for offshore outfalls located approximately 900 m from the shoreline. Figure 9-10 shows the location of these options.

These options were removed from the Preferred Scheme evaluation process at the RPSC's meeting on 20th August 2015. This decision was made following favourable discussions about installing a land contact and cascade system at the WWTP site prior to the discharge to the adjacent areas of Lake Rotorua. The decision was guided by Te Arawa Lakes Trust members on the RPSC.

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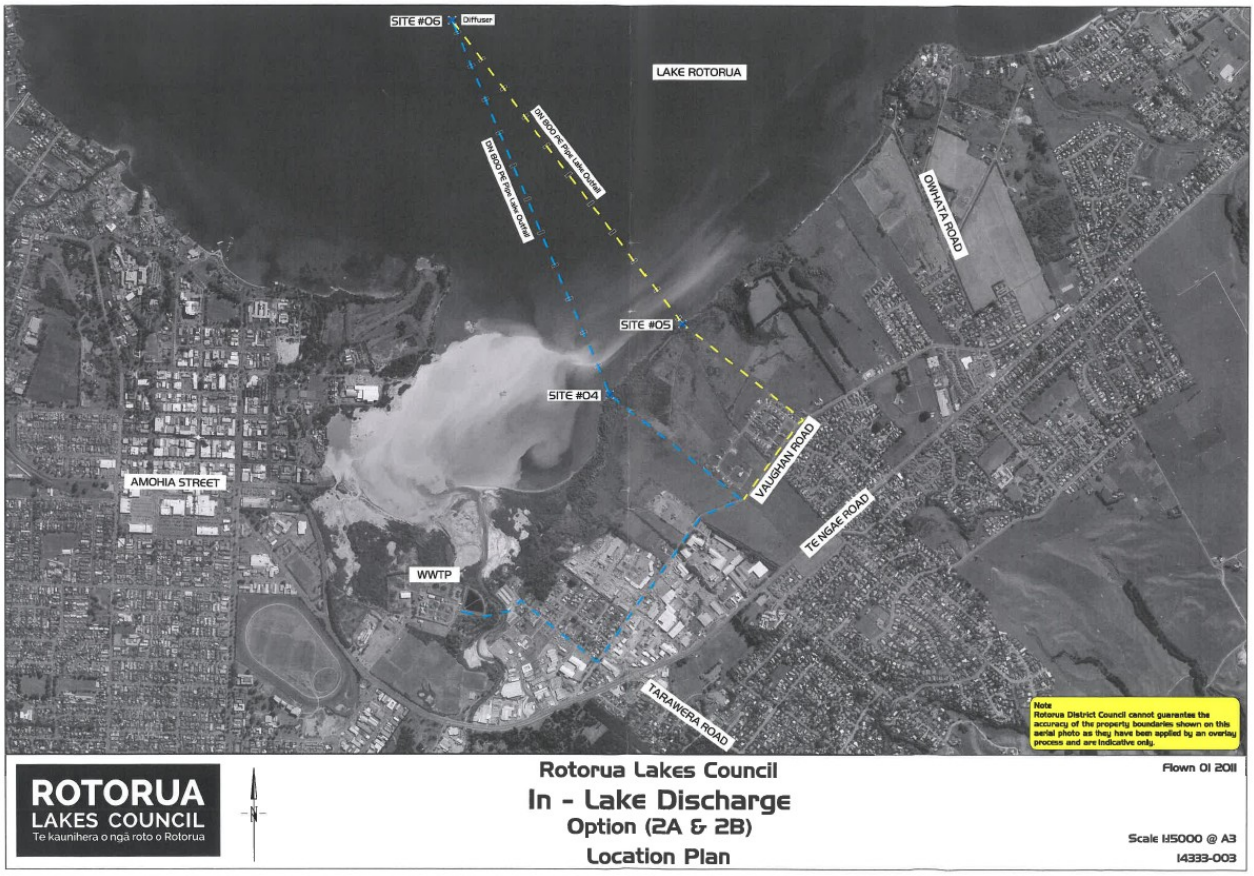


Figure 9-10: Lake Rotorua Offshore Outfall Options

9.12.6 Lake Rotorua Shoreline Options including Te Arikiroa Thermal Channel

The consideration of these included a shoreline option out from Vaughan Road and the shoreline options in the Puarenga (Sulphur) Bay area.

Following the RPSC's decision not to further consider direct discharge into the Puarenga Stream the focus shifted to assessing the feasibility of a discharge into Te Arikiroa Thermal Channel adjacent to the WWTP site. This channel flows into Sulphur Bay (Lake Rotorua) approximately 250 m away. Such a discharge was determined by the RPSC and the CAS to be the preferred solution although that decision was not unanimous as recorded in the committee minutes.

As outlined in the second CIA (Companion Document No. 2) the CAS subsequently considered this option and determined that a natural looking channel and a bund on the channel's eastern side to prevent any chance of flow across Sulphur Flat to the Puarenga Stream would be an acceptable solution.

9.12.7 Development of Preferred Land Contact Bed and Discharge Structure to Te Arikiroa Thermal Channel

Once the preferred option of discharging to Te Arikiroa Thermal Channel was determined, the focus turned toward the inclusion of a land contact bed being installed immediately after the new WWTP prior to the discharge to the Thermal Channel.

The RLC worked with members of the CAS to develop the concept for the land contact bed system. A Mātauranga Māori Experts Group was formed to provide advice on the development of this proposal. The proposal is set out as Component 4 of the Preferred Scheme.

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The "Cultural Impact Assessment of a discharge of treated wastewater to Lake Rotorua through a land contact bed at Puarenga Bay Rotorua" prepared by the Te Onewa Consultants – November 2017 sets out the deliberations, consultation, cultural considerations and proposed land contact and discharge system. The CIA notes that:

> "*there are a number of geothermal expressions on the eastern side of the Puarenga Stream, which should be avoided. If a discharge here was to proceed, a physical structure such as a bund will need to be constructed to direct flow to Lake Rotorua. The sensitivity of this area to Te Arawa Lakes Trust and tangata whenua would suggest that an 'unobtrusive' and 'natural looking' structure would be required. Equally, geothermal waters in surface expressions (ngawha) may be affected. Again, a structure such as a bund may prove useful in avoiding known ngawha with geothermal activity*".

Section 4.4.4 of this AEE includes the concept drawings and description of these facilities as part of the describing the Preferred Scheme.

9.12.8 Alternative Arrangements Discharging to Te Arikiroa Thermal Channel

This section of the AEE expands on the alternatives/options assessment for the preferred option of discharge of treated wastewater to Te Arikiroa Thermal Channel.

The further assessment of options for the discharge to Te Arikiroa Thermal Channel including the works necessary to ensure treated wastewater does not flow across the Sulphur Flat sinter area to the Puarenga Stream. This work required the following technical and effects assessments. These investigations are included in separate reports compiled into Support Document No. 7:

- Ecological;
- Natural character, landscape and amenity effects;
- Geothermal;
- Contaminated land;
- Hydraulic modelling;
- Construction considerations;
- Alternatives to the use of the Thermal Channel as outlined below; and
- Maori cultural considerations and outputs included in the two CIA's (Companion Documents No .1 and 2);

Alternatives (options) in terms of methods considered for Te Arikiroa Thermal Channel discharge of treated wastewater were as follows:

- Option Thermal Channel 1 (TC1): Full discharge to the western bamboo area or areas and thence to the lake end of the Te Arikiroa Thermal Channel;
- Option Thermal Channel 2 (TC2): Dry weather flow to the Te Arikiroa Thermal Channel and wet weather flow to the western bamboo area nearest the Thermal Channel (three different conveyance arrangements);
- Option Thermal Channel 3 (TC3): Full discharge to the Te Arikiroa Thermal Channel with a full length bund on the western side of the lower section of the channel (~210 m);
- Option Thermal Channel 4 (TC4): Full discharge to the Te Arikiroa Thermal Channel with five small bunds adjacent to the Puarenga Stream (~48 m of total length of bunding);
- Option Thermal Channel 5 (TC5) Full discharge to the Te Arikiroa Thermal Channel with no bunds IF further hydraulic modelling shows a hydraulic barrier and this is otherwise acceptable.

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Table 9-13 evaluates each of the options identified as TC1 to TC5 and compares them in terms of physical matters, effects assessments and mitigation measures. This table has been compiled from the output of the above listed investigations.

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Table 9-13 Evalution of Options TC1 to TC5

OPTIONS / FACTORS AND ASSESSMENT (References)	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
Option Reference Overall	Section 9.13 of this AEE	Section 9.13 of this AEE and Support Document No. 7			Section 9.13 of this AEE and Support Document No. 7	Section 4.4.5 of this AEE and Companion Document No. 2	Section 9.13 of this AEE
Physical Description	Large conveyance line either open channel, gravity pipeline or pressure pipeline to the western bamboo area laid through old landfill for part of the length.	Minor widening and minor deepening of thermal channel + With constructed gravity open channel to bamboo discharge area – with distribution pipes	Minor widening and minor deepening of thermal channel + With gravity pipeline to bamboo discharge area - with distribution pipes (Figure 9-11)	Minor widening and minor deepening of thermal channel + With pressure pipeline to bamboo discharge area - with distribution pipes and retrofit existing WWTP pump station	Widening and minor deepening of Te Arikiroa Thermal Channel with constructed bund (~210 m length) on the eastern side.	Widening and minor deepening of Te Arikiroa Thermal Channel with construction of five small bunds (~48m length) adjacent to the Puarenga Stream on the western side (Figure 9-12)	Widening and minor deepening of Te Arikiroa Thermal Channel only.
Constructability (as set out by Jacana Consultants included in Support Document No. 7 for Options TC1, TC2 and TC4)	• Pressure pipeline crosses existing open drains. • Pressure pipeline vehicle bridges required. • Pressure pipeline cycle and pedestrian bridge required. • Pipeline and manhole materials required for geothermal environment.	• Power poles along open channel route. • Drainage channel crosses existing open drains. • Drainage channel vehicle bridges required. • Drainage channel cycle and pedestrian bridge required. • Drainage channel maintenance. • High ground water table.	• Gravity pipeline crosses existing open drains. • Gravity pipeline vehicle bridges required. • Gravity pipeline cycle and pedestrian bridge required. • Pipeline and manhole materials required for geothermal environment. • High ground water table. • Unstable ground.	• Pressure pipeline crosses existing open drains. • Pressure pipeline vehicle bridges required. • Pressure pipeline cycle and pedestrian bridge required. • Pipeline and manhole materials required for geothermal environment.	• Similar to construction requirements to TC4 but significantly more extensive as a continuous bund in addition to the Te Arikiroa Thermal Channel works. Construction was not considered in the same level of detail as TC4.	• Refer to the Construction Methodology in Support Document No. 7 which covers each of the four zones as set out in Figure 9-12 • Construction vehicle access to the Te Arikiroa Thermal Channel; • Earthworks; • Stock piling and disposal of excess materials; • Bund construction materials; • Sediment and erosion control measures; • Landscaping;	• Construction vehicle access to the Te Arikiroa Thermal Channel; • Earthworks; • Stock piling and disposal of excess materials; • Bund construction materials; • Sediment and erosion control measures; • Landscaping;

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OPTIONS → / FACTORS AND ASSESSMENT (References) ↓	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
	• High ground water table. • Existing pump station requires modification. • Unstable ground, subject to settlement. • Vandalism. • Considerable difficulties expected in old landfill area.	• Unstable ground. • Geothermal features.	• Vandalism.	• Existing pump station requires modification. • High ground water table. • Unstable ground. • Vandalism.		• On-going maintenance; • Works to be undertaken within a Construction and Environmental Management Plan	
Risks (as set out by Jacana Consultants included in Support Document No. 7)	• High construction cost. • Differential settlement. • Infrastructure damage. • High maintenance cost. • Risks associated with working through old landfill area, which include settlement, construction difficulties and possible leachate/ contamination issues • Material corrosion.	• Differential settlement. • Flow capacity reduction. • High construction cost. • Differential settlement. • High construction cost. • Material corrosion.	• High construction cost. • Differential settlement. • Infrastructure damage. • High maintenance cost.	• High construction cost. • Differential settlement. • Infrastructure damage. • High maintenance cost.	• Risk of hydrothermal eruption if excavation goes beyond 0.6m.	• Risk of hydrothermal eruption if excavation goes beyond 0.6m.	• Risk of hydrothermal eruption if excavation goes beyond 0.6m.

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OPTIONS → / FACTORS AND ASSESSMENT (References) ↓	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
Hydraulic Modelling (assessed by Stantec included in Support Document No. 7)	Not modelled as no discharge to the Te Arikiroa Thermal Channel	Modelled for the Average Daily Flow to the Te Arikiroa Thermal Channel as set out in the two Stantec Hydraulic Modelling Reports dated 24 July 2018 and 27 July 2018	Modelled for the Average Daily Flow to the Te Arikiroa Thermal Channel as set out in the two Stantec Hydraulic Modelling Reports dated 24 July 2018 and 27 July 2018	Modelled for the Average Daily Flow to the Te Arikiroa Thermal Channel as set out in the two Stantec Hydraulic Modelling Reports dated 24 July 2018 and 27 July 2018	This was assessed in a Stantec Memo dated 14 March 2018. This Memo found the full length bund on the lower section of Te Arikiroa Thermal Channel would contain the channel flow from flowing across the Sulphur Flat towards to Puarenga Stream	This was assessed in a Stantec Report dated, 27 July 2018. This Report found that there were five short locations where bunding is required on the Sulphur Flat near the Puarenga Stream to prevent to connectivity of the channel flow to the Puarenga Stream (assuming there is not a hydraulic driving force from Puarenga Stream towards Te Arikiroa Thermal Channel.	Further hydraulic modelling of the Puarenga is underway. To assess whether a hydraulic driving forces occurs at high lake and high Puarenga water level on all occasions.
Capital Cost Estimate	Not costed, but greater than the TC2 options.	$1,293,000	Range between Option 1 and 3	$1,949,000	Not costed, but relatively high cost and significantly greater than TC4. Cost for widening and deepening the Te Arikiroa Thermal Channel the same for TC3, TC4 and TC5.	Considerably lower cost than TC3 due to reduced bunding requirement. Cost for widening and deepening the Te Arikiroa Thermal Channel the same for TC3, TC4 and TC5.	No cost for the bunding. So lowest cost of TC3, TC4 and TC5. Cost for widening and deepening the Te Arikiroa Thermal Channel the same for TC3, TC4 and TC5.

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OPTIONS → / FACTORS AND ASSESSMENT (References) ↓	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
Cultural Values Considerations • Section 7 and 8 of this AEE and; • CIA's (Companion Document No. 1 and 2)	Not assessed for the wet weather flow discharge to the bamboo area. No discharge to the Te Arikiroa Thermal Channel.	Not assessed for the wet weather flow discharge to the bamboo area Average daily flow to the Te Arikiroa Thermal Channel as per TC3 but expect to be of lesser magnitude. In terms of works required for minor widening and minor deepening of Te Arikiroa Thermal Channel the effects are generally the similar as TC3 and TC4.	Not assessed for the wet weather flow discharge to the bamboo area. Average daily flow to the Te Arikiroa Thermal Channel as per TC3 but expect to be of lesser magnitude. In terms of works required for minor widening and minor deepening of Te Arikiroa Thermal Channel the effects are generally the similar as TC3 and TC4.	Not assessed for the wet weather flow discharge to the bamboo area. Average daily flow to the Te Arikiroa Thermal Channel as per TC3 but expect to be of lesser magnitude. In terms of works required for minor widening and minor deepening of Te Arikiroa Thermal Channel the effects are generally the similar as TC3 and TC4.	The April 2018 CIA states that the proposal which was then TC3 (but is now TC4), exhibits a number of positive and negative cultural effects. The significant positive effects were identified as: • the mauri of the treated wastewater quality; • water quality at the point of discharge; and • on the Whakarewarewa Forest through reduction in water inundation and nutrient saturation; • on the mana and mauri of Te Puarenga Stream through the cessation of treated wastewater discharges in the upper catchment. The significant adverse effects are deemed to be: • Loss of mana among local hapu who are strongly opposed to the discharge to the Rotorua-nui-	The April 2018 CIA states that the proposal which was then TC3 (but is now TC4), exhibits a number of positive and negative cultural effects. It is considered that these will be the same as TC3, however noting the reduced extent of the bunding. The significant positive effects were identified as • the mauri of the treated wastewater quality; • water quality at the point of discharge; and • on the Whakarewarewa Forest through reduction in water inundation and nutrient saturation; • on the mana and mauri of Te Puarenga Stream through the cessation of treated wastewater discharges in the upper catchment. The significant adverse effects are deemed to be:	If it proven from the further hydraulic considerations being undertaken that there was a positive driving force from the Puarenga Stream to Te Arikiroa Thermal Channel and that no bunding was required, and that tangata whenua agreement was reached. Then the same effects would apply in terms of TC3 and TC4 other than natural character.

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OPTIONS → / FACTORS AND ASSESSMENT (References) ↓	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
					• Kahumatamomoe as a matter of principle; • loss of mana from the discharge of treated wastewater to an ancestral icon, Rotorua-nui-Kahumatamomoe; • Effects on the relationship between local resident hapu members and the lake expressed through the activities of fishing and harvesting, cooking and healing. There are also some negative effects of a low to moderate nature that are likely. These include: • Effects on natural character of the Puarenga environment.	• Loss of mana among local hapu who are strongly opposed to the discharge to the Rotorua-nui-Kahumatamomoe as a matter of principle; • loss of mana from the discharge of treated wastewater to an ancestral icon, Rotorua-nui-Kahumatamomoe; • Effects on the relationship between local resident hapu members and the lake expressed through the activities of fishing and harvesting, cooking and healing. There are also some negative effects of a low to moderate nature that are likely. These include: • Effects on natural character of the Puarenga environment.	

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OPTIONS → / FACTORS AND ASSESSMENT (References) ↓	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
Geothermal Assessment (assessed by GNS Science included in Support Document No. 7)	Not assessed as the infrastructure required would not cross the Sulphur Flat geothermal area.	Not assessed for the infrastructure required to the bamboo area, as this would not cross the Sulphur Flat geothermal area. For the widening and deepening of Te Arikiroa Thermal Channel, the assessment concludes that deepening should be no more than 0.6 m on the Sulphur Flat thermal area due risk of hydrothermal eruption if excavated below this depth, particularly where high temperatures exist. It noted that areas of CO_2 degassing ground should be avoided. GNS commented that there were no obvious benefits of the widening and deepening of Te	Not assessed for the infrastructure required to the bamboo area, as this would not cross the Sulphur Flat geothermal area. For the widening and deepening of Te Arikiroa Thermal Channel, the assessment concludes that deepening should be no more than 0.6 m on the Sulphur Flat thermal area due risk of hydrothermal eruption if excavated below this depth, particularly where high temperatures exist. It noted that areas of CO_2 degassing ground should be avoided. GNS commented that there were no obvious benefits of the widening and deepening of	Not assessed for the infrastructure required to the bamboo area, as this would not cross the Sulphur Flat geothermal area. For the widening and deepening of Te Arikiroa Thermal Channel, the assessment concludes that deepening should be no more than 0.6 m on the Sulphur Flat thermal area due risk of hydrothermal eruption if excavated below this depth, particularly where high temperatures exist. It noted that areas of CO_2 degassing ground should be avoided. GNS commented that there were no obvious benefits of the widening and deepening of	For the widening and deepening of Te Arikiroa Thermal Channel, the assessment concludes that deepening should be no more than 0.6 m on the Sulphur Flat thermal area due risk of hydrothermal eruption if excavated below this depth, particularly where high temperatures exist. It noted that areas of CO_2 degassing ground should be avoided. GNS commented that there were no obvious benefits of the widening and deepening of Te Arikiroa Thermal Channel on the surface geothermal features of the Sulphur Flat. GNS stated that minor geothermal features within or adjacent to Te Arikiroa Thermal Channel are not considered of sufficient significant to be specially protected.	For the widening and deepening of Te Arikiroa Thermal Channel, the assessment concludes that deepening should be no more than 0.6 m on the Sulphur Flat thermal area due risk of hydrothermal eruption if excavated below this depth, particularly where high temperatures exist. It noted that areas of CO_2 degassing ground should be avoided. GNS commented that there were no obvious benefits of the widening and deepening of Te Arikiroa Thermal Channel on the surface geothermal features of the Sulphur Flat. GNS stated that minor geothermal features within or adjacent to Te Arikiroa Thermal Channel are not considered of sufficient significant to be specially protected.	For the widening and deepening of Te Arikiroa Thermal Channel, the assessment concludes that deepening should be no more than 0.6 m on the Sulphur Flat thermal area due risk of hydrothermal eruption if excavated below this depth, particularly where high temperatures exist. It noted that areas of CO_2 degassing ground should be avoided. GNS commented that there were no obvious benefits of the widening and deepening of Te Arikiroa Thermal Channel on the surface geothermal features of the Sulphur Flat. GNS stated that minor geothermal features within or

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OPTIONS / FACTORS AND ASSESSMENT (References)	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
		Arikiroa Thermal Channel on the surface geothermal features of the Sulphur Flat. GNS stated that minor geothermal features within or adjacent to Te Arikiroa Thermal Channel are not considered of sufficient significant to be specially protected.	Te Arikiroa Thermal Channel on the surface geothermal features of the Sulphur Flat. GNS stated that minor geothermal features within or adjacent to Te Arikiroa Thermal Channel are not considered of sufficient significant to be specially protected.	Te Arikiroa Thermal Channel on the surface geothermal features of the Sulphur Flat. GNS stated that minor geothermal features within or adjacent to Te Arikiroa Thermal Channel are not considered of sufficient significant to be specially protected.			adjacent to Te Arikiroa Thermal Channel are not considered of sufficient significant to be specially protected.
Ecological Assessment (assessed by Wildlands Consultants included in Support Document No. 7)	This was a preferred option from an ecological perspective as it has no effect on the Sulphur Flat and Te Arikiroa Thermal Channel would require the removal of the bamboo which was seen as positive.	Widening and deepening of Te Arikiroa Thermal Channel will have adverse effects due to the potential modification or removal of significant geothermal vegetation. Sediment loss and bank instability may occur as a result of proposed works may occur. The bamboo discharge was a preferred option	Widening and deepening of Te Arikiroa Thermal Channel will have adverse effects due to the potential modification or removal of significant geothermal vegetation. Sediment loss and bank instability may occur as a result of proposed works may occur.	Widening and deepening of Te Arikiroa Thermal Channel will have adverse effects due to the potential modification or removal of significant geothermal vegetation. Sediment loss and bank instability may occur as a result of proposed works may occur. The bamboo discharge was a	Widening and deepening of Te Arikiroa Thermal Channel will have adverse effects due to the potential modification or removal of significant geothermal vegetation. Sediment loss and bank instability may occur as a result of proposed works may occur. The construction of a continuous bund on the Sulphur Flat will have adverse effects due to the modification and burial of significant geothermal habitats.	Widening and deepening of Te Arikiroa Thermal Channel will have adverse effects due to the modification and burial of significant geothermal habitats. Sediment loss and bank instability may occur as a result of proposed works may occur. The construction of five small bunds will have adverse effects due to the modification and burial of significant geothermal habitats.	Widening and deepening of Te Arikiroa Thermal Channel will have adverse effects due to the potential modification or removal of significant geothermal vegetation. Sediment loss and bank instability may occur as a result of proposed works may occur. With no bunding required the effects only relate to the

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OPTIONS → / FACTORS AND ASSESSMENT (References) ↓	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
		from an ecological perspective as it would require the removal of the bamboo which was seen as positive.	The bamboo discharge was a preferred option from an ecological perspective as it would require the removal of the bamboo which was seen as positive.	preferred option from an ecological perspective as it would require the removal of the bamboo which was seen as positive.	Bunds will also provide for weed establishment and enhance predator access.	Bunds will also provide for weed establishment and enhance predator access. It is noted that the bund area is significantly less that Option TC3.	widening and deepening of Te Arikiroa Thermal Channel.
Natural Character, Landscape and Amenity Assessment (assessed by Wildlands Consultants included in Support Document No. 7)	This was a preferred option from a natural character, landscape and amenity perspective as it has no effect on the Sulphur Flat and Te Arikiroa Thermal Channel.	The minor widening and minor deepening of Te Arikiroa Thermal Channel will have some adverse effects on natural character because of the removal of sediment, increase in flow and the potential change in water colour. These will be significantly less than TC3, TC4 and TC5. The proposed works will have an adverse effect on the ONF. The significance of this adverse effect is	The minor widening and minor deepening of Te Arikiroa Thermal Channel will have some adverse effects on natural character because of the removal of sediment, increase in flow and the potential change in water colour. These will be significantly less than TC3, TC4 and TC5. The proposed works will have an adverse effect on the ONF. The significance of this adverse effect	The minor widening and minor deepening of Te Arikiroa Thermal Channel will have some adverse effects on natural character because of the removal of sediment, increase in flow and the potential change in water colour. These will be significantly less than TC3, TC4 and TC5. The proposed works will have an adverse effect on the ONF. The significance of this adverse effect is	The widening and minor deepening of Te Arikiroa Thermal Channel and construction of the continuous bund will have some adverse effects on natural character because of the removal of sediment, impact on area under the bund, increase in flow and the potential change in water colour. The proposed works will have an adverse effect on the ONF. The significance of this adverse effect is partly dependent on the amount of works required. The effect on amenity of modifying Te Arikiroa Thermal Channel will be to diminish the	The widening and minor deepening of Te Arikiroa Thermal Channel and construction of the five small bunds will have some adverse effects on natural character because of the removal of sediment, impact on area under the bunds, increase in flow and the potential change in water colour. These effects will be less than TC3. The proposed works will have an adverse effect on the ONF. The significance of this adverse effect is partly dependent on the amount of works required. The effect on amenity of modifying Te Arikiroa Thermal Channel will be	The widening and minor deepening of Te Arikiroa Thermal Channel will have some adverse effects on natural character because of the removal of sediment, increase in flow and the potential change in water colour. The proposed works will have an adverse effect on the ONF. The significance of this adverse effect is partly dependent on the amount of works required.

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OPTIONS → / FACTORS AND ASSESSMENT (References) ↓	Full Discharge to Western Bamboo Areas – 2 Sites (TC1)	Dry Weather Discharge to the Te Arikiroa Thermal Channel and Wet Weather Flow to the Bamboo Discharge Area (TC2)			Te Arikiroa Thermal Channel with Continuous Bund on Channel (All Flows) (TC3)	Te Arikiroa Thermal Channel with Small Bunds Adjacent to the Puarenga Stream (All Flows) (TC4) The Preferred Option	Te Arikiroa Thermal Channel and No Bund (TC5)
		Option 1 – Open Channel to Bamboo	Option 2 - Gravity Pipe to Bamboo	Option 3 - Pumped Pipe to Bamboo			
		partly dependent on the amount of works required, noting the works required is less than TC3, TC4 and TC5. The effect on amenity of modifying Te Arikiroa Thermal Channel will be to diminish the experience of visitors and users of the Te Ara Ahi trail. Change hidden from trail views will therefore have inconsequential effects on and amenity.	is partly dependent on the amount of works required, noting the works required is less than TC3, TC4 and TC5. The effect on amenity of modifying Te Arikiroa Thermal Channel will be to diminish the experience of visitors and users of the Te Ara Ahi trail. Change hidden from trail views will therefore have inconsequential effects on and amenity.	partly dependent on the amount of works required, noting the works required is less than TC3, TC4 and TC5. The effect on amenity of modifying Te Arikiroa Thermal Channel will be to diminish the experience of visitors and users of the Te Ara Ahi trail. Change hidden from trail views will therefore have inconsequential effects on and amenity.	experience of visitors and users of the Te Ara Ahi trail. Change hidden from trail views will therefore have inconsequential effects on and amenity.	to diminish the experience of visitors and users of the Te Ara Ahi trail. Change hidden from trail views will therefore have inconsequential effects on and amenity.	The effect on amenity of modifying Te Arikiroa Thermal Channel will be to diminish the experience of visitors and users of the Te Ara Ahi trail. Change hidden from trail views will therefore have inconsequential effects on and amenity.

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Table 9-13 should be read in conjunctions with Figures 9-11 and 9-12 which show the different options for the discharge.

Option TC2 involves discharging the average daily flow from WWTP via the land contact bed structure to the Te Arikiroa Thermal Channel with the wet weather flows from the WWTP discharged to a slightly western location where there is currently a bamboo grove. The driver to investigate this option was to eliminate the need for a bund along the Te Arikiroa Thermal Channel to prevent any flow across the Sulphur Flat to the Puarenga Stream. Subsequent hydraulic modelling highlighted that the critical consideration was high lake levels and at these times flow from the channel would flow across the Sulphur Flat. Accordingly these options did not eliminate the need for a bund. However, this work showed that smaller bund(s) could be used to achieve the same result.

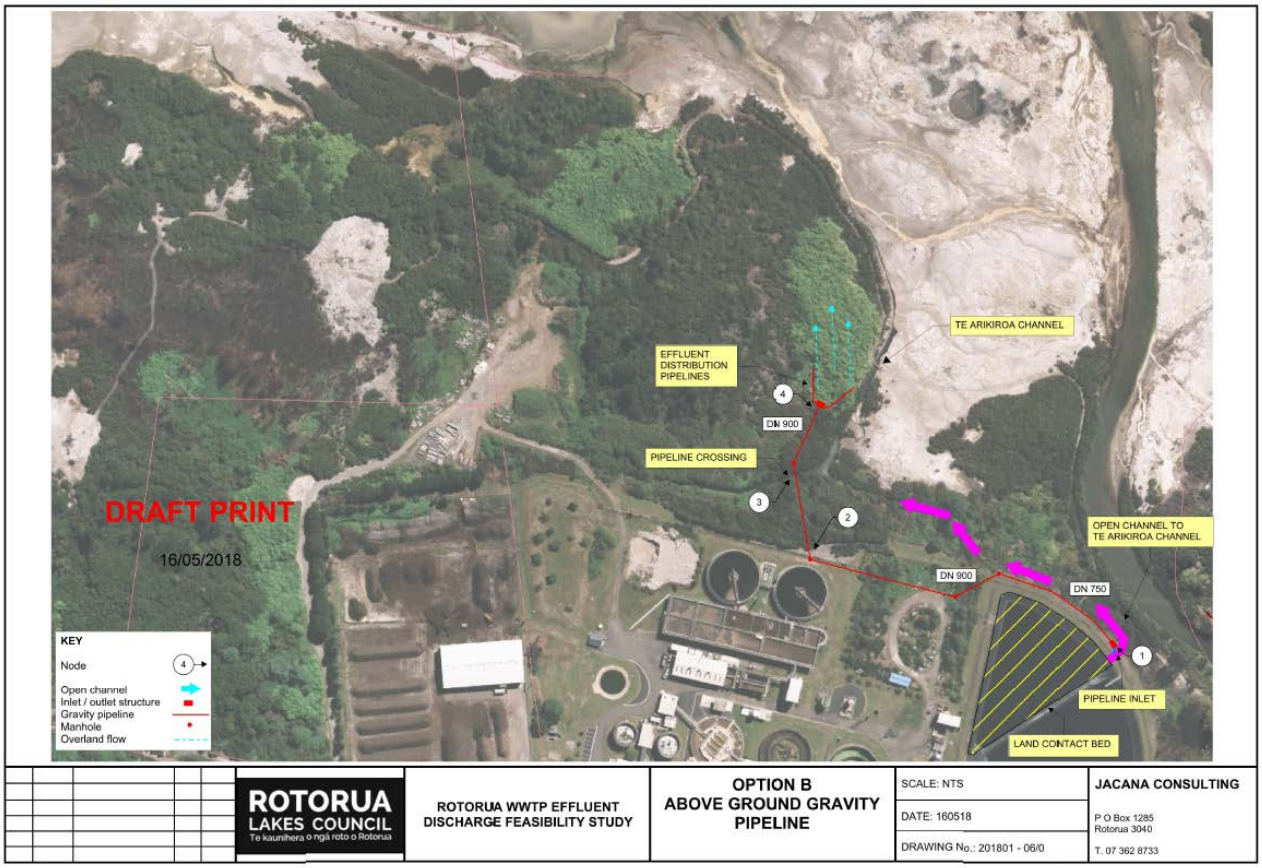


Figure 9-11: Te Arikiroa Thermal Channel Option TC2

9.12.9 Preferred Discharge Arrangement into the Te Arikiroa Thermal Channel

The effects of deepening and widening Te Arikiroa Thermal Channel and construction of a continuous bund up to 900 cm high on the eastern side were assessed (by GNS and Wildlands Consultants) and indicated a number of adverse effects including identification of silica sinter pan which, if disturbed by rapid excavation over 0.6 m depth, could lead to a hydrothermal eruption(s). Wildlands Consultants recommended reconsideration of the option of discharging the treated wastewater directly to the Puarenga Stream. In this respect the earlier assessment against this option by the RPSC and the CAS was reviewed and that review resulted in this option being not reassessed.

The further hydraulic assessment (also included in Support Document No.7) led to confirmation that using a widened Te Arikiroa Thermal Channel together with five small short bunds (~48 m combined length) located at zones 4.1 to 4.5 inclusive, and up to approximately 0.5 m high, being adjacent to the Puarenga Stream as shown Figure 9-12 would prevent treated wastewater flowing into the Puarenga

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Stream. These five small bunds would be located in depressions in Sulphur Flat that currently provide connectivity between the Puarenga Stream and Te Arikiroa Thermal Channel.

The outcome of this further hydraulic work coupled with the further assessment work by Wildlands Consultants of the ecological, natural character, landscape and amenity effects have led to the selection of Option TC4 as a preferred solution. Wildlands Consultants have some residual concerns about adverse effects that cannot be practicably avoided, remedied or mitigated.

Appendix L includes a response from Antoine Coffin, the author of the two CIA's (Companion Documents No. 1 and 2) supporting Option TC 4 involving the five small short bunds near the Puarenga Stream.

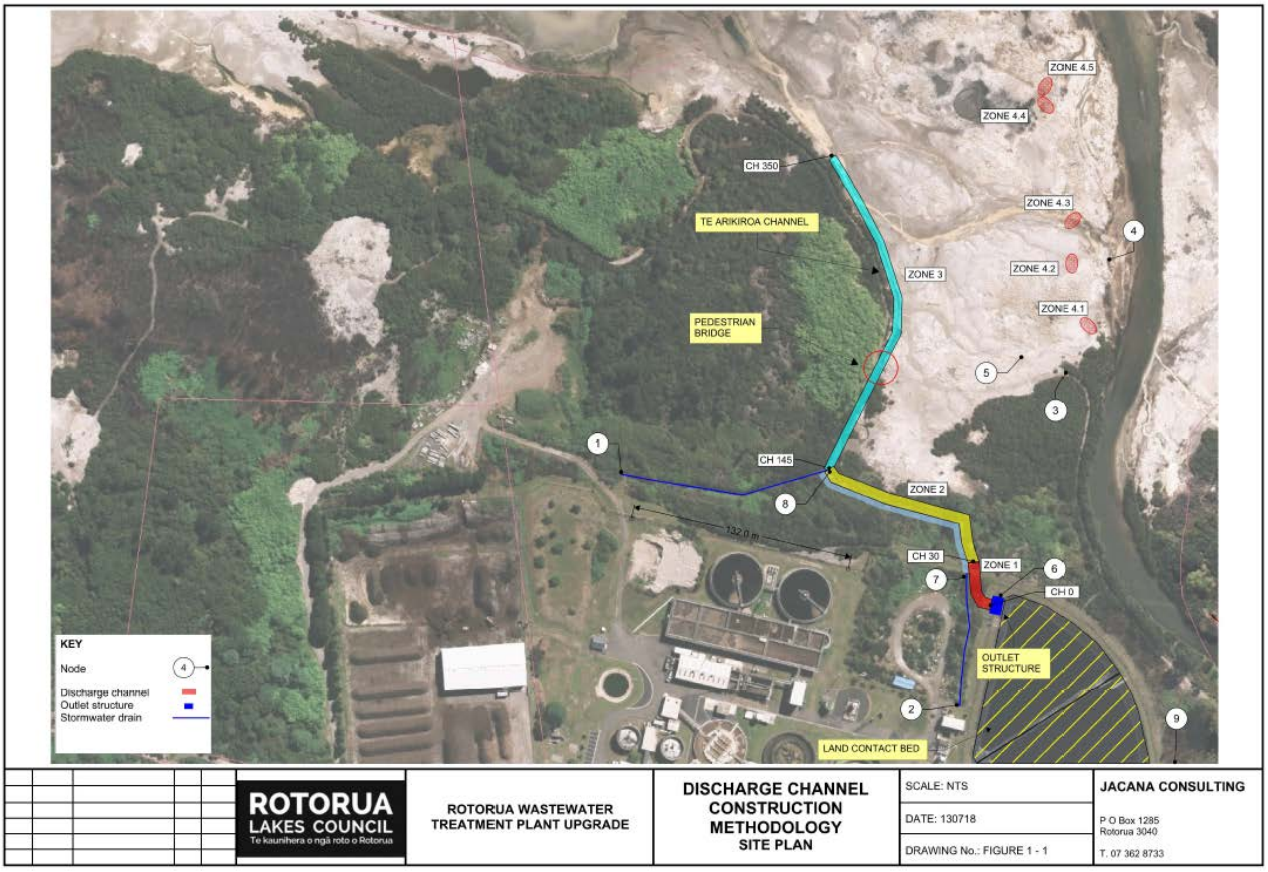


Figure 9-12: Te Arikiroa Thermal Channel Preferred Option TC4

The more recent hydraulic investigations have also highlighted that high flows in the Puarenga Stream are very likely to coincide with high wet weather flows from the WWTP being discharged into Te Arikiroa Thermal Channel and that a hydraulic barrier would effectively be created with the gradient from the high Puarenga Stream level falling across Sulphur Flat to the Thermal Channel. Should this be proven conclusively, it would eliminate the need for any bunds providing cultural values are not impacted in respect to the need for the bunds from the outset. The RLC is continuing to investigate the hydraulics and hydrology in this respect, such investigations will take some time and are reasonably complex.

9.13 Summary of Discharge Options Assessment Sequence

Figure 9-13 summarises the discharge options identified and progressively evaluated to arrive at the Preferred Scheme. This figure incorporates all the options discussed in the Sections 9.12 of this AEE above and further included in Support Documents No. 2 and 7.

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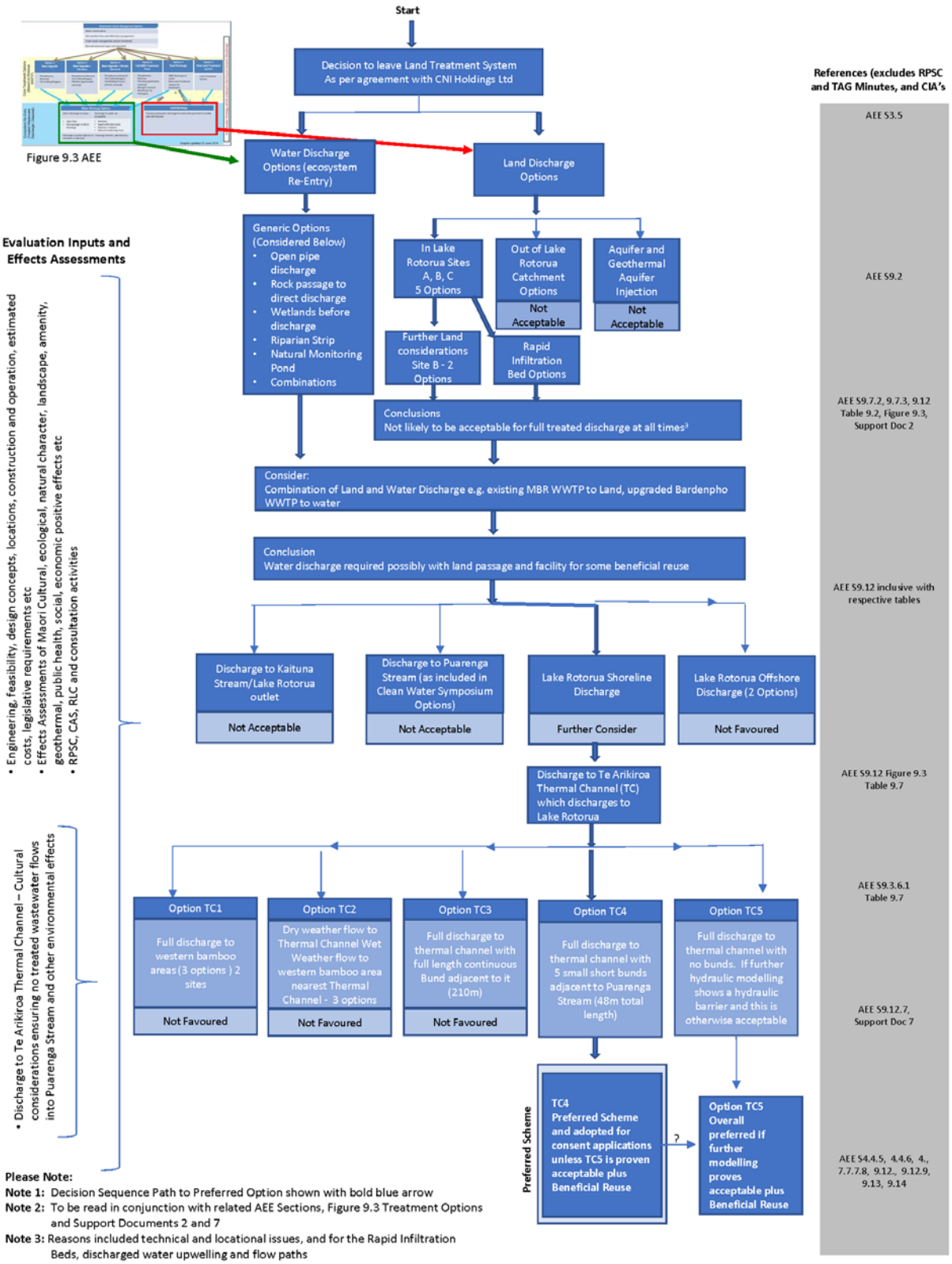


Figure 9-13: Summary of Discharge Options Assessment Sequence

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9.14 Beneficial Reuse Options

Throughout all deliberations of the RPSC, TAG, CAS and RLC the concept of being able to beneficially reuse the highly treated wastewater as well be produced by the preferred treated arrangements was promoted not withstanding appreciation that finding a fool proof beneficial reuse solution to take all the flow all the time was unlikely.

It was also appreciated that land treatment was in fact a beneficial reuse option if productive use was made of that land by, for example, forestry or a cut and carry hayledge operation.

Following the RPSC's and RLC's deliberations a beneficial reuse component was included in the Preferred Scheme as Component 6. This is outlined in Section 14 and included in the volunteered conditions in Appendix K.

The RPSC's key resolutions at its meeting on 9 June 2016 (second resolution item 2, as recorded in Sections 3.5 and 3.11 of this AEE) on the reuse of recovered water were adopted and expanded on 9 June 2016 by the RLC's Strategy, Policy and Finance Committee and further approved by full Council on 23 June 2016.

These two RLC meeting reports and resolutions are included in Appendix A of this AEE.

The actual wording of RPSC's resolution (2) is *"To continue to work with interested parties to investigate alternative discharge options including the reuse of recovered water".* The same wording is, in effect, included in the RLC's Committee and full Council's resolutions.

In order to facilitate these resolutions, the RLC working with Officers of the BOPRC have developed an approach of underpinning the suggested resource consent condition by facilitating beneficial reuse of the highly treated wastewater through a Beneficial Reuse Management Plan approach.

Beneficial Reuse of Treated Wastewater is included as Component 6 of the Preferred Scheme as set out in Section 4.4.6 of this AEE. Section 14 and Appendix K volunteered conditions includes a condition on the formulation and implementation of a Beneficial Reuse Management Plan.

9.15 Comparative Effects Assessment Alternatives

Throughout the assessment of alternatives, technical and economic considerations have allowed the comparison of these matters from an "effects" basis including the effects on the built environment, namely the existing wastewater infrastructure. Much of the RPSC's deliberations entailed comparing options from an effects basis. The records of RPSC's deliberations highlight this. Refer to Appendix B and Support Document No. 7 of this AEE.

The comparative effects of options on the natural environment, that is the freshwater ecosystem receiving environment into which treated wastewater would be discharged, has been covered in the University of Waikato's (Abell et al) ERI Report 80, October 2015 which is included as Support Document No. 3 to this AEE. Some information from that document is included in Section 7 of this AEE.

Table 9-13 and Section 9.13 of this AEE includes a high level comparative effects assessment of the Te Arikiroa Thermal Channel options.

Cultural considerations of the options have been reflected through the Cultural Impact Assessment (CIA) and sections of this report covering Maori cultural matters and the activities of CAS, RPSC and input from the various hui held.

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10 Consultation

This section of the AEE provides information on the consultation undertaken in respect of this Project.

Early in the development of the Project the RLC set up the RPSC and a TAG. The RPSC was initiated to be a key part of the consultation and engagement. Section 3.7 and Appendix B of this AEE covers the activities of the RPSC and Section 3.8 and Appendix C covers the TAG's activities.

This Section of the AEE should be read in conjunction with Support Document No. 8 – Project Consultation Information. This document is a compilation of the main consultation information documents and records. The two CIAs being Companion Documents 1 and 2 to this AEE also record Tangata Whenua Consultation matters.

10.1 Introduction

The RMA encourages, but does not require, consultation as part of the resource consent process. The Fourth Schedule of the RMA states that any AEE that must accompany resource consent applications should include:

> *h) An identification of those persons interested or affected by the proposal, the consultation undertaken, if any, and any response to the views of those consulted.*

Section 6 of the RMA sets out the 'matters of national importance' that must be recognised and provided for by all persons exercising functions and powers under the RMA and includes:

> *e) The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga.*

Section 7 of the RMA sets out 'Other Matters' those persons whom exercising functions and powers under the RMA shall have particular regard 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*
>
> *(d) intrinsic values of ecosystems*
>
> *(f) maintenance and enhancement of the quality of the environment*
>
> *(g) any finite characteristics of natural and physical resources*
>
> *(h) the protection of the habitat of trout and salmon*
>
> *(i) the effects of climate change*
>
> *(j) the benefits to be derived from the use and development of renewable energy.*

Section 8, Treaty of Waitangi of the RMA requires that:

> *In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).*

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10.2 Who Was Consulted?

10.2.1 Tāngata Whenua

In 2014 the RPSC was formed to investigate and recommend a preferred option to the RLC for both the upgrade of the treatment plant and an alternative discharge location and method. The committee was made up of Council members, tāngata whenua representatives and an independent chair. There were tāngata whenua representatives from the following groups:

- Tapuika Iwi Authority;
- Ngāti Te Kahu/Ngāti Hurunga Te Rangi;
- Ngāti Whakaue;
- Ngāti Pikiao;
- Ngāti Makino;
- Te Roro-o-te-rangi / Uenukukopako;
- Ngāti Hurunga Te Rangi;
- Tuhourangi Tribal Authority;
- Te Arawa Lakes Trust;
- CNI Iwi Land Management Ltd;
- Ngāti Rangiwewehi; and
- Tuhourangi/Ngāti Wahiao.

The Cultural Assessment Subcommittee (CAS) was established by the RPSC to facilitate discussions among potentially affected iwi and hapū regarding cultural aspects of the Project. A cultural assessment specialist consultant, Antoine Coffin, was appointed to assist the CAS in their input of cultural advice to the RPSC and oversee the preparation of a cultural impact assessment. The two CIA's (Companion Documents Number 1 and 2) include output from the CAS.

Consultation with wider tāngata whenua has occurred in three phases. These were supplementary to the regular meetings of the RPSC and CAS:

1. Consultation (meetings/workshops) with the local community at Ngapuna;
2. Consultation with wider Maori community and public; and
3. Consultation with iwi, hapū and statutory entities regarding the land contact bed as is included in the April 2018 CIA (Companion Document No. 2).

10.2.2 Statutory Bodies

The key statutory bodies consulted in respect of this Project included the following:

- The BOPRC;
- Te Arawa Lakes Trust;
- Department of Conservation; and
- Toi Te Ora Public Health and the Medical Officer of Health

Initial discussions were undertaken with the statutory bodies from January 2014 – November 2017 to introduce the Project. As the Preferred Scheme was developed, further meetings and discussions have been held with these statutory bodies.

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It is noted that the BOPRC and Toi Te Ora Public Health had representatives on the RPSC. The BOPRC representative had voting authority.

Email correspondence between Toi Te Ora Public Health on the Public Health Risk Assessment and QMRA is included in Support Document Number 8.

10.2.3 Other Key Stakeholders

The key stakeholders consulted in respect of this Project included:

- CNI Iwi Land Management Ltd
- Iwi and hapu groups who were not members of the RPSC; and
- Community representatives on the RPSC.

Initial discussions were undertaken with the key stakeholders from January 2014 – November 2017 to introduce the Project. As the Preferred Scheme was developed, further meetings and discussions have been held with these key stakeholders.

10.2.4 Wider Community

A number of consultation approaches were taken to encourage the wider community, public and organisations interested in, or potentially affected by the Preferred Scheme to become involved in the consultation process. These included two information brochures, site visits to the WWTP and regular project updates via the RLC website and ratepayer newsletters.

A series of frequently asked questions were also prepared and made available on the RLC website and feedback and ideas were invited through the RLC's "Let's Talk Korero Mai" website. These are included in Support Document Number 8.

10.3 Stages of Consultation

The project programme and associated consultation activities were undertaken in three stages with an additional activity towards the end of the process relating to the development of the land contact bed and discharge structure.

- Stage 1: The RLC's announcement of the Project at its formulation stage and the establishment of the RPSC. This took place in late 2013 to early 2014;
- Stage 2: The wider community information dissemination on the overall Project and how it was being developed along with a draft timeline. A key resource in this stage was the information booklet titled "Out of the Forest by 2019". This took place in the later part of 2015; and
- Stage 3: Substantial consultation activity. This stage included public meetings as described in Table 10-1, site visits to WWTP and two hui. A detailed brochure titled "Finding a Solution for the Future" underpinned this substantial stage of consultation. These activities took place in early to mid 2016; and
- Following Stage 3 and the resolutions from both the RPSC, RLC's Strategy, Policy and Finance Committee and the RLC's full Council, RLC Officers and CAS then proceeded with further iwi consultation on the development the land contact bed and discharge structure. An engagement plan was developed and this included the establishment of a Mātauranga Māori Experts Group. This activity included the preparation of a video and artist impression of the proposed land contact bed and discharge structure (refer Section 4.4.4 of this AEE). These activities took place in mid to late 2017 (details of which included in the Companion Document No. 2 Cultural Impact Assessment of a Discharge of Treated Wastewater to Lake Rotorua through a Land Contact Bed at Puarenga Bay.

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10.4 Role of the Rotorua Project Steering Committee (RPSC) in Undertaking Consultation

As set out in Appendix B, the RPSC's Terms of Reference included leading the consultation process and to ensure that it complies with the requirements of the RMA and LGA.

In this respect the RPSC was closely involved in the development and undertaking of the Stage 2 consultation with Chair Warren Webber and other members involved in the development of the consultation strategy and presenting at the three meetings in December 2015.

For the Stage 3 consultation the RLC's executive and communication personal led the community meetings and hui with RPSC representatives also involved. The RLC called for written submissions and comments, which are summarised Section 10.5.3 of this AEE.

10.5 Issues and Responses

As evident in the above parts of this section, a wide range of consultation activities have been undertaken with the public, key stakeholders and statutory organisations, community groups and the community at large during the many technical and scientific studies, the alternatives assessment and the overall development of the Preferred Scheme.

The output from this consultation has assisted the RLC to formulate the Preferred Scheme and associated resource consent approach and the set of resource consent conditions offered by the RLC (as included in Section 14 and Appendix K of this AEE).

10.5.1 Maori Cultural Issues and Reponses

A broad range of more than 37 issues, have been identified in the preparation of two CIAs included with this AEE as Companion Documents. The key issues are provided in Table 10-1 with the RLC's response.

Table 10-1: Issues and Respones

Issues raised	RLC's response
Avoid a discharge to rivers and a direct discharge to Lake Rotorua	The proposal has avoided discharges to Puarenga Stream, cease discharge to Puarenga tributaries, and other rivers. The discharge of treated wastewater to Lake Rotorua will be through a land contact bed to provide spiritual cleansing of the treated wastewater.
Preference of a discharge of treated wastewater to land.	The Whakarewarewa Forest is no longer available as a discharge site for treated wastewater. Considerable time and effort was spent on exploring alternative land sites but were discounted. A land contact bed has been developed in consultation with pūkenga (tribal experts) to provide a treatment facility based on Matauranga and Matapono Māori. Future options for discharge to land and re-use have not been discounted. The proposal can be retrofitted to provide use of water at alternative sites and uses.
The plant to meet the performance expectations of tāngata whenua across a range of scientific, practical and matauranga Maori indicators.	The proposal has been selected to best meet the broad expectations of the RPSC and CAS members. This included attributes such as Nitrogen, Phosphorus, human health, aquatic life, clarity, colour, smell, sediment, as well as reliability,

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Issues raised	RLC's response
	certainty, ability to upgrade and improve over time, effectiveness and capacity for storage.
Alternative sites, technology and processes	Considerable time and effort was spent on exploring alternative land sites but were discounted. Future options for discharge to land and re-use have not been discounted. The proposal can be retrofitted to provide use of water at alternative sites and uses. Council will look to periodically review new technologies, systems and processes with a view to potential improvements at the wastewater treatment plant. The opportunity for alternative sites and uses of the treated water may be available and feasible in the future. The plant is configured to facilitate this occurring.
Potential impact on customary resources such as geothermal area, mahinga kai, access/use and presence of wāhi tapu and sites of significance.	The proposal has avoided discharges to Puarenga Stream, cease discharge to Puarenga tributaries, and other rivers. The discharge point is immediately adjacent to the treatment plant and requires some modification, however, uses existing infrastructure and natural rivulet. The area is a dangerous and hostile environment for most terrestrial and aquatic life. Mitigations are being implemented to control the flow of the discharge to the lake.
There is a history of public works and planning decisions that have negatively affected local Maori communities and have contributed to long-term social and cultural deprivation.	The Council proposes to continue dialogue with local communities to identify and implement programmes and projects that contribute positively to the social, cultural, environmental and economic well-being of the people.
The Council should do more to conserve, reduce, reuse and recycle.	The Council currently recycles solid waste through a vermi-composting facility in Kawerau. This will continue. Council is investigating some interventions at source to reduce water usage and waste production.
There should be a range of mitigation, enhancement and remedial works as a result of the proposal.	Council will establish a tāngata whenua representative group to provide advice and feedback on the implementation of the consents, and provide oversight on monitoring. A range of measures to remediate the Whakarewarewa Forest will be negotiated with CNI Holdings. Enhancement programmes for the Puarenga Stream are proposed as part of a wider project.
Incorporate and recognise tikanga Māori, matauranga Māori in the monitoring of the Project.	Council has committed to developing performance standards for the land contact bed and reporting on a range of attributes/indicators that are of importance to tāngata whenua.

10.5.2 Stage 2 Issues

Table 10-2 sets out the series of public meetings held and summarises comments and questions raised and identifies RLC's and RPSC's responses and also where these comments and questions are addressed in the AEE documentation.

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Table 10-2: Public Meetings

Date/Location	Comments/Question	RLC/RPSC Response
8 November 2014 Whakaue Marae, Maketu	• Background to the Project presented including the work of the RPSC, the CAS and the TAG.	
	• Question about the treatment options being looked at	Indicated Options 1, 2 and 3 being looked at with 4 and 5 still open for consideration.
	• Question about Option 5 and LTS	Land is a limiting factor.
	• Question whether the CAS has considered effects on the Maketu community.	Assurance given that this is the case.
	• Question on funding commitments for Options 4 and 5.	Research and consultation budget is $500,000 for the current year.
	• Questions on whether a cropping system on irrigated was being looked at, like Taupo.	The TAG are aware of the technology and the questioner was invited to present to TAG.
	• Concern was raised that Maketu was being overlooked in the process in process of developing the Project.	This was a first meeting in the public consultation round and the importance of consulting with Maketu residents is well recognised.
	• Comment was made about the degree of treatment.	The guiding principle is to have the Mauri restored and be capable of sustaining life.
	• Question whether the CAS can come to Maketu and assess the effects and whether the Mauri model can be utilised to guide RPSC's decision making	Explained that the CAS would consider the appropriateness of the Mauri model a possible option along with other tools and processes.
	• Discussion on decision making responsibilities and the history of the previous proposal to discharge treated effluent to the headwaters to the Kaituna	The Regional Council is the decision maker for the discharge. Was noted that the Waitangi Tribunal recommendation was that Council should abandon its (then) proposal to discharge direct to the Kaituna River. Therefore, this is a precedent that exists in terms of a tribunal decision.
11 November 2014 Te Ao Marama Hall	• Update on the Project and the activities of the RPSC	
	• Discussion on the N sustainable load	Approximately 23 tonnes per annum discharged from the 350 to 450 received at the WWTP.

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Date/Location	Comments/Question	RLC/RPSC Response
	• Question about farming and N loads	Not part of the Project.
	• Question about the urban footprint regarding stormwater and urban runoff	Yes, information available on request.
	• Question on monitoring of the LTS	The LTS is monitored in addition to the resource consent condition.
	• Question about a new LTS	This would require more than 400 ha of land, investigations have been put on hold but were to be further investigated as by the TAG. Noted that as part of the RMA process, all options are given the same prominence. Preference would be for a cut and carry operation. Indicated there would be difficulties to find required amount of land and the may cultural concerns with iwi owned land.

10.5.3 Stage 3 Issues

Table 10-3 sets out the series of public meetings held and summarises comments and questions raised and identifies RLC's and RPS's responses and also where these comments and questions are addressed in the AEE documentation.

Table 10-3: Public Meetings

Date/Location	Comments/Question	RLC/RPSC Response
7 May 2016 Te Papaiouru Marae	• Contingency plans or considerations in times of natural disaster/shut down or earthquakes.	• Included in Council's Emergency Management and Operational documentation
	• The meaning of practicable.	• As per the interpretation of Best Practicable Option in the Resource Management Act 1991. Refer AEE Section 17 of this AEE Glossary of Terms and Abbreviations.
	• Reason for the removal or elimination of land based option – was it cost?	• Refer to Sections 2.2, 2.4. 2.6, 3.5, 3.6 and 9 of this AEE. Cost was one of the many factors but not the driver to leave the LTS in the Whakarewarewa Forest.
	• Can the water be pumped back to the drinking water system?	• Technically this could be done with addition of a very advanced water treatment plant after and upgraded WWTP. Whether the Health Authorities would allow this is not known

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Date/Location	Comments/Question	RLC/RPSC Response
	• Ngati Huranga Te Rangi's opposition to the discharge location was expressed: o This is our whenua our wahi, where our kaitiaki live, our taniwha – Ruamano. o Our tipuna would gather kai there o Dream to restore the waterways o Unacceptable for gathering kai (tapu) – not addressed by running through rocks o Treated wastewater needs to go back to land o Possibility of splitting the project (WWTP (1 part) + discharge (1 part)) o CNI – reconsider reuse of the land in the Whakarewarewa Forest o Further discussion on options	• These matters are covered in the two CIAs being Companion Documents 1 and 2 to this AEE and in AEE Sections 6.6, 7.8, 10 along with the alternatives/options Section 9. Throughout the project development both the treatment and discharge options were separately then jointly considered.
	• The upgraded WWTP emulates the natural cleansing process of papatuanuku	• Refer to the second CIA – Companion Document No. 2 and Section 4.4.4 of this AEE
11 May 2016 SHMCPA (Civic Centre)	• When the Whakarewarewa Forest was handed back to the iwi under the CNI collective, there were covenants in place to allow for spray irrigation to continue in perpetuity subject to compliance to resource consent.	• Refer to Section 2.2 "Overall Background" of this AEE. A resource consent has a duration associated with it, 35 years is the maximum duration before a new consent is needed.
	• The people in London drink this type of water (treated recovered water) - why is it not acceptable to go the lake?	• The assessment of effects show that from a public health, water quality and ecological view point it is acceptable to discharge it back into Lake Rotorua in terms of the provisions of the RMA, other legislation and planning instruments.
	• Culturally offensive to discharge to lake – need more options.	• Refer to the two CIA's – Companion Documents 1 and 2 and Sections 6.6, 7.8, 8.4, 9 and 10.2 of this AEE.
	• Recharge to geothermal field option.	• This was considered by the Technical Advisory Group (TAG) and RPSC and deemed not to be an acceptable option
	• Can the water be bottled or other reuse.	• Yes it can be reused and this is proposed for some to the treated wastewater, refer Sections 4.4.6 and 7.9 and Appendix K of this AEE. For bottled drinking water a very advanced water treatment plant would also be required along with a very high level of quality control. This is practiced in Singapore.
	• Virus and endocrine disruption monitoring.	• Virus removal will be monitored by using a validated ultraviolet (UV) light does procedure as set out in volunteered condition 12 Appendix K of this AEE. Emerging Organic contaminants are discussed in Section 7.5.3 of this AEE and will be

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Date/Location	Comments/Question	RLC/RPSC Response
		monitored as set out in volunteered condition Part B – Appendix K
	• Take it out of catchment in a tank.	• The RPSC considered "out of catchment discharges" and decided against any such option. Specifically tanking all wastewater out of the catchment was not considered as it would be basically impracticable and very expensive.
28 May 2016 Whakaue Marae, Maketu	• Attendees mostly RPSC members together with one or two people from the local community	• Questions and comments from the meeting include whether there has been any progress on alternatives and any land sites. The RPSC stated that there were no developments at that time to report and discussions were ongoing.

A broad range of issues and support for the Project was raised through the submission and comments period. A summary of which is provided below.

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Table 10-4: Breakdown of Written Submissions

	Number
Number of written submissions received	20
Supports the proposed treatment plant upgrade	16
Supports the discharge to a land contact bed at Sanatorium Reserve, then into Te Arikiroa (Puarenga Bay)	3
Supports the alternative discharge to land	6

Key points raised in the written submissions are:

- The current proposal of discharging wastewater into Lake Rotorua, even if it is treated to a high standard, is considered to be distasteful and culturally insensitive.
- The Whakarewarewa Forest was part of the Treaty Settlement. The agreement guaranteed the use of designated areas within the Whakarewarewa Forest being used by Rotorua Lakes Council, to dispose treated wastewater consistent within the requirements of the current resource consent.
- Lake Rotorua has improved in water quality since 2004, as measured using the Trophic Level Index (TLI). Discharging into Lake Rotorua would put this at risk and a step back to pre-1989 times.
- The CNI Deed of Agreement should never have been agreed, or at least it should not have been agreed until an alternative option to the existing discharge had been identified and costed.
- Discuss the potential for compensation from the CNI Collective to Council to facilitate the change in discharge system. The CNI Collective's negotiation with Government over the return of the land involved compensation to allow Rotorua to spray treated wastewater on this land.
- The cost to upgrade the WWTP to remove nitrogen is expensive. The budget allocation for the proposed WWTP upgrade is better spent by implementing more cost and outcome effective nitrogen removal alternatives.

These submissions were duly considered by the RSPC and the RLC prior to making their recommendations for the Preferred Scheme.

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11 Monitoring

11.1 Introduction

The following sub-sections briefly discuss the different purposes and types of monitoring. Section 14 and Appendix K includes these matters in respect to the volunteered conditions.

11.2 Monitoring of the WWTP Operation

As part of normal and prudent WWTP operation the RLC has a range of monitoring procedures in place that ensure efficient and effective operation of the WWTP including the immediate notification of operating issues. This protocol will be expanded and modified in accordance with the treatment upgrade. The volunteered conditions (Section 14 and Appendix K of this AEE) include the requirement for the RLC to submit a WWTP Management Plan (WTPMP). This will include an outline of the RLC's in plant monitoring procedures. These will include a range of treated wastewater parameters. It is noted that the in plant monitoring does not form part of volunteered compliance conditions for the discharge consents (assuming the consents are granted).

11.2.1 Discharge Volumes

The monitoring procedure is as outlined in the RLC's volunteered conditions and involves measuring and recording the continuous rate that treated wastewater is discharged to the Land Contact Bed. Refer to the discussion in Section 14 of this AEE and Appendix K for the proposed monitoring.

11.2.2 Discharge Quality and Treatment Process Requirements

The RLC's volunteered conditions (Appendix K) include three technology conditions relating to the installation and operation of the preferred treatment system being a fine filtration membrane (MBR) arrangement with UV disinfection and additional phosphorus removal. A time-proportional weekly composite sample of wastewater samples will be collected from the point where the treated wastewater enters the Land Contact Bed. These samples will be analysed for TN and TP. In addition, every five years samples will be analysed for 12 EOCs as set out in Part B of Appendix 2 attached to the volunteered conditions (Appendix K).

11.3 Receiving Water Quality

The RLC's volunteered conditions (Appendix K) include a monitoring programme. The proposed monitoring focusses on assessing effects on water and sediment quality within Sulphur Bay as this is considered to be the receiving environment for the discharge from the WWTP. No specific monitoring is proposed, or considered necessary, within Te Arikiroa Thermal Channel.

Water samples will be collected from eight sites every three months and analysed for a wide range of determinands including nutrients and metals. Lake bed sediment samples will be collected annually from three sites and also analysed for a wide range of determinands including nutrients and metals.

11.4 Discharge of Contaminants (Odour) to Air

The volunteered conditions (Appendix K) include the provision of an Odour Management Plan (OMP). The provisions of this plan set out the requirements in terms of odour monitoring.

11.5 Beneficial Reuse of Treated Wastewater

The monitoring procedures for such activities associated with the discharge of treated wastewater to land will be in accordance with the Beneficial Reuse Management Plan (BRMP) approach outlined in Section 14 and Appendix K of this AEE.

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12 Statutory Assessment

12.1 Introduction

The following sections set out the key statutory considerations applicable to these applications.

12.2 Section 104 Resource Management Act

Section 104 of the RMA sets out the matters a consent authority must, subject to Part 2 of the RMA[22], have regard to when considering resource consent applications. The matters that are of relevance in considering these applications are outlined below.

12.2.1 Section 104(1)(a) RMA: Actual and Potential Environmental Effects

Section 104(1)(a) requires the consent authority to have regard to any actual and potential effects on the environment of allowing the activity. Table 12-1 sets out which sections of this AEE describe any actual and potential environmental effects associated with the Preferred Scheme.

Table 12-1: Actual and Potential Environmental Effects

Effects of the Preferred Scheme in Relation to	Section of this AEE
Positive effects	Section 7.2
Water quality	Section 7.3 – 7.6 and Support Document No. 4
Public health	Section 7.6
Air quality	Section 7.7
Ecology	Section 7.3.5
Natural Character, Landscape and Amenity	Section 7.3.4
Geothermal	Section 7.3.6
Contaminated Land	Section 7.3.7
Cultural effects	Section 7.8 and the Companion Documents No.1 and 2.

12.2.2 Section 104(1)(ab) RMA: Measures Proposed or Agreed to by the Applicant for the Purpose of Ensuring Positive Effects

Measures proposed or agreed to by the applicant for the purpose of ensuring positive effects on the environment to offset or compensate for any adverse effects on the environment are set out in Sections 7.2, 14 and Appendix K of this AEE.

12.2.3 Section 104(1)(b)(i) RMA: National Environmental Standards

Section 104(1)(b)(i) requires the consent authority to have regard to any relevant provisions of a national environmental standard. The following standards are assessed below.

[22] See further discussion on current legal position on this matter in Section 12.5 of this AEE.

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12.2.3.1 National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health 2011

The National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health (the NES-CS) regulation commenced on 1 January 2012 and provides a nationally consistent set of planning controls and soil contaminant values to ensure land affected by contaminants in soil is appropriately identified and assessed before it is developed, and if necessary, remediated or contained to make the land safe for human use.

As set out in Section 5.2 of this AEE, resource consent is required for a controlled activity under the NES-CS. Therefore, the RLC's application is limited to the matters of control set out in Table 12-2.

Table 12-2: Matters of Control

Matter	Comment
s9(2)(a) the adequacy of the detailed site investigation, including— (i)site sampling: (ii)laboratory analysis: (iii)risk assessment:	A Contamination Assessment Report and Site Management Plan (SMP) have been prepared for the Te Arikiroa Thermal Channel area. These are included in Support Document No 7. and include site sampling, laboratory analysis and a risk assessment.
s9(2)(b) how the activity must be— (i)managed, which may include the requirement of a site management plan: (ii)monitored: (iii)reported on:	A SMP has been prepared by Stantec. This is included in Support Document No. 7. The SMP outlines the investigations recommended prior to excavation occurring, as well as addressing the management of stockpiles of any contaminated material encountered during construction and the reuse of suitable soils.
s9(2)(c) the transport, disposal, and tracking of soil and other materials taken away in the course of the activity:	The SMP states that contaminated material must be disposed of off-site at a landfill licensed to receive contaminated material. A number of requirements are set out in the SMP with regard to the transport and disposal of contaminant material.
s9(2)(d) the timing and nature of the review of the conditions in the resource consent:	The resource consent is only required for the minor widening and deepening of the Te Arikiroa Thermal Channel and construction of the five small bunds adjacent the Puarenga Stream.
s9(2)(e) the duration of the resource consent.	A duration of ten years is sought.

12.2.3.2 National Environmental Standard for Sources of Human Drinking Water 2008

The National Environmental Standard (the NES-DW) for Sources of Human Drinking Water seeks to reduce the risk of contaminating New Zealand's drinking water sources such as rivers and groundwater. It does this by requiring regional councils to consider the effects of activities on drinking water sources in their decision making. The NES-DW came into effect on 20 June 2008 and is a regulation under the RMA.

The RLC has confirmed that the proposed discharge is not upstream or up gradient of any of the minor, medium, or large community drinking water supplies i.e. those providing water for 501 or more people, in the Eastern Bay of Plenty (Health District 5) or Rotorua and Taupo (Health District 6). Therefore, the NES-DW is not considered relevant in this instance.

12.2.3.3 National Environmental Standard for Air Quality 2004

In October 2004 the Government introduced the National Environmental Standards for Air Quality (the

NES-AQ) which specifies concentration limits and in some instances allowable exceedances of those limits.

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Furthermore, a review of the NES-AQ in 2011 introduced regulations to restrict the granting of resource consent for industry after 2013 if they exceed specified PM10 (fine particulate matter less than 10 microns in diameter) concentrations. The discharges to air associated with the Preferred Scheme will not involve contaminants listed in Schedule 1 of the NES-AQ and, as such, it is not relevant in this instance.

12.2.3.4 Section 104(1)(b)(iii) RMA: National Policy Statement for Urban Development Capacity 2017

The National Policy Statement (NPS-UDC) on Urban Development Capacity came into effect on 1 December 2016. The NPS-UDC seeks to ensure that adequate land is identified and zoned to enable the growth of urban communities. Further to this, the NPS-UDC sets out that infrastructure required to support urban development is likely to be available (Policy PA2).

An assessment of the Preferred Scheme against Policy PA2 of the NPS-UDC is contained in Appendix I of this AEE. It is considered that the Preferred Scheme is consistent with the objectives and policies of the NPS-UDC.

12.2.3.5 Section 104(1)(b)(iii) RMA National Policy Statement for Freshwater Management 2014

The National Policy Statement for Freshwater Management 2014, updated in August 2017 (the NPS-FM 2014) reflects Central Government's policy and directions to local government regarding the management of the nation's freshwater resources. Consent authorities must have regard to the NPS-FM when considering resource consent applications.

The NPS-FM 2014 was amended to give more certainty around the requirements for water quality and provides a common language for describing and measuring water quality. The NPS-FM 2014 specifies processes for setting objectives, scientifically-informed bottom lines for key attributes of water quality, and a requirement that regional councils put in place measures to better account for the contaminants going into water.

The BOPRC has set an implementation programme of implementing the provisions of the NPS-FM. This includes establishing limits for the total amount of specified contaminants that enter the receiving waters within a catchment at risk. For Lake Rotorua the mass of TN that enters the lake need to be reduced so that they not exceed 435 t/yr by the year 2032. No discharges shall be authorised beyond 2032 that results in the TN limit for Lake Rotorua being exceeded. The intention is to allocate TN allowances amongst the various land use sectors within the catchments, having regard to principles of equity and fairness.

An assessment of the Preferred Scheme against the relevant provisions of the NPS-FM 2014 is contained in Appendix I of this AEE. Section 7 of this AEE assessed the predicted water quality against the attribute states of the NPS-FM.

It is considered that the Preferred Scheme is consistent with the objectives and policies of the NPS-FM.

12.2.4 Section 104(1)(b)(v) RMA: Regional Policy Statement

12.2.4.1 Regional Policy Statement for the Bay of Plenty 2014

The second generation Regional Policy Statement for the Bay of Plenty (RPS) was made operative on 1 October 2014.

The RPS provides a framework for sustainably managing the region's natural and physical resources. It highlights regionally significant issues with land, air, fresh and coastal water, infrastructure and biodiversity, including issues of significance to iwi. Decision makers on resource consent applications must have regard to the relevant provisions of a Regional Policy Statement as required by Section 104(1)(b)(v) of the RMA.

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An assessment of the Preferred Scheme against the relevant provisions of the RPS is contained in Appendix I of this AEE. It is considered that the Preferred Scheme is consistent with the majority with the objectives and policies. Whilst regard has been had to relevant provisions of the RPS, the Preferred Scheme is not consistent with all the natural character, Outstanding Natural Features and significant indigenous vegetation objectives and policies.

12.2.5 Section 104(1)(b)(vi) RMA: Regional and District Plans

12.2.5.1 Regional Natural Resources Plan

The various 'regional' resource consents sought by the RLC are outlined in Section 5.3 of this AEE and an assessment against the relevant provisions of the Regional Natural Resources Plan (RNRP) is contained in Appendix I.

It is considered that the Preferred Scheme is consistent with the majority of relevant objectives and policies of the RNRP with the exception of objectives and policies on natural character and avoiding adverse effects on cultural values.

Two of the resource consents sought are for restricted discretionary activities. The matters for which Council's discretion is restricted are set out in Tables 12-3 and 12-4.

Table 12-3: Matters of Discretion for Rule RL R7 Increased Discharges of Nitrogen and Phosphorus from Discharge Activities in the Catchments of Lakes Okareka, Rotoehu, Okaro, Rotorua and Rotoiti

Matter	Comment
(a) Measures to offset adverse effects on water quality, including surface water and groundwater.	As described in the Section 4 and 7 of this AEE the preferred treatment system will produce a very high quality of treated wastewater. This system has been developed to address the following: • That TN mass load discharge limits discharged to Sulphur Bay (Lake Rotorua) will not exceed the sustainable long term limits that have been determined to be consistent with the provisions of wastewater allocation of the RPS; • That the TP mass loads will similarly ensure sustainable discharge in terms of the phosphorus and the phosphorus: nitrogen ratios relating to Sulphur Bay (Lake Rotorua); • Providing a very high level of public health protection through the provision of the proposed membrane filtration and UV disinfection system; and • Ensuring high level removal of other contaminants including suspended solids – organic material, micro-pollutants, such that the effects and receiving environment are less than minor. In terms of 'offsetting' it is considered that the transfer of TN to the WWTP through the MoU (as described in Section 4.7 of this AEE) will result in a no net increase of N discharged to Lake Rotorua from the WWTP.
(b) Measures to fully offset the increase in the discharge of nitrogen or phosphorus from the activity within the same lake catchment.	As described in Section 4.7 of this AEE, a Memorandum of Understanding (MoU) between the BOPRC, the RLC, and Te Arawa Lakes Trust outlines how N allocations are to be dealt with as rural land is developed and reticulated into the future. The MoU identifies that changes that have already occurred since the baseline 2001-2004 period means

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Matter	Comment
	that the additional 2.4 t/yr of N has effectively been transferred from rural land to the WWTP, meaning that the annual load, which equates to 32.4 tonnes per year, represents “no increase” in the load to Lake Rotorua. The transfer of N allocations to the WWTP will continue and there will be no increase in the discharge of N within the same catchment.
(c) Measures to avoid, remedy or mitigate adverse effects on aquatic ecosystems in streams and rivers.	As described in Section 7 of this AEE. The Preferred Scheme will produce a very high quality of treated wastewater. It has been developed to ensure high level removal of other contaminants including suspended solids – organic material, micro-pollutants, such that the effects and receiving environment are less than minor.
(d) Aspects of the activity that cause an increase the export of nitrogen or phosphorus from the activity.	As described above there will be no increase in N or P load to Lake Rotorua.
(e) Administration charges under section 36 of the Act.	Not applicable.
(f) Financial contributions under the Appendix 2 of this regional plan.	Not applicable.
(g) Information and monitoring requirements	A detailed Monitoring Programme is volunteered in the suite of volunteered consent conditions in Appendix K.

Table 12-4: Matters of Discretion for Rule DW R25 Remediation or Disturbance of Contaminated Land

Matter	Comment
(a) The remediation processes to be employed.	As discussed in the SMP included in Support Document No. 7, if excavated material from Zone 1 and Zone 2 is found to have contaminant concentrations above background concentrations then this material will be disposed of off-site at a landfill licensed to receive such material. All material excavated from Zone 3 is also to be removed from the site. A detailed set of requirements for contaminated material that is to be disposed off-site is included in the SMP.
(b) Degree and extent of off-site discharges.	Approximately 660 m^3 of earthworks are proposed to be undertaken as part of the widening and minor deepening of the Te Arikiroa Thermal Channel and construct five small bunds adjacent to the Puarenga Stream. Any material found to have contaminant concentrations above background concentrations will not be reused and will be disposed of as set out in the SMP.
(c) Reporting, information and monitoring requirements.	A Contamination Assessment Report and SMP have been prepared and are included in Support Document No. 7. The SMP outlines management measures in order to minimise risks posed by soil contamination to either construction workers, public health or the environment.
(d) The duration of the consent.	A duration of ten years is sought.

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Matter	Comment
(e) The administration charges under section 36 of the Act.	Not applicable.
(f) Matters to achieve DW O16, DW P22 and DW P23, and DW M48 and DW M52.	Refer to Appendix I of this AEE.

12.2.5.2 Plan Change 10 (Lake Rotorua Nutrient Management) to the Regional Water and Land Plan

Plan Change 10 to the RNRP introduced rules to limit the amount of nitrogen entering Lake Rotorua from land uses in order to improve water quality. The rules target pastoral farming but also include other point source discharges.

One appeal on Plan Change 10 has been resolved which has changes to Rule RL R7 of the RNRP. Resource consent is sought under the amended Rule RL R7 as set out in Section 5.3 of the AEE.

12.2.5.3 Proposed Plan Change 13 (Air Quality) to the Regional Water and Land Plan

The BOPRC notified Plan Change 13 to the RNRP on 27 February 2018 and submissions closed on 18 April 2018. The summary of decisions requested has been notified and further submissions are being called for until 31 July 2018. Given that Plan Change 13 has not proceeded to a hearing at this stage, more weight needs to be given to the objectives and policies of the Operative RAQP as set out in Section 12.2.5.4 of this AEE.

An assessment of the objectives and policies has been undertaken in Appendix I and it is considered that the Preferred Scheme is consistent with the relevant objectives and policies of Plan Change 13 of PC13.

12.2.5.4 Regional Air Quality Plan

An assessment of the Preferred Scheme against the relevant provisions of the RAQP is contained in Appendix I of this AEE.

It is considered that the Preferred Scheme is consistent with the objectives and policies of the RAQP.

12.2.5.5 Rotorua District Plan 2016

The various 'district' resource consents sought by the RLC for the WWTP are outlined in Section 5.6 of this AEE, and an assessment against the relevant provisions of the RDP is contained in Appendix I.

As set out in Appendix I, whilst regard has been had to the relevant provisions, there are objectives and policies that the Preferred Scheme is inconsistent with, due to some significant adverse effects on natural character, an Outstanding Natural Features, amenity values and a Significant Natural Area which cannot practicably be avoided, remedied or mitigated. These adverse effects have been considered in detail in the assessment of alternatives, summarised in Table 9-13 of this AEE which concludes that these effects are unavoidable.

12.2.6 Section 104(1)(c) Any Other Matters

Section 104(1)(c) requires the consent authority to have regard to any other matter the consent authority considers relevant and reasonably necessary to determine the application. The followings matters set out below are considered relevant to these applications.

12.2.6.1 Iwi Management Plans

The Ngāti Rangiwewehi Iwi Environmental Management Plan, 2012 (EMP) is considered relevant as identified in the April 2017 CIA. The EMP sets out priority areas for Ngāti Rangiwewehi for the next 3-5 years. Wai Maori is a priority area, and the following objectives have been set to address water quality concerns:

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i. Waters and associated ecosystems within the traditional and customary boundary boundaries of Ngāti Rangiwewehi are healthy and support Ngāti Rangiwewehi customs;

ii. The spiritual and cultural significance of water to Ngāti Rangiwewehi is recognised and provided for in all water management;

iii. All water ownership issues have been resolved;

iv. Catchment water quality standards; in-stream minimum flows and flow regimes; lake and tributary levels are consistent with the cultural values of Ngāti Rangiwewehi;

v. Contaminants discharged directly or indirectly to water are reduced; and

vi. There is no discharge of human waste directly into water.

As described in the April 2018 CIA (Companion Document No. 2) a land contact bed concept has been developed. This concept will involve *"the spiritual cleansing of the treated wastewater as it passes through the various experiences and contexts within the land contact bed and be in a state of 'mauri tau'"* which is considered a positive cultural effect. Further the second CIA states the Preferred Scheme will have "*positive effects on water quality at the point of discharge, Puarenga Bay. The water and environment is toxic to most aquatic life and hazardous to humans. The water being discharged is a higher quality than the receiving environment."*

It is considered that the Preferred Scheme is consistent with the objectives of the EMP.

12.2.6.2 Lakes Rotorua and Rotoiti Action Plan 2009

The Lakes Rotorua and Rotoiti Action Plan 2009 prepared by the BOPRC, RLS and Te Arawa Lakes Trust sets out what interventions should be undertaken by the community to reduce nutrient inputs to Lakes Rotorua and Rotoiti. The Action Plan was developed in consultation with local communities and Action Plan Working Groups were established.

The Action Plan, while non-statutory, include targets for sustainable nitrogen and phosphorus loads to the lakes and also target reductions of these nutrients so that the lake's target trophic level index (TLI) is achieved.

It is considered that the Preferred Scheme is consistent with the Action Plan.

12.2.6.3 The Te Arawa Settlement Act 2006

The Te Arawa Settlement Act 2006 establishes the ownership of the Lake Rotorua and the commitments to restoring the lakes and the status of the lake as a taonga.

Consideration has been given to the Te Arawa Settlement Act 2006 through the two CIAs produced for this application.

12.2.6.4 Affiliate Te Arawa Iwi and Hapu Claims Settlement Act 2008

The Affiliate Te Arawa Iwi and Hapu Claims Settlement Act 2008 confirms the status of the Rotorua Geothermal Field as a taonga. Consideration has been given to the Te Arawa Affiliates Settlement Act through the two CIAs produced for this application which identify effects on cultural values such as taonga.

12.2.6.5 Local Government Act 2002

The purpose of the Local Government Act 2002 (LGA 2002) is to:

> *"Promote the social, economic, environmental and cultural wellbeing of communities in the present and for the future".*

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The RLC under Section 77 of the LGA 2002 is required to consider the benefits and costs of the decision making process in terms of the present and future social, economic, environmental and cultural wellbeing of their district.

In addition, in the case of a significant decision that relates to land or a body of water, the RLC and BOPRC are also required to take into account the relationship of Maori and their culture and traditions with their ancestral land, water, sites, waahi tapu, valued flora and fauna and other taonga.

The RLC and BOPRC have to assess each option by considering the extent to which community outcomes would be promoted or achieved in an integrated and efficient manner by each option, and the impact of each option on the local authority's capacity to meet present and future needs in relation to any statutory responsibility of the local authority.

The views and preferences of persons likely to be affected by, or to have an interest in any matter have to be considered at every stage of the decision making process.

Section 123 of the LGA 2002 requires local authorities to undertake assessments of sanitary services which includes assessment of alternatives, quality and quantity of wastewater discharge.

The RLC considers that it has met its LGA obligations in the course of the consideration of alternatives and selection of the Preferred Scheme.

12.2.6.6 Reserves Act 1977 and the Rotorua Township Reserves Management Plan 2006

The Rotorua Township Reserves Management Plan 2006 (RTRMP), prepared pursuant to the Reserves Act 1977 was approved following hearings on 10 May 2006 and includes the Sanatorium Reserve. However, as discussed in Section 6.7.1 of this AEE, the WWTP site and land to the north of it, including the Sulphur Flat area, are classified as "no reserve" and therefore the RTRMP does not strictly apply to the area where works are proposed.

Despite this, the RTRMP does signal that the area to the north of the WWTP should be reclassified as "recreation reserve" but that has not formally occurred. Therefore, while the RTRMP includes objectives and policies which cover the WWTP site and Sulphur Flat area, they are strictly not applicable until the area is formally re-classified.

The proposed works will require removal of small areas of indigenous vegetation which is not consistent with Policy 7.2.10.8.3 of the RTRMP. As described in Section 7 and 9 of this AEE, a minimal intervention approach is proposed in terms of the unavoidable vegetation removal required to be undertaken on the Sulphur Flat area and the suite of volunteered conditions sets out a requirement for planting of indigenous geothermal species following the proposed works.

Policy 7.2.10.8.2 of the RTRMP acknowledges that the character of "Zone B" (refer Figure 6-2) includes a mixture of modified and unmodified landscapes. However, the purpose of Zone B is stated as being for the preservation and conservation of significant natural vegetation, geothermal activity and wildlife habitat. However this policy also records that part of the area is used for wastewater treatment and sludge composting and that these are also significant and must be taken into account. The proposed works to widen and deepen Te Arikiroa Thermal Channel will result in modification to an already modified channel and are directly associated with wastewater management.

It is noted that the RTRMP has not been updated in respect of the Sanatorium Reserve since it was prepared in 2006[23]. The RDP and the various regional plans produced by the BOPRC have come into force since 2006 which include objectives and policies which apply to the Sulphur Flat area. For these reasons it is considered that the provisions of the RTRMP as they pertain to the area where works are

[23] For example, we note that the RTRMP still refers to, and provides for, the now cancelled Eastern Arterial Project within the Sanatorium Reserve.

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proposed, be given little weighting relative to more recent provisions contained in the RDP and the applicable regional plans.

12.3 Section 105 Resource Management Act

As some of the consents sought in Section 5 of this AEE are for discharge permits, section 105 of the RMA requires the consent authority to consider the additional matters set out in Table 12-5.

Table 12-5: Section 105 of the RMA

Matter	Section of this AEE
The nature of the discharge and the sensitivity of the receiving environment to adverse effects	Sections 7.3 – 7.5
The applicant's reasons for the proposed choice	Section 4.9
Any possible alternative methods of discharge, including discharge into any other receiving environment	Section 9

12.4 Section 107 Resource Management Act

Section 107 of the RMA restricts a consent authority from granting a consent to discharge contaminants to water or to land in circumstances which may result in that contaminant entering water if, after reasonable mixing, the contaminant is likely to give rise to all or any of the effects listed in The assessment of effects in Section 7 of this AEE has identified potential changes in water quality as a result of the discharge. As a precaution, an exemption is being sought (through the grant of a resource consent) for the discharge of sediment as a result of widening and minor deepening within Te Arikiroa Thermal Channel. This may result in a conspicuous change in the colour or visual clarity. The consent is sought pursuant to s107(2)(b) as the discharge is of a temporary nature and will only occur during the construction period.

Table 12-6 in the receiving waters.

The assessment of effects in Section 7 of this AEE has identified potential changes in water quality as a result of the discharge. As a precaution, an exemption is being sought (through the grant of a resource consent) for the discharge of sediment as a result of widening and minor deepening within Te Arikiroa Thermal Channel. This may result in a conspicuous change in the colour or visual clarity. The consent is sought pursuant to s107(2)(b) as the discharge is of a temporary nature and will only occur during the construction period.

Table 12-6: Section 107 of the RMA

Matter	Section of this AEE
The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials	Sections 7.3 – 7.5
Any conspicuous change in the colour or visual clarity	
The rendering of fresh water unsuitable for consumption by farm animals	

12.5 Part 2 Resource Management Act 1991

A recent High Court decision [*R J Davidson Family Trust v Marlborough District Council* [2017] NZHC 52] found that when decision-makers are considering an application for resource consent under section

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104(1) of the RMA they can now only have recourse to Part 2 of the RMA if the relevant statutory planning documents are invalid, incomplete or uncertain – this decision has been appealed to the Court of Appeal. This is despite clause 4(2)(f) of Schedule 4 of the RMA requiring an assessment of the activity against the matters set out in Part 2 to be included within an application for a resource consent; and section 104 of the RMA being 'subject to Part 2'.

It is considered that the question on whether Part 2 matters are relevant to consent decision making (with respect to applications for resource consent) is currently in something of a state of legal flux until the Court of Appeal decides the *Davidson* appeal following its hearing of the matter in November 2017. Given the current legal uncertainty an assessment with regards to Part 2 of the RMA is set out below.

12.5.1 Section 6 RMA: Matters of National Importance

In achieving the purpose of the RMA, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the section 6 RMA matters of national importance set out in Table 12-7.

Table 12-7: Section 6 of the RMA – Matters of National Importance

Matter	Assessment
(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 the protection of them from inappropriate subdivision, use, and development:	As discussed in Section 7 and 9 of this AEE, it is considered that the proposed widening and minor deepening of the Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream will have significant adverse effects on natural character which cannot be practicably avoided, remedied or mitigated. A thorough assessment of alternatives has been undertaken in Section 9 of the AEE which considered the tensions in terms of natural character and Maori cultural values. The option which requires the smallest amount of modification to the Sulphur Flat has been selected. It is noted that bunds are required to guarantee that no treated wastewater reaches the Puarenga Stream as this is unacceptable in terms of cultural values. Whilst this matter has been recognised and provided for, it is considered that the Preferred Scheme is not consistent with this matter.
(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development:	The proposed widening and minor deepening of the Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream is located within an identified Outstanding Natural Feature, being Lake Rotorua. It is considered that this part of the Preferred Scheme will have significant adverse effects on the Outstanding Natural Feature which cannot be practicably avoided, remedied or mitigated. A thorough assessment of alternatives has been undertaken in Section 9 of the AEE which considered the tensions between the Outstanding Natural Feature and Maori cultural values. The option which requires the smallest amount of modification to the Sulphur Flat has been selected whilst ensuring that no treated wastewater reaches the Puarenga Stream, as this is unacceptable in terms of cultural values. Whilst this matter has been recognised and provided for, it is considered that the Preferred Scheme is not consistent with this matter.
(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna:	The proposed widening and minor deepening of the Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream is located within an identified Significant Natural Area. Vegetation removal is required to undertake the works and for construction vehicle access. It is considered that this part of the Preferred Scheme will have significant adverse effects on the Significant Natural Area which cannot be practicably avoided, remedied or mitigated.

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Matter	Assessment
	A thorough assessment of alternatives has been undertaken in Section 9 of the AEE which considered the tensions between the Significant Natural Area and cultural values. The option which requires the smallest amount of modification (and vegetation removal) to the Sulphur Flat has been selected whilst ensuring that no treated wastewater reaches the Puarenga Stream, as this is unacceptable in terms of Maori cultural values. Whilst this matter has been recognised and provided for, it is considered that the Preferred Scheme is inconsistent with this matter.
(d) the maintenance and enhancement of public access to and along the coastal marine area, lakes, and rivers:	The Preferred Scheme, particularly the land contact bed will improve public access to and along Te Arikiroa Thermal Channel and Sulphur Bay (Lake Rotorua). In terms of the widening and minor deepening of the Te Arikiroa Thermal Channel and construction of five small bunds adjacent to the Puarenga Stream, this will not impact public access to the Sulphur Flats. It is considered that the Preferred Scheme is consistent with this matter.
(e) the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga:	The relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga has been recognised and provided for through the appointment of the Cultural Assessment Sub-committee (CAS) by the RPSC to facilitate discussions among potentially affected iwi and hapu regarding cultural aspects of the proposed options and Preferred Scheme. A cultural assessment expert was appointed to assist the CAS in their input of cultural advice to the RPSC and oversee the preparation of the cultural impact assessments. Two CIAs were prepared and a cultural land contact bed concept was developed by matauranga maori experts to culturally treat the wastewater which is included as part of the Preferred Scheme. Following further development of the land contact bed concept, the April 2018 CIA concluded that there is both broad support and local condemnation for the discharge proposal. Among those who support the proposal are significant entities with important roles in the well-being of Lake Rotorua and its people. These include Te Arawa Lakes Trust, Te Tatau o Te Arawa, Te Pukenga Koeke o Te Arawa and Pukeroa-Oruawhata Trust. Wider iwi and hapū groups are either neutral, supportive or opposed to the proposal. It is understood that the support or neutrality of most parties is based on the effort to find an 'innovative cultural' solution for the proposed discharge. There is, however, strong opposition to the proposal from hapu who have primary or close relationships with the land on which the WWTP is located and the areas proposed for the discharge. The group of opposition includes Ngāti Hurunga Te Rangi, Ngāti Uenukukopako, Ngāti Te Roro-o-Te-Rangi and Ngāti Te Rangiaorere. These hapu have marae and resident communities at Ngapuna, Puarenga and Ohinemutu, all within close proximity to the WWTP. The April 2018 CIA concluded that there are both significant positive effects and significant cultural effects on cultural values. It is considered that the Preferred Scheme is not consistent with this matter.
(f) the protection of historic heritage from inappropriate subdivision, use, and development:	There are no known or identified items of historic heritage located within the existing WWTP site, or along the Te Arikiroa Thermal Channel or within the Sulphur Flat area that will be affected by the proposed activities. It is considered that this matter is not applicable to this Project.
(g) the protection of protected customary rights.	Through the preparation of the two CIAs no impact on protected customary rights have been identified. It is considered that the Preferred Scheme is consistent with this matter.

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Matter	Assessment
(h) the management of significant risks from natural hazards.	As discussed in section 3.8 of this AEE, the TAG was established to consider the technical aspects of the proposed options. The TAG developed a list of minimum standards to in order to select the Preferred Scheme. One of the minimum standards was engineering resilience, which includes natural hazards and climate change. It is considered that the Preferred Scheme is consistent with this matter.

12.5.2 Section 7 RMA: Other Matters

In achieving the purpose of the RMA, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall have particular regard to the section 7 RMA matters set out in Table 12-8.

Table 12-8: Section 7 of the RMA – Other Matters

Matter	Assessment
(a) kaitiakitanga	In recognising the role of tāngata whenua as kaitiaki and the relationship of tāngata whenua with the environment, the RLC has engaged with tāngata whenua throughout the development of the Preferred Scheme. The CIAs note that the Project has achieved a high level of participation and engagement of iwi/hapu in decision-making processes and exploration of options. Both CIAs recommend a new committee or forum that is made up of most affected iwi and hapū members, that is, those closest to the wastewater treatment plant and the final discharge location. This forum or committee would have a role that recognises their kaitiaki responsibilities and oversight of the Project as it goes through its phases of consent, and monitoring. This has been provided for in the suite of volunteered consent conditions set out in Section 14 of this AEE. It is considered that the Preferred Scheme is consistent with this matter.
(aa) the ethic of stewardship:	The CIAs note that the Project has achieved a high level of participation and engagement of iwi/hapu in decision-making processes and exploration of options. Both CIAs recommend a new committee or forum that is made up of most affected iwi and hapū members, that is, those closest to the wastewater treatment plant and the final discharge location. This forum or committee would have a role that recognises their kaitiaki responsibilities and oversight of the Project as it goes through its phases of consent, and monitoring. This has been provided for in the suite of volunteered consent conditions set out in Section 14 of this AEE. It is considered that the Preferred Scheme is consistent with this matter.
(b) the efficient use and development of natural and physical resources:	A detailed analysis of alternatives, including costings was undertaken to identify the Preferred Scheme (refer section 9 of this AEE). The Preferred Scheme is considered to be an efficient use and development of resources. It is considered that the Preferred Scheme is consistent with this matter.
(ba) the efficiency of the end use of energy:	Section 4.5.3 of this AEE sets out the energy savings of the Preferred Scheme in comparison the existing WWTP and LTS. By not pumping and spray irrigating in the LTS, this will save approximately $800,000 pa (2016 figures). This saving will outweigh additional energy costs for the full MBR and UV treatment processes that are incorporated in the Preferred Scheme. It is considered that the Preferred Scheme is consistent with this matter.

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Matter	Assessment
(c) the maintenance and enhancement of amenity values:	As reiterated in the April 2018 CIA (Companion Document No. 2) the land contact beds will have positive effect on amenity values of the local area. The contact bed and the discharge structure will be a high quality landscaped area that will improve public access, education and visual attractiveness. However as discussed in Section 7 of this AEE, it is considered that the proposed works to widen and deepen Te Arikiroa Thermal Channel and construct five small bunds will have adverse effects on amenity values which cannot be avoided. Whilst particular regard has been had for this matter, it is considered that the Preferred Scheme is not consistent with this matter.
(d) intrinsic values of ecosystems	As set out in Section 7 of this AEE, based on evaluation of the water quality modelling results, tāonga species are not expected to colonize Sulphur Bay following implementation of the proposed discharge. Accordingly, there is also assessed to be no effect of the proposed wastewater discharge on tāonga species in Lake Rotorua. It is considered that the Preferred Scheme is consistent with this matter.
(f) maintenance and enhancement of the quality of the environment	Section 7 of this AEE has assessed the environmental effects of the Preferred Scheme in detail. With regard to the discharge of contaminant to air (odour), Section 7.7 of this AEE concludes that there are unlikely to be any odour nuisance effects at any sensitive receptor location, providing that the odour mitigation measures are implemented at the WWTP. In terms of the discharge of treated wastewater, as discussed in Sections 7.3 to 7.5 and Appendix I of this AEE. It is considered that the adverse effects of the discharge can be mitigated through monitoring and the suite of volunteered consent conditions set out in Section 14 and Appendix K of this AEE. The efficient use of regionally significant wastewater infrastructure also provides an important social and economic positive effect, as it provides the communities with economically sustainable an affordable wastewater treatment system. It is considered that the Preferred Scheme is consistent with this matter.
(g) any finite characteristics of natural and physical resources	In terms of the discharge of treated wastewater, as discussed in Sections 7.3 to 7.5 and Appendix I of this AEE. It is considered that the adverse effects of the discharge can be mitigated through monitoring and the suite of volunteered consent conditions set out in Section 14 and Appendix K of this AEE. It is considered that the Preferred Scheme is consistent with this matter.
(h) the protection of the habitat of trout and salmon:	As set out in Support Document No. 4, field investigations conducted in February 2017 revealed no sightings of fish, kōura or kākahi in the heavily geothermally-influenced Te Arikiroa Thermal Channel. It is considered that the Preferred Scheme is consistent with this matter. The biological monitoring of Sulphur Bay that has taken place suggests that apart from wildfowl, chironomids (family: Chironomidae) are the only aquatic organisms present (Kanapathippillai 1999). This is entirely predictable given the highly acidic nature of the water, which ranges from pH 3.4 to pH 6.2 (Landman and Ling 2008), and the high concentrations of colloidal sulphur and high water temperatures. It is considered that the Preferred Scheme is consistent with this matter.
(i) the effects of climate change	As discussed in section 9.3 of this AEE, the TAG was established to consider the technical aspects of the proposed options. The TAG

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Matter	Assessment
	developed a list of minimum standards to in order to select the Preferred Scheme. One of the minimum standards was engineering resilience, which includes natural hazards and climate change. It is considered that the Preferred Scheme is consistent with this matter.
(j) the benefits to be derived from the use and development of renewable energy.	It is considered that this matter is not applicable to this Project.

12.5.3 Section 8 RMA: Treaty of Waitangi

In achieving the purpose of the RMA, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi).

As set out in the April 2018 CIA (Companion Document No. 2), the Courts/Waitangi Tribunal have confirmed the following core principles;

- Partnership;
- Active protection;
- Duty to act in good faith;
- Duty to make informed decision through consultation;
- Principle of redress and a duty not to create new grievances;
- Principle of reciprocity; and
- Principle of mutual benefit;

It is considered that the above principles have been taken into account in the development of the Preferred Scheme. While there is both broad support and local condemnation for the discharge proposal, among those who support the proposal are significant entities with important roles in the well-being of Lake Rotorua and its people. Wider iwi and hapū groups are either neutral, supportive or opposed to the proposal. It is understood that the support or neutrality of most parties is based on the effort to find an 'innovative cultural' solution for the proposed discharge.

There is, however, strong opposition to the proposal from hapu who have primary or close relationships with the land on which the treatment plant is located and the areas proposed for the discharge. This opposition is not unanimous, but nevertheless should not be discounted.

12.5.4 Section 5 RMA: Purpose

The purpose of the RMA as set out in section 5 is to promote the sustainable management of natural and physical resources.

Whilst the Preferred Scheme will have some significant adverse effects in terms of cultural values, natural character, landscape, amenity and ecology, it is considered that the provision of wastewater infrastructure and the associated discharge of treated wastewater, being regionally significant infrastructure, will enable people and communities to continue to provide for their social, economic, and cultural well-being and for their health and safety while safeguarding the life-supporting capacity of air, water, soil, and ecosystems. Further the Preferred Scheme has been selected to avoid significant adverse effects on cultural values by preventing treated wastewater reaching the Puarenga Stream which is of significant importance to tangata whenua.

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The Preferred Scheme will replace the current LTS arrangement and will contribute to reaching the RPS's 435 t/yr annual load of TN to Lake Rotorua.

Extensive consultation and an evaluation of alternatives and options has been considered to arrive at the Preferred Scheme. Tensions in terms of adverse effects were considered carefully, and the objective of ensuring no treated wastewater enters the Puarenga Stream was given considerable weight in terms confirming the Preferred Scheme.

Overall it is considered that the Preferred Scheme will achieve the purpose of the RMA for the reasons discussed above and as set out in Tables 12-7 and 12-8 above.

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13 Duration and Lapsing

13.1 Duration

13.1.1 Duration of Discharge Permits for the Ongoing Discharges from the WWTP

Section 123 of the RMA covers duration of the different types of consents. The RLC is seeking a consent duration of 35 years (the maximum allowed for under the RMA) for the discharge permits associated with the operation of the upgraded WWTP – that is, the discharge of treated wastewater to Te Arikiroa Thermal Channel, discharges of contaminants (primarily odour) to air, and beneficial reuse discharges to land.

When a consent duration condition is being considered, regard should be given to:

- the intended duration of an activity or structure;
- the sensitivity of a receiving environment over time;
- the volunteered conditions of consent; and
- the level of existing and future investment made by an applicant.

The WWTP is an existing significant facility and its intended life well exceeds the 35-year term being sought. It services a large number of customers and the upgrades being proposed will be able to treat flows and loads predicted over the next 35 years. The RLC and its customers have invested in a substantial and regionally significant infrastructure asset in terms of the existing WWTP. The replacement value of the existing WWTP is listed in the RLC's asset valuation records at $53.6 million and total wastewater system at $331.5 million based on 2017 values. In addition, the RLC is committing in the order of $42M on further upgrades to the WWTP in order to comply with the volunteered conditions of consent (discussed in further detail in Section 14 and Appendix K of this AEE).

It is important that the RLC has financial security for this substantial infrastructural asset and is able to provide future flexibility to accommodate domestic and business / industry trade waste growth. Future growth projections set out in Sections 4.2 and 6.2 of this AEE, demonstrate the population / business growth planned for the WWTP catchment.

To achieve financial security and provide certainty for future investors, community and business growth, it is important for the RLC to have long-term certainty in terms of the on-going operation of the WWTP. This is a critical consideration in seeking a 35-year duration for the consents being sought.

It is also important that the urban population of Rotorua has certainty in the ongoing and uninterrupted provision of wastewater services to them. This enables the urban population to provide for their social and economic wellbeing.

The assessment of environmental effects that accompanies this application concludes no significant effects are expected within Lake Rotorua outside of the mixing zone as a result of the discharge of wastewater from the WWTP. In addition, no significant odour effects predicted to occur beyond the designation boundary of the WWTP but excluding the adjacent composting plant.

In order to address concerns relating to potential cumulative effects, the RLC proposes consent conditions providing for regular water quality monitoring and reporting and a specific review condition so that the BOPRC may review the consent conditions to address any adverse effects on the environment that may arise from the exercise of consent.

The Environment Court considered factors relevant to consent duration in PVL Proteins Ltd v Auckland Regional Council (A61/2001). While that case related to a discharge of contaminants to air, its principles are applicable to the current application. The Environment Court reviewed earlier decisions on

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duration of consents under the RMA and stated the relevant factors for determining consent duration which include:

> *… that conditions may be imposed requiring adoption of the best practicable option, requiring supply of information relating to the exercise of the consent, requiring observance of minimum standards of quality in the receiving environment, and reserving power to review the conditions.*

Section 108(2)(e) of the RMA allows a consent authority to impose a condition requiring a consent holder to adopt the BPO to prevent or minimise any actual or likely adverse effect on the environment of a discharge. In this case, the Preferred Scheme constitutes the current BPO and this approach is one of the key drivers for this Project.

The volunteered conditions provide for technology reviews during the term of the consent. The RLC has volunteered a condition requiring a Monitoring and Technology Review to be undertaken (and reported to the BORPC) by the 9th, 18th, and 27th anniversaries of commencement of consent. This schedule has been adopted to fit with every third Long Term Plan (LTP), so the RLC can allocate additional finance if required. The volunteered section 128 RMA review condition provides a mechanism for the BOPRC to respond to a Monitoring and Technology Review Report by reviewing the BPO assessment contained in the report and RLC's intention to adopt the revised BPO, if any, for the treatment and discharge of treated wastewater.

Having regard to the Court's comments in PVL Proteins, those opportunities for reviews throughout the life of the consent support a maximum consent duration of 35 years for this application. They provide a mechanism by which BOPRC can ensure that conditions imposed on a resource consent do not become outdated, irrelevant, or inadequate.

Further, the volunteered conditions include annual reporting to BOPRC on monitoring results and consent compliance. This too is consistent with the observation in PVL Proteins that conditions requiring the supply of information about the exercise of the consent are relevant to consent duration.

The Environment Court in PVL Proteins also considered uncertainty, and the applicant's need to protect their investment, as relevant factors regarding duration:

> *Uncertainty for an applicant of a short term, and an applicant's need (to protect investment) for as much security as is consistent with sustainable management, indicate a longer term.*

Given the RLC's proposed significant investment in the WWTP (as well as its existing investment in the total wastewater scheme and the urban population's total reliance on the service provided by the WWTP), certainty and security are considered to be critical factors justifying a longer consent duration in this case.

Thirty five year durations for discharges from municipal wastewater treatment plants are commonly imposed by regional councils[24]. Almost all those cases involve significant investment in upgrading treatment technologies and discharge infrastructure such as is the case here.

13.1.2 Duration of Resource Consents for Development of Te Arikiroa Thermal Chanel and Construction of Bunds

Section 123 of the RMA covers duration of the different types of consents. The RLC is seeking a consent duration of 15 years for the discharge permit, water permit, and land use consent under section 13 of the RMA from the BOPRC needed for the works to widen and deepen Te Arikiroa Thermal Channel and construct the five small bunds. A 15 year duration for these resource consents is requested to provide sufficient time for the construction to be completed (up to five years once they commence)

[24] Examples include: Mangere, Lyttleton, Hastings, Gisborne, Tauranga, Ruakaka/Marsden Point, Pukekohe Christchurch, Milton, Cromwell, Alexandra, Rolleston, Westport

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plus the 10 year lapsing period for all the resource consents that is sought – the reasons for a 10 year lapsing period are set out in Section 13.2 of this AEE.

An unlimited duration, as provided for by section 123(b) of the RMA, is sought for the section 9 RMA land use consents needed to widen and deepen Te Arikiroa Thermal Channel and construct the five small bunds. For the avoidance of doubt, this unlimited duration is being sought for the section 9 RMA land use consents needed from both the RLC (as consent authority) and also the BOPRC.

13.2 Lapsing

Section 125 of the RMA states that consents lapse 5 years after their date of commencement unless the consent is given effect to or if the consent specifies another timeframe.

While the RLC was anticipating ceasing the use of the LTS by the end of December 2019, this being before the expiry date of the current consents that apply to the LTS, being 31 July 2021 (i.e. in around four and a half years), the RLC requests that a ten year lapsing period be specified in the consent. This lapsing period is sought to ensure the RLC has sufficient time to ensure the WWTP upgrade is optimised in respect of being able to manage and treat the expected peak wet weather flows that arrive at the plant. To ensure this is achieved, the RLC intends on, *inter alia*, investigating sources of infiltration and inflow (I/I) within the reticulation system with the aim of then reducing I/I to levels which the WWTP can optimally manage and treat to ensure that the proposed conditions of consent will always be able to be met. This programme of work is expected to extend beyond December 2019, being the original intended date to cease using the LTS, and may also extend beyond the expiry date of the current LTS consents. In the event that the LTS is required to be used beyond the expiry of the current consents, the RLC will apply for new consents for the LTS at least six months prior to the expiry date (i.e. before 31 January 2021).

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14 Volunteered Consent Conditions

14.1 Overall Approach to Conditions

The RLC is applying for consents from both the BOPRC (under various regional plans) and the RLC (under the RDP and NES-CS). The RLC has developed a combined suite of volunteered conditions which are contained in Appendix K. All of the volunteered conditions would apply to the BOPRC consents. However, there is significant overlap between the activities for which consent is required from the RLC and some of the 'regional' consents – this overlap being earthworks and vegetation clearance associated with developing Te Arikiroa Thermal Channel. The RLC expects that volunteered conditions 1, and 68 to 79 would be imposed on the land use consents issued by the RLC and as such no separate 'district' suite of conditions are presented. It should be noted that Condition 79 relates specifically to NES:SC and this may be the only RLC specific condition (ie. it may not need to be imposed on the BOPRC land use consent for earthworks).

The conditions are divided such that there are 'General Conditions That Apply to All Consents', being conditions that apply to all the activities, and then sections for specific conditions applicable to each of the consented activities. It should be noted that the RMA application Form 9 at the beginning of this AEE document identifies that a discharge permit is being sought for increased discharges of N or P from a point source but it is not listed as a separate consent in Appendix K. The reason for this is that this activity is covered in the discharge permits to discharge treated wastewater to Te Arikiroa Thermal Channel and beneficial reuse.

All the various consents associated with construction of the discharge channel, widening of Te Arikiroa Thermal Channel, and construction of the bunds adjacent to the Puarenga Stream have been grouped together as they are so interrelated and a suite of common conditions would apply to all these activities.

The following sections discuss the rationale behind a number of the more important conditions (should such consents be granted).

14.2 Discussion on Specific Conditions

14.2.1 General Conditions that Apply to All Consents

14.2.1.1 Condition 2 – Lapsing

The RLC has requested a ten year lapsing period for the consents. This matter is discussed in Section 13.2 of this AEE.

14.2.1.2 Condition 3 - Expiry

The RLC is seeking, and has justified in Section 13.1.1 of this AEE, a 35 year duration for the three discharge permits associated with the operation of the upgraded WWTP. The final dates that would be inserted for these resource consent (currently shown as yellow highlighted X XXXX) would be 35 years from the date of commencement of the consents.

The RLC is seeking, and has also justified in Section 13.1.2 of this AEE, a duration of 15 years for the discharge permit, water permit, and land use consent under section 13 of the RMA from the BOPRC needed for the works to widen and deepen Te Arikiroa Thermal Channel and construct the five small bunds. The final dates that would be inserted for these resource consents (currently shown as yellow highlighted X XXXX) would be 15 years from the date of commencement of the consents.

An unlimited duration is sought for the section 9 RMA land use consents needed to authorise the development and use of a widened and deepened Te Arikiroa Thermal Channel and five small bunds

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from both the RLC (as consent authority) and also the BOPRC. This matter is discussed in Section 13.1.2 of this AEE. A duration of 'unlimited' is therefore specified for those consents in Condition 3.

14.2.1.3 Condition 4 – Annual Report

Condition 4 requires the RLC to prepare an Annual Report to summarise all monitoring required by the conditions of the various consents, including a trend analysis of previous data and cultural monitoring.

The Annual Report also needs to include copies of any records required by the conditions as well as a summary of complaints received.

14.2.1.4 Condition 5 – Monitoring and Technology Review

Condition 5 requires the RLC to undertake reviews every nine years of any significant technological changes and advances in relation to wastewater management, treatment, discharge, and beneficial reuse technologies which have been developed that could be of relevance for the WWTP. A nine year review period has been selected to coincide with every third Long Term Plan (LTP).

The condition requires an assessment to be undertaken as to whether any newly available technology option(s) or combination of options represent the BPO to minimise the potential and actual adverse effects of the treated wastewater discharge and whether the RLC intends to adopt that BPO and incorporate such technologies. The condition also requires the RLC to summarise the actions that it has implemented (and their success) as part of the Rotorua Wastewater Strategy (or any document that replaces this Strategy) during the preceding period.

14.2.1.5 Conditions 6 to 21, 26, and 68 – Cultural Conditions

The RLC has volunteered a large number of conditions to address cultural concerns raised through consultation with iwi.

Conditions 6 to 12 require the RLC to invite one representative from each of the identified iwi and hapu to establish, in association with the RLC, a Rotorua Tangata Whenua Wastewater Treatment Monitoring Group. The purpose and functions of the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group are specified in Conditions 7 and 8, respectively and include reviewing various documents and reports as well as making recommendations on a number of matters.

Conditions 13 to 18 requires the RLC to invite 12 Te Arawa cultural experts to establish Te Hunga Mātauranga Māori to provide guidance and advice on the design of the Land Contact Bed.

Conditions 19 to 21 requires a Cultural Mitigation and Environmental Enhancement Plan to be prepared and implemented.

Condition 26 requires the RLC to consult with the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group so as to establish appropriate performance standards for the Land Contact Bed and monitoring of its performance.

Condition 68 requires the RLC to consult with the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group to select appropriate native plant species for enhancement of ecological values of the area.

An accidental discovery protocol is also volunteered, this is discussed in more detail below.

14.2.1.6 Condition 23 – Complaints Register

Condition 23 requires the RLC to maintain a Complaints Register to cover complaints received for all the activities authorised by the consents rather than having separate requirements for such a register/log under each of the consented activities.

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14.2.2 Conditions for Discharge of Treated Wastewater

14.2.2.1 Condition 25 – Minimum Level of Treatment

Condition 25 specifies the minimum level of treatment that the wastewater must achieve before being discharged or reused, namely fine filtration followed by ultraviolet (UV) disinfection and extra phosphorus removed.

14.2.2.2 Conditions 27 to 42 – Nutrient Limits

Conditions 27 to 42 cover nutrient limits and their monitoring requirements. An annual total phosphorus mass load limit of 3 tonnes is proposed with compliance to be based on a rolling 52 week period.

Conditions 30 to 33 require online turbidity monitoring with a trigger level approach.

An annual TN mass load limit of 32.4 tonnes is proposed, again with compliance to be based on a rolling 52 week period. However, the RLC may discharge greater amounts of TN as calculated by the Memorandum of Understanding (MoU) that was signed by the consent authority, the RLC, and Te Arawa Lakes Trust (refer Appendix D). The WWTP will, over the 35 year-term of the consent, receive additional wastewater and therefore additional TN as the wastewater reticulation system is expanded into the Rural Area and where urban infill occurs. The MoU outlines how TN allowances from land within the Rural Area that is subdivided (with the built development being connected to the wastewater treatment plant) is to be transferred to this resource consent – meaning that the annual mass of TN authorised to be discharged can increase over time without impacting the RPS's 435 tN/yr load limit for Lake Rotorua. The general principles of the MoU are included in these conditions and will be further established in a future 'Nitrogen Allowance Transfer Plan'.

In addition to the annual TN mass load limit, the consent also requires the average concentration of TN in the treated wastewater discharged, also based on a rolling 52 week period, to not exceed 4.3 milligrams per litre (mg/L).

For all the discharge limits compliance is to be based on results of wastewater samples collected before it is discharged to the Land Contact Bed. The sampling and analysis will be undertaken weekly.

No limits are proposed in terms of the volumes of treated wastewater that may be discharged. This is because the annual mass load limits for total phosphorus and nitrogen effectively limit the rate/volume of wastewater that can be discharged and are based on effects, whereas volume/rate does not necessarily correlate with effects.

14.2.2.3 Condition 43 – Section 107 RMA Restrictions

Condition 43 covers the matters outlined in section 107 of the RMA and specifies that these cannot occur beyond the zone of reasonable mixing, which is deemed to be an area 250 metres from the point where Te Arikiroa Thermal Channel discharges into Sulphur Bay – a figure showing the zone of reasonable mixing attached to the conditions.

14.2.2.4 Condition 44 – Receiving Environment Monitoring

Condition 44 requires the RLC to undertake receiving environment monitoring in accordance with the programme(s) contained in Appendix 2 attached to the conditions. No receiving environment standards (apart from the section 107 RMA restrictions discussed above) are proposed or considered necessary given the very high level of treatment the wastewater receives before being discharged. However, the RLC still proposes to monitor the receiving environment so as to confirm the effects of the discharge are in accordance with what this AEE predicts.

In summary, the proposed monitoring involves:

- Collection of water samples from eight (8) locations every three (3) months. The water samples will be analysed for 36 determinands including nutrients, indicator bacteria, and metals;

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- The sampling locations include the Te Arikiroa Thermal Channel, the Puarenga Stream, a sampling site within the zone of reasonable mixing, two sites at the edge of the mixing zone, two sites within Sulphur Bay, and one site at the boundary of Sulphur Bay and Lake Rotorua;
- Collection of lake bed sediments from three (3) sites annually. The sediment samples will be analysed for 25 determinands including nutrients, indicator bacteria, and metals; and
- Collection of samples of treated wastewater every five years with these samples analysed for a suite of 12 emerging organic contaminants (EOCs).

14.2.2.5 Condition 45 to 54 – Wastewater Treatment Plant Management Plan

Conditions 45 to 54 require the RLC to prepare and regularly review a Wastewater Treatment Plant Management Plan (WTPMP). Requiring a WTPMP is standard practice on such conditions and it will give the consent authority certainty that the WWTP will be operated and maintained so that the conditions of consent will be able to be complied with on an ongoing basis. It will include some in-plant monitoring of parameters such as TSS, COD, and *E Coli* and reporting of these.

14.2.3 Conditions for the Discharge of Treated Wastewater to Land via Reuse

14.2.3.1 Conditions 56 to 60 – Beneficial Reuse Management Plan

Condition 56 allows the RLC to provide treated wastewater to third parties at site(s) remote from the WWTP for reuse provided it is fully treated and its use is in accordance with the Beneficial Reuse Management Plan (BRMP) that is required to be prepared if reuse is proposed.

The intention is that the BRMP will be added to when additional users wish to use the treated wastewater. Each time a new user wishes to reuse treated wastewater from the WWTP the RLC would need to resubmit the BRMP for consent authority certification. Reuse cannot occur until certification is provided.

14.2.4 Conditions for the Discharge of Contaminants (Odour) to Air

14.2.4.1 Condition 61 – Odours

Condition 61 prohibits discharges to air causing objectionable or offensive odours beyond the 'property boundary' which is shown in Figure 2 attached to the conditions. The property boundary is set around the existing WWTP but does not include the adjacent composting facility which, while on the WWTP designation, is operated by a third party.

14.2.4.2 Conditions 62 to 67 – Odour Management Plan

Conditions 62 to 67 require the RLC to prepare and regularly review an Odour Management Plan (OMP). Requiring an OMP is standard practice on such conditions and it will give the consent authority certainty that the WWTP will be operated and maintained so that condition 61 will be able to be complied with on an ongoing basis

14.2.5 Conditions for the Construction of the Discharge Channel, works in the Bed of Te Arikiroa Thermal Channel, and Construction of Bunds

14.2.5.1 Condition 68 and 72 – Construction and Environmental Management Plan

Condition 69 requires the RLC to prepare a Construction and Environmental Management Plan (CEMP) prior to undertaking earthworks or works in the bed of Te Arikiroa Thermal Channel. No works can commence until the CEMP is certified by the consent authority as prescribed by Condition 70.

14.2.5.2 Condition 73 – Accidental Discovery Protocol

Condition 73 requires the RLC to cease works if any archaeological sites or koiwi being are uncovered. If this occurs then the condition requires the RLC to contact Heritage New Zealand and works cannot

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recommence in the area of the discovery until the relevant Heritage New Zealand approval has been obtained.

This condition is particularly relevant because a number of hapu have primary or close relationships with the land in which the treatment plant is located and the areas proposed for the discharge.

14.2.5.3 Condition 79 – Potentially Contaminated Soil

Condition 79 requires the RLC to comply with the Site Management Plan that is included as Support Document No. X which has been prepared under the NES:SC. The Site Management Plan outlines how the soil material will be managed, including a requirement that any excess material be taken off-site to a facility licensed (authorised) to accept such material.

14.3 Conclusion on Conditions

The RLC considers that the volunteered conditions contained in Appendix K of this AEE, both singularly and in total, are appropriate to avoid, remedy or mitigate potential adverse effects identified by the AEE. The proposed monitoring programme is considered to be appropriate to identify whether the activities for which consents are sought are resulting in effects as described and predicted in this AEE.

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15 Conclusion

The RLC operates the Rotorua WWTP and treated wastewater is currently irrigated to land at a Land Treatment System (LTS) located within the Whakarewarewa Forest. However, the irrigation is scheduled to cease and the RLC must find a viable alternative to the LTS before this date.

The RLC has undertaken a large amount of work and followed a lengthy process to find a viable alternative to the LTS. This process has involved a large number of stakeholders and various committees, sub-committees, and advisory groups were formed. The RPSC established specific project goals which were critical in setting the terms of reference for the project development and decision making in identifying and selecting the Preferred Scheme. These goals included working with the community, key stakeholders, and tāngata whenua to ensure a BPO wastewater treatment and disposal / discharge solution was selected.

The Preferred Scheme involves a significant upgrade to the WWTP, resulting in a highly treated wastewater, and that treated wastewater will be discharged to an unnamed tributary of Lake Rotorua, referred to as Te Arikiroa Thermal Channel. Various resource consents are required to implement the Preferred Scheme and for the discharge of treated wastewater and contaminants to air from the WWTP over the next 35 years (being the duration of consent being sought for the discharges from the WWTP).

A comprehensive assessment of alternatives in respect of wastewater treatment options, discharge methods, and discharge locations, has been undertaken as part of selecting the Preferred Scheme. The Preferred Scheme has been progressed to the point that a concept design has been developed for a proposed upgrade to the WWTP so that treated wastewater can be appropriately discharged to Te Arikiroa Thermal Channel, which in turn discharges to Puarenga Bay (also known as Sulphur Bay), which is part of Lake Rotorua. As part of the WWTP upgrade design, the treated wastewater is proposed to pass through a new land contact bed before being discharged to Te Arikiroa Thermal Channel via a new discharge structure – this component of the design has been included to specifically address Māori cultural concerns associated with direct discharges of human waste to almost (no matter how well treaded) water.

The level of treatment that the wastewater will receive means that it will be able to be beneficially reused by other persons (e.g. for irrigation and/or industrial process water) – a ‘double barrier’ treatment system is proposed involving the use of membrane filtration followed by ultra-violet (UV) light disinfection which will remove pathogens and particulate matter to exceptionally low concentrations. Beneficial reuse will reduce the volume of treated wastewater needing to be discharged to Lake Rotorua via Te Arikiroa Thermal Channel. The double barrier system also means that the public health risks associated with contact recreation (swimming and boating) within the receiving environment will be acceptable.

Importantly, the Preferred Scheme will not increase nutrient inputs into Lake Rotorua above those provided for in the BOPRC’s ‘allocations’ and it will not compromise the target TN load of 435 t/y that is sought to be met by 2032. Annual mass load limits for TN and TP allowed to be discharged are proposed, with the TN limit allowed to be increased as rural land is developed and connected to the WWTP – a transfer of TN allocation from the rural land use to the WWTP is proposed which aligns with the MoU entered into between the BOPRC, the RLC, and Te Arawa Lakes Trust.

The RLC has undertaken a wide range of environmental and technical investigations to inform this AEE. Studies have investigated the water quality, ecology, and mixing of the treated wastewater discharge to Te Arikiroa Thermal Channel and Puarenga Bay (Lake Rotorua). Section 7 of this AEE concludes that no significant adverse water quality effects are expected within Puarenga Bay outside of the zone of reasonable mixing as a result of the proposed discharge. In addition, no significant adverse odour effects are predicted to occur beyond the designation boundary of the WWTP.

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Removal of some indigenous geothermal vegetation, modifications of Te Arikiroa Thermal Channel and construction of five small bunds adjacent to the Puarenga Stream are expected to have some unavoidable adverse ecological, natural character, landscape and amenity effects. However, a minimal intervention approach is proposed to minimise these adverse effects to the greatest extent practicable.

Extensive consultation between 2014 and July 2018 has been undertaken with tāngata whenua, statutory bodies, key stakeholders, and the wider community. Consultation with tāngata whenua has included the commissioning of two Cultural Impact Assessments (CIAs), both of which confirm that the Preferred Scheme exhibits a number of positive and significant adverse cultural effects. The RLC considers the Preferred Scheme to be innovative and the RLC has put cultural concerns and incorporation of Māori concepts/values at the forefront in the conceptualisation and design of the proposed land contact bed and discharge structure.

A range of measures are proposed to avoid or mitigate the identified actual and potential adverse effects – these being included in a comprehensive set of volunteered consent conditions which will ensure that acceptable effects result from the ongoing operation of the upgraded WWTP and discharge of treated wastewater to Te Arikiroa Thermal Channel.

The activities will meet a large number of objectives and are consistent with a large number of policies of the relevant statutory planning documents. However, the proposed works associated with redevelopment of Te Arikiroa Thermal Channel and construction of the five small bunds adjacent to the Puarenga Stream do not find full support in these documents, however the RLC's proposed 'minimal intervention' approach for these works is considered to be the best approach to minimise these unavoidable adverse effects.

The activities have been shown to meet the purpose of the RMA and there are no reasons why the resource consents sought should not be granted.

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16 He Mihi / Acknowledgements

The RLC acknowledges the many people, groups and organisations who have been involved with this Project to date.

We give special acknowledgement too, to Mauriora Kingi, Te Uru o te Whetu Whata, Arama Pirika and Morris Meha who all provided their guidance and expertise to the project steering committee but sadly passed away during its tenure.

The dedication, leadership and input provided as well as the many and varied challenges also proffered by everyone involved have helped develop the project and shape its outcomes into proposed wastewater management solutions that aim to meet high technical standards; respect and provide for tikanga, mātāpono and mātauranga Māori; responsibly serve our growing community, and, be environmentally sustainable.

Particular appreciation and recognition go to:

- The RPSC, with voting members from:
    - CNI Iwi Holdings;
    - Timberlands;
    - Te Arawa Lakes Trust;
    - Ngāpuna hapū / iwi;
    - Ngāti Whakaue;
    - Tūhourangi Tribal Authority;
    - Ōwhata / Rotokawa iwi;
    - Ngāti Whakaue ki Maketū;
    - Ngongotahā iwi;
    - Ngāti Rangiwewehi;
    - Ngāti Pikiao;
    - Ngāti Makino;
    - Lakes Water Quality Society;
    - Tapuika Iwi Authority;
    - Kaitiakitanga o Puarenga;
    - The BOPRC and the RLC Governance Reps;
    - Rotorua Lakes Community Board;
- Medical Officer of Heath and Officers of Toi Te Ora Public Health Services;
- Officers of the BOPRC;
- Members of the Project TAG;
- Members of the Project Cultural Assessment Subcommittee (CAS);
- Mātauranga Māori / Mātauranga-ā-Te Arawa Experts and Technicians;
- Pukeroa Oruawhata Trust;

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- Dr David Hamilton and colleagues at, and associated with, University of Waikato;
- Consultant firms Stantec New Zealand, Mott MacDonald, APR Consultants Ltd, Te Onewa Consultants, Wildlands Consultants, GNS Science and Jacana Consulting;
- The many Marae from Maketū to the city of Rotorua who hosted consultation and engagement hui; and
- All people, hapū/iwi members, groups and entities who made submissions and participated at hui, public meetings, open days and lectures.

E rau rangatira mā, tēnā rawa atu koutou katoa i tō koutou āwhina.

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17 Glossary of Terms and Abbreviations

Abbreviation	Description
$M	Million NZ dollars
Activated sludge	Activated sludge refers to the mass of microorganisms cultivated in the treatment process to break down organic matter and other inorganic compounds, including nutrients.
Adaptive Management	A systematic, iterative process of decision making in the face of uncertainty, with an aim of reducing uncertainty over time through system monitoring and changes to management in response to the results of monitoring. This approach can be used in setting resource consent conditions. “Trigger and response” or “adaptive management” conditions can provide more flexibility for consent holders and greater certainty for both the consent holder and the consenting authority.
ADF	Average daily flow (of wastewater). The ADF for Rotorua is around 20,000 m^3/day
ADWF	Average dry weather flow.
AEE - Assessment of Effects on the Environment	Assessment of Effects on the Environment. The document required under the Resource Management Act to support new Resource Consents applications.
AEP	Annual exceedance probability
Algae	Simple chlorophyll-bearing cells. Most are aquatic and unicellular. Some may link to form colonies or filaments and become macroscopic. An evolutionary early form of plants.
Alum	Aluminium Sulphate. A chemical used to efficiently react with P and DRP, which then settles and is called an alum-sludge, not available to plants and algae.
ANZECC	Australian and New Zealand Environment and Conservation Council.
ANZSIC-06	Australian and New Zealand Standard Industrial Classification (2006)
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ARP	ARP Consultants Ltd
AWT	Consultants now Mott MacDonald – involved in the technical studies for this project.
Bardenpho	The Biological Nutrient removal treatment process as installed at the Rotorua Treatment Plant which treats approximately two thirds of the present wastewater flow. Installed in 1990.
BERL	Business and Economic Research Limited
Best Practicable Option (BPO)	In terms of the Resource Management Act 1991 – “in relation to a discharge of a contaminant or an emission of noise, means the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to: a) The nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; b) The financial implications, and the effects on the environment, of that option when compared with other options; and

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Abbreviation	Description
	c) The current state of technical knowledge and the likelihood that the option can be successfully applied."
Biochemical Oxygen Demand (BOD, $cBOD_5$)	Carbonaceous biochemical oxygen demand ($cBOD_5$) measured as 5 day standard test. It is a measure of organic matter or organic strength of the water, reported as the mass of oxygen consumed per L of water (mg/L). A quicker measure of the organic strength is COD, which is measured through chemical oxygen. The COD in urban wastewater is roughly twice the BOD.
Biological Nutrient Removal (BNR)	Biological Nutrient Removal (biological nitrogen and phosphorus removal) is a wastewater treatment process that cultivates a live population of naturally occurring micro-organisms to breakdown organic matter and other inorganic compounds.
Biomass	The weight of living matter, eg of bacteria, algae, plant or animal. In wastewater treatment the biomass is the population of organisms that treat the wastewater. It is often referred to as 'mixed liquor', and expressed as the concentration of solids in the mixed liquor 'MLSS'.
Biosolids	Sludge from a wastewater treatment plant or unit that has been treated or stabilised.
Biota	Any assemblage of living organisms in a specific area
BioWin Models	A computer modeling tool used to assess wastewater treatment plant process operations.
BRMP	Beneficial Reuse Management Plan
BOPRC	The Bay of Plenty Regional Council is responsible for (among other things) managing the effects of using freshwater, land, air and coastal waters.
Buffer zone	We use to refer specifically to the unirrigated area between a spray-block and an area of either main public access or with a direct connection to a waterway discharging to lake Rotorua. Also used for the zone between a Wastewater Treatment Plant and an environmental or odour compliance zone is established around.
CAPEX	The abbreviated term for Capital cost – that is the cost to design and build infrastructure.
Carbon (C)	Carbon, carbon compounds provide chemical energy for growth and development and form the basis of organic life.
Carbon-dosing	Refers to the carbon provided as a food source to the organisms that remove nitrogen. Rotorua adds ethanol, a byproduct from the dairy industry.
CAS	Cultural Assessment sub Committee of the Rotorua Project Steering Committee (RPSC)
cfu/100ml	A measure of colony forming units (of micro-organisms) per 100ml of liquid sample.
Chlorination	The disinfection of wastewater using chlorine chemicals.
CIA	Cultural Impact Assessment
Clarifier	A settling tank in which fine solids, usually measured as suspended solids, settle to the base of the tank to be removed, and the water flows out over the top. Settling can aided by the addition of chemicals such as alum.
CNI	CNI Iwi Holdings Limited - owners of the land where the LTS is located.

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Abbreviation	Description
Coagulation	Coagulation / Flocculation. Treatment process to precipitate phosphorous and flocculate the solids, usually undertaken in a chemical clarifier.
COD	Chemical Oxygen Demand being a measure of the organic strength of the waste, measured chemically.
Contaminant	In terms of the RMA, " includes any substance (including gases, liquids, solids, and micro-organisms) or energy (excluding noise) or heat, that either by itself or in combination with the same, similar, or other substances, energy, or heat – a) When discharged into water, changes or is likely to change the physical, chemical, or biological condition of water; or b) When discharged onto or into land or into air, changes or is likely to change the physical, chemical, or biological condition of the land or air onto or into which it is discharged".
Cumulative Effects	Effects arising over time; and effects arising in combination with other effects. Any one incremental change may be insignificant in itself but at some point in time or space the accumulation of insignificant effects becomes significant.
Cyanobacteria	Filamentous bacteria containing chlorophyll and capable of full autotrophy (capable of making nutrients from inorganic materials). Previously grouped with the algae, but now recognised as a distinct group of organisms more closely related to bacteria.
DAF	Dissolved Air Flotation (a wastewater treatment process involving fine air bubbles floating out contaminants)
DB	Design Build (a contracting process)
DBO	Design Build Operate (a contracting process)
Denitrification	A biological process in which nitrates are reduced to nitrogen gas.
DIN	Dissolved Inorganic Nitrogen = ammonia nitrogen + nitrate nitrogen + nitrite nitrogen.
Discharge to land	A discharge that flows onto or into land.
Discharge to water	A discharge that flows into surface water, either directly or indirectly.
Discharge to water mixing zone	A discharge to groundwater or hyporheic water (saturated sediments, the flow that transitions between groundwater and surface waters). There is the potential for additional nutrient removal. Refer also to Zone of Reasonable mixing.
Discharge water	The discharge, effluent, treated wastewater, outflow AFTER treatment at WWTP. Rotorua's discharge water is currently irrigated into the Whakarewarewa Forest. We are looking for an alternative option for this discharge.
Disk Filter	A mechanical treatment filtration device using disks of woven fabric to remove total suspended solids (TSS). Filter mesh size range often 10-100 micrometres (micron).
DO	Dissolved Oxygen.
Domestic wastewater	Wastewater originating from residential dwellings, from: toilets, urinals, kitchens, bathrooms, showers, baths, basins, laundries. It excludes wastewater from commercial laundries, schools, cafes and restaurants, tradewaste and commercial waste. It excludes rainwater or stormwater.

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Abbreviation	Description
DON	Dissolved Organic Nitrogen = total dissolved nitrogen – dissolved inorganic nitrogen. Typically around 80% of TP in domestic wastewater.
DRP	Dissolved Reactive Phosphorus.
DWF	Dry weather flow of wastewater in Rotorua is around 19,000 to 20,000 cubic metres (m^3/day), which is around 215 L per person per day from Rotorua citizens and visitors. This is 'normal' for NZ.
EBPR	Enhanced Biological Phosphorus Removal
E. coli	Escherichia Coli, a species of bacterium normally present in the intestinal tract of humans and other animals. It is widely used as an indicator of faecal contamination, ie it is an indicator micro-organism for other pathogenic micro-organisms.
Ecosystem	Communities of interacting organisms in conjunction with the physical environment, interacting as a system. Therefore by definition, humans and their built environment are not separate from, but are interdependent and integral parts of ecosystems.
Ecosystem Re-entry	The re-entry by one or other methods of discharge of the final treated wastewater into the ecosystem.
EDCs	Endocrine Disrupting Compounds
Effect	"Effect means – In this Act (RMA 1991), unless the context otherwise requires, the term "effect" includes: Any positive or adverse effect Any temporary or permanent effect; Any past, present or future effect; Any cumulative effect which arises over time or in combination with other effects – regardless of the scale, intensity, duration, or frequency of the effect, and also includes – Any potential effect of high probability Any potential effect of low probability which has a high potential impact."
Effluent	The water that leaves a system or treatment plant – as opposed to influent, the water that enters. Effluent is often considered an old fashioned word and treated wastewater or discharge water are often used instead nowadays.
Environment	Environment, in terms of the Resource Management Act 1991, includes – (a) Ecosystems and their constituent parts, including people and communities; and (b) All natural and physical resources; and (c) Amenity values; and (d) The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters."
EOCs	Emerging Organic Contaminants
Ethanol	A chemical carbon source used as supplementary carbon for denitrification in the biological treatment process. Currently used at the WWTP.

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Abbreviation	Description
EWS	Electronic Weather Station
Faecal Coliform (FC)	Faecal coliform (FC) are bacteria. Their presence may indicate that the water has been contaminated with faecal material from of humans or other animals. Like E.coli this bacteria is used as an indicator micro-organism for other micro-organisms.
Ferric	A form of iron used to react with P. Naturally abundant in the environment, brown, like in soda springs.
FIDOL	Air emission factors, Frequency, Intensity, Duration, Offensiveness, Location
Filtration	A process to remove solids from water.
Flocculation	Flocculation / Coagulation. Treatment process to precipitate phosphorous and flocculate the solids usually undertaken in a chemical clarifier.
g/m^3 = mg/L = ppm	Common units for expressing concentration. The mass in a specified volume such as grams per cubic metre, milligrams per litre, or parts per million.
Gabion Baskets	A Basket of rocks retained in a wire mesh, or similar basket
Grinder Pump	Grinder pumps are used to collect and convey wastewater from properties in some of Rotorua Lakes Council's outlying small communities. The grinder pump grinds up solids entering the pump, and the resulting liquid slurry is pumped to a low pressure reticulation system.
Hapu	Kinship group, clan, tribe, subtribe - section of a large kinship group and the primary political unit in traditional Māori society
Hectares (ha)	1 Hectare = 10,000 m^2
Indicator micro organisms	The bacteria (E.Coli, faecal coliforms and enterococci) that are used to indicate the possible presence of pathogens (disease causing microorganisms).
Infiltration rate (soil)	Infiltration is the process by which water on the surface of the soil enters the soil. Infiltration rate is the rate that soil can absorb water (mm/hr). The rate decreases as the soil becomes saturated. It is related to the characteristics of the soil.
Inflow and Infiltration (I and I)	Inflow and infiltration is the extraneous water entering a reticulation system. Inflow is water entering via a deliberate connection (downspouts, gully traps, manholes, etc. Infiltration is water entering from the ground. The RLC has an ongoing programme to reduce I and I.
Influent	The water that enters a system or treatment plant– as opposed to effluent, the water that leaves a system or treatment plant.
L	Litre is a metric unit of volume. 1L = 1000 millilitres (ml)
L/s	Litres per second, a flow rate.
Land Treatment = Land Application	The application of appropriately (pre) treated wastewater at a controlled rate, into or onto land. The purpose to either obtain beneficial use of the wastewater and its constituents, for improved environmental outcomes, or to achieve treatment goals. The principal land treatment processes are Slow Rate (SR), Overland Flow (OF), Rapid Infiltration (RI).
Land Treatment System (LTS)	The Rotorua District Council's land application system established in 1991 in the Whakarewarewa Forest
LGA	Local Government Act 2002 and subsequent amendments

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Abbreviation	Description
LTP	A local authority's 10 year Long Term Plan
LVR	Log Reduction Values – relating to specified micro-organism reduction by UV disinfection and other treatment processes in the receiving environment
m	Metre, a measure of length.
Micrometer/(µm)	Also called a micron being 0.001 of a millimeter
m^3	Cubic metres, a measure of volume.
m^3/day	Cubic metres per day, a measure of the daily flow rate
m^3/sec	Cubic metres per second, a measure of flow rate – also referred to as cumecs.
Mass Load	The mass in tonnes or kilograms of a compound or other material. In this project the mass load of TN and TP are important considerations. The units are often given as tonnes per annum.
Mauri	The Te Reo word that refers to the life-force, spiritual energy, or portion of the universal energy that is associated with, and connects with, the material/physical aspect of this world.
MBR	Membrane Bioreactor (a biological treatment system included in the Preferred Treatment Scheme)
MDF	Median daily flow – relating to wastewater flow
Membrane Bioreactor MBR	High degree of biological treated though suspended growth processes and membrane filtration treatment as introduced into the RLC WWTP in 2012 to cater for approximately one third of the total wastewater flow being treated and now proposed for the full plant as part of the Preferred Scheme being Option 6 as covered in this AEE.
Membrane Filtration	An advanced tertiary polishing step using microfiltration to remove (all) suspended solids and some colloidal material
MfE	Ministry for the Environment
mg/L	Milligrams per litre is a concentration measure of a contaminant in liquid, is the same as mg/L is the same as g/m^3 and is in effect the same as parts per million (ppm)
mg/m^3	Milligrams per cubic metre which is the same as 0.001 mg/L per litre.
mgN/L	Milligrams of Nitrogen per litre
Micrometres (µm)	One millionth of a metre
Micron = Micrometre	1 millionth of a metre (10^{-6} metre)
ML	Million Litres
ML/day	Million Litres per day
MoH	Ministry of Health
MoU	Memorandum of Understanding
MWH	Consultants involved in the project through their staff representation on the TAG and facilitator to the RPSC (now called Stantec)
N	Nitrogen, one of the main nutrients used by plants and algae to grow
NA or N/A	Not Applicable

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Abbreviation	Description
Natural Character	In terms of the Resource Management Act 1991 – means "the qualities of the environment that give recognisable character to an area. These qualities may be ecological, physical, spiritual, cultural or aesthetic in nature. They include modified and managed environs."
ng/L	Nanogram per litre, parts per trillion. Equal to 0.000001 mg/L or 0.0001 µg/L.
NH_3	Ammonia.
NH_4 - N	Ammoniacal – Nitrogen. AmmoniacaI-N is the sum of both ammonia and ammonium
Nitrate and Nitrite	Nitrate (NO_3) and nitrite (NO_2) are oxidation states of nitrogen. In order of decreasing oxidation state: nitrate, nitrite, ammonia, and organic nitrogen.
Nitrification	A biological process in which ammonia is converted first to nitrite (by specific bacteria) and then to nitrate (by specific bacteria).
Nitrogen	N, one of the main nutrients used by plants and algae to grow.
Nitrogen renovation	Removing nitrogen from water. We transform the nitrogen in sewage to ammonia (not very mobile through soil, not good for aquatic life and like a fertiliser for plants) then to nitrate (very mobile in the soil and a fertiliser for plants) and ultimately nitrogen gas (harmless). There will always be some residual N that cannot be converted. It is dissolved organic N, not harmful to aquatic life, somewhat mobile in soils, not very available to plants.
NIWA	National Institute of Water and Atmospheric Research – a New Zealand Crown Research Institute.
NPS-FM 2014	National Policy Statement for Freshwater Management 2014 (updated August 2017)
NPV	Nett Present Value – made up of capital costs and annual operating and maintenance cost over a set time period at stated discount rates often called lifecycle cost.
Nutrients	Organic or inorganic chemicals needed by organisms for growth and reproduction. In this and most projects, the principle nutrients are the various forms of nitrogen and phosphorus.
O & M	Operation and Maintenance. Also called OPEX
OMP	Odour Management Plan
OPEX	The Abbreviation for operation and maintenance costs – costs usually given on a per annum basis. Care is needed as to whether depreciation allowances in accordance with local government procedures are included.
OSET	On-Site Effluent Treatment. A small-scale domestic wastewater treatment system comprising the technologies and management protocols for the handling of household wastewater within the property boundaries of the place of origin of the wastewater, including processing and re-entry to the in-boundary environment.
P	Phosphorus, one of the main nutrients used by plants and algae to grow. Refer TP below also.
P & G	Preliminary and General – cost component in cost estimates.
P or TP-stripping	Removal of P by adding compounds to precipitate and flocculate with the dissolved P. Usually adding Alum (Aluminium Sulphate) or Iron (Ferris) salts

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Abbreviation	Description
P removal	Phosphorus can be removed from wastewater biologically to relatively low concentration, where the P is taken up by the microorganisms that are cultivated and removed as sludge. Compounds can be added to remove dissolved-P to very low concentrations by precipitation and flocculation, and the solids formed are removed. Both of these processes are common in WWTPS as a continuous or batch process. P can also be held by reactive surfaces of a range of materials, including soils, and these can be used in beds and trenches for example to remove any Dissolved Reactive Phosphorus (DRP) remaining after treatment. The capacity to retain P is finite and adsorbed P can be released under some conditions. Particulate-P can be removed by different types of filtration.
Pathogens	Disease causing microorganisms.
PDWF	Peak Dry Weather Flow for wastewater flows in litres per second (L/s) or cubic metres per second (cumecs) (m^3/sec).
PE and PL	PE, Population equivalent, is the wastewater from inhabitants, expressed as water volume or BOD. The 2 definitions used worldwide that are based on fixed non-changeable values are: 1 PE = 200 Litres/day; or 1 PE = 60 g BOD/d. PL, person load, is the actual contribution of wastewater from a person (which varies).
Peak Demand	For engineering type assets such as water and wastewater networks and infrastructure the extra demand can be calculated based on peak requirements in such periods as holidays, major conferences etc. The peak demand is taken as 100% occupancy of all accommodation and infrastructure and assets are sized accordingly.
Percentile	Division of a frequency distribution into one hundredths.
Permeability (soil)	The capacity of the soil to allow water to pass through it.
PF	Peak Flow on an hourly basis (m^3/h).
pH	Measure of acid or base nature of liquid.
Phosphorus	P, one of the main nutrients used by plants and algae to grow.
Photosynthesis	The process where starches and sugars are produced within plant (or plant - like) cells using carbon dioxide, inorganic nutrients and sunlight. Sunlight is captured with the chlorophyll molecules.
PWWF	Peak Wet Weather Flow in litres per second (L/s) or cubic metres per second (cumecs) (m^3/sec).
QMRA	Quantitative Microbial Risk Assessment
Rapid Infiltration Beds (RIB's)	A high porous soil type structure into which treated wastewater is discharged from which it infiltrates away quickly. Often RIB's are constructed in the form of a series of open basins.
RAQP	Bay of Plenty Regional Council Regional Air Quality Plan
RAS	Return Activated Sludge. The proportion of the activated sludge retained within the treatment processes to achieve the biological breakdown
RDC Now RLC	Rotorua Lakes Council (formerly Rotorua District Council) is one of 7 territorial authorities in the BOPRC region. The RLC is responsible for (among other things) controlling the effects of land use and the effects of activities on the surface of lakes and rivers (managing the effects is a Regional Council

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Abbreviation	Description
	responsibility); providing local infrastructure, including water, stormwater and sewerage (as required).
Receiving Environment	The natural environment into which a discharge is made.
Residual Aluminium	The Residual or left over proportion of Aluminium chemical (as Al) in the treatment of the wastewater after Alum (Aluminium Sulphate) treatment
Residuals	The by-products of wastewater treatment (other than the treated water). These include screenings, sludges, biosolids, grit, grease, fat, air emissions including odour.
Resource Consent	A resource consent is the authorisation given to certain activities or uses of natural and physical resources required under the RMA.
Reticulation	A network of pipes and pumps etc used to transport wastewater. Stormwater (rain) is also reticulated separately. Reticulation systems are made up of collection and conveyance systems.
Riparian zone	The edge of a wetland or stream
RLC	Rotorua Lakes Council (formerly Rotorua District Council)
RMA	Resource Management Act 1991 and subsequent amendments
RNRP	Regional National Resources Plan
RO	Reverse Osmosis – reverse osmosis treatment system involving semi permeable ions, molecules, and larger particles a very fine filtration process. ROL membranes are often preceded by ultra-filtration (UF). ROL Membrane pore size typically in 0.001 micron range.
Rock Passage	A passage, or bed or broad wall of rocks over and or through which treated wastewater discharges before entering the water receiving environment – through ecosystem re-entry.
Rohe	Boundary, district, region, territory, area, border (of land).
Rotorua LTS = LTS	Land Treatment System in Whakarewarewa Forest, it is Slow-Rate (SR) application by spray-irrigation.
RPS	Bay of Plenty Regional Council's Regional Policy Statement.
RPSC	Rotorua Project Steering Committee (previously also called the Rotorua Land Treatment System) – for this Project involving investigations, planning and consultation for the future disposal/discharge or reuse of Rotorua's treated wastewater.
Sewage (interchangeable with wastewater)	The water-carried waste that leaves a house or community.
Sewerage System (Wastewater Reticulation System)	The infrastructure (system of pipes, fittings, pump stations, manholes etc) for collecting and conveying the sewage.
Stormflow	Refers to the wastewater entering the WWTP during a storm. It is sewage diluted with rainwater. It can double the daily volume received in Rotorua during an intense storm, which is low compared to other cities, because we have an ongoing 'I and I' programme.
Suspended Solids (SS) and TSS	Suspended Solids (SS) equals Total Suspended Solids (SS=TSS)
t	Tonne = 1000 kg
t/yr	Tonne per year

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Abbreviation	Description
Tāngata whenua	In terms of the Resource Management Act 1991 – means "in relation to a particular area, means the iwi, or hapu, that holds mana whenua over that area."
Tapu	To be sacred, prohibited, restricted, set apart, forbidden.
TBA	To Be Advised
TBC	To Be Confirmed
TDP	Total Dissolved Phosphorus
Technical Advisory Group (TAG)	The Technical Advisory Group(s) established by the RLC for this Project
TERAX	A sludge processing unit that deconstructs the sludge from the WWTP by thermal and pressure processes
TLI	Tropic Level Indicator of the nutrient status of a freshwater body
Total Ammoniacal Nitrogen	$[NH_3+NH_4]$-N, the fraction of the ammonia that is nitrogen.
Total K Nitrogen (TKN)	Total Kjeldahl Nitrogen
Total Nitrogen (TN)	Total Nitrogen = Total Organic Nitrogen + Ammonia + Nitrate + Nitrite
Total Phosphorus (TP)	Total Phosphorus – all Phosphorus compounds
Total Suspended Solids (TSS)	Fine solids in wastewater, determined by a standard test (TSS=SS)
Tradewaste	Tradewaste is wastewater from trade or industrial processes that is discharged into the RLC Sewerage System.
Treated wastewater	The water discharged after wastewater has been treatment. Depending on the quality of the water, it can be reused, or re-enter the ecosystem. It is also called effluent.
UF	Ultra filtration – fine filtration typically the range of 0.01 to 0.15, often precedes Reverse Osmosis (RO)
UV	Ultra violet light irradiation used as a wastewater disinfection process.
UV Dose Rate	UV dose is measured in millijoules seconds per cm2 (mJ/cm2)
UVT	Ultra-Violet Transmittance – a measure of the clarity and other characteristics of water (treated wastewater in this project) in terms of the effectiveness of Ultra-Violet light disinfection – this has a termination on UV dose rate to achieve predetermined microorganism kill rates.
Wastewater	The mix of domestic sewage and tradewaste. It can also include some rainwater and ground water that can enter the reticulation system during rainfall and/or areas with damaged pipes and a high water-table.
Water Quality	The chemical and physical attributes of water such as turbidity, nitrogen and phosphorus concentrations, temperature and major ion concentrations.
Water Quality Target (TLI)	An objective or result for water quality towards which efforts are directed.
Water Table	The 'surface' of the water or ground that is saturated. It can vary.
WWTP	Rotorua's Wastewater Treatment Plant

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Appendices

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Appendix A Rotorua Lakes Council (RLC): Strategy, Policy and Finance Committee and Full Council Reports and Resolutions

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RDC-635290

ROTORUA LAKES COUNCIL

File No: 85-08-503
RDC-635290

ROTORUA LAKES COUNCIL

Mayor
Chairperson and Members
STRATEGY, POLICY & FINANCE COMMITTEE

PREFERRED ALTERNATIVE TO THE ROTORUA LAND TREATMENT SYSTEM

Report prepared by: Greg Manzano, Manager Water Planning
Report reviewed by: Andy Bell, Director Water Solutions
Report approved by: Geoff Williams, Chief Executive

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1. PURPOSE

The purpose of this report is to seek approval to proceed with the implementation of the Preferred Alternative to the Rotorua Land Treatment System.

2. RECOMMENDATIONS:

1. **That the report 'Preferred Alternative to the Rotorua Land Treatment System' be received.**

2. **That the Committee recommends to Council to proceed to a resource consent application of the preferred upgrade of the Rotorua Wastewater Treatment Plant, which includes conversion of the existing plant into a full Membrane Bioreactor (MBR) with additional phosphorous removal and the addition of Ultraviolet Disinfection (UV) system.**

3. **That the Committee recommends to Council to proceed to a resource consent application for the Rotorua Wastewater Treatment Plant discharge, on the basis of the preferred option:**

   (a) The identified option to discharge through to Puarenga Bay and;

   (b) To continue to work with interested parties, to investigate alternate discharge options, including the reuse of recovered water.

4. **That the Committee recommends to Council to note that the estimated capital cost of the preferred wastewater treatment plant upgrade and the discharge to Puarenga Bay is $29 million. The budget allocation for this project in the Long Term Plan is $18.6 million.**

5. **That the Committee recommends to Council to acknowledge and thank the Rotorua Project Steering Committee and all parties involved in the process, culminating to this decision**

3. BACKGROUND

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A report summarising the options to the Whakarewarewa Land Treatment system was submitted to the Strategy, Policy and Finance Committee meeting on 14 October 2015.

The report presented the different options to upgrade the existing wastewater treatment plant and options for disposal of the treated effluent. This was the result of about 18 months of

comprehensive options identification, evaluation and stakeholder engagement process, led by the Rotorua Project Steering Committee (RSPC).

The RSPC further considered the options and has unanimously agreed on a preferred option for treatment which would involve conversion of the existing plant to a full membrane bioreactor (MBR) with additional phosphorous removal by alum dosing and further ultraviolet (UV) disinfection to reduce bacteria, pathogens and virus to a very low level.

The RSPC however was not unanimous on the type and location of the discharge . Majority of the RSPC members supported the very high level of treatment being proposed followed by discharge through a cultural land contact bed within the treatment plant site (Sanatorium Reserve), then cascades into an existing open channel and flow overland into Lake Rotorua at Puarenga Bay.

Other members of the RSPC raised their concern on the above type and location of the discharge. They indicated their preference that the discharge should still be to land by irrigation.

Further investigations were undertaken to establish the concept and cost of land disposal through rapid infiltration beds. Another proposal was put forward to Rotorua Lakes Council for a potential reuse option of the treated effluent. Discussions with the proponents of the reuse option continues .

Another report was submitted to the Strategy, Policy and Finance Committee on 17 March 2016. This report sought the approval of Council to proceed with a public consultation programme on:

- The preferred wastewater treatment plant upgrade option being a full MBR treatment plant with additional phosphorous removal and ultraviolet disinfection.
- The preferred, but not unanimously agreed option, to discharge to earth contact beds within the treatment plant site at Sanatorium Reserve. The water would flow through the beds, cascade into an existing open channel and flow overland into Lake Rotorua at Puarenga Bay.
- The alternative to pipe the treated effluent to a location somewhere in the catchment and discharge to rapid infiltration beds.

The Stage 2 public engagement process has been completed through marae hui, public meetings and site visits, as follows:

• Marae hui	Saturday, 7 May 2016	Te Papaiouru Marae, Ohinemutu
• Public meeting	Wednesday, 11 May 2016	Sir Howard Morrison Performing Arts Centre
• Site visit	Thursday, 12 May 2016	WWTP and Te Arikiroa
• Site visit	Saturday, 14 May 2015	WWTP and Te Arikiroa
• Marae hui	Saturday, 27 March 2016	Whakaue Marae, Maketu

Submissions were also received and these will be summarised in the later part of this report.

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A meeting between Rotorua Lakes Council staff and the proponents of the potential reuse of the recovered water was held on 8 June 2016. There was general agreement to progress the due diligence investigation of the proposal.

The Rotorua Project Steering Committee met on 9 June 2016. During the meeting, the result of the Stage 2 Public Engagement and the conclusions and recommendations of the Cultural Impact Assessment developed by the Cultural Assessment Subcommittee were presented to the Rotorua Project Steering Committee. The proponents of the potential reuse of the recovered water also presented their initial ideas of the proposal.

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After considerable discussions and deliberations, a resolution was put forward to the Rotorua Project Steering Committee, as follows:

(a) That the Rotorua Project Steering Committee recommends to Rotorua Lakes Council to proceed to a resource consent application for the Rotorua Wastewater Treatment Plant upgrade, on the basis of the following preferred option:

- Treatment - a 100% MBR membrane filtration plant, including phosphorous removal and UV Treatment.

Except for one abstention, the resolution was unanimously supported by all members of the Rotorua Project Steering Committee.

(b) That the Rotorua Project Steering Committee recommends to Rotorua Lakes Council to proceed to a resource consent application for the Rotorua Wastewater Treatment Plant discharge, on the basis of the following preferred option:

- The identified option to discharge through to Puarenga Bay and;
- To continue to work with interested parties, to investigate alternate discharge options, including the reuse of recovered water.

This resolution was put to a vote with 8 for, 4 against and 2 abstentions . The resolution was carried.

4. DISCUSSION AND OPTIONS

4.1 The Preferred Wastewater Treatment Plant Upgrade

The preferred wastewater treatment plant upgrade will involve converting the existing plant to a full membrane bioreactor plant with additional phosphorous removal and ultraviolet disinfection. The RSPC unanimously agreed that this is the preferred option moving forward. Comments and submissions from the public engagement process also supported the preference for this option.

This option was selected as the preferred option because of the key benefits it provides, as follows:

(a) The resulting treated effluent (recovered water) is very high quality, with both nitrogen and phosphorous levels reduced to as low as practicable. Resource consent compliance would not be an issue.
(b) The double barrier health protection from the MBR and UV treatment reduce pathogens and virus levels to a very low level where it is safe to return to environment.
(c) The technology selected is well proven and the operators are familiar with the operational and maintenance requirements. The existing wastewater treatment plant is part MBR and Rotorua Lakes Council's water supply is treated using UV system.
(d) The proposed upgrade will enable the treatment process to be streamlined and simplified, which would make it easier to operate and carries fewer risks than other systems.

4.2 The Preferred Discharge Option

The preferred, but not unanimously agreed option, is to discharge to earth contact beds within the existing treatment plant site at Sanatorium Reserve. The treated effluent would flow through the beds, cascade into an existing open channel and flow overland into Lake Rotorua at Puarenga Bay.

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Majority of the RSPC members considered this as the preferred discharge option because of the following:

(a) This will enable Rotorua Lakes Council to complete the project within the December 2019 agreement with CNI.

(b) The proposed treatment process will bring the pathogen and virus levels to a very low level, that public health risks associated with the proposed discharge type and location is nil. It is expected that pathogen levels from the systems are a lot lower than that at Lake Rotorua, Puarenga Stream, Waipa Stream and Awahou Stream.

(c) The proposed treatment process will consistently bring the nutrient levels to the same level as the current land treatment system, that there are no environmental risks associated with the proposed discharge type and location.

(d) The discharge to a properly designed earth contact bed would provide for the cultural treatment requirements.

4.3 The Alternative Discharge Option

The alternative discharge option is to pipe treated effluent (recovered water) to a location somewhere in the catchment and discharge to rapid infiltration beds where the water would flow as groundwater before entering the lake. Approximately 20 hectares of land is required for this type of discharge. Some of the RSPC members are advocating for this as this will be a type of discharge into land.

For this option to progress, the required area of land within the catchment needs to be made available. Initial investigations indicated that there is no readily available land for this purpose.

4.4 Other Discharge Options

There is potential to reuse the treated effluent (recovered water.) Some very preliminary proposals have been suggested by various parties, but outcomes are not known at this stage. Discussions related to these proposals continue.

5. ASSESSMENT OF SIGNIFICANCE

The decisions or matters of this report are part of a process, to arrive at a decision that will be significant in accordance with Council's Significance Policy. This states that a matter shall be determined to be significant when:

The financial implications of the proposal or decision on the Council's overall issues are substantial.

- It involves $10M or more budgeted expenditure
- It involves $3M or more unbudgeted capital expenditure

The upgrade of the WWTP is budgeted for in the LTP at $18.6M. If the preferred treatment plant upgrade option and the discharge to water is approved and consented, this will increase Council's debt level over the LTP period, but will remain within the debt cap.

Should the discharge option be to land, these will be a major impact on Council's LTP.

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6. COMMUNITY INPUT/ENGAGEMENT AND PUBLICITY

This project has been the subject of a comprehensive stakeholder engagement process. Community input/submissions to the Stage 2 Public Engagement process described in section 1(Background) is summarised below:

(a) Summary written submissions:

	Number
Number of written submissions received	20
Supports the proposed treatment plant upgrade	16
Supports the discharge to a land contact bed at Sanatorium Reserve, then into Te Arikiroa (Puarenga Bay)	3
Supports the alternative discharge to land	6

(b) Key points in the written submissions:

- The current proposal of discharging wastewater into Lake Rotorua, even if it is treated to a high standard, is considered to be distasteful and culturally insensitive.
- The Whakarewarewa Forest was part of the Treaty Settlement. The agreement guaranteed the use of designated areas within the Whakarewarewa Forest being used by Rotorua Lakes Council, to dispose treated effluent consistent with resource consent.
- Lake Rotorua has improved in water quality since 2004, as measured using the Trophic Level Index. Discharging into Lake Rotorua would put this at risk and a step back to pre-1989 times.
- The CNI Deed of Agreement should never have been agreed, or at least it should not have been agreed until an alternative option to the existing discharge had been identified and costed.
- Discuss the potential for compensation from the CNI Collective to Council to facilitate the change in discharge system. The CNI Collective's negotiation with government over the return of the land involved compensation to allow Rotorua to spray treated wastewater on this land.
- The cost to upgrade the WWTP to remove nitrogen is expensive. The budget allocation for the proposed wastewater treatment plant upgrade is better spent by implementing more cost and outcome effective nitrogen removal alternatives.
- The majority of these submissions relate to historical decisions that have already been made. The submissions were considered by the RSPC prior to making any recommendations.

7. CONSIDERATIONS

7.1 Financial/budget considerations

The budget allocation for this project in the Long Term Plan is $18.6M. Both options are a higher capital cost than what has been budgeted for in the Long Term Plan. This will impact Council's debt retirement programme over the ten year period of the Long Term Plan. To minimise the impact of this, the possibility of staging the work over time to delay expenditure and stay within the LTP

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estimate, was undertaken. Because of the nature of the proposed upgrade works, it was established that it is not practical to stage the work over time.

(a) The preferred plant upgrade and preferred discharge location:

The estimated capital cost for the preferred plant upgrade and discharge to Te Arikiroa (Puarenga Bay) is about $29M. If this option is implemented, Council's debt level will increase by about $11M over the LTP period, but will remain within the debt cap.

The discharge location for this option is in close proximity to the Wastewater Treatment Plant, hence operational cost (pumping cost) would cost less than spraying in the forest. Because of this, there will be no impact on forecast long term operational costs or targeted rates.

(b) The preferred plant upgrade and alternative discharge option:

The estimated capital cost for the preferred plant upgrade and the alternative discharge option to a rapid infiltration bed somewhere within the catchment is about $54M. If this option is implemented, Council's debt level would increase by $36M over the LTP period and will exceed the debt cap. This would affect Council's credit rating and could lead to an increase in the cost of borrowing. It is expected that if this option is implemented, the wastewater targeted rate would increase by $74 per year per property.

7.2 Policy and planning implications

The Long Term Plan includes the implementation of an alternative to the existing Whakarewarewa Land Treatment System.

7.3 Risks

Following is a summary of potential risks associated with the different discharge types and locations:

Discharge Options	**Risks**	**Comments**
Discharge to an earth contact bed within the plant at Sanatorium Reserve and cascade flow into an existing open channel and flow overland to Lake Rotorua at Puarenga Bay	Adverse effect on the community including publicity/public perception	The local iwi stated their objection to this option. This could potentially progress into an Environment Court appeal during the resource consent application process.
Discharge to land through a 20 hectare rapid infiltration bed within the catchment	Timeframes	There is no readily available site for a proposed rapid infiltration bed. Additional time is needed to locate and confirm the suitability of a site. It is not possible to complete the project within the December 2019 timeframe.
	Financial	Refer to discussion in 7.1

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Discharge Options	Risks	Comments
Reuse options proposed	Timeframes	No definite proposals/sites have been established. Development and evaluation of option will require considerable amount of time. It is not possible to complete the project within the December 2019 timeframe.
	Financial	The cost has not been established yet but it is considered significantly higher than the other two options.

7.4 Authority

The committee has the authority to make recommendations to Council on the desired decision.

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3. That the following recommendations of the Strategy, Policy & Finance Committee meeting held 15 June 2016 be adopted:

Recommendation 1
SOLID WASTE BYLAW 2016 - PUBLIC CONSULTATION That the Solid Waste Bylaw 2016 Statement of Proposal proceed to the special consultative procedure. Cr Searancke/Cr McVicker C16/06/034 CARRIED
Recommendation 2
PREFERRED ALTERNATIVE TO THE ROTORUA LAND TREATMENT SYSTEM That Council to proceed to a resource consent application of the preferred upgrade of the Rotorua Wastewater Treatment Plant, which includes conversion of the existing plant into a full Membrane Bioreactor (MBR) with additional phosphorous removal and the addition of Ultraviolet Disinfection (UV) system. That the committee recommends to Council to proceed to a resource consent application for the Rotorua Wastewater Treatment Plant discharge, on the basis of the preferred option: (a) The identified option to discharge through to Puarenga Bay and; (b) To continue to work with interested parties including Mana Whenua and Te Tatau o Te Arawa, to investigate alternate discharge options, including the reuse of recovered water. That the committee recommends to Council to note that the estimated capital cost of the preferred wastewater treatment plant upgrade and the discharge to Puarenga Bay is $29 million. The budget allocation for this project in the Long Term Plan Is $18.6 million. That the committee recommends that Council acknowledge and thank the Rotorua Project Steering Committee and all parties Involved In the process, culminating to this decision. Cr Donaldson/Cr Kent C16/06/035 CARRIED
Recommendation 3
ANNUAL PLAN 2016/17 That Council adopt the Annual Plan 2016/17. Cr Donaldson/Cr Hunt

A division was called with the following result:

For: Mayor Chadwick, Cr Donaldson, Cr Hunt, Cr Raukawa-Tait, Cr Sturt, Cr Tapsell and Cr Wepa (7) Against: Cr Bentley, Cr Gould,Cr Kent, Cr McVicker and Cr Searancke (5)

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Appendix B Rotorua Project Steering Committee (RPSC) – Terms of Reference, Membership and Meeting Summary Record

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Purpose of Steering Committee

The Steering Committee is established to reach consensus on a **Preferred Alternative Option to the Rotorua LTS**, and to recommend this preferred option to the RLC.

The Proposed Terms of Reference (TOR) of the Project Steering Committee are outlined in this document. The TOR establishes an agreement by the members of the Project Steering Committee to assist the Rotorua District Council in ensuring that thorough objective and appropriate investigations of all practically feasible options are undertaken, and taking account of community concerns. The proposed TOR of the Project Steering Committee will provide for:

- Recommendations on determining the key strategic decisions associated with this project to ensure cost effective and efficient management of the project inclusive of identifying and mitigating project risks;
- Participate in the assessment of the wastewater disposal, discharge and reuse options, and in the agreement of a preferred option for implementation;
- Lead the consultation process and ensure that it complies with the requirements of the RMA and LGA; and
- RLC to fulfil its legal responsibilities under the RMA and LGA and act on the recommendation of the committee.

Goals

The Committee is to select from various options an alternative which is overall the best practicable option, and which:

- Contributes to improving the water quality in Lake Rotorua by reducing nutrient and contaminant flows from the Rotorua WWTP;
- Acceptably meets the cultural needs of tāngata whenua;
- Achieves acceptable community environmental outcomes;
- Acceptably safeguards public health;
- Complies with regulatory requirements – national and regional;
- Is an acceptably cost effective option for local rate payers as well as the RLC; and
- Has acceptable levels of community support.

Scope of RPSC Considerations

The Scope of the Rotorua Project Steering Committee:

1. Is to consider all practicably feasible alternative options to the current LTS in the Whakarewarewa Forest; and
2. Is to develop the options in conjunction with the RLC, to choose the most preferred option for recommendation to the RLC, and to facilitate consultation with the wider community and other key stakeholder groups.

Rotorua Project Steering Committee Establishment

The Steering Committee was convened by the RLC at a meeting on 2nd December 2013, after consultation with stakeholders. The first meeting of the RPSC was held on the 16th January 2014.

Responsibility and Reporting of Steering Committee

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The Steering Committee is a meeting of equals among stakeholders: community groups, (especially iwi), authorities (especially the RLC), and such other stakeholders as may have a specific and declared interest.

The Committee is not a Statutory Committee and is not subject to direction by the RLC. Nor is there any delegation of Council decision making authority to the Steering Committee.

The Steering Committee is to report to the community and to the RLC. All engagement with media shall only be through, or with the agreement of, the RPSC Chair.

The Committee it to recommend to the RLC its preferred alternative option to the current LTS.

The Steering Committee in its own right shall not make formal submissions on Council plans or resource consent matters, but members of the committee retain their rights to do so.

Table to be updated by the RLC as were changes along the way

RPSC Membership at the Time of Formation of the Committee
(19 voting members and 10 non-voting = 29)

Role	Organisation ./ Iwi	Primary Rep	Alternate
Chairperson (voting)	Lakes Water Quality Society (LWQS)	Warren Webber	Morris Meha (Deputy Chair)
Facilitator (non-voting)	*and* Chair, RPSC Technical Advisory Group (TAG)	Jim Bradley	
Members (voting)	*Lakes Community Board - Chair*	*Geoff Palmer*	*Leo Meharry* *Phill Thomass*
	CNI Iwi Holdings Ltd	*Alamoti Te Pou*	*John Hura*
	Timberlands	*Piripi Jennings*	
	Te Arawa Lakes Trust (also *Tuhourangi, Ngati Wahiao)*	*Roku Mihinui*	*Leilani Ngawhika* *Hera Smith*
	Ngati Pikiao	*Fred Whata*	*Joe Tahana*
	Ngati Makino	*Morris Meha*	*Hare Wiremu*
	Tuhourangi Tribal Authority	*Rangitihi Pene*	*Shane Gibbons*
	Ngati Rangiwewehi Iwi Authority	Gina Mohi	Rikihana Hancock
	Ngati Whakaue	Anaru Te Amo	Katie Paul
	Tapuika Iwi Authority	Geoff Rice	Dean Flavell
[Owhata / Rotokawa iwi]	Ngati Rangiteaorere Ngati Uenukukopako Ngati Te Rora o Te Rangi	Arama Pirika	Hera Naera

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Role	Organisation ./ Iwi	Primary Rep	Alternate
	Kaitiakitanga **(Tuhourangi, Ngati Wahiao)**	Wally Lee	
[Ngapuna iwi]	Ngati Hurunga Te Rangi Ngati Hinemihi Ngati Tumatawera Ngati Te Kahu Positive Rotorua Environmental Society	Piripi Mutu Irihapeti Wineera Peter Staite	Ana Wilson Marama Meikle Te Atatu Epapara Katarina Epapara Carol Leonard Louise Kirk
[Ngongotaha iwi]	Ngati Tura Te Ngakau Ngati Ngararanui	Hone Newton (jnr)	Guy Ngatai
Governance (voting)	RLC – Deputy Mayor	Cr Dave Donaldson	Cr Peter Bentley
	BOPRC - Councillor	Cr Neil Oppatt	Cr Lyall Thurston
Observers & Council Staff (non-voting)	Toi Te Ora – Public Health Service	Annaka Davis	
	Rotomā Rotoiti Sewerage Steering Committee (RRSSC) - Chair	Ian Mclean	
	BOPRC - Lake Operations Manager	Andy Bruere	Reina Meha
	RLC Group Manager Chair of Infrastructure Services	Andy Bell	
	RLC General Manager - Hydrus Engineering Consultants	Greg Manzano	
	RLC Director Kaupapa Maori	Mauriora Kingi	
	RLC Senior Environmental Scientist	Alison Lowe	
	RLC Utilities Operations Manager	Eric Cawte	
	RLC Secretary - Shared Services	Yvette Van Vliet	
29 members (19 voting)			

Cultural Advisory Sub-Committee

Role	Organisation / Iwi	Primary Rep	Alternate
Chair	Ngati Rangiwewehi Iwi Authority/RPSC	Gina Mohi	Rikihana Hancock
Member	Tapuika Iwi Authority/RPSC	Geoff Rice	Dean Flavell
Advisory Consultant	Consultant	Antoine Coffin	

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Updated List of RPSC Voting Members and Non-Voting Members:

- Alamoti Te Pou
- Alison Lowe
- Anaru Te Amo
- Andy Bruere
- Annaka Davis
- Antoine Coffin
- Clark Pirika
- Cr Dave Donaldson
- Elizabeth Wineera
- Eric Cawte
- Geoffrey Rice
- Gina Mohi
- Greg Manzano
- Hariata Ngatai
- Hone Newton
- Jenny Riini
- Jim Bradley
- Jimi McLean
- Joe Tahana
- Louise Kirk
- Manu Pene
- Marama Meikle
- Maria Horne
- Matthew Heke
- Neil Oppatt
- Nereaha Pirika
- Ngaire Khan
- Peter Staite
- Phill Thomass
- Pia Bennett
- Ray Poupoasa
- Roku Mihinui
- Shane Gibbons
- Stavros Michael
- Tania Tapsell
- Te Taru White
- Wally Lee
- Warren Webber

The following is a brief summary listing of the main matters discussed at each RPSC meeting. Full minutes (available from Greg Manzano, the RLC's Project Manager) are available on request.

Meeting 16th January 2014

- Welcome and Introduction;
- Appointment of Facilitator;
- Representation and Terms of Reference;
- Pre-feasibility Study Clean Water Symposium Options; and
- Project milestones and way forward

Meeting 11th February 2014

- Nutrient allocation for Rotorua catchment;
- Terms of Reference;
- Technical advice sources; and
- Election of Warren Webber as RPSC chair.

Meeting 12th March 2014

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- Committee representation;
- Scope of deliberations; and
- Appointment of Jim Bradley as Technical Advisory Group (TAG) Chair.

Meeting 16th April 2014

- CNI Heads of Agreement (on LTS land);
- Consent application update;
- Technical Advisory Group (TAG) membership;
- Field trip planning for 18 July 2015.

Meeting 13th May 2014

- Local place names – clarification;
- Need for public consultation;
- Draft TOR for RPSC and need to adapt;
- Study trip on 18th July planning.

Meeting 10th June 2014

- Targets, challenges and opportunities;
- TAG – Terms of Reference;
- Assessment criteria for options;
- Technical Glossary development.

Meeting 16th July 2014

- Field trip on 18th July report to Tauranga's cities Chapel Street and Te Maunga and Western Bay of Plenty Districts' Te Puke and Makatu plants;
- TAG Report – Alternative Options Short List and Long List;
- Add-On technologies;
- Cultural viewpoint and Kaituna River decision;
- Dredging of lake; and
- Nutrient discharge charts.

Meeting 12th August 2014

- TAG Report (emerging technologies, National Policy Statement Freshwater Management 2014);
- Iwi representation;
- Consultation strategy; and
- Discharge impacts on receiving environment – introductory report Professor David Hamilton.

Meeting 17th September 2014

- Report on hui with Te Maru O Kaituna;
- TAG Report (Information process, Q&A sessions, cost estimates, "Add-On" processes);
- Environmental effects studies;

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- Decision processes; and
- Consultation Strategy draft and consultation brochure

Meeting 14th October 2014

- Stage 2 Consultation Strategy;
- TAG Report (Cultural Impact feed in, Endocrine Disrupting chemicals (EDC's) nutrients, microbiological (health) guidelines;
- Options feasibility studies (Mott MacDonald Consultants); and
- Antoine Coffin to contribute to CIA process.

Meeting and Workshop 11th November 2014

- Cultural business items;
- Cultural assessment process;
- Revised timelines;
- Stage 2 Community Consultation feedback – Makatu Mare hui 8th November 2014);
- TAG Report new technologies – "Add-On's"; and
- Wastewater systems and water conservation (RLC staff).

Meeting 17th December 2014

- Detailed Feasibility Study presented by Kevan Brian Mott Macdonald consultation;
- Discharge options favour and not favoured;
- Reverse Osmosis and reuse;
- Stage 2 consultation three public meetings report back;
- Cultural Assessment subcommittee (CAS) report;
- Resolved that Upper Kaituna is withdrawn as a discharge option;
- Resolved that the location effects study and import to Upper Kaituna continue; and
- TAG Report – add-on's, sludge, contaminant concentrations.

Cultural Sub Committee and RPSC Meeting 21st January 2015

CAS – presentation by Dr Kepa Morgan on Mauri Model

RPSC

- Appointment of Antoine Coffin to assist with cultural matters;
- Cultural assessment strategy and process update;
- Discharge location and effects;
- Land treatment alternative sites;
- Treatment add-on's;
- Ground water replenish systems (Orange County etc USA) video; and
- Local Government NZ water workshops

Meeting 19th February 2015

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- Cultural strategy and progress update;
- Treatment "Add-On's" update; and
- Waitangi Tribunal Report on Sovereignty Summary of Conclusions.

Meeting and Visit to Rotorua WWTP (WWTP) and LTS 19th March 2015

- Lake Tarawera wastewater plans and attendance of RPSC representative at meetings;
- Cultural assessment update including objectives confirmation and Cultural Impact Assessment approach;
- Technical feasibility update;
- Estimated costs; and
- Discharge location and effects

Workshops and Meeting 22nd April 2015

- TERAX update (RLC Officers) – Workshop;
- Discharge location and effects – Workshop;
- Cultural Assessment Strategy and process update;
- Technical and Environmental Investigations update;
- Q&A session; and
- Technical "Add-On's" summary table

Meeting 20th May 2015

- Membrane Reactor (MBR) pore size;
- Cultural process;
- Technical Q&A session; and
- Confirmation of TAG shortlisted options.

Workshop and Meeting 25th June 2015

- Workshop Discharge on locations for land application (land treatment sites);
- Alternative land treatment sites presented by Kevan Brian (Mott MacDonald Consultants) need to be treated in confidence;
- Overall summary of shortlisted Options 1 to 6 discussion;

  Resolved – acceptance of TAG's suggested approach to Add-On's
- Cultural Assessment Sub Committee update; and
- Council's Stormwater Project – introduction.

Meeting 28th July 2015

- Current concentrations of key parameters and contaminants in surface waters;
- Professor David Hamilton Environmental Effects Study presentation;
- Lake Rotorua Trophic Level Index (TLI);
- Puarenga Stream nutrient levels;

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- Discharge locations;
- Lake Rotorua dispersion; and
- Need to get quality of treated water right.

Meeting 20th August 2015

- Endocrine Disruptors/micro and emerging pollutants;
- Impact of land treatment;
- Effects of discharges on Taonga food sources and other ecology;
- Puarenga Bay (Sulphur Bay) discharge option; and
- Decision not proceed with an offshore outfall discharge into Lake Rotorua;
- Public health risks of water discharge option.

Resolved and carried

> ***That the RPSC recommends that the preferred treatment option 100% membrane filtration include UV treatment and extra phosphorus removal***

Resolved and carried

> ***That the RPSC recommend that in terms of the discharge location a spiritually cleansing passage to Puarenga Bay (Sulphur Bay) is the preferred option***

Meeting 20th September 2015

- Correct description of Puarenga Bay;
- Collaboration with Pukeroa Oruawhata Trust;
- Ownership of wastewater;
- Treated wastewater discharge to Lake Rotorua and land contact system;
- Dump site;
- Puarenga Stream water quality and bathing;
- Review of Water Quality/Science work by Professor David Hamilton and questions/discussion;
- Parameters for culturally acceptable land contact and discussion on options e.g. wetlands, rock passages about water having contact with papatuanuku;
- Report on recreational uses of Puarenga Bay;
- Consultation with Ngapuna iwi and other iwi;
- Further discussion on shortlisted options and forward programme;
- Next stages of consultation and hui;
- Invitation to formally invite Hariata Ngata, a member of Te Roro o Te Rangi hapu trust onto the Committee;
- Further consideration of earlier discharge location and spiritual cleansing passage to Puarenga Bay (Sulphur Bay) as the preferred option – this discussion being based on cultural assessment matters;
- Cultural Impact Assessment discussion and timing;

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- RPSC recommends motion on page 7 of previous minutes (regarding discharge location) rescinded – carried; and
- RPSC reserves its decision on its recommended discharge option until the receipt of further cultural impact information – carried

Meeting 21st October 2015

- Treatment methods to remove pathogens;
- Feedback back from hui Hurunga Te Rangi and Te Roro O Te Rangi and discussion in feedback (refer to Consultation Section 10 of this AEE and Support Document 8;
- Revisit preferred treatment option;
- Other treatment options revisited;
- Rapid Infiltration Bed options to be reviewed;
- Technical Q&A;
- Direct and Indirect Discussion;
- Opposition to dire water discharge;
- Roles of iwi and collective approach; and
- Upcoming public consultation process

Meeting 18th November 2015

- Te Arikiroa Restoration Plan;
- Paper received from Arama Pirika ;
- Land ownership, vesting, historical maps, place names and clarification of the term Te Arikiroa (in depth discussion);
- Preliminary Report on Rapid Infiltration Bed options prepared by RLC Officers;
- Alternative discharge to land options;
- Questions to CAS about use of Mauri Model; and
- RLC's goals and priorities – Goal 7 Priority 4 "an enhanced environment and sustainable infrastructure and affordable and effective Council services".

Meeting 16th December 2015

- Matters raised by Arama Pirika including dredging lake sediment, cost estimates piping to Rotoiti and Tarawera
- Confirmation of RPSC previous decision of no discharge out of catchment or to Lake Rotoiti or Kaituna River
- Update on CAS deliberations on discharge location, public consultation and cultural assessment approaches
- Water testing Puarenga Bay reported on
- Preliminary workup on Rapid Infiltration Bed options
- Update on technical work
- Deliberations on and recommendations to RLC. Recommendations included (abridged):

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- Proceed to Sage 2 public consultation
- Treatment be Option 6 full MBR plus extra phosphorus and UV treatment
- Discharge be at one or two locations namely
  - i) land based bed to Te Arikiroa Thermal Channel
  - ii) Rapid Infiltration Bed site, concept, design to be confirmed

- Discussion of next stage of consultation

Meeting 18th March 2016

- Report back from RLC's Strategy Policy and Finance Committee meeting 17th March 2016;
- Update on Draft Cultural Impact Assessment; and
- Technical Matters (flow balancing, contingencies for power supply, TERAX, WWTP site matters, growth and consenting limits).

Meeting 9th June 2016

- Option presented by Hera Naera, a trustee of the Whakapoungakau Land Trust member of Uenukukopako and Te Roro Te Rangi, to take discharge from upgraded treatment plant to Rotokawa;
- Stage 2 consultation feedback (refer Section 10 of this AEE and Support Document 8 Consultation Record);
- Draft Cultural Impact Assessment ;
- Recommendation to the RLC having regard to public consultation feedback and draft Cultural Impact Assessment; and
- The recommendations passed at this meeting and forwarded on to the RLC are:

Resolved

"That the RPSC recommends to Rotorua Lakes Council proceed to a resource consent application for the Rotorua WWTP upgrade on the basis of the following preferred option":

- **Treatment – a 100% MBR membrane filtration plant, including extra phosphorous removal and UV treatment"**

Vote - unanimous, Abstention - 1

Resolved

"That the RPSC recommends Rotorua Lakes Council proceed to a resource consent application for the Rotorua WWTP discharge, on the basis of the following preferred option":

3. ***The identified option to discharge through Puarenga Bay***

And

4. ***To continue to work with interested parties to investigate alternate discharge options including the reuse of recovered water"***

Vote - carried by majority. For - 8, Against - 4, Abstention - 2

Meeting 7th April 2017

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- Discussion on the need for the Committee to continue as the recommendation has been made to the RLC;
- Ngati Uenuku Kopako, Ngati Te Roro O Te Rangi and Ngati Hurunga Te Rangi objection to the RSPC's recommendation be recorded in the minutes;
- Recommendation for new engagement process for land contact bed development;
- Clarify the terms of reference of the committee going forward;
- Update on land contact bed, comments from a Maori cultural perspective on the land contact bed;
- Land contact bed design;
- New engagement process including Mātauranga Māori experts that will be brought in to advise and improve on the land contact bed and discharge structure design and are also the start of the engagement process. We are also looking at cultural indicator development as part of the design;
- Overall programme update on consent application documentation; and
- The RLC is committed to ensuring the feasibility of the alternative options is explored;

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Appendix C Rotorua Project Technical Advisory Group (TAG) – Terms of Reference, Membership and Meeting Summary Record

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Purpose of the Technical Advisory Group

The Technical Advisory Group (TAG) will provide technical advice and guidance to the Project Steering Committee and provide overview in the project with respect to:

- Development of alternative options including evaluation criteria and shortlisted options
- Detailed feasibility investigation of shortlisted options
- Application of evaluation criteria to determine the preferred alternative option from short-listed options
- Resource consent application of the preferred alternative option

Scope of TAG Considerations

The Scope of the RPSC Technical Advisory Group:

1. Is to consider all viable alternative options to the current LTS in the Whakarewarewa Forest.
2. The scope specifically does not extend to the consideration of mitigation of nutrient inputs to the Puarenga Stream, or from the wider Lake Rotorua catchment, *unless* discharge from the Rotorua WWTP is directly causative
3. The scope specifically does not extend to remediation of the old Rotorua dump site at Te Ariki Roa (Sulphur Bay) *unless* this directly relates to the management of WWTP discharge, and is so directed by the RLC
4. The scope specifically does not extend to relocation of the current Rotorua WWTP

Responsibility and Reporting of the Technical Advisory Group

The Technical Advisory Group Terms of Reference (herein) shall be determined in a collaborative manner between the Rotorua District Council (RLC) and the Rotorua Project Steering Committee (RPSC).

The Technical Advisory Group is a meeting of equals among technical specialists/professionals who have been chosen based on the specific specialized expertise required for the project.

- The Technical Advisory Group is to report to the Project Steering Committee through the Technical Advisory Group (TAG) Chairperson
- The Technical Advisory Group is to provide advice on specific Technical questions posed by the Committee. The TAG shall also offer its collective comment based on members' experience to further assist the Committee with its activities
- The Technical Advisory Group in its own right shall not make formal submissions on Council plans or resource consent matters, but members of the committee retain all their rights to do so.

Technical Advisory Group composition, member selection, chairing and quorum

The Technical Advisory Group shall comprise:

- A core membership of Jim Bradley (Chair) Consultants (MWH, now Stantec), Dr David Hamilton (University of Waikato), Kepa Morgan (University of Auckland), Greg Manzano (RLC), Alison Lowe (RLC), Andy Bruere (BOPRC)
- Additional appointees as appropriate depending on the Committee's and TAG's activities. Such additional appointees may be engaged for a specific topic, but may at the discretion of the TAG Chair, in consultation with the RPSC, be invited to join as core TAG members.
- Chris McBride (University of Waikato) joined the TAG but not as a voting member. Other RLC staff including Andy Bell and Eric Crawte, RPSC Chair Warren Webber, and CAS Advisor

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Antoine Coffin also attended a number of TAG Meetings as did Kevan Brian of Mott MacDonald to present that firm's Technical Reports.

Technical Advisory Group Procedures

1. The Technical Advisory Group shall operate in a collaborative fashion, both within its own setting and in its engagement with others, guided by the following:
    a) Respect for all views at the table.
    b) Decisions on advice shall be by consensus, with a majority vote taken only if necessary.
    c) Minority opinions shall be recorded in TAG minutes and reported to the RPSC through the TAG Chair. Supplementary reports of minority views shall be by agreement with the RRSSC Chair
    d) The timely circulation of meeting agendas and minutes.
2. The Technical Advisory Group shall meet as required and as determined by the TAG Chair in consultation with the Chair of the Project Steering Committee.
3. Meeting venues shall be at the discretion of the TAG Chair. Meeting through video conference or conference call shall also be appropriate.

The following is a brief summary listing the main matters discussed at the TAG meetings. Full minutes (available from Greg Manzano, the RLC's Project Manager) are available on request.

Meeting 5th May 2014

- TAG's terms for reference and communication protocols
- Project background
- RPSC's Goals and TAG's consideration of those
- Options Register – developing a long list
- TAG's suggested evaluation criteria
- "Must Haves" and "Fatal Flaws" for options assessments
- Lake Action Plans
- Update on urine separation and other options
- Pending RPSC hikoi and other plant visits
- TAG way ahead

Meeting 5th June 2014

- TOR re minority view procedure
- Project background and RPSC goals
- Indigitech technology presentation
- TAGS's baseline criteria – TAGS's minimum requirements
- Development of Options Register/Long List
- Pending RPSC hikoi and treatment plant visits

Meeting 8th July 2014

- Wide ranging discussion
- RPSC hikoi review
- Project milestones
- Long list options development
- Development of short list options
- Discussion of range of options
- Land application/land treatment and land contact options

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Meeting 29th July 2014

- TAG ↔ RPSC interaction
- Lake and Rivers (water) discharge options
- Further development “short listed” and “flagged options”

Meeting 12th September 2014

- Update on Kaituna hui
- Updated on Mott MacDonald
- Technical options to LTS Report output (included in Support Document 2)
- Water discharge options and effects – investigation needs – presentation by Dr. David Hamilton
- Wetland options
- Water receiving environments (quality, ecology, treated wastewater qualities)
- Technical content of consultation material
- Cultural aspects and consideration of use of MauriOmeter to assist decision making

Meeting 20th November 2014

- Update RPSC and CAS activities
- The RLC’s Water Conservation Strategy
- Kevan Brian of Mott MacDonald presentation on Wastewater Treatment Technical Review (included in Support Document 2) on Options 1, 2 and 3 and Ecosystem Entry/Disposal System Options
- LTSs
- “Add-On” technologies
- Discussion with Michael Quintern on nutrient recovery and TERAX
- Presentation on Microvi Technology with John Darmody
- Costs of Nitrogen reduction options
- Deloittes Study – nutrient removal costs
- Cultural and technical interaction

Meeting 8th April 2015

- Cultural Assessment Sub-Committee update (CAS)
- Interaction of TERAX and shortlisted options
- LTSs update
- Discharge to Water options and locations
- Add-On technologies
- Advanced Treatment options – Ultra Filtration and Reverse Osmosis (UF/RO)

Meeting 28th May 2015

- Land applications and dairy industry/Fonterra position
- CAS update including their technical requirements
- Alternative Land Treatment sites – Mott MacDonald’s Kevan Brian presentation
- Mott MacDonald – Kevan Brian Draft Wastewater Strategy Report
- Effects Study (water discharges) update by Chris McBride

Meeting 16th June 2015

- CAS Update
- Effects Study presentation for water discharges
- Alternative Land Treatment Sites Update and Supplementary Report
- Wastewater Strategy Draft Report (Mott MacDonald) update

Meeting 15th July 2015

- Cultural Assessment Subcommittee (CAS) feedback on land and water based options
- Presentation by Dr David Hamilton and Chris McBride on effects on water discharges

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- TAG Minimum Technical Requirements and options marking table
- Further identification of Shortlisted Options
- NPS-Freshwater Management 2014 implications and Environment Court Decisions
- Add-On's and Fonterra enquiry updates
- Micro-pollutants/emerging/organic pollutants update

Meeting 15th August 2016

- Review RPSC's key two discussions relating to the Preferred Scheme
- CAS and CIA updates
- The RLC current position and future programme
- Proposed WWTP update and concept/preliminary design
- Proposed discharge arrangements
- Further scientific and technical studies needed for AEE and consent applications

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Appendix D Memorandum of Understanding – Nitrogen Accounting Approach for Rotorua Wastewater Treatment Plant Discharge

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MEMORANDUM OF UNDERSTANDING

NITROGEN ACCOUNTING APPROACH FOR ROTORUA WASTE WATER TREATMENT PLANT DISCHARGE

between

ROTORUA LAKES COUNCIL

and

BAY OF PLENTY REGIONAL COUNCIL

and

TE ARAWA LAKES TRUST

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Dated 2017

PARTIES

1 **BAY OF PLENTY REGIONAL COUNCIL**

2 **ROTORUA LAKES COUNCIL**

3 **TE ARAWA LAKES TRUST**

BACKGROUND

1. Te Arawa Lakes Trust (TALT), Rotorua Lakes Council (RLC) and Bay of Plenty Regional Council (BOPRC) are the partners that make up the Rotorua Te Arawa Lakes Programme ("the Programme"). The Programme seeks to ensure sustainable outcomes for the twelve Rotorua Te Arawa lakes.

2. The Regional Policy Statement (RPS) for the Bay of Plenty (operative 1 October 2014) includes policies to manage contaminants entering catchments at risk, including Lake Rotorua. Policy WL 3B sets out the need to establish limits for contaminants entering catchments at risk and includes c) For Lake Rotorua the total amount of nitrogen that enters the lake shall not exceed 435 tonnes per annum.

3. In order to achieve the RPS 435 tonnes nitrogen target the BOPRC adopted an Integrated Framework which includes the introduction of rules via Proposed Plan Change 10 (PPC10) to the Regional Water and Land Plan (RWLP). The Integrated Framework provides the basis for the proportional nitrogen reductions being implemented through the rules. The Integrated Framework assumes a nitrogen load from urban sewage of 30 tonnes

4. The Programme wishes to allow for the urban sector and commercial activity such as tourism to grow, and to consider the potential to reticulate out-of-catchment loads (in order to benefit other at risk catchments), in order to meet the aspirations of iwi, hapuu, whanau of Te Arawa and the Rotorua community while at the same time not compromising the RPS 435 tonnes nitrogen target. On this basis staff from both BOPRC and RLC worked closely together to develop the nitrogen accounting approach recorded in this Memorandum of Understanding (MoU). It is based on there being no net increase in nitrogen entering Lake Rotorua.

5. This MoU is designed to accurately reflect the accounting of nitrogen loss that occurs when rural land within the Lake Rotorua Groundwater Catchment becomes urban land connected to Rotorua's reticulated sewerage system, and when existing point source loads of nitrogen to the lake are connected to the sewer e.g. geothermal. The approach, described in this MoU, is a method to ensure that this nitrogen is recognised as part of the discharge of waste water into Lake Rotorua.

6. This MoU is an operational policy but on a matter that is of significance to the Rotorua Te Arawa Lakes community. For this reason it has been created as a formalised position between the three Parties.

AGREEMENT

Purpose

7. To describe the agreed nutrient accounting approach to integrate the potential WWTP nitrogen mass discharge limit with catchment nitrogen accounting when rural land changes to urban use or when any existing discharges to Lake Rotorua become discharges to sewer.

8. This MoU assumes nitrogen allocation to land is implemented through the RWLP via PPC10 in a form similar to the notified version of PPC10. If significant subsequent changes to PPC10 and the RWLP occur this MoU will be reviewed and amended as necessary and unanimously agreed by the three Parties.

Principles

9. It is acknowledged that there are sewage-derived nutrient discharge loads via the WWTP discharge from the rural area following expansion of sewerage reticulation into the rural area.

10. This accounting approach enables increasing gross nitrogen loads from the WWTP as a result of this expansion while maintaining the net 30 tonne limit and therefore not compromising the 435 tonnes nitrogen sustainable load target.

11. RLC will consider discharging to sewer where practicable, any point source discharges to the lake or tributaries with a higher concentration of nitrogen than the WWTP discharge, because treating this water will reduce the load of nitrogen to Lake Rotorua.

12. The WWTP will use best practicable technology and operational procedures to maximise nutrient reductions rather than focus on the mass discharge limit.

13. This accounting approach does not pre-determine the resource consent process for the WWTP or any consent conditions that may be imposed through that process.

14. This accounting approach does not pre-empt the upgrade design solution for the WWTP. This approach is required and will be applicable regardless of which design solution proceeds.

Approach

15. The 2001–2004 Urban Reticulation Area[1] has been defined. During the 2001-2004 benchmarking period, the WWTP was consented to discharge 30 tonnes of nitrogen per year. This figure is used as the baseline WWTP mass discharge limit.

16. The WWTP mass discharge limit can increase from the baseline with no increase in the overall load of nitrogen to Lake Rotorua if loads discharged to sewer since the 2001-2004 benchmarking period are tracked and accounted for as follows:

    a. Septic tanks loads that were discharges to Lake Rotorua in 2001-2004, and have since been connected to sewer as part of the lakeside settlement reticulation programme (which represents a 10 tonne reduction in nitrogen into Lake Rotorua[2]), have a residual nitrogen load that is recognised in the WWTP mass discharge limit.

[1] Urban Reticulation Area is a defined spatial polygon that closely represents the reticulated area during the 2001-2004 period.
[2] Reticulation of Lake Rotoiti and Lake Okareka has reduced nitrogen to these catchments by a separate 10 tonnes with no increase in mass discharge limit at the WWTP for the residuals from these loads.

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b. Other nitrogen loads that are currently discharged to Lake Rotorua or tributaries (e.g. geothermal), and are subsequently discharged to sewer (excluding septic tank loads that were connected to sewer as part of the lakeside settlement reticulation programme above), are recognised in the WWTP mass discharge limit.

c. As sewerage reticulation extends into new subdivisions in the Rural Area[3] within the catchment, at the time the land is subdivided, the full potential Household Unit Equivalents (HUEs) per hectare in the applicable zone are allowed for when BOPRC calculates the allocation for the new land use with a sewage allowance of 1.4 kg/HUE[4] recognised in the WWTP mass discharge limit (refer to Table 1). The accounting basis for this is:

   i. Land in the Rural Area has a Nitrogen Discharge Allocation (NDA[5]) based on rural land use activity. Subsequent urban expansion into the Rural Area will result in the rural land use discharges being replaced by sewage-derived nitrogen losses via the WWTP and urban land use background discharges.

   ii. If the sewage-derived nitrogen losses via the WWTP and urban land use discharges are equal or less than the NDA there will be no increase in nitrogen load to Lake Rotorua. Any remaining NDA remains with the land.

   iii. If the sewage derived nitrogen losses via the WWTP and urban land use discharges are greater than the NDA an offset or purchase will be required to ensure no increase in nitrogen load to the lake[6].

   iv. PC10 nitrogen accounting allows for transfers to and from the parent block that is being subdivided.

d. Discharges to sewer from new builds within the 2001-2004 urban area (urban infill) will be an additional load to the WWTP with no allowance recognised in the baseline WWTP mass discharge limit unless offset through reductions in the Rural Area discharge.

e. Additional nitrogen arising from possible future reticulation outside the Lake Rotorua catchment is not recognised in the WWTP mass discharge limit without Programme agreement. These connections may need to be offset from within the Lake Rotorua Groundwater catchment.

17. A measured WWTP discharge that is lower than the WWTP mass discharge limit is a reduction in the overall load to the lake and a benefit to the Lakes Programme. A concentration-based target, as well as reduced sewage volumes, will help realise these reductions, and will provide headspace for urban infill and potentially out-of-catchment loads.

18. For BOPRC nitrogen accounting purposes additional residual loads resulting from new connections to the WWTP since 2001-2004 remain on the land of origin but are also recognised in the WWTP mass discharge limit. Land-losses (see Table 1) remain associated with the land.

[3] Rural Area is all land within the Lake Rotorua Groundwater Catchment that is not Urban Reticulation Area.
[4] See Annex 1: Sewage allocation per household unit.
[5] Note that the term "provisional NDA" or "pNDA" is used to describe NDA until it is confirmed under the Lake Rotorua Nutrient Management provisions.
[6] Exemption to this requirement may be made if the amount is minor or there are exceptional circumstances. Exemptions will occur through an agreed process.

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Changes between the 2001-2004 benchmark and current

19. Accounting for changes that have already occurred since the baseline 2001-2004 period, a WWTP mass discharge limit of 32.4 tonne represents no increase in the load to Lake Rotorua and will be considered the starting point for the available mass discharge limit from January 2017.

Calculation of nitrogen required for land proposed to be subdivided

20. For subdivisions on properties within the Rural Area[7], Table 1 includes the figures to be used when assessing the minimum nitrogen required at time of subdivision. This is based on the area of land proposed for the various land use activities. This minimum requirement will then be compared with the property/farming enterprise NDA to ensure the accounting of nitrogen associated with the sewage losses in reticulated areas to the WWTP mass discharge limit does not increase the overall nitrogen load to Lake Rotorua.

21. The estimated average nitrogen required under different zoning scenarios is presented in Table 2. Table 2 is indicative as it includes assumptions around area of land in roads etc. Individual subdivisions will need to use Table 1 to calculate actual nitrogen loss requirements.

22. The projected nitrogen loss required depends on the land restrictions, zoning, land use and land use area. The estimated required nitrogen has been compared to NDAs for polygons of land in zones RD1, RD4 and RD5 excluding land in the old urban sector, forest, wetlands, bush and scrub. With the exception of these exclusions, and based on assumptions around area of land in roads etc, all farmed land in RD4 and RD5 has sufficient provisional NDA and all land (except one parcel of land) in RD1 was within 3% of the required provisional NDA.

Calculation of nitrogen required for other intensification that includes reticulation

23. For other calculations for intensification, such as Papakāinga, the three partners will discuss and assess the nitrogen calculation based on the particular circumstances of the intensification.

[7] Where land within the Urban Area has been given a pastoral allocation this will be recognised in any subdivision process.

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Table 1: Nitrogen allocation required for subdivision

	Land Use and Activity	Residential zones where no grazing is allowed	Rural zones with potential for grazing
N required for non-house-lot land losses	Sealed roads and other impermeable surfaces not available for house lots.	Area of land at 0.5 kg N/ha/yr	
	Restricted or specified land use and reserves not available for house lots	Area of land at applicable N loss rate	
N required for house-lot land loss	Impermeable surfaces based on 350 m2/potential house.	Area of land at 0.5 kg N/ha/yr	N/A
	Restricted or specified use land available for house lots	Area of land at covenented loss rate	
	Garden losses	Area of cultivated garden at 138% of the house block reference file (in 6.2.0 108 kg N/ha/yr)	N/A
	Background losses	Remaining land at background losses for OVERSEER houseblocks specified as a % of the Drystock reference file	Remaining land at permitted activity level for pastoral Drystock specified as a % of the Drystock reference file
N required for sewage losses	Sewage losses	Sewage allocation per potential house (based on zone)	
N required for other losses	Other losses	Other losses	
Total N required for subdivision		**Sum of above**	**Sum of above**

Table 1 Definitions:

Potential house numbers	Total number of houses that can be built under relevant district plan rules or through consent (whichever is greater) on the land available for house lots (excludes roads, reserves outside of house lots eg in RD1 zone divide the house lot area (ha)/0.045).
Potential pastoral land use	The area of the lot that is permitted to be used for pastoral grazing (where there are no restrictions on the title the potential pastoral area is the area of the lot. This includes any house sites and unformed roads).
Restricted or specified land use	The area of the lot where there are legal constraints on land use. In most cases this will be an area of trees where there is a covenant on the title (e.g. through a BOPRC environmental programme, a QEII covenant, a designated SNA or a consent notice). For these areas an appropriate nitrogen discharge for the land use should be used otherwise the nitrogen required must default to at least the appropriate background losses.
Sewage allocation per potential house	13.5 kg Non-reticulated - septic tank 3.0 kg Non-reticulated - advanced OSET that discharges 15 mg/l nitrogen or less 1.4 kg Reticulated to Rotorua WWTP (refer to Annex 1)

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Cultivation allocation per potential house	RD1 (0.045ha mean minimum lot) is 25 m^2 per house RD4 (0.1 ha mean minimum lot) is 50 m^2 per house RD5 (0.2 ha mean minimum lot) is 100 m^2 per house Rural zones is permitted activity level for pastoral Drystock specified as a % of the Drystock reference file.
Table 1 represents the minimum requirements. Any consented use and allocations need to be allowed for. If restricted non-pastoral land uses are being included, measure the area on each lot. Alternatively higher land losses (e.g. as for pasture) could be assigned to negate the need to identify the exact area of restricted land use.	

Table 2: Estimated nitrogen requirements per ha by zone (relative to OVERSEER 6.2.0)

	Residential low-density	Residential lifestyle lakeside	Residential lifestyle	Rural Lifestyle (reticulated)	Rural Lifestyle (Osets)	Rural Working (Osets)
Zone	RD1	RD4	RD5	RR2	RR2	RR1
Sewage	Reticulated	Reticulated	Reticulated	Reticulated	Oset	Oset
Average lot size (minimum m2)	450	1000	2000	8000	8000	152500
Potential number of houses per lot	1	1	1	2	2	2
Garden area allocation per potential house (m2)	22.5	50	100	background	background	background
Impermeable surface allocation per potential house (m2)	350	350	350	background	background	background
Potential to graze based on zoning	no	no	no	yes	yes	yes
Loss rates						
Land not available for house lots (kg/ha)	5.9	5.9	5.9	5.9	5.9	5.9
Roads (kg/ha)	0.5	0.5	0.5	0.5	0.5	0.5
Impermeable surfaces rainfall (kg/ha)	0.5	0.5	0.5	0.5	0.5	0.5
Garden losses (kg/ha)	108.0	108.0	108.0			
Background grass (with/without grazing) (kg/ha)	5.9	5.9	5.9	18.0	18.0	18.0
Allocation for sewage losses (kg/ potential house)	1.4	1.4	1.4	1.4	3.0	3.0
Non-houselot land (% of total area)	35.00%	35.00%	35.00%	35.00%	35.00%	35.00%
Roads (estimated % of total area)	18.00%	18.00%	18.00%	18.00%	18.00%	18.00%
Other (estimated % of total area)	17.00%	17.00%	17.00%	17.00%	17.00%	17.00%
Estimated N for non-houselot land losses (kg/ha)	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**	**1.1**
Houselot land (% of total area)	65.00%	65.00%	65.00%	65.00%	65.00%	65.00%
Potential number of houses per ha (on land available for house lots)	14.4	6.5	3.3	1.6	1.6	0.1
Impermeable surfaces	50.56%	22.75%	11.38%			
Garden	3.25%	3.25%	3.25%			
Remaining area	11.19%	39.00%	50.38%	65.0%	65.0%	65.0%
Estimated N for houselot land losses (kg/ha)	**4.4**	**5.9**	**6.5**	**11.7**	**11.7**	**11.7**
N required for sewage (kg/ha)	**20.2**	**9.1**	**4.6**	**2.3**	**4.9**	**0.3**
Estimated total N required per ha (includes land that will be roads and reserves with a lower allocation)	**25.7**	**16.1**	**12.2**	**15.1**	**17.7**	**13.0**
Estimated N/ha on houselot land following subdivision, including sewage allocation (ie available for future subdivision of this land)		**23.1**	**17.1**	**21.5**	**25.5**	**18.4**

Projected WWTP discharge

24. The current WWTP discharge is around 5.5 mg/l of nitrogen. Figure 1 (red line) shows the load of nitrogen to Lake Rotorua if the WWTP were to continue to discharge at this concentration.

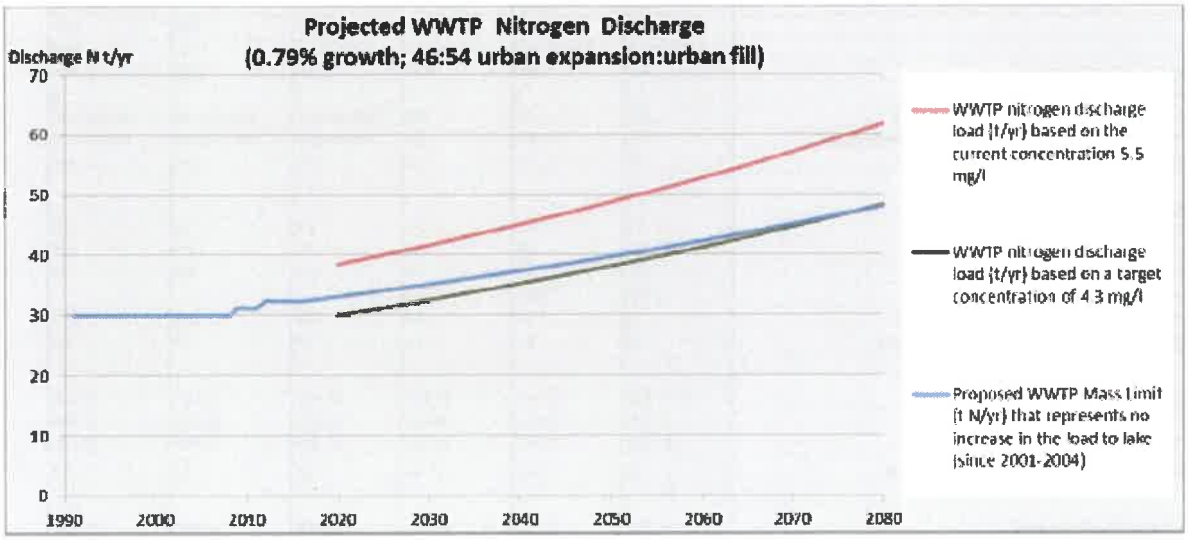
25. Figure 1 also shows the projected WWTP mass discharge limit based on the proposed approach to ensure no overall increase in nitrogen to Lake Rotorua (blue line). The approach assumes a sewage allocation of 1.4 kg per potential house (refer to definitions in Table 1) for all reticulated subdivision outside the Urban Reticulation Area.

26. A WWTP discharge concentration of around 4.3 mg/l would allow for both urban expansion into the Rural Area and urban infill, with a low chance of increasing the load to Lake Rotorua, i.e. is unlikely to exceed the WWTP mass discharge limit before 2070 (Figure 1, green line).

27. Beyond 2070 further technological advancement and investment in reducing either the discharge concentration or the volume of discharge water, or a lower rate of urban infill relative to expansion will be required to remain within the mass discharge limit that meets the RPS 435 tonnes nitrogen target.

Figure 1: The projected WWTP mass discharge loads, assuming 'best guess' growth assumptions (0.79% catchment growth rate; 46:54 ratio for expansion:urban infill) with three WWTP discharge scenarios:

- *If WWTP is not upgraded and continues to discharge nitrogen at 5.5 mg/l (red/top line)*
- *If WWTP discharges nitrogen at 4.3 mg/l (green/bottom line)*
- *If WWTP nitrogen mass discharge limit is based on the proposed approach to allow for urban expansion into the Rural Area (blue/middle line)*



Implementation

28. The Incentives Committee will be advised of this MoU and the implications for properties considering subdivision connecting to reticulation.

29. TALT, BOPRC and RLC will jointly determine the processes for: allocation of NDA at time of subdivision; process for accounting for the nitrogen losses at the WWTP; and process for accounting for other loads to sewer.

30. RLC will provide an advice note on Rural Area LIMs and refer all subdivisions to BOPRC for assessment.

31. RLC will register a consent notice requiring the applicant to obtain BOPRC's approval of the nitrogen allocations for the new parcels created through the subdivision consent process.

32. RLC will advise BOPRC when a subdivision consent has been enacted to allow BOPRC to update and record the revised nitrogen allocations.

33. RLC will consider a plan change to its District Plan to give effect to this MOU.

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Review and changes to this MoU

34. Over time there may be a need to update this MoU to ensure that the accounting methodology remains accurate and robust.

35. Review and updating this MoU will occur by unanimous agreement of the Chief Executives of the three Parties. Input from technical staff involved in the establishment of this approach is highly recommended where possible.

SIGNED for and on behalf of **BAY OF PLENTY REGIONAL COUNCIL**)

.....
[Authorised signatory]

SIGNED for and on behalf of **ROTORUA LAKES COUNCIL**)

.....
[Authorised signatory]

SIGNED for and on behalf of **TE ARAWA LAKES TRUST**)

.....
[Authorised signatory]

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ANNEX 1: Sewage allocation per household unit

The transfer of 1.4 kg per potential household unit was based on looking at the sewage nitrogen from a number of different approaches outlined below.

Household N Loads	Raw sewage load kg/p/yr	Raw sewage load kg/hse/yr (3 people/hse)	Septic Tank Discharge kg/yr (3 people/hse)	Septic Tank Load to lake kg/yr (3 people/hse)	WWTP N removal rate	Residual after WWTP treatment (3 people/hse)	Residual after WWTP treatment (2.5 people/hse)
Overseer' load from septic tank 13.44 kg/yr to land		14.8	**13.44**	10.75	0.89	1.63	1.36
Septic tank discharge at 10 g/p/d		14.5	13	**11**	0.89	1.59	1.32
Mott McDonald design for Rotorua (14 g/cap.d)	**5.1**	15.3			0.89	1.69	1.41
Design raw sewage load (3-5 kg/cap.yr)	**5.0**	15.0			0.89	1.65	1.38

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Appendix E Rotorua Context and Business Growth – APR Consultants Ltd

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Appendix E.1 Tourism Wastewater Processing Needs

Visitors have many of the same needs as residents and contribute to the need for wastewater processing CAPEX and operating costs. In this section of the report, APR estimates the approximate extra wastewater processing load tourists create in terms of approximately how many "effective" residents they represent.

Adding annual Rotorua visitor nights and day visitors' numbers together gives the total number of full days stayed by visitors. Day visitors were assumed to represent the equivalent load of one-third of a resident's day and overnight visitors were assumed to create approximately the same load as made by a resident on an average day in Rotorua[25]. Dividing by 365 days provides an indication of how many Rotorua residents this is equivalent to in terms of annual wastewater load.

Table 7 shows the projected annual visitors' resident equivalent wastewater processing load in terms of a visitors' resident population equivalent.

Table 7: Annual Rotorua Visitors' resident-equivalent impact on wastewater

Year ended December	Visitor nights	Day visitors (estimated)	Visitors' resident equivalent days in regard to wastewater processing load	Visitors' resident equivalent days (regarding wastewater) expressed as a resident population equivalent
2008	3,395,096	1,424,083	3,869,316	10,601
2009	3,159,799	1,360,171	3,612,736	9,898
2010	3,213,952	1,407,504	3,682,651	10,089
2011	3,139,230	1,367,319	3,594,547	9,848
2012	3,036,850	1,372,650	3,493,942	9,572
2013	3,128,840	1,373,083	3,586,077	9,825
2014	3,213,971	1,394,883	3,678,467	10,078
2015	3,490,350	1,520,355	3,996,628	10,950
2016	3,693,660	1,617,930	4,232,431	11,596

Source: APR analysis using Statistics New Zealand Commercial Accommodation data and APR Rotorua Private Household Monitor

Notes:

(1) SNZ commercial accommodation data sourced from: www.stats.govt.nz/browse_for_stats/industry_sectors/accommodation/AccommodationSurvey_HOTPJun16.aspx
(2) APR Consultants Private Household Visitor Monitor data was sourced from the APR's Private Homes Survey database.
(3) Visitor nights specified are the sum of commercial and private accommodation visitor nights.
(4) Annual day visits as a proportion of total annual Rotorua visits (ie, 50.2%) was based on the proportion specified in MBIE's 2010 visitor projections for 2016 available at: http://www.mbie.govt.nz/info-services/sectors-industries/tourism/tourism-research-data/international-tourism-forecasts/previous-tourism-forecasts/old-forecasts-regional
(5) Total load is the sum of visitor nights but one-third of day visitors
(6) Visitors' resident population equivalent is the total load divided by 365 days.

Tables 8 and 9 show the projected visitors' resident equivalent annual wastewater load at selected average annual growth rates of visitors' resident equivalent days. Maintaining an average annual growth rate of visitor nights and day visitors of 5% over 20 years is unrealistic, although possible. Realistically, average annual growth rates will likely be between 1% and 3%.

At an average 3% annual growth rate during the 35 years' subsequent to 2016, the visitors' wastewater in 2051 would be approximately equivalent to an additional 32,629 Rotorua residents, or 21,033 residents if the analysis is based purely on growth in visitor activity.

[25] This implies that the majority of overnight visitor stay, for 24 hours.

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Table 8: Projected visitors' resident equivalent impact on annual Rotorua wastewater (based on current visit levels and growth)

Number of years ahead	Annual growth rate		
	1%	3%	5%
5 (2021)	11,508	12,694	13,975
10 (2026)	12,095	14,715	17,836
15 (2031)	12,712	17,059	22,764
20 (2036)	13,361	19,776	29,053
30 (2046)	16,427	28,146	50,116
35 (2051)	15,629	32,629	63,962

Source: APR analysis

Table 9: Projected visitors' resident equivalent impact on annual Rotorua wastewater – additional impact from 2015 baseline

Number of years ahead	Annual growth rate		
	1%	3%	5%
5 (2021)	559	1,744	3,025
10 (2026)	1,146	3,766	6,886
15 (2031)	1,763	6,110	11,814
20 (2036)	2,411	8,827	18,103
30 (2046)	4,831	16,550	38,520
35 (2051)	4,034	21,033	52,366

Source: APR analysis

Conclusions

In 35 years' time, Rotorua will need to possess the capacity to handle increased visitors' wastewater treatment demands. In 2051 the wastewater load created by visitors is likely to range between the annual equivalent of 15,629 residents (at an average of 1% visitor growth pa during the period 2016-51) and 32,629 residents (at an average of 3% visitor growth pa during the period 2016-35).

In 2051, the additional load (from 2016 levels) created by visitors is likely to range between the equivalent of 4,034 "extra" residents (at an average of 1% visitor growth pa) and 21,033 "extra" residents (at an average of 3% visitor growth pa).

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Appendix E.2 Selected Recent Business Investments / Developments

Selected recent business investments/developments are as follows:

Pukeroa Oruawhata Group (POG)

- With the enclosure of the Mall and refurbishment of the Smiths City premises in 2014/2015, Rotorua Central is essentially fully developed and fully tenanted with the exception of the ex Dick Smith and Cheesecake Factory premises that are likely to be combined into one rental space.
- The RSA building has been recently purchased with a view to converting the building into a mix-use commercial development.
- The lakefront site is a truly unique opportunity to develop this site in a manner that makes a definitive statement for Rotorua. Rotorua's Pukeroa Oruawhata Trust expects to get its ambitious $13-15 million health and wellness spa centre under way by the end of this year. The spa will be the first project in the planned redevelopment of the trust's 11.4ha Lakeside site into a health and wellness precinct. The Lakeside site will also include new purpose-built premises for the QE Health rehab centre, expected to get under way early next year, and a beauty and pampering spa to follow in a couple of years.

Planned new hotels

A growing international tourism market has stimulated potential investment in three new hotels:

- The Chow Group has bought the Zen Building in Rotorua and have plans to convert it into a four-star, 150 room hotel.
- Planned five-star hotel on the lakefront by POG.

Lynmore Junction entertainment complex

- A $13 million entertainment and retail complex in the city's Te Ngae Road has recently opened. At 27,746 sqm, the Lynmore Junction complex is one of the largest all-weather entertainment centres in the country.
- The entertainment portion includes a Strike Zone 10 pin bowling centre, Megazone Laser Tag, Timezone Games, trampoline centre and a Chipmunks play area and cafe. It will be accompanied by convenience shops, such as a small supermarket and pharmacy, service station and fast food outlets.
- It is expected the centre would draw people from the Bay of Plenty, south Waikato and Auckland complement existing attractions. The attractions will help fill a large gap when it comes to all-weather options, thereby extending the Rotorua's wider offering.

Waipa Bike park upgrade

- A boutique spa complex has been announced as part of a massive upgrade to Rotorua's mountain biking hub at Waipa. The upgrade, which started in May 2016 with renovations to the carpark, includes a health and well-being complex with timber spas alongside facilities such as bike-hiring services and retail and hospitality services, including a cafe/restaurant/bar. The plan is to create a hub for adventure and broader tourism in the Waipa Valley.
- Rotorua Lakes Council is upgrading the carpark while Red Stag Investments, which owns the land, will develop the facilities through different commercial operations. Red Stag hope to have the spa operational by the end of this year, and have the rest of the facilities running by the end of the coming summer.

New Fairy Springs supermarket

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Located on the corner of Fairy Springs Road and Maisey Place, Countdown Rotorua North covers an area of 3,500sqm and employs about 85 people. The new Countdown store is an important new development for the Rotorua district, particularly on the western side of the city and shows investors' confidence domestic tourism growth.

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Appendix E.3 Selected 2013 Census Metrics

Ethnicity

- Rotorua maintains a strong Maori cultural heritage and has a growing cosmopolitan feel, with over 150 different ethnicities represented in the district. The major ethnic groups are European (61.8%), Mäori (34.3%), Pacific Islands (4.6%), and Asian (5.8%).

Work

Total population aged 15 years and over:

- A total of 43% full time employed versus 45.6% for New Zealand as a whole.
- A total of 6.3 % unemployed compared 4.5% for New Zealand as a whole.
- The unemployment rate in Rotorua District is 10.0 percent for people aged 15 years and over, compared with 7.1 percent for all of New Zealand.
- The most common occupational group in Rotorua District is 'professionals', and 'professionals' is the most common occupational group in New Zealand.

Home ownership

- In Rotorua District, 61.6 percent of households in occupied private dwellings owned the dwelling or held it in a family trust.
- For New Zealand as a whole, 64.8 percent of households in occupied private dwellings owned the dwelling or held it in a family trust.

Household composition

- One-family households make up 67.6 percent of all households in Rotorua District. For New Zealand as a whole, one-family households make up 68.3 percent of all households.
- In Rotorua District, there are 5,775 one-person households making up 25.0 percent of all households. In New Zealand, one-person households make up 23.5 percent of all households.
- The average household size in Rotorua District is 2.6 people, compared with an average of 2.7 people for all of New Zealand.

Income

- For people aged 15 years and over, the median (gross) personal income (half earn more, and half earn less, than this amount), in Rotorua District is $26,900. This compares with a median of $28,500 for all of New Zealand.
- 38.8 percent of people aged 15 years and over in Rotorua District have an annual income of $20,000 or less, compared with 38.2 percent of people for New Zealand as a whole.
- In Rotorua District, 22.9 percent of people aged 15 years and over have an annual income of more than $50,000, compared with 26.7 percent of people in New Zealand.

Family type

- Couples with children make up 37.2 percent of all families in Rotorua District, while couples without children make up 38.5 percent of all families.
- In New Zealand, couples with children make up 41.3 percent of all families, while couples without children make up 40.9 percent of all families.
- 24.3 percent of families in Rotorua District are one parent with children families, while one parent with children families make up 17.8 percent of families for New Zealand as a whole.

Tenure of household and household income

This item classifies the tenure of the household (owned or not owned) by total household income from all sources in the 12 months ending 31 March 2013. There is a strong correlation between housing tenure and household income. Median household income in dwellings is:

- $74,600 for dwellings held in a family trust.
- $66,400 for dwellings owned or partly owned by their occupants.

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- $41,000 for dwellings not owned by the occupant or held in a family trust.

For dwellings with a household income of $20,000 or less, the home ownership rate is less than 40 per cent.

Qualifications

Total population aged 15 years and over:

- 75.2 percent of people aged 15 years and over in Rotorua District have a formal qualification, compared with 79.1 percent of people in New Zealand.
- In Rotorua District, 14.8 percent of people aged 15 years and over held a bachelor's degree or higher as their highest qualification, compared with 20.0 percent for New Zealand as a whole.

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Appendix E.4 Evidence for Continued Fast Tourism Growth

This section outlines an evidential basis for asserting that Rotorua is capable of achieving average annual visitor night growth of 3% pa. The rate of visitor night growth is significant as it will determine the future wastewater processing capacity needed for visitors and this in turn will influence the overall need for future wastewater processing capacity. The evidential basis is significant in that council, in the interests of investment efficiency, must invest in capacity that covers the potential for maximum growth, even if this level does not manifest.

Strong projected New Zealand international visitor growth

According to MBIE's latest international visitor forecasts, Australia is New Zealand's largest visitor market, providing over 1.3 million visitors in 2015. MBIE expects this market to remain healthy, with projected growth of 3.2 per cent a year to 2022. China is expected to become New Zealand's largest tourism market by spend in the next two years, and to surpass $5 billion by 2022. Visitor numbers are expected to reach nearly one million by the end of the forecast period of 2022. Overall, China and Australia are expected to remain key markets in the coming years, with arrivals from these two countries projected to make up 57 per cent of visitors by 2022.

Rotorua's international visitor mix is in alignment with fast-growing international visitor origins

This is evidenced by the fact that Rotorua's largest international visit arrival markets are Australia and China who collectively represented a total of 58.7% of Rotorua international visitor arrivals in 2015. Based on International Visitor Survey (IVS) data[26], average annual growth for Australian visitors during the period 2010 to 2015 was 11.6% pa while it was 10.9% pa for China during the same period.

Rotorua Investment Scheme

The Rotorua Investment Scheme (or "partners' Programme") is a tourism attraction and accommodation operator joint investment in domestic marketing. The Famously Rotorua campaign is funded by the Scheme and profiles Rotorua as a series of comprehensive visitor experiences with each experience being targeted to appeal to a specific domestic market segment.

Continued success of the Rotorua Investment Scheme in funding Auckland marketing is likely to ensure continued domestic visitor growth. The latest visitor statistics are evidence that the Famously Rotorua domestic marketing campaign continues to resonate with its audience, broadening New Zealanders perceptions of Rotorua and driving them to visit.

Diversified product mix

Rotorua has a very well diversified product that covers Maori culture, spa and wellness, mountain biking, geothermal sites, adrenalin/activity-based attractions, forest scenery and trails and lakes. This diversification ensures across segment appeal and across season appeal. Rotorua's cultural offering, geothermal attractions, and the wellness proposition will continue to make Rotorua the logical primary destination for international visitors to the Bay of Plenty region.

Diversified visitor market

The visitor market is approximately a 50/50 international/domestic visitor arrivals mix. This enables overall greater tourism volumes and a degree of protection from economic slowdown.

Proximity to three fast growing cities

Rotorua's proximity to Auckland is a strong advantage as this provides both international and domestic visitors in close proximity. Rotorua is considered to be one of the three points on the North Island's

[26] Downloaded from: http://nzdotstat.stats.govt.nz/wbos/Index.aspx?DataSetCode=TABLECODE7573#

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international tourist triangle (along with Auckland and Waitomo). All of Rotorua's main domestic markets (ie, Auckland, Hamilton and Tauranga cities) have steadily growing populations.

Accommodation hub - Proximity to other key tourism areas

Rotorua is well-suited to functioning as a tourism accommodation hub for surrounding districts. Visitors are able to make day visits to Whakatane, Tauranga, South Waikato, Hamilton and Taupo.

Crankworx Festival

Rotorua hosted Crankworx in 2015 and 2016. Crankworx is the largest mountain biking event in the world. Funding support was provided by the Major Events Development Fund. Rotorua will be home to Crankworx through to 2027, with the signing of a new 10-year contract to host the world-class mountain biking event. The Crankworx World Tour travels to the world's top mountain biking destinations, including Rotorua, Les Gets in France and Innsbruck, Austria, before returning to its Canadian base of Whistler, British Colombia, each year.

With the signing of this 10-year contract, has secured its status as the first stop on the tour for the next decade. This long-term contract will contribute to developing the mountain biking attractiveness of Rotorua and provide a significant amount of annual international marketing.

Potential "international-ready" Rotorua Golf

There is a high likelihood of a future upgrade to Arikikapakapa Golf Course to produce a course of significant interest, highlighting the geothermal aspects of the site. A transformed/upgraded course on the Arikikapakapa Reserve, designed and constructed to export-ready standard would (with appropriate marketing) likely initiate considerable international and domestic interest and attract international visitors to Rotorua who otherwise would not visit, or have extended their stay.

Positioning Rotorua as a globally-recognised destination for health and wellness[27]

The 2015 Toi Moana Bay of Plenty Regional Growth Study (BOPGS) recommended that Rotorua industry and council collaborate to develop a wellness-based strategy, positioning Rotorua as a globally-recognised destination for health and wellness. The health and wellness industry is large, with the wellness tourism sector estimated at US$440 billion worldwide. Within that sector, the spa tourism market is estimated at US$180 billion[28]. With global mega-trends such as ageing populations, and a focus on proactive health, New Zealand's health and wellness industry is expected to grow.

Rotorua will have the opportunity to leverage its location, geothermal assets and history as well as linking spa assets with outdoor recreational assets such as forests and lakes. Additionally, Pukeroa Oruawhata Trust's planned lake front development will include the World Spa.

Evidence of an increasing investment levels and a consolidation of Rotorua's domestic visitor attraction base

There is evidence of increased level of investment in the domestic visitor market in Rotorua. For example, a significant entertainment complex at Lynmore Junction is clearly an investment that will primarily service the domestic visitor population as much as the local population and Rotorua has a new Countdown supermarket, even though it already had several large supermarkets. A continuing upgrade of visitor attractions aimed at the domestic market such as Lynmore Junction, new adventure activities and the likely development of more off-road trails (at least one of which will link to the Waikato River

[27] Downloaded from: www.mpi.govt.nz/document-vault/8656

[28] SRI International. (2013). *Global Wellness Tourism Economy 2013.* New York: A report commissioned by the Global Wellness Institute. Downloaded from: http://www.esteswellness.com/assets/wellness_tourism_economy_exec_sum_final_10022013.pdf

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Trails) will predominantly increase the number of visitors from the rest of Bay of Plenty, Waikato and Auckland to Rotorua.

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Appendix F Existing Resource Consent 60739

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Bay of Plenty Regional Council

Resource Consent

Pursuant to section 105 of the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 13 September 2001, **Hereby Grants** to:

ROTORUA DISTRICT COUNCIL

A resource consent:

a) pursuant to section 15(1)(b) of the Resource Management Act 1991 to **Discharge Treated Effluent from the Rotorua District Council Wastewater Treatment Plant on to Land in the Whakarewarewa State Forest**;

b) pursuant to section 13(1)(a) of the Resource Management Act 1991 to **Place, Use and Maintain a Series of Structures in or on the Bed of the Waipa Stream and Associated Tributaries**; **and**

c) pursuant to section 15(1)(c) of the Resource Management Act 1991 to **Discharge Treated Effluent from the Rotorua District Council Wastewater Treatment Plant into Air in the Whakarewarewa State Forest**;

subject to the following conditions:

1 Purpose

1.1 For the purpose of discharging secondary treated effluent via irrigation sprinklers to land within the Whakarewarewa State Forest, and

1.2 For the purpose of placement, use and maintaining of a series of v-notch weirs, a concrete structure and a concrete flume in or on the bed of the Waipa Stream and associated tributaries for water monitoring, and

1.3 For the purpose of discharging odours and aerosols from secondary treated effluent via irrigation sprinklers to air within the Whakarewarewa State Forest.

2 Location

2.1 Whakarewarewa State Forest within the areas delineated in the easement between the Crown and Rotorua District Council as registered February 2000 being those parts of the servient tenement marked ‘AW’, ‘AY’, ‘Q’, “AX’, and ‘BA’ on DPS 54801 and ‘A’ on DPS 84008, as shown on BOPRC Plan Number RC60739/1 submitted with the application for the consent.

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2.2 The monitoring structures are located within the bed of the Waipa Stream and associated tributaries as shown on BOPRC Plan Number RC60739/1.

3 Quantity and Rate

3.1 The peak daily quantity of treated effluent discharged shall not exceed 44,000 cubic metres.

3.2 Effluent may be applied to each irrigation sub area as delineated on plan BOPRC Plan Number RC60739/1 for a maximum continuous period of 24 hours and the rate of application shall not exceed 5mm/hour with a maximum of 120mm/day on any specific sub area.

4 Map Reference

At or about an area bounded by map references NZMS 260 U16 9470-3200, U16 9900-3200, U16 9900-2800, and U16 9470-2800.

5 Legal Description

Rotomahana Parekarangi Part 4A, Part 651, Part 652B, Block V, Tarawera SD (Rotorua District).

6 Effluent Disposal

6.1 The wastewater treatment and disposal system shall be operated and maintained at all times generally in accordance with the Land Treatment Management Plan dated March 2000, and any subsequent amendments acceptable to the Bay of Plenty Regional Council as confirmed in writing by the Chief Executive of the Regional Council or delegate.

6.2 Effluent shall not be applied to any area where ponded surface water is present and when water is flowing off the surface of that area, such that it could directly enter any drain or natural watercourse by overland flow.

6.3 The consent holder shall operate the effluent disposal system in a manner that does not cause erosion where practicable.

7 Buffer Zones

7.1 The consent holder shall not spray in the designated buffer zones as shown on drawing BOPRC Plan No RC60739/1 submitted with the application.

7.2 The consent holder shall maintain a buffer zone of undisturbed natural vegetation not less than 15 metres wide, separating the irrigated areas from wetlands.

7.3 The consent holder shall ensure there is no objectionable odour or aerosols beyond the boundary of the spray irrigation area as defined in condition 2.1 of this consent.

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8 Monitoring Stations

8.1 The consent holder shall maintain an easily accessible sampling point immediately prior to discharge where a representative sample of the effluent can be obtained.

8.2 The consent holder shall maintain two water sampling stations on the Waipa Stream at Rotorua District Council monitoring sites 5 and 10 as shown in BOPRC Plan Number RC 60739/1 submitted with the application, for the purpose of assessing the environmental effects of the discharge from the land treatment area on the stream.

8.3 Analyses shall be carried out as set out in the latest edition of "Standard Methods for the Examination of Water and Wastewater" — APHA — AWWA — WPCF or such other similar method as may be acceptable to the Bay of Plenty Regional Council as confirmed in writing by the Chief Executive of the Regional Council or delegate.

9 Monitoring of Constituent Loads to the Land Treatment System

9.1 The Consent holder shall measure and record the volume of effluent discharged each day and the corresponding sub areas irrigated.

9.2 The consent holder shall collect a weekly 7 day composite of the effluent discharged to the Land Treatment System and analyse for the following constituents:

- Chloride;
- Total Kjeldahl Nitrogen;
- Ammoniacal-Nitrogen;
- Total Oxidised Nitrogen;
- Total Phosphorus and
- Dissolved Reactive Phosphorus.

9.3 From these results the nutrient loads applied to the Land Treatment System shall be calculated on a calendar monthly basis.

9.4 The consent holder shall collect a representative sample of effluent on at least 4 days per month, representing different days of the week and analyse for *Escherichia coli* bacteria per 100 millilitres.

9.5 Effluent analyses as required under condition 9.2 for the determination of loads to the land treatment system as required under condition 10 for the determination of nutrient inputs to the Waipa Stream shall be carried out as set out in the latest edition of "Standard Methods for the Examination of Water and Wastewater' - APHA - AWWA - WPCF or such other similar method as may be acceptable to the Bay of Plenty Regional Council as confirmed in writing by the Chief Executive of the Regional Council or delegate.

10 Monitoring of Nutrient and Bacterial Concentrations in the Waipa Stream

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10.1 The consent holder shall collect water quality samples from the Waipa Stream at the two points identified in condition 8.2 and at a frequency as specified in conditions 10.2 and 10.3.

10.2 At the downstream site (Site 5) the consent holder shall operate a continuous flow proportional water sampler, with appropriate sample preservation, and collect the samples no less than weekly.

10.3 At the upstream site (Site 10) the Consent holder shall collect a grab sample of water on no less than one occasion per month.

10.4 Samples collected at both sites identified in conditions 10.2 and 10.3 shall be analysed for the following constituents:

- Total phosphorus,
- Dissolved reactive phosphorus,
- Nitrate-nitrogen,
- Ammoniacal- nitrogen,
- Total Kjeldahl nitrogen,
- Chloride.

10.5 The consent holder shall collect grab samples at both sites no less than one occasion per month and analyse the samples for *Escherichia coli* bacteria per 100 ml.

11 Nutrient Limits- Surface Water Quality

SEE CHANGE 2

The wastewater treatment plant and spray irrigation land treatment system shall be operated to ensure that the total sewage-derived nitrogen measured at the outlet of the wastewater treatment plant does not exceed 51 tonnes, and the total sewage-derived phosphorus in the Waipa Stream at site 5 does not exceed 4 tonnes during any 12 month period beginning on the 1st day of any 4, but not greater than the 5 week period to coincide, as close as possible, with the end of the calendar month.

12 Flows in Excess of the Treatment Capacity

In the event of flows delivered to the treatment plant in wet weather exceeding the hydraulic capacity of the treatment plant and its associated transfer pumps, pipelines and holding lagoons or in the event of power outage or mechanical failure such that spillage of partly treated wastewater occurs the consent holder shall report to the Bay of Plenty Regional Council within 7 days on the following matters:

(a) The cause of the spillage, including return period of rainfall, if that be the cause,
(b) The approximate duration and quantity of the spillage,
(c) Nature of the spillage and estimate of nutrient and bacterial strength,
(d) Assessment of measures, which could be taken to prevent or mitigate the effects of such events in future.

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13 Monitoring Structures in the Stream

13.1 The consent holder shall maintain the following structures required for the purpose of monitoring.

GAUGING STATION ID No.	STRUCTURE DESCRIPTION	LOCATION	APPROX. MAP REFERENCE NZMS 260 U16
4	V notch weir	Tributary to the Waipa Stream	950 313
5	Concrete structure	Lower Waipa Mill Road	947 312
6	V notch weir	Waipa Mill Road	954 309
8	V notch weir	Stream by Poplar Ave	967 302
10	Concrete flume	Stream by Hill Road	975 302
11	V notch weir	Up stream by Nice Road	985 306

13.2 Any scour of the river channel or banks resulting from any maintenance works under this consent, shall be effectively stabilised to the satisfaction of the Chief Executive of the Regional Council or delegate.

13.3 All works associated with the maintenance of the structures shall be carried out in a manner that minimises discoloration of the tributaries to the Waipa Stream and the Waipa Stream, as far as practicable.

13.4 The works shall be carried out in a manner that minimises adverse effects on fish passage as far as practicable.

14 Reports

14.1 Results of the monitoring stated in conditions 9.1, 9.2, 9.3 and 9.4 shall be sent to the Regional Council within 21 days after the end of March and September.

14.2 The results of analyses carried out as required by conditions 10.4 and 10.5 together with the mean daily flow of the Waipa Stream at site 5 shall be sent to the Regional Council within 21 days after the end of each calendar month.

14.3 A monitoring report shall be sent to the Regional Council based on the results of the analyses reported for condition 11, detailing the total sewage-derived nitrogen and phosphorus loads within the Waipa Stream for any continuous 12-month period within 21 days after the end of any 4, but no greater than the 5 week period to coincide as close as possible with the end of the calendar month.

SEE CHANGE 2

14.4 The information required to be provided to the Regional Council by conditions 14.1 to 14.3 shall also be provided to CNI Iwi Holdings Limited and to a nominated

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representative for iwi from Rotorua Project Steering Committee 2014, within the time frames specified in those conditions.

15 Warning Signs

The consent holder shall erect and maintain signs to the satisfaction of the Chief Executive of the Regional Council or delegate on the perimeter of the spray areas, at the main access points and any paths where the public readily gain access, to warn the public that spray irrigation of treated sewage effluent is taking place and the public health risks involved.

16 Consent Review

16.1 The Regional Council may, within six months of the fifth, tenth, fifteenth and sixteenth year anniversary of the commencement of this consent, serve notice on the consent holder under sections 128(1)(a)(iii) of the Resource Management Act 1991 of its intention to review condition 11.1 of this consent. The purpose of the review is to assess impact, compliance and monitoring reports, on the general quality of the Waipa and Puarenga Streams, Lake Rotorua and down stream waters, and if necessary alter nutrient loads.

SEE CHANGE 2

16.2 The consent holder may, within six months of the fifth, tenth and fifteenth year anniversary of the commencement of this consent, apply to the Regional Council under section 127(1)(a) of the Resource Management Act 1991 to change discharge limits pursuant to conditions 3.1 and 11.1 and monitoring as set out in conditions 8, 9, and 10 of this consent. The purpose of the change is to adjust discharge limits based on the general water quality of the Waipa and Puarenga Streams, Lake Rotorua and down stream waters.

17 Term of Consent

This consent shall expire on 31 July 2021.

18 Resource Management Charges

The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

19 **The Consent** hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

SEE CHANGE 2

20 Alternative Discharge Programme

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20.1 Within 2 months of the change of conditions of this consent coming into effect, the consent holder shall submit an "Alternative Discharge Programme" to the Chief Executive of the Bay of Plenty Regional Council or delegate for technical certification. The Alternative Discharge Programme shall outline the processes necessary to investigate, apply for the necessary consents and implement an alternative discharge by the expiry date of this consent, should the necessary consent be obtained. Critical milestones shall be detailed in the programme, including:

SEE CHANGE 2

i) Completing feasibility investigations including any trials to confirm the performance of the short-listed options, to be completed no later than 30 November 2014.

ii) Reaching of a decision by the Consent Holder on the preferred option, to be completed no later than 30 April 2015.

iii) Lodgement of all resource consent applications for the preferred option, to be completed no later than 30 November 2015.

20.2 Following consultation with CNI Iwi Holdings Ltd, Kaingaroa Timberlands Partnership and through the Rotorua Project Steering Group 2014, local iwi who are members of that Group, any changes proposed to the Alternative Discharge Programme shall be advised in writing by the Consent Holder and submitted for technical certification by the Chief Executive or delegate.

SEE CHANGE 2

20.3 The Consent Holder shall consult CNI Iwi Holdings Ltd, Kaingaroa Timberlands Partnership, through the Rotorua Project Steering Group 2014, local iwi who are members of that Group, on progress with the Alternative Discharge Programme and the implementation of an alternative discharge, at not less than 3 month intervals from the date of the change of conditions to this consent coming into effect.

SEE CHANGE 2

20.4 The Consent Holder shall report to Bay of Plenty Regional Council on progress with the Alternative Discharge Programme and the implementation of an alternative discharge at not less than 3 month intervals from the date of the change of conditions to this consent coming into effect.

SEE CHANGE 2

Advice Notes:

1. *The calculation of sewage derived nitrogen and phosphorus in the Waipa Stream should take into account the background load in the stream as determined at the upstream sampling site number 10.*

2. *Reports pursuant to condition 14 shall be addressed to the Principal Compliance Officer of Environment B·O·P.*

3. *The consent holder is advised that non-compliance with consent conditions may result in enforcement action against the consent holder and/or their contractors.*

4. *The consent holder is responsible for ensuring that all contractors carrying out works under this consent are made aware of the relevant consent conditions, plans and associated documents.*

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5. *Calculation of the starting day of any 12-month period referred to in conditions 11 and 14.3, is to ensure that reporting periods commence as close as possible to the first day of the month, having regard to the consent holder's weekly monitoring regime.*

DATED at Whakatane this 26th day of October 2001

For and on behalf of

The Bay of Plenty Regional Council

J A Jones

Chief Executive

Change 2

The change to this resource consent was approved under delegated authority of the Bay of Plenty Regional Council, 7 July 2014.



Helen Creagh

Consents Manager

for Mary-Anne Macleod
Chief Executive

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Appendix G Existing Resource Consent 60739 Monitoring – Annual Summary Report to March 2018

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Rotorua WWTP Discharge Consent 60739
Annual Summary to 27 March 2018

Prepared by Alison Lowe, RLC






ROTORUA LAKES COUNCIL

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EXECUTIVE SUMMARY

Resource Consent Number 60739 allows for the discharge of treated effluent from the Rotorua Lakes Council Wastewater Treatment Plant (WWTP) to the Land Treatment System (LTS) in Whakarewarewa Forest.

This report summarises the monitoring data for the 12 months to the end of March 2018 and presents it in relation to long-term trends and averages and consent limits.

Key points:

- The average daily discharge was 22,214 m^3/d. This is higher than the average for previous years and is roughly 10% higher than the same period last year.
- The average daily flow of Waipa Stream for the period 28 March 2017 to 27 March 2018 was 82,470, significantly higher than long term average of 55.2 m3/d.
- The consent limits the discharge of nitrogen to the LTS to 51 t in any 12-month period. The discharge peaked at 49.7 t in the 12-months to the end of March 2018, below the 51 t consent limit.
- Of the 49.7 t nitrogen discharged, 29 t was in the form of nitrate-N which is soluble and very mobile; 4 t as ammoniacal nitrogen; 17 t as organic nitrogen including both soluble and particulate material.
- The sewage-derived load, i.e. the load to the lake to the end of March 2018 was 26.7 t, below the previous consented limit of 30 t/yr. The nitrogen in the stream is predominantly nitrate.
- The LTS has retained or removed 20 t of nitrogen over the 12-month period - similar to the amount discharged to land as organic-nitrogen, which includes both particulate and dissolved nitrogen and has very limited mobility.
- The average concentration of phosphorus in the discharge water was 1.6 g/m^3 and nitrogen was 6.1 g/m^3, and hasn't changed much since the last upgrade in 2012.
- The load of phosphorus discharged to the LTS over the 12 month period was 13.9 t, and the consent does not limit this load.
- The concentration of dissolved P in Waipa Stream below the LTS appears to be increasing slightly. Particulate-P is lower than average.
- The discharge water is currently not disinfected and the median level of E coli in the discharge was 7400 mpn/100 ml. The level of E coli upstream of the LTS was 7, and downstream was 39, although it needs to be noted that the LTS is not the only source of E Coli in the Waipa catchment.
- The WWTP currently removed around half of the P biologically and the remaining 13.9 t P was discharged to land. The load downstream of the LTS was estimated to be 1.1 t/yr. By difference, the soil adsorbed around 12.8 t/yr.

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1 PURPOSE

The Bay of Plenty Regional Council granted Resource Consent Number 60739 to the Rotorua Lakes Council to 'Discharge Treated Effluent from the Rotorua District Council Wastewater Treatment Plant on to Land in Whakarewarewa Forest'.

RLC monitors (i) the discharge to of treated wastewater to land and (ii) Waipa Stream that flows from the catchment to Lake Rotorua.

In accordance with the Consent, monitoring results have been submitted to the BOPRC (Environment Bay of Plenty data-file '06 0739 GJM.xls').

Although not a requirement of the consent, the purpose of this report is to provide a written summary of the discharge from the Wastewater Treatment Plant and the load of nutrients to Lake Rotorua, for the 12 months to end of March 2018.

2 WASTEWATER TREATMENT PLANT - DISCHARGE TO LAND

2.1 Volume of WWTP discharge water

A total of 8.1 million m^3 of treated wastewater was discharged to land by spray irrigation to Whakarewarewa Forest in the Waipa catchment in the year to 31 March 2018 (Table 1).

The maximum daily discharge to the LTS was 42247 m^3 on 15 April 2017. The average daily discharge for this period was 22,214 m^3/d, roughly 10% higher than the previous year (Figure 1).

Rainfall during this period was high and influenced the volume of wastewater treated, the hydraulic load to the LTS, and the streamflow draining the Waipa catchment. The total hydraulic load from both irrigation and rainfall over time is shown in Figure 2.

Table 1. Volume of water discharged to the LTS in the past year (m^3/d)

Month	Total Discharge (m3)	Average Daily Discharge (m3/d)
Apr-17	869834	28994
May-17	764563	24663
Jun-17	631345	21045
Jul-17	694272	22396
Aug-17	676049	21808
Sep-17	676984	22566
Oct-17	639487	20629
Nov-17	602231	20074
Dec-17	589258	19008
Jan-18	653618	21084
Feb-18	675165	24113
Mar-18	625934	20191
12 months	8,098,740	22214

Figure 1. Daily volume discharged to the LTS from 1991-2018

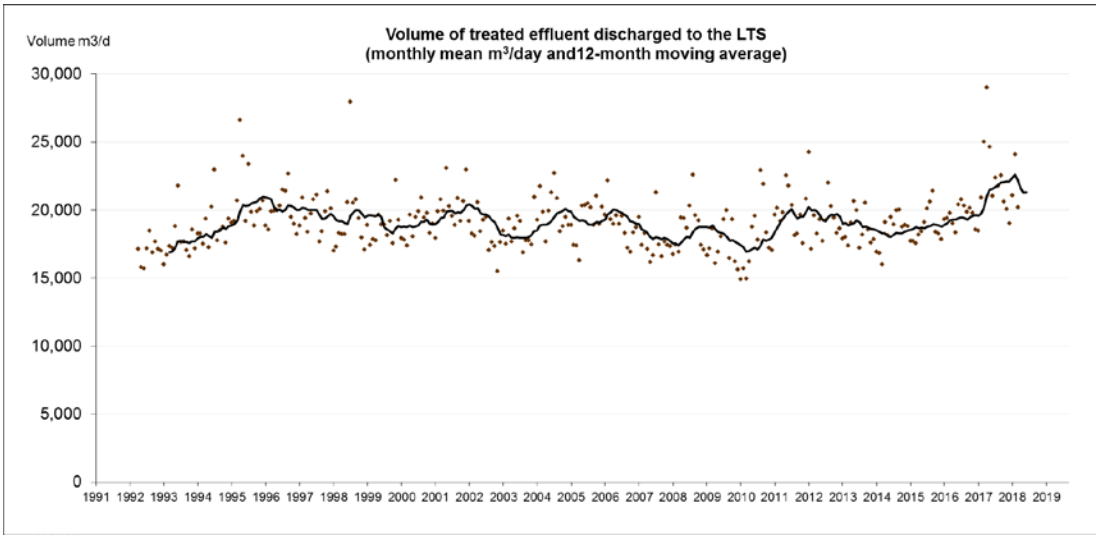
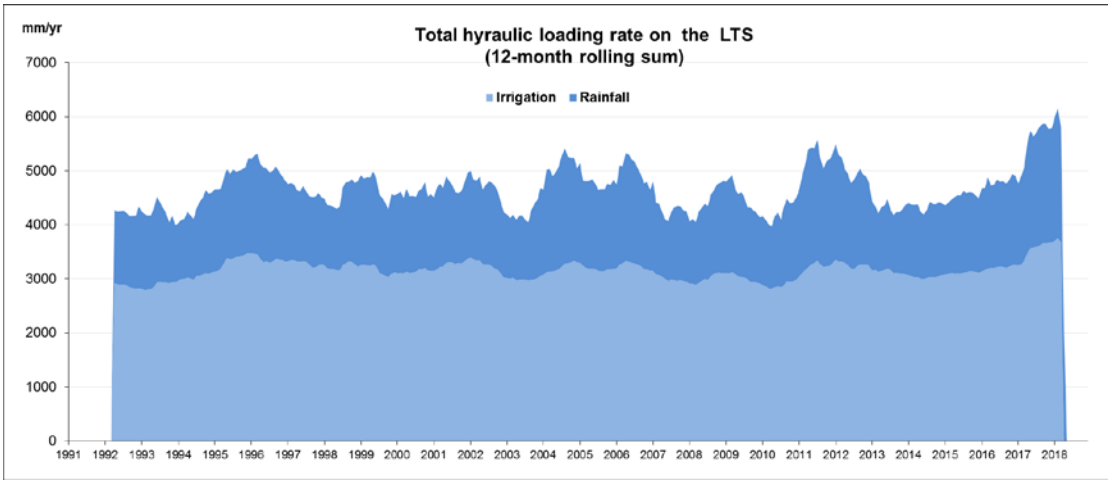


Figure 2. Land Treatment System hydraulic load 1991-2018



2.2 Quality of the WWTP discharge water

A 7-day flow-proportional composite sample of treated wastewater prior to discharge was collected and analysed on Tuesdays for chloride (Cl), total kjeldahl nitrogen (TKN), ammoniacal-nitrogen (NH_4-N), total oxidised nitrogen ($T_{OX}N$), total phosphorus (TP) and dissolved reactive ortho-phosphate (DRP). A representative sample of final effluent was collected on at least 4 days per month, representing different days of the week and analysed for *Escherichia coli* bacteria.

The quality of the discharge water over the past year is similar to the 5-year mean following the last treatment plant upgrade in 2012 (Table 2). The average concentration of phosphorus in the discharge water was 1.6 g/m^3 and total nitrogen was 6.1 g/m^3. The long term trends in the concentration of nutrients being discharged are shown in Figures 3 and 4.

Table 2. Mean concentration of constituents in the discharge water to the LTS

Date	TP g/m^3	DRP g/m^3	TN g/m^3	TOX-N g/m^3	Org-N g/m^3	TKN g/m^3	NH4-N g/m^3	Cl g/m^3	E coli /100ml
12 months to Mar-2018	1.7	1.6	6.1	3.5	2.1	2.6	0.5	42	7400
2012-2016	2.6	2.2	5.3	3.1	1.8	2.3	0.4	45	5500

Figure 3. The concentration of phosphorus in the WWTP discharge water applied to land (1996-2018)

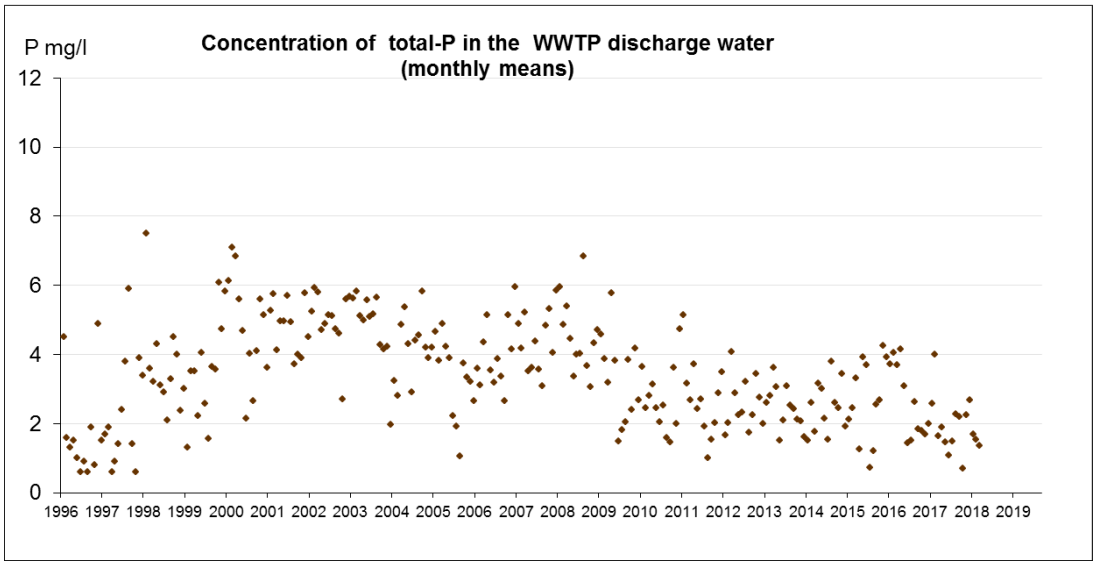
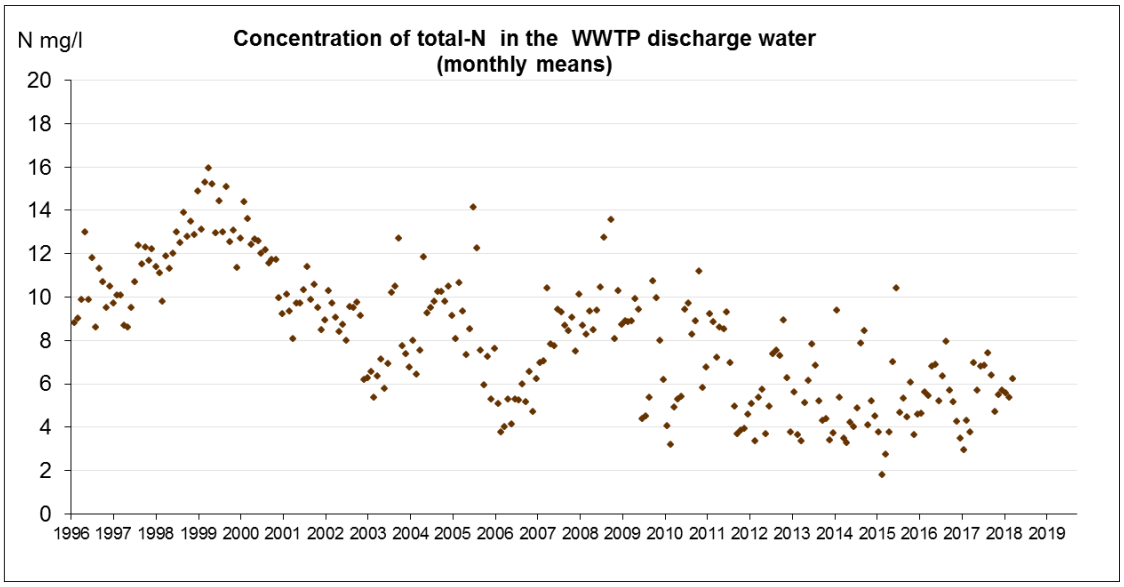


Figure 4. The concentration of nitrogen in the WWTP discharge water applied to land (1996-2018)



2.3 Quantity of nitrogen and phosphorus discharged to land

The consent limit for the discharge of nitrogen to the forest is 51 t, and is not to be confused with the load of nitrogen in Waipa Stream which is the load to the lake which is covered in section 4.3 of this report.

The loads of nutrients discharged to the forest are calculated from the volume of daily volume of water irrigated (summarised in Table 1), and the weekly concentration of nutrients in the discharge water (summarised in Table 2).

During the 12 months to 31 March 2018, 49.7 t of nitrogen was discharged to the forest – 29 was as nitrate-nitrogen which is soluble and very mobile; 4 t was as ammoniacal nitrogen which is soluble ; 17 t was organic nitrogen including both soluble and particulate material.

The load of phosphorus discharged was 13.9 t and the consent does not limit this load.

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3 WAIPA STREAM – DOWNSTREAM OF THE LTS

3.1 Pathogens in Waipa Stream

Grab samples were monthly above and below the Land Treatment System and tested to determine the level of E coli per 100ml as an indicator of the level of pathogens. Figures 5 and 6 show the level of E coli above and below the LTS respectively. The median level of E coli upstream was 7 and downstream was 39.

Figure 5. The level of pathogens in a tributary of the Waipa Stream above the LTS (Hill Road monitoring site M10), over time as indicated by E coli. The colours are related to the recreational guidelines where green=low risk; orange=alert; red=action.

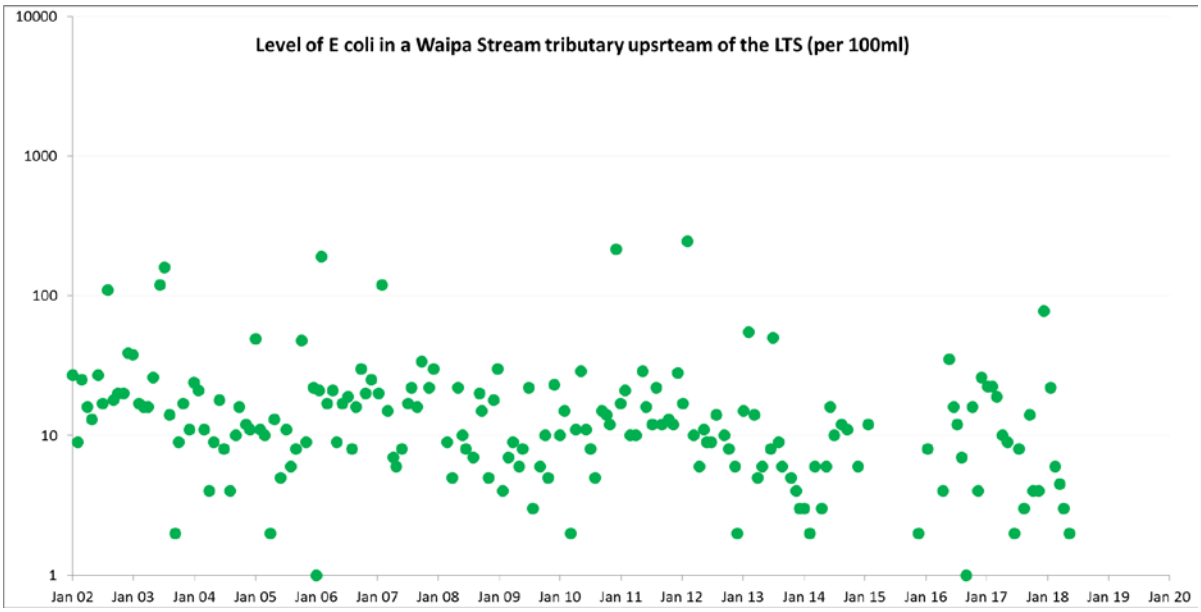
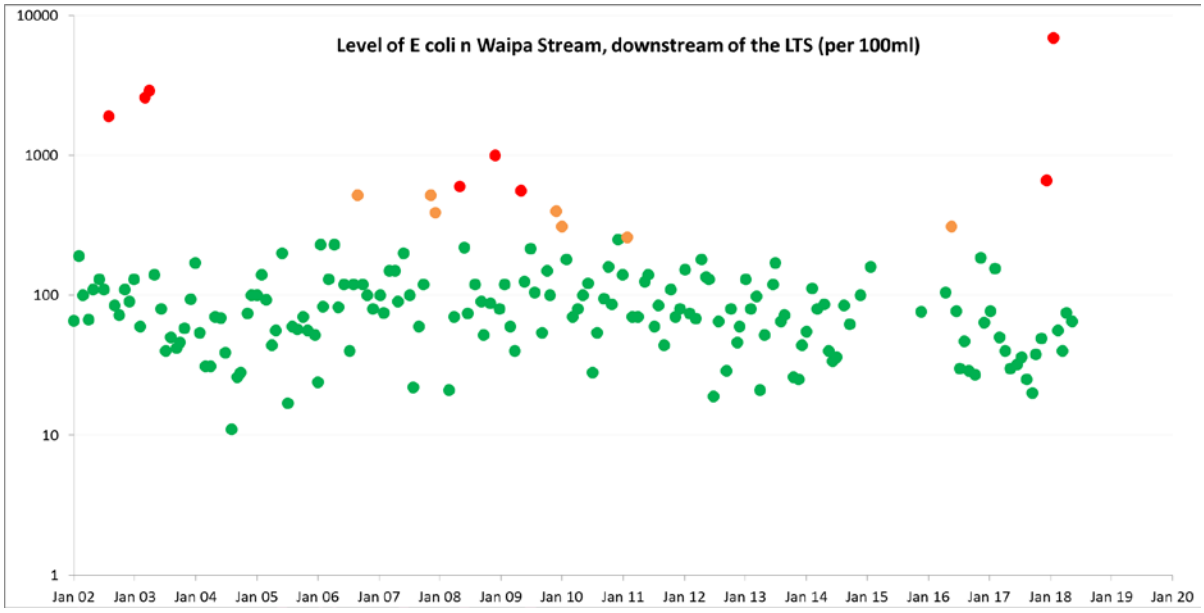


Figure 6. The level of pathogens in Waipa Stream below the LTS (Monitoring site M5), over time as indicated by E coli. The colours are related to the recreational guidelines where green=low risk; orange=alert; red=action.



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3.2 Waipa Stream flow and concentration of nutrients

The average daily flow of Waipa Stream for the period 28 March 2017 to 27 March 2018 was 82,470 m^3/d, significantly higher than long term average of 55.2 m^3/d (Table 4).

The total phosphorus concentration downstream of the LTS was 0.09 mg/l with 0.08 mg/l is dissolved. Total-P is lower than average but the dissolved fraction was higher and appears to be increasing (Table 4 and Figure 7).

The total-nitrogen concentration downstream of the LTS averaged 1.2 and most of this is as nitrate-nitrogen. Nitrogen concentrations are decreasing over time reflecting the lower concentration of nitrate discharged to land as a result of the WWTP has been upgraded over time (Figure 9).

Table 4. The flow and concentration of nutrients in Waipa Stream

Period	Flow (m3/d)	TP (g/m3)	DRP (g/m3)	N (g/m3)	TOX-N (g/m3)	TKN (g/m3)	NH4-N (g/m3)	Cl (g/m3)
12 months to the end of March 2018	82,470	0.09	0.08	1.2	1.0	0.3	0.04	16
2012-2016 (5-yr mean)	50,000	0.17	0.07	1.5	1.1	0.4	0.05	20
1992-2016 (25-yr mean)	55,200	0.14	0.05	1.7	1.2	0.4	0.04	16

Figure 7. The concentration of dissolved phosphorus in Waipa Stream over time

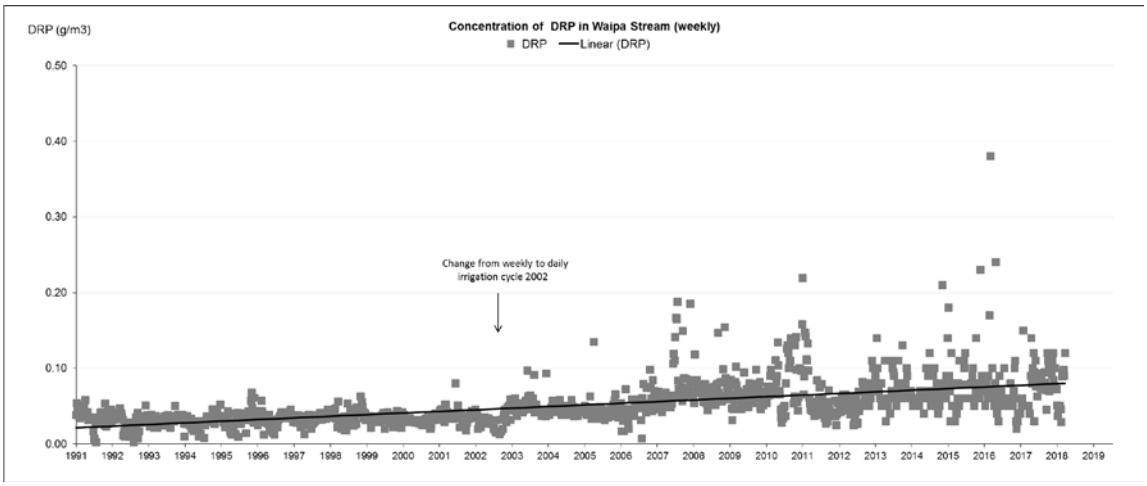
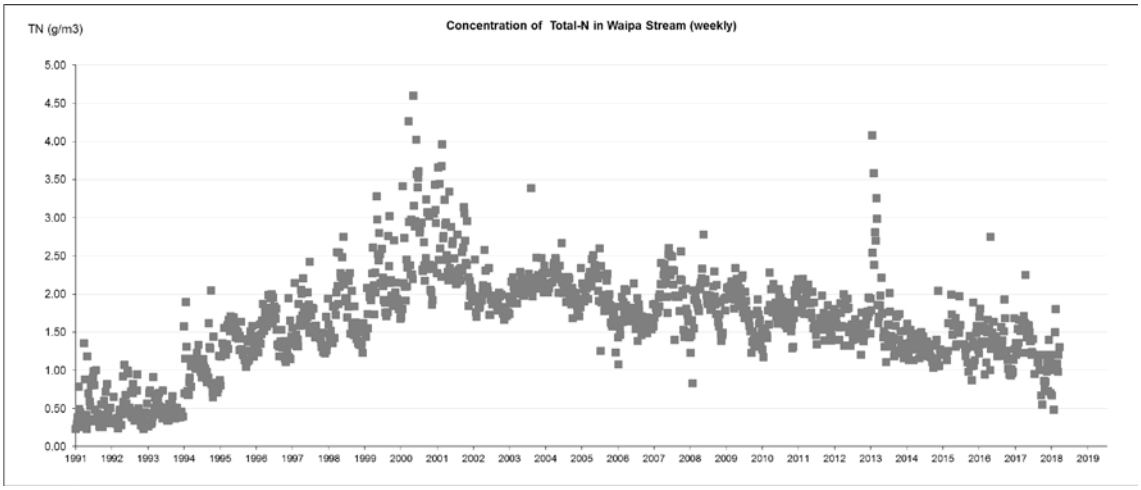


Figure 8. The concentration of nitrogen in Waipa Stream over time



3.3 Load of nitrogen and phosphorus in Waipa Stream

The annual load of nutrients in Waipa Stream is calculated from the weekly total stream flow and the concentration of nutrients in a flow proportional sample of the stream collected weekly, then summed. The 'sewage-derived' nutrients are determined by subtracting the background load of nutrients. Total and 'sewage-derived' loads if total-P (TP) total-N (TN) dissolved reactive P (DRP) and nitrite-nitrate-nitrogen (NNN) are presented in Table 5.

Table 5. The loads of nutrients in Waipa Stream from all sources and derived from sewage.

	Nutrients in Waipa Stream from all sources				Nutrients in Waipa Stream from WWTP	
	TP (t/yr)	TN (t/yr)	DRP (t/yr)	NNN (t/yr)	TP (t/yr)	TN (t/yr)
12 months to the end of March 2018	2.6	38.3	2.4	30.1	1.1	26.7
2012-2016 (5-yr mean)	2.9	27.8	1.2	20.1	1.5	20.0
1992-2016 (25-yr mean)	2.8	34.4	1.0	25.6	1.4	27.7

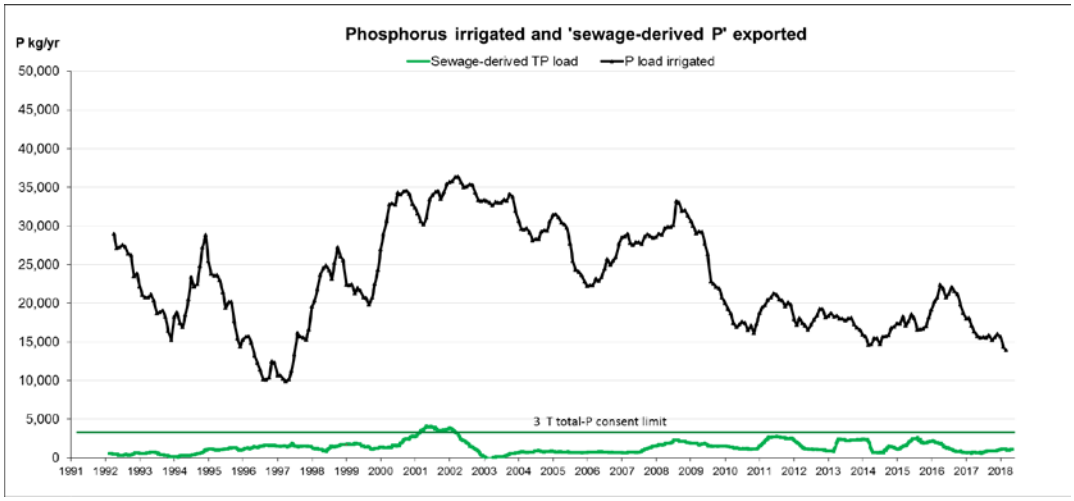
Phosphorus

The resource consent restricts the increase in the load of P in Waipa Stream from 1990 levels to 4t. It acknowledges that some of the additional phosphorus originates from other sources in the Waipa catchment, and not only from the WWTP discharge that should not exceed 3t. The sewage-derived load of phosphorus to the lake remains below the consented limit.

The load of phosphorus in Waipa Stream for the 12 months to the end of March 2018 from all sources was 2.6 t and 2.4 t of this was dissolved-P. Of the total load in the steam, 1.1 t was estimated to be from the WWTP treated discharge water (Table 5).

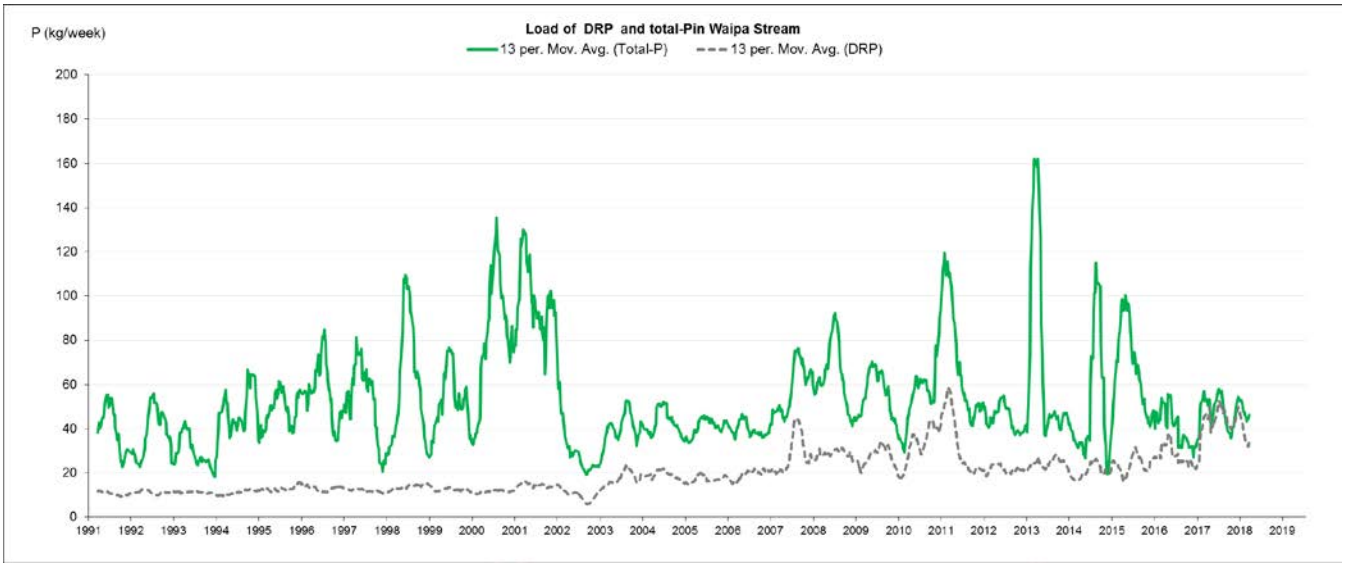
The WWTP currently removes around half of the P biologically and the remaining 13.9 t P was discharged to land in the 12 months to the end of March 2018 (Section 2.3). Figure 9 shows the load of phosphorus that has been irrigated on the forest over time, and the sewage-derived load of phosphorus leaving the land in Waipa Stream. The estimated annual load of sewage-derived P in Waipa Stream below the LTS was 1.1 t. Plant uptake is very low, and therefore by difference the soil in the LTS has adsorbed around 12.8 t of P in the 12 months to the end of March 2018.

Figure 9. The load of phosphorus discharged to the LTS and the load to the lake measured in Waipa Stream



The portion of the P as DRP in the flow-proportional Waipa Stream (collected weekly) appears to be increasing over time (Figure 10), and recently this has been very pronounced. Sample bottles have been pre-loaded with preservation and the preservation technique changed from mercuric-chloride to acid-preservation in June 2016. It is not clear if this is related.

Figure 10. The load of total-phosphorus in Waipa Stream below the LTS and the portion that as DRP



Nitrogen

The peak load of nitrogen to the lake was 29.2 during the 12 months to 10 Oct 2017, below the previous consented limit of 30 t/yr.

The peak load of nitrogen discharged to land was 49.7 t for the 12 months to the end of March 2018, below the 51 t consent limit (Section 2.3). These peak loads are shown relative to the consented limits in Figure 11.

Nitrite-nitrate-nitrogen (NNN) is soluble and very mobile through the soil, and is the predominant form of nitrogen in Waipa Stream (Figure 12). Of the 49.7 t of N that was discharged - 29 t was as NNN; 4 t was as ammoniacal nitrogen which is soluble; 17 t was organic nitrogen including both soluble and particulate material (Section 2.3).

The load of nitrogen in Waipa Stream originating from the WWTP treated discharge water for the 12 months to the end of March 2018 (Table 5) was 26.7 t, similar to the load of nitrogen discharged to land in the form of nitrate-N, which is highly mobile. The LTS has retained or removed 20 t of nitrogen in the 12 months to the end of March 2018 (49.7 discharged minus 29.7 leached), similar to the load of nitrogen discharged to land as organic-nitrogen, which includes both particulate and dissolved nitrogen and has very limited mobility.

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Figure 11. The load of nitrogen discharged to the LTS and the load to the lake measured in Waipa Stream

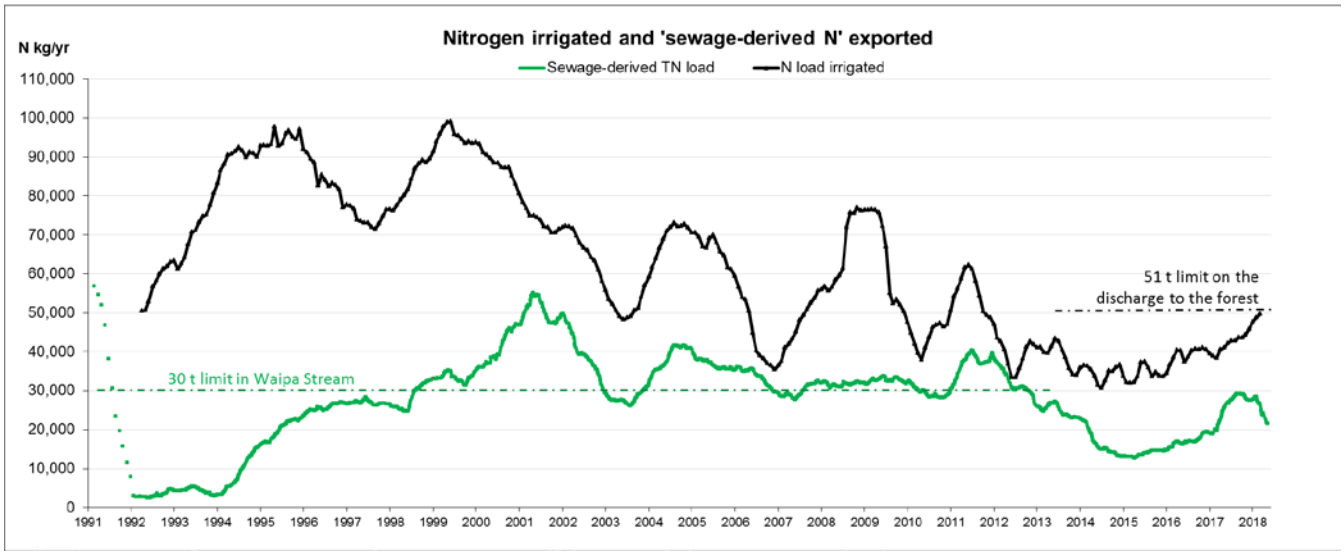
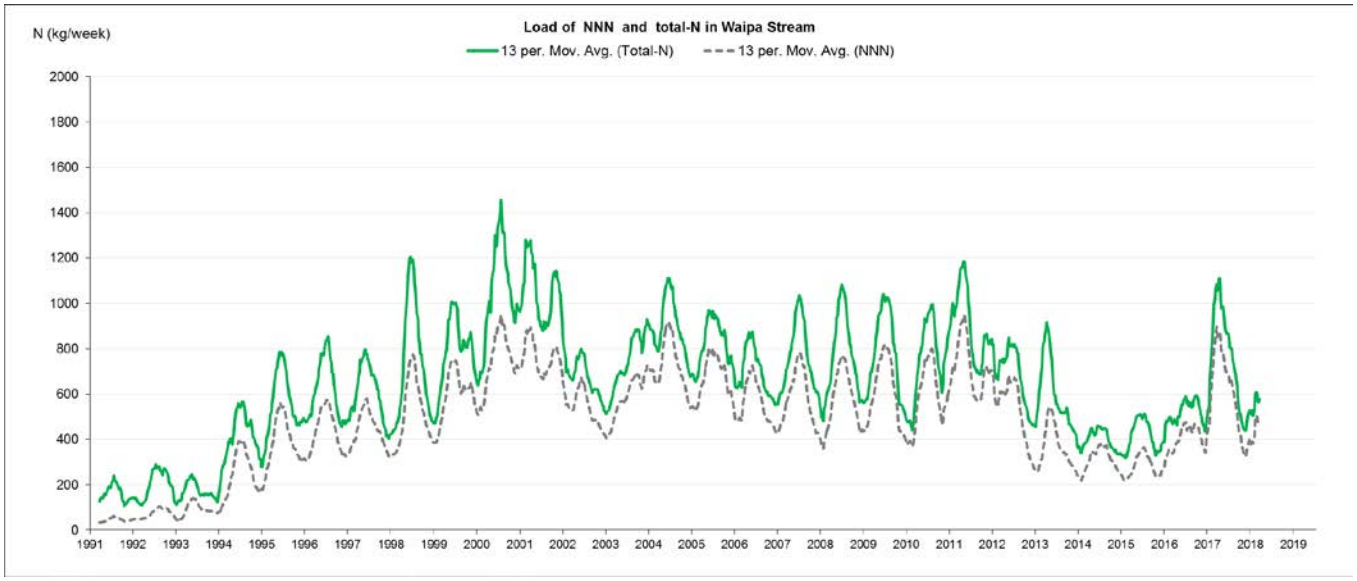


Figure 12. The load of total nitrogen in Waipa Stream and the portion as nitrite-nitrate-nitrogen (NNN)



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Appendix H Mott MacDonald Wastewater Treatment Design Statement December 2017

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MOTT MACDONALD

Rotorua Wastewater Treatment Plant

Design Statement for Preferred Treatment Arrangement

29 May 2018

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Version: 1, Version Date: 25/03/2026

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Rotorua Wastewater Treatment Plant

Design Statement for Preferred Treatment Arrangement

29 May 2018

Mott MacDonald New Zealand Limited
Registered in New Zealand no. 3338812

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B	6/12/17	KB	JB	KB	Final Draft
C	29/5/18	KB	JB	KB	Final

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1 Introduction

1.1 Background

The Rotorua WWTP was constructed in 1973 to treat wastewater from Rotorua City. Since this time the plant has seen many changes with the progressive removal of nutrients. The plant currently discharges to the Whakarewarewa forest irrigation system (land treatment system or LTS). Due to a change in the ownership of the LTS land, a plant upgrade and new resource consent is required for the discharge of treated wastewater to Lake Rotorua at Sulphur Bay.

The following is a design statement prepared to support the application for resource consent for the discharge of treated wastewater under section 15(1)b of the Resource Management Act 1991. Information contained herein is a further development of the preferred arrangement for a full membrane bioreactor (MBR) arrangement for the total wastewater flow as is set out in the report to Rotorua Lakes Council, titled “Wastewater Strategy – version three – June 2015” prepared by Mott Mac Donald. This report is included as Support Document 2D to the Assessment of Environmental Effects report.

This design statement is based upon a preferred option consisting of activated sludge, submerged membrane filtration (collectively referred to as MBR), ultraviolet disinfection and associated screening, solids management and chemical dosing for additional phosphorus removal. The AEE document sets out in sections 3,4 and 9 how this preferred option was arrived at. Section 4.7.3 of the AEE summarises this preferred treatment scheme. It is noted that while the MBR option is the preferred treatment scheme, drawing on information contained in this Design Statement, RLC may consider alternatives to it as set out in Section 4.9 of the AEE.

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2 Wastewater Flow and Loads

2.1 Introduction

The following sections summarise the influent flow and wastewater loads used in preparing the preliminary design of the preferred treatment scheme. Note that these will be updated and revised as the design of the scheme is developed, and are therefore indicative only. The wastewater flows and loads we have used in this design statement have been extended from 2051 to 2054 to reflect the likely timing of the project in view of the 35 year consent duration being sought.

2.2 Influent Flow and Loads

The preliminary design influent flows and loads for the proposed scheme are shown in table 1. The wastewater characteristics are based upon sampling data from the raw sewage at the plant and projected average daily flows based upon a growth rate of 0.7% p.a compound to 2054. This projection arrives at a total wastewater volume in 2054 of 25ML/d (25 million litres per day)

The nature of the Rotorua Treatment Plant catchment is mostly domestic, and no significant changes to this such as connection of a large wet industry are included in growth forecasts for the scheme. As such it is assumed that the characteristics of the wastewater will remain as shown in table 1 over the lifetime of the scheme and that wastewater loads will only increase with increases in flows over time.

Table 1: Raw wastewater characteristics

Parameter	Units	Average
Average daily flow (2014)	ML/d	18.9
Design future average daily flow	ML/d	25
Design peak wet weather flow	L/s	1130
Current and Future Average Total COD concentration	mg/L	571
Current and Future Average Total Kjeldahl Nitrogen concentration	mgN/L	51
Current and Future Average Ammonia nitrogen concentration	mgN/L	37
Current and Future Average Total phosphorus concentration	mgP/L	5.9
Alkalinity (as $CaCO_3$)	mg/L	208
Current and Future Average Total suspended solids concentration	mg/L	364
Current and Future Average Volatile suspended solids concentration	mg/L	334

The COD and TKN loads used in the preliminary process design are summarised below.

Table 2: Current and projected future COD and TKN mass loads

Year	COD load (kg/d)	TKN load (kg/d)
2014 (measured)	10,487	964
2024	11,265	1006
2034	12,101	1081
2044	12,999	1161
2054	14,275	1275

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2.3 Treated Wastewater Quality Criteria

The treated wastewater quality criteria used to size and develop the preferred scheme preliminary design are based upon the discharge of nutrients to the lake. At the time of writing, concentrations of parameters such as BOD, suspended solids and the various forms of nitrogen are not defined. It is noted however that with the preferred option having a fine pore size (0.04 micron) this will ensure a very high degree of removal of BOD and suspended solids. To meet the stringent mass limits of nitrogen and phosphorus, parameters such as suspended solids and BOD will be very low by default, hence they have not been considered in detail in the development of the preferred treatment scheme. Concentrations of nitrogen and phosphorus have been presented as medians to reflect the anticipated annual mass loads for the discharge to the Lake.

Table 3: Treated Wastewater Quality Criteria

Parameter	Value	Unit
Total nitrogen (TN)	4.3	mgN/L
Total phosphorus (TP)	0.33	mgP/L
E.coli or other suitable disinfection parameter	TBD	TBD

Source: Memorandum of Understanding: Nitrogen Accounting Approach for Rotorua Wastewater Treatment Plant Discharge 2017

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3 Design Philosophy

3.1 Introduction

The following sections summarise the design philosophy that was used to develop the preferred option for the wastewater treatment part of the total scheme. The methods to reduce each of the targeted wastewater constituent are summarised. Note that the method of removal of each constituent may be subject to change depending on the nature of the scheme the RLC implement.

3.2 Nitrogen removal

An evaluation around the nitrogen removal requirements for the biological process considered whether the current secondary (activated sludge) process (either in its current or modified form) can meet the proposed nitrogen concentration of 3.5mgN/L, or if another tertiary stage is required. An overall efficiency of 93% is required to meet this concentration. While this will be challenging, the existing Bardenpho configuration should achieve this standard of treatment.

3.3 Filtration

The existing Bardenpho process loses significant quantities of suspended solids from the final clarifiers of the activated sludge process. This loss contributes significantly to the proposed annual mass load limits for nitrogen and phosphorus as these solids contain approximately 7% nitrogen and 2% phosphorus. Filtration is therefore considered to be essential to achieving the proposed limits.

A filtration process could be either incorporated into the secondary biological process (such as MBR) or provided as a tertiary stage. Membrane filtration was identified as the most reliable means through its provision of a “physical barrier” to solids and its very low pore size. The very low pore size of the membrane is also considered essential to achieving the required pathogen reduction and to allow for reuse should this be considered in the future.

The experience with the side stream MBR that has been operating since 2012 on the current wastewater treatment plant site, is that the particulate nitrogen and phosphorus levels in the membrane permeate are essentially zero. Further to this the pore size of the membranes (0.04micron) are such that additional nitrogen and phosphorus removal is achieved from removing colloidal solids further enhancing the ability of the process to meet low nitrogen and phosphorus levels.

Tertiary filtration as a separate stage was considered as an alternative to MBR. For this process to be effective, final clarifier solids need to be less than approximatley10mgTSS/L. The current and historical performance of the plant is not of this standard. Therefore, additional final clarification is likely required for tertiary filtration to be successfully implemented.

3.4 Phosphorous removal

An evaluation of means to remove phosphorus from the wastewater considered using either supplemental carbon dosing (in the form of acetate) to enhance biological phosphorus removal (EBPR) against dosing of a metal salt.. This analysis shows a favourable operating cost for salt addition compared to dosing carbon. In addition, the use of EBPR has implications for the management of biosolids, and is more complex to operate and optimise than chemical dosing.

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Our experience is that the dose rates of chemicals for phosphorus removal are likely to be lower in MBR than in conventional activated sludge plants, reducing the amount of chemical needed to achieve a low phosphorus concentration.

Notwithstanding this, RLC may wish to pursue removal of phosphorus via biological uptake, thereby reducing or eliminating the need for chemical dosing. However, it is envisaged that some form of chemical dosing will be required either as the primary means of removing phosphorus or as a backup to biological removal.

3.5 Sustainability and Resource Use

Current operations at the wastewater treatment plant consists of:

- Removing carbon (chemical oxygen demand) via primary sedimentation
- Adding carbon via ethanol to the secondary MBR and Bardenpho to supplement denitrification
- Thickening and dewatering both primary and secondary sludges and removing these from site (currently processed in vermi-compost system)

The current operation does not derive any value from the COD removed during primary treatment. In fact, primary sedimentation in the current treatment operations, represents a very significant cost in terms of dewatering, transporting and managing the off-site effects of this waste stream from the plant. The proposed solution is aimed at extracting as much value from the wastewater as possible to meet the treatment objectives of the plant and therefore primary sedimentation should be discontinued.

3.6 Carbon Balance

Ensuring an effective carbon balance is critical for the nitrogen removal process. One of the key reasons for the selection of MBR for this upgrade was maximising the use of all the COD in the influent wastewater for nitrogen removal and minimising or eliminating the need for supplemental carbon dosing. Mass balances and simulation models developed for the proposed process confirm that with a COD:TKN ratio of 10 and a physical barrier to final effluent suspended solids provided by the membranes, that very low (<3.5mgN/L) total nitrogen concentrations should be possible with the current plant infrastructure. If primary sedimentation is removed from the process, this will increase the solids concentration within the Bardenpho structure, if additional volume is not added. MBR, while providing a physical barrier to solids is also able to run at higher solids concentrations than clarifier processes, meaning that with MBR, it is anticipated that no additional Bardenpho tankage volume is required.

3.7 Additional Disinfection

The MBR, due to its small pore size, effectively removes most larger microorganisms such as bacteria and protozoa. However, the removal of virus through MBR is not as effective. In order to reduce the risk of virus in the effluent, particularly norovirus, the proposed solution includes for membrane filtration and UV disinfection. The installation of UV disinfection will in effect give a “double barrier” pathogenic micro organism removal system. A validated ultra violet (UV) light dose of at least 35milli Watt seconds per square centimetre (mWs/cm^2) is to be delivered for 99% of the time (calculated on the basis of 15 minute average) over each calendar month. In addition to the membrane and the UV system the activated sludge process also contributes to the removal of pathogens from the treated wastewater.

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3.8 Operational Matters

The section below summarise the methods proposed in the preferred treatment solution to manage some of the plants existing operational risks and issues.

3.8.1 Single Treatment Train

Currently the wastewater treatment plant is configured in two parallel streams, consisting of an activated sludge process with final clarifiers (referred to as the Bardenpho) and a side stream membrane bioreactor (MBR). As currently configured, inflows are split 2/3 to the Bardenpho and 1/3 to the side stream MBR. During the development of the preferred scheme this configuration was reviewed for operational flexibility and risk. In conjunction with the plant's operations team it was decided that the full MBR would consist of a single process taking all inflows. The preferred scheme was developed to reuse as much of the equipment as possible from the side stream MBR, including the reuse of all the existing side stream membranes. This configuration is shown in Figure 1.

3.8.2 Diurnal Flow Balancing

The reference design considers the use of diurnal flow balancing in the operation of the MBR to smooth any variability in treated wastewater quality through the day. This could be achieved in either the disused final clarifier tanks and/or the disused primary sedimentation tanks.

3.8.3 Peak Flow Balancing

In addition to diurnal balancing the preferred option includes for the balancing of peak inflows as part of RLC's Containment Policy – refer to section 4.3 of the AEE relating to the Wastewater Strategy. This balancing is provided to ensure that if the instantaneous rate of wastewater inflow were, for any reason, to exceed the capacity of the membranes, there is no bypass of the MBR and UV disinfection system. After the 2014 Strategy Study was completed, there have been several significant rainfall events in Rotorua. Measured wastewater flow and rainfall data from two of these events has been used to confirm that the proposed future infrastructure at the WWTP will be able to ensure that flows resulting from similar extreme wet weather events pass through the proposed MBR and UV system.

3.8.3.1 April 2017 Event

The first storm event that was analysed occurred in April 2017. During this event Rotorua received 167mm of rainfall over 48 hours, measured at Whakarewarewa. Based on Intensity, frequency, duration tables sourced from NIWA, this event was between a 5 and 10 year ARI for the 48 hours of rainfall recorded.

As a result of this event, the WWTP received a total volume of 71.8ML over the peak 24 hour period of the storm. This flow compares to the average day flow of approximately 19ML/d.

This event was preceded by a period of wet weather resulting in the level of Lake Rotorua being very high. Background infiltration into the reticulation network was therefore higher than typical due to the lake level. In addition, the rainfall intensity was such that there we no overflows at the WWTP or within the reticulation network and therefore all flows were received at the WWTP.

The proposed onsite storage of wastewater and the proposed throughput of the MBR was modelled to ensure that this volume of water could be treated in the proposed plant. That analysis showed that the proposed infrastructure including the reuse of the existing final clarifier tanks (assumed to be empty at the start of the rain event) as storage would have contained this

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event ensuring that all flows received at the WWTP would have been able to pass through the proposed MBR and UV system.

3.8.3.2 April 2018 Event

The second event that was analysed occurred in April 2018. During this event Rotorua received 182mm of rain over 24 hours with a peak intensity over 6 hours of 148 mm. This was a 95 year recurrence interval (BOPRC Environmental Data Portal EK577135 April 2018).

During the peak of this event, the WWTP received a volume of approximately 56ML over 24 hours. This volume of water was impacted by flooding in the Ngongotaha catchment and overload of the reticulation network with some subsequent network overflows.

This recorded volume has been compared to the capacity of the proposed plant and associated infrastructure. This analysis shows that the all flows received at the WWTP during this event could have been contained and would have received treatment in the MBR and UV system.

Peak hourly rainfall in this event was very high, approximately 63mm/hr, and the heavy rain lasted for a full day with 172mm recorded over 24 hours and 148mm falling in 6 hours. This very high intensity resulted in overflows at the WWTP and within the reticulation system, thereby reducing the total volume that was received at the WWTP.

3.8.3.3 Future Proofing of Network Performance

The volume of balancing and the treatment rate of the proposed MBR and UV system has been determined based upon measured flows to the WWTP during rainfall events. These events are the best guide available as to the volume and intensity of extreme flows that arrive at the treatment plant. The onsite storage and sizing of the proposed MBR and UV system are based on containing and treating these events. It is noted that over time the intensity and frequency of rainfall events may increase and/or the wastewater network may deteriorate, thereby increasing the magnitude of infiltration and inflow in these events. RLC proposes to mitigate this risk by:

- Implementation of an ongoing infiltration and inflow strategy specifically targeted at reducing peak flows and volume in rainfall events
- Considering storage in addition to that already included in the proposed plant should this be needed in the future. This would consist of additional onsite storage in some of the disused structures on the existing WWTP site and/or targeted additional storage in the wastewater network
- A program of pipe renewals based on criticality, condition and remaining useful life assessments
- Preventative maintenance on the network including identifying cross connections

3.8.4 Energy Consumption

By altering the influent wastewater configuration, the preferred option reduces the number of pumping stages from the previously twice pumped (to MBR and Bardenpho) to a one stage pumping configuration. This reduces the energy consumption of the plant. Additionally, the preferred option does not use the final treated wastewater pumping station that delivers water to the land treatment system. This is covered in section 4.5.6 of the AEE.

3.8.5 Biosolids Production

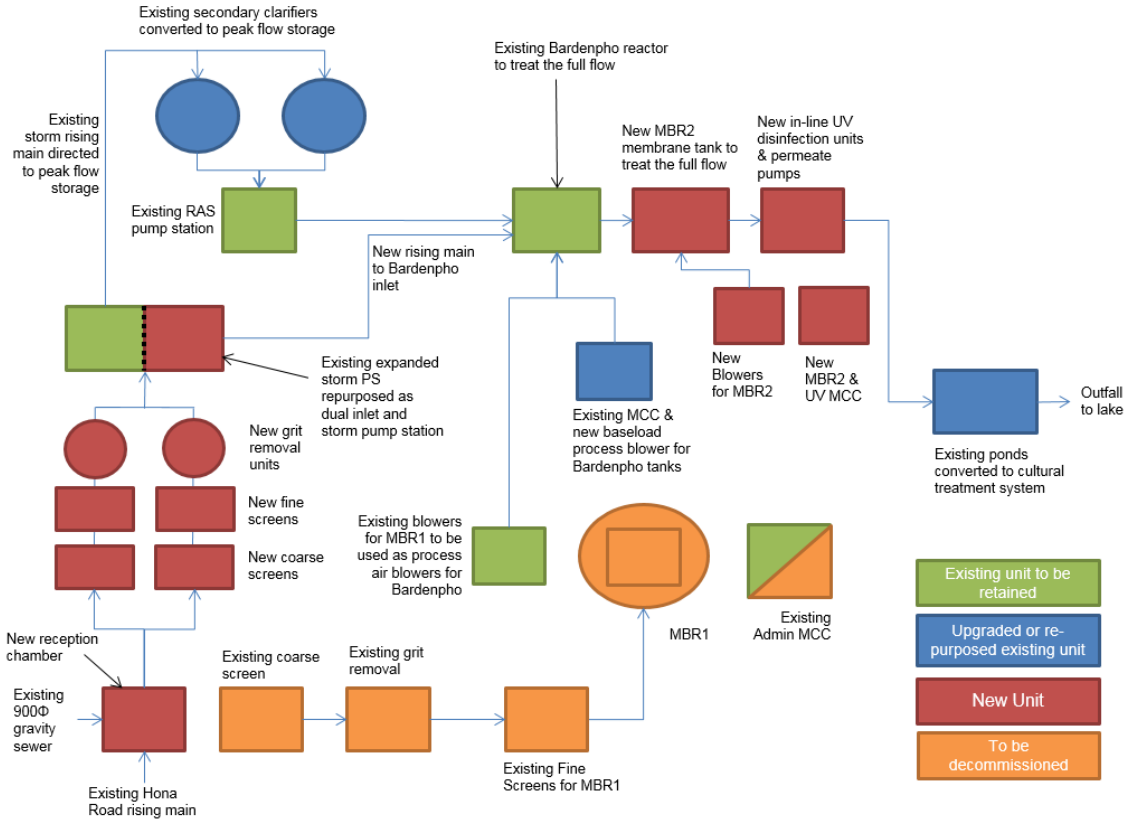
The preferred option has been developed to minimise the amount of biosolids that are removed from site. The elimination of the primary sedimentation tanks and ethanol dosing in the

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preferred scheme is expected to reduce solids production by approximately 40%. In addition, improved dewatering, will further reduce the volume of biosolids removed from site.

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Figure 1: Plant Schematic – Single Train Treatment



3.9 Future Proofing

The preferred option has been developed with the following future proofing in mind:

- Potential to reduce phosphorus below three tonnes per year. This is due to the ability of the MBR to remove all suspended solids from the treated wastewater and the provision of chemical dosing for phosphorus removal
- Potential to reconfigure the plant in the future to incorporate additional nitrogen removal technologies that reduce energy consumption due to savings in aeration energy
- Potential to retrofit new membrane technology in the future
- Additional containment at the WWTP and/or in the network if required
- Future proofing of the network performance as set out in section 3.8.3.3 above
- Designing to achieve a high level of pathogen kill and providing for a reuse management plan to be implemented
- Space and single train to the earth beds provide potential to add inline tertiary treatment such as activated carbon filtration e.g. should any emerging contaminant require further removal.

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Appendix I Relevant Objectives and Policies

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Table I-1: Significant Infrastructure and Growth

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Infrastructure is developed in an integrated and sustainable manner which provides for environmental, social, cultural and economic wellbeing, while protecting regionally significant infrastructure	NPS-UDC	Policy PA2	Local authorities shall satisfy themselves that other infrastructure required to support urban development are likely to be available.	The NPS-UDC defines an urban environment as an area of land containing or intended to contain a concentrated settlement of 10,000 people or more and any associated business land. As noted in Section 4.3.1.2 of this AEE, the WWTP catchment is anticipated to grow and it is considered that the provision of wastewater infrastructure is a critical element of achieving an effective and efficient urban environment. The efficient use of regionally significant wastewater infrastructure also provides an important social and economic positive effect as it provides the communities with economically sustainable an affordable wastewater treatment and disposal system. Further, the Preferred Scheme will ensure that wastewater infrastructure is integrated with urban development. A 35 year duration for the discharge permits will enable the Project to provide for future generations in the short, medium and long-term in a manner consistent with current growth planning. Adverse effects are discussed in detail in the subsequent table. Measures have been put forward through the volunteered consent conditions in Appendix K to manage adverse effects from the Preferred Scheme.
	RPS	Objective 6	Provide for the social, economic, cultural and environmental benefits of, and the use and development of nationally and regionally significant infrastructure and renewable energy	
		Policy EI 3B	Protect the ability to develop, maintain, operate and upgrade existing, consented and designated nationally and regionally significant infrastructure from incompatible subdivision, use or development. Ensure that where potentially incompatible subdivision, use or development is proposed near regionally significant infrastructure, it should be designed and located to avoid potential reverse sensitivity effects.	
		Policy EI 4B	Recognise and provide for the social, economic, cultural and environmental benefits of: (a) Nationally and regionally significant infrastructure, including: (i) The ability for people and goods to travel to, from and around the region efficiently; (ii) Maintaining public health and safety through the provision of essential services, supply of potable water and the collection and transfer of sewage; (iii) Maintaining access to energy so people can meet their energy needs; (iv) Maintaining access to telecommunication services so people can meet their communication needs; and (v) Maintaining reliable and resilient infrastructure for major industrial users and rural production activities to meet their needs to function effectively and efficiently. (b) Energy generated from renewable energy resources including: (i) Maintaining security of supply and diversifying energy sources; (ii) Reducing dependency on external energy sources; (iii) Reducing greenhouse gas emissions; and (iv) Reducing dependency on non-renewable energy sources.	
		Objective 7	Provide for the appropriate management of:	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			(a) any adverse environmental effects (including effects on existing lawfully established land uses) created by the development and use of infrastructure and associated resources; (b) any reverse sensitivity effects on established, consented or designated infrastructure.	It is considered that the Preferred Scheme will achieve the identified objectives and is consistent with the identified policies.
		Policy EI 7B	Manage the development and use of infrastructure and associated resources so as to address actual or potential effects on existing lawfully established activities in the vicinity	
	RDP	Objective 15.3.1	Infrastructure that provides for the economic, cultural, social and environmental wellbeing of the Rotorua district, the region and New Zealand.	As set out in Section 7 of this AEE there are adverse ecological, natural character, landscape and amenity effects that cannot be practicably avoided, remedied or mitigated. An assessment of alternatives and hydraulic modelling have been completed to ensure that the adverse effects are avoided and minimised as far as practicable whilst ensuring that treated wastewater does not enter the Puarenga Stream across Sulphur Flat. In 2017, the RLC commissioned an Ecological Management Plan for the Sanatorium Reserve. The Plan makes a number of recommendations in terms of weed removal and planting to ensure that geothermal vegetation and fauna habitats within Sanatorium Reserve and the Sulphur Flat area are restored. The volunteered consent conditions in Appendix K have been drafted taking into account the Ecological Management Plan and the Cultural Mitigation and Environmental Enhancement Plan condition requires the following activities:
		Policy 15.3.1.1	Enable the research, exploration, development, operation, maintenance and upgrading of infrastructure that avoid, remedy or mitigate adverse effects on the environment.	
		Policy 15.3.1.2	Recognise the technical and operational requirements and constraints of infrastructure when considering the actual and potential adverse effects, including cumulative effects of infrastructure on the environment.	
		Policy 15.3.1.3	Where adverse environmental effects cannot be avoided, remedied or mitigated, regard shall be given to offsetting measures and/or environmental compensation to benefit the local environment and community.	
		Policy 15.3.1.4	Infrastructure shall be co-located where practicable or otherwise designed, located, installed, operated and maintained to ensure the safe, secure and efficient operation of adjacent infrastructure is not compromised.	
		Objective 15.3.2	Infrastructure that avoids, mitigates or remedies the adverse effects on the character and amenity of the area.	
		Policy 15.3.2.3	Ensure that above ground infrastructure are designed and located in a manner that avoids, mitigates or remedies the adverse effects on the character of the surrounding environment.	
		Policy 15.3.2.4	Enable the development of infrastructure where the potential for reverse sensitivity effects will be minimised.	

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				• Revegetation of areas adjacent to the wastewater treatment plant with native species endemic to the area; • Riparian planting at the mouth of Puarenga Stream, Lake Rotorua edge and areas adjacent to the discharge channel; and • Landscaping of areas immediately adjacent to the WWTP. It is considered that regard has been given to offsetting measures and that the Preferred Scheme will achieve the identified objectives and is consistent with the identified policies.
		Objective 12.3.3	Serviced development that safely connects to the existing road network, utility reticulation, provides a potable drinking water supply and sufficiently caters for the future development potential of the site.	The Preferred Scheme will ensure that wastewater infrastructure is integrated with development. A 35 year duration for the discharge permits will enable the Preferred Scheme to provide for future generations in the short, medium and long-term in a manner consistent with current growth planning. It is considered that the Preferred Scheme will achieve the identified Objective and is consistent with the identified policies.
		Policy 12.3.3.1	Manage urban subdivision and land development to connect with the existing infrastructure and transportation network, according to the capacity limitations of that network where available and the potential requirements for upgrading its capacity.	
		Policy 12.3.3.2	Require all subdivision and development to be coordinated with the planned provision of infrastructure, integrated with the transport network and the district's road hierarchy.	
		Policy 12.3.3.3	Provide for urban expansion where such growth does not adversely affect the safe and efficient use and development of land, roads and infrastructure.	

Table I-2: Water Quality

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Maintain or improve water	NPS-FM 2014	Objective A1	To safeguard:	The BOPRC has implemented the policy directive of the NPS-FM 2014 of maintaining or improving water quality by

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
quality, including by managing discharges in a manner that avoids, remedies or mitigates adverse effects on water quality and the health, safety and wellbeing of people and communities			(a) the life-supporting capacity, ecosystem processes and indigenous species including their associated ecosystems, of fresh water; and (b) the health of people and communities, at least as affected by secondary contact with fresh water; in sustainably managing the use and development of land, and of discharges of contaminants.	establishing limits for the total amount of specified contaminants that enter the receiving waters within a catchment at risk. For Lake Rotorua the mass of TN that enters the lake need to be reduced so that they not exceed 435 t/yr by the year 2032. No discharges shall be authorised beyond 2032 that results in the TN limit for Lake Rotorua being exceeded. The intention is to allocate TN allowances amongst the various land use sectors within the catchments, having regard to principles of equity and fairness. To work towards achieving this target, with regard to the WWTP, a Memorandum of Understanding (MoU) was signed by the consent authority, the RLC, and Te Arawa Lakes Trust. The MoU is designed to accurately reflect the accounting of nitrogen losses that occurs when rural land within the Lake Rotorua Groundwater Catchment becomes urban land and is connected to Rotorua's reticulated sewerage system, and when existing point source loads of nitrogen to the lake are connected to the sewer e.g. geothermal by transferring the TN to the WWTP. The transfer of TN to the WWTP will result in a no net increase of N discharged to Lake Rotorua from the WWTP. In terms of water quality, sections 7.3, 7.4 and 7.5 of this AEE along with Support Documents Nos 3 and 4 cover this in detail. In summary, projected concentrations of E. coli in the discharge from the WWTP will be lower than background concentrations in Te Arikiroa Thermal Channel and Lake Rotorua. The mass balance dilution modelling shows that the proposed discharge option is predicted to reduce E. coli concentrations in the receiving environments, thus providing improved water quality with regards to this indicator bacteria. In terms of the Public Health Risk Assessment (refer Section 7.6 of this AEE), this found that the proposed MBR treatment process alone is expected to satisfy the RLC's first desired outcome that the treated wastewater can be used directly for primary contact recreation; and that the proposed MBR
		Objective A2	The overall quality of fresh water within a region is maintained or improved while: (a) protecting the significant values of outstanding freshwater bodies; (b) protecting the significant values of wetlands; and (c) improving the quality of fresh water in water bodies that have been degraded by human activities to the point of being over-allocated.	
		Policy A4	By every regional council amending regional plans (without using the process in Schedule 1) to the extent needed to ensure the plans include the following policy to apply until any changes under Schedule 1 to give effect to Policy A1 and Policy A2 (freshwater quality limits and targets) have become operative: 1. When considering any application for a discharge the consent authority must have regard to the following matters: a. the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			b. the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided. 2. When considering any application for a discharge the consent authority must have regard to the following matters: a. the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their secondary contact with fresh water; and b. the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their secondary contact with fresh water resulting from the discharge would be avoided. 3. This policy applies to the following discharges (including a diffuse discharge by any person or animal): a. a new discharge or b. a change or increase in any discharge – 4. of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge of that contaminant, any other contaminant) entering fresh water.	treatment process with UV disinfection is expected to satisfy the RLC's second desired outcome that the treated wastewater meets the unrestricted reuse standard. The effects of the Preferred Scheme on eutrophication in Lake Rotorua were considered in detail by Abell et al. (2015) and are summarised in Section 7.5 of this AEE. The modelling showed that the mean 8-year TLI would be 0.02 TLI units higher than the modelled baseline scenario (no discharge). This difference is small relative to model error and is negligible to low from an ecological perspective. The quality of the treated wastewater will be such that it will be able to be reused by other persons (e.g. for irrigation and/or industrial process water). This opportunity for beneficial reuse will potentially reduce the volume of treated wastewater needing to be discharged to Lake Rotorua via Te Arikiroa Thermal Channel. Whilst the proposed discharge is described as a discharge of treated wastewater to land in a manner that it may enter an unnamed tributary of Lake Rotorua, a complete assessment against Policy DW P1 (Policy 38) has been undertaken as the discharge will reach Te Arikiroa Thermal Channel and Sulphur Bay (Lake Rotorua). This is set out below. The treated wastewater will pass through a cultural land contact bed before being discharged to Te Arikiroa Thermal Channel. The April 2018 CIA considered this a positive effect on the mauri of the treated wastewater. As this will involve the spiritual cleansing of the treated wastewater as it passes through the various experiences and contexts within the land contact bed and be in a state of 'mauri tau'. It is considered that the Preferred Scheme constitutes the current BPO and this approach is one of the key drivers for the Project. It is considered that any adverse effects on water quality will be appropriately mitigated through the suite of volunteered
	RPS	Objective 27	The quality and mauri of water in the region is maintained or, where necessary to meet the	

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			identified values associated with its required use and protection, enhanced.	consent conditions in Appendix K and that the Preferred Scheme will contribute to meeting the 435 t/yr TN limit to be met by 2032. It is considered that the Preferred Scheme will achieve the identified objectives and is consistent with the identified polices.
		Policy WL 1B	Regard as a positive effect any significant reduction in contaminant discharge (including nitrogen and phosphorus) likely to result from land use change proposals.	
		Objective 28	Enhance the water quality in the lakes of the Rotorua district and other catchments at risk.	
		Policy WL 2B	Control contaminant discharges in the following catchments at risk: (a) The catchments of Lakes Rotoiti, Rotorua, Rotoehu, Ōkaro, Ōkāreka, Rotomā, Ōkataina, Tarawera, Tikitapu, Rotokākahi, Rerewhakaaitu and Rotomāhana; and (b) The catchments of other water bodies when they are defined and included in the Regional Water and Land Plan or Regional Coastal Environment Plan. Consideration of whether a catchment is at risk will have regard to whether it has significant values (e.g. cultural, ecological, economic, recreational) that may be adversely affected by land use or land use change or have limited capacity to assimilate discharges of contaminants without affecting those values	
		Policy WL 3B	Establish limits for the total amount of specified contaminants that enter the receiving waters within a catchment at risk including: (a) Contaminants to be managed to avoid compromising public health and each catchment's ecology, mauri, fishability, swimmability and aesthetics; (b) For the Rotorua Te Arawa Lakes the amount of nitrogen and phosphorus that can enter each lake in order to achieve its target trophic level index; and	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			(c) For Lake Rotorua the total amount of nitrogen that enters the lake shall not exceed 435 tonnes per annum.	
		Policy WL 6B	Require, including by way of rules, the managed reduction of any nutrient losses that are in excess of the limits established under Policy WL 3B by ensuring that: (a) Rural production land use activities minimise their loss of nutrients as far as is reasonably practicable by implementing on-farm best management practices; (b) Any land use change that is required within the Rotorua Te Arawa lakes catchments to achieve the limits takes into account an equitable balancing of public and private costs and benefits; and (c) No discharges shall be authorised beyond 2032 that result in the limit for Lake Rotorua being exceeded. A catchment intermediate target for the managed reduction of nitrogen loss is to be set to achieve 70% of the required reduction from 746 t/yr to 435 t/yr by 2022.	
		Objective 29	Land use activities are: (1) within the capability of the land to support the activity; (2) integrated with the wider environmental values of their surroundings; and (3) within the capacity of receiving waters to assimilate any discharge.	
	RNRP	RL O1 (Objective 11)	The water quality in the Rotorua lakes is maintained or improved to meet the following Trophic Level Indices: (j) Lake Rotorua – 4.2	
		RL O2 (Objective 12)	Reduced occurrence of cyanobacterial algal blooms on the Rotorua Lakes.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
		IM O3 (Objective 13)	The water quality in rivers and streams is maintained or improved to meet the Water Quality Classifications set in the Water Quality Classification Map, and the following environmental outcomes: (a) Natural State (Lake) Water Quality Classification - the natural quality of the water shall not change. (b) Natural State (River) Water Quality Classification - the natural quality of the water shall not change. (c) Managed State (Lake) Water Quality Classification - the water quality in the lake shall not deteriorate. (d) Aquatic Ecosystem (Bay of Plenty) Water Quality Classification - water quality shall be sufficient to support diverse and healthy aquatic ecosystems. (e) Contact Recreation Water Quality Classification - water quality shall be sufficient to allow contact recreational uses. (f) Water Supply Water Quality Classification - water quality shall be sufficient to allow for municipal water supply purposes, while recognising water treatment may still be required. (g) Drains with Ecological Values Water Quality Classification - water quality shall be sufficient to support aquatic ecosystems, while recognising that aquatic ecosystems in such areas are limited. (h) Regional Baseline Water Quality Classification - water quality shall not deteriorate.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
		DW O1 (Objective 23)	Discharges of contaminants to water are managed to meet the following goals: (a) After reasonable mixing, discharges of contaminants to lakes, streams and rivers meet the water quality classification of the receiving water bodies as a minimum; and have no more than minor adverse effects on heritage values, existing users in downstream areas, and lakes, harbours and estuaries. (b) Discharges of contaminants to water are in a manner that takes into account the cultural values of tāngata whenua acknowledged for that area.	
		DW O3 (Objective 25)	Prevent the accumulation of persistent toxic contaminants in the environment, particularly in lakes, estuaries and harbours and their catchments.	
		DW O4 (Objective 27)	Discharges of water to water avoid, remedy or mitigate adverse effects on the environment as appropriate to the values, uses and existing environmental quality of the activity site.	
		DW O7 (Objective 26)	Discharges of contaminants to land are managed to: (a) Not exceed the natural treatment capacity of the soil. (b) Avoid, remedy or mitigate the adverse effects of run off to surface water. (c) Prevent the long-term contamination of the soil by hazardous substances and safeguard the life-supporting capacity of soil. (d) Ensure that any adverse effects on high quality groundwater are no more than minor: (e) Where there is potable water, including aquifers used for municipal water supply.	

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			(f) Where natural water quality has not been adversely affected by land use or point source discharges. (g) Where there are recharge areas of (i) and (ii) (h) In the groundwater catchments of the Rotorua lakes, Ohiwa and Tauranga harbours. (i) Ensure adverse effects on groundwater not otherwise addressed by (d) are avoided, remedied or mitigated. (j) Prevent adverse effects on lake water quality in relation to the TLI of the lake, where the discharge is in the catchment of a lake.	
		Policy 43	To take appropriate action to avoid, remedy or mitigate the cumulative effects of discharges of contaminants to water or to land where such discharges are having an adverse effect on water quality, the life-supporting capacity of soil, or the coastal environment.	
		DW P6 (Policy 43A)	When considering any application for a discharge the consent authority must have regard to the following matters: (a) the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water; and (b) the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided. (c) the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their secondary contact with fresh water; and	

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			(d) the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their secondary contact with fresh water resulting from the discharge would be avoided. This policy applies to the following discharges (including a diffuse discharge by any person or animal): (e) a new discharge; or (f) a change or increase in any discharge - of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge of that contaminant, any other contaminant) entering fresh water.	
		DW P7 (Policy 45)	To consider requiring a bond or an acceptable alternative for any point source discharge of contaminants from industrial or trade premises where the contaminant is a hazardous substance, and the scale, intensity, duration or frequency of the effects of the discharge have a high probability or high potential to cause the long-term contamination of soil, or adverse effects on water quality and aquatic ecosystems. The amount of the bond will be sufficient to cover the future costs of site remediation, and will take into account the long-term management and monitoring of the activity site. Bond will be administered according to section 108A of the Act.	
		DW P10 (Policy 48)	To encourage, as appropriate, discharge activities to comply with current best engineering practices and best practicable options to avoid or mitigate adverse effects on the environment so that the requirements of this regional plan and other Environment Bay of Plenty requirements are met.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			Best engineering practices are relevant where the scale, intensity and potential adverse effects require such engineering practices.	
		DW P13 (Policy 44)	To require the appropriate management of discharges of contaminants to land, and to land where the contaminant may enter water, to ensure that: (a) The rate and volume of the discharge does not exceed the natural treatment and assimilative capacity of the soil and its vegetative cover. (b) Surface runoff of contaminants to rivers, streams, lakes, wetlands and drains is avoided, remedied or mitigated. (c) The creation of contaminated sites is prevented. (d) Any adverse effects on high quality groundwater are no more than minor: i. Where there is potable water, including aquifers used for municipal water supply. ii. Where natural water quality has not been adversely affected by land use or point source discharges. iii. Where there are recharge areas of (i) and (ii). iv. In the groundwater catchments of the Rotorua lakes, Ōhiwa and Tauranga harbours. (e) Adverse effects on groundwater not otherwise addressed by (d) are avoided remedied or mitigated. (f) There is no net increase of nitrogen or phosphorus in lake catchments.	
		DW P4 (Policy 41)	To encourage the change from the discharge of contaminants to water to the land based treatment	This policy applies to current discharges to water (which is not the case here) but that land based treatment and disposal

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			and disposal of contaminants, where this is environmentally sustainable	was assessed and the Preferred Scheme was deemed to be environmentally sustainable.
		DW P5 (Policy 42)	To recognise and provide for the effects on the mauri of the receiving environment caused by the discharge of contaminants to water by: (a) Where appropriate, encouraging early and ongoing consultation with tāngata whenua during the consideration of wastewater treatment systems to take into account the cultural values of tāngata whenua acknowledged for that area. (b) Where reasonable and practicable to do so, take steps to promote better use of freshwater by discouraging disposal of toxic materials via wastewater systems. (c) Encouraging a shift to land based treatment and disposal systems, where appropriate and environmentally sustainable and socially, technically and economically feasible. This includes disposal of sewage by passage through land, soil or wetlands. (d) Avoid, remedy or mitigate adverse effects on water, land and geothermal resources or sites that are of significance to tāngata whenua, where such resources or sites have been identified by tāngata whenua. (e) Avoiding physical degradation of the life-supporting capacity of receiving waters.	The treated wastewater will pass through a cultural land contact bed before being discharged to Te Arikiroa Thermal Channel. The April 2018 CIA considered this a positive effect on the mauri of the treated wastewater. As this will involve the spiritual cleansing of the treated wastewater as it passes through the various experiences and contexts within the land contact bed and be in a state of 'mauri tau'. Alternative LTSs were considered in the assessment of alternatives in Section 9 before arriving at the Preferred Scheme. In terms of effects on geothermal resources and sites that are of significance to tāngata whenua, the rationale for constructing the proposed bunds is to address cultural concerns as expressed in the following quotation from the second CIA (Companion Document No. 2): "…there are a number of geothermal expressions on the eastern side of the Puarenga Stream, which should be avoided. If a discharge here was to proceed, a physical structure such as a bund will need to be constructed to direct flow to Lake Rotorua. The sensitivity of this area to Te Arawa Lakes Trust and tangata whenua would suggest that an 'unobtrusive' and 'natural looking' structure would be required…". As discussed above, the quality of the treated wastewater following the upgrade to the WWTP will be such that it will be able to be reused by other persons (e.g. for irrigation and/or industrial process water). This opportunity for beneficial reuse will potentially reduce the volume of treated wastewater needing to be discharged to Lake Rotorua via Te Arikiroa Thermal Channel.

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				It is considered that these effects on mauri of the receiving environment have been recognised and provided for. It is considered that the Preferred Scheme is consistent with this Policy.
		DW P9 (Policy 47)	To avoid, remedy or mitigate the adverse effects of discharges of water to water on: (a) Flooding. (b) Any relevant Maori cultural values. (c) Stability of the beds and banks of the receiving water body. (d) Ecological values.	These matters are addressed in Tables I-8 for natural hazards, I-3 for Maori cultural values, Table I-4 for Te Arikiroa Thermal Channel bed disturbance and I-6 ecological values respectively. The April 2018 CIA (Companion Document No. 2) notes that the overall assessment of cultural effects of this proposal do not sit nicely on one side or the other. The proposal cannot be neatly described as having effects less than minor or having significant adverse effects. That would be simplistic and convenient. The proposal exhibits a number of positive and negative cultural effects. Whist there has been considerable consultation with iwi and input from the CAS on the design of the land contact bed concept, as there are unavoidable potential significant adverse effects on cultural values, it is considered that the Preferred Scheme is not consistent with this Policy. It must be noted that there are significant positive effects of the Preferred Scheme on cultural values also.
		DW P1 (Policy 38)	Discharges of contaminants to water are to comply with the following requirements: (a) Lakes: (i) Direct discharges of contaminants to lakes are discouraged, while allowing for minor discharges that are unlikely to have adverse effects on water quality. (ii) There shall be no net increase of nitrogen or phosphorus in lake catchments. This does not preclude the use of nutrient	With regard to the specific requirements of Policy DW P1, comments are set out against each of the matters. The requirements for lakes have been assessed over streams, as it is noted that Te Arikiroa Thermal Channel is not identified in Schedule 9 or the Water Quality Classification Maps and flows to Sulphur Bay (Lake Rotorua) and not the open coast. (i) Direct discharges of contaminants to lakes are discouraged, while allowing for minor discharges that are unlikely to have adverse effects on water quality.

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			trading within the same lake catchment to achieve this policy. (iii) Where discharges are made directly to lakes, the discharge is to: • Meet the water quality classification of the lake after reasonable mixing. • Avoid, remedy or mitigate adverse effects on heritage values and existing users of the lake. This will include implementing appropriate treatment and mixing methods for the discharge. (b) Rivers and streams: (i) Discharges of contaminants to streams and rivers with Water Supply or Natural State (river) water quality classifications are avoided where practicable. (ii) Discharges to rivers and streams are to: • Meet the water quality classification of the stream or river after reasonable mixing. • Avoid, remedy or mitigate adverse effects on heritage values and existing users in downstream areas. This may include consideration of appropriate mixing methods for the discharge. (iii) For discharges to rivers and streams that are tributaries of lakes, there shall be no net increase of nitrogen or phosphorus in lake catchments. Full regard will be given to the effect on the TLI of the lake, including cumulative effects. (iv) For discharges to rivers and streams that flow directly to the open coast, or are tributaries of harbours and estuaries, the effect on the water quality of coastal waters will be given full	As discussed in Section 4.8 of this AEE, treated wastewater will be discharged from the land contact beds, via the discharge structure to Te Arikiroa Thermal Channel. This discharge is not directly to the lake and the wastewater is highly treated. (ii) There shall be no net increase of nitrogen or phosphorus in lake catchments. This does not preclude the use of nutrient trading within the same lake catchment to achieve this policy. As discussed above, in order to achieve a no net increase of nitrogen or phosphorus in Lake Rotorua, a MoU has been signed to accurately reflect the accounting of nitrogen loss that occurs when rural land within the Lake Rotorua Groundwater Catchment becomes urban land connected to Rotorua's reticulated sewerage system, and when existing point source loads of nitrogen to the lake are connected to the sewer e.g. geothermal. No net increases in nitrogen and phosphorus are anticipated. (iii) Where discharges are made directly to lakes, the discharge is to: • Meet the water quality classification of the lake after reasonable mixing. Sulphur Bay (Lake Rotorua) is classified as managed state in Schedule 9 and therefore the water quality in the lake shall not deteriorate. The assessment in Section 7.3 – 7.5 of this AEE was undertaken against the NPS-FW 2014 Attribute States, in summary the water quality is not anticipated to deteriorate after reasonable mixing. • Avoid, remedy or mitigate adverse effects on heritage values and existing users of the lake. This will include implementing appropriate treatment and mixing methods for the discharge.

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			regard. This includes cumulative effects. (v) For discharges to streams that are not shown on the 1:50,000 Water Quality Classification Maps, the discharge shall comply with the Regional Baseline water quality classification as a minimum, subject to an assessment of the appropriate water quality classification in accordance with Method 81. Where the assessment determines an appropriate water quality classification, the discharge will be considered relative to the higher water quality classification. (vi) Where a river or stream has more than one water quality classification along its length, a discharge will be assessed relative to the water quality classification at the point of discharge, as shown on the Water Quality Classification map. (vii) The owners or operators of hydroelectric generation dams are required to gain resource consent for the discharge of contaminants associated with dredging activities and extraction of bed materials necessary to maintain the function of the dam. Dam owners and operators are not responsible for contaminants discharged within the catchment above the dam. Ephemeral flow paths: Discharges of contaminants to ephemeral flow paths will be considered to be discharges to land, or discharges to land where	It is considered that adverse effects on existing users of the Lake will be mitigated through monitoring and the volunteered consent conditions in Section 14 and Appendix K of this AEE. It is considered that the preferred scheme is consistent with the Policy.

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			the contaminant may enter water, whichever is appropriate to the individual circumstances.	
		DW P11 (Policy 49)	To set a reasonable mixing zone in conditions of resource consents to discharge contaminants to water where relevant, having regard to the criteria specified in Method 115.	With regard to the mixing zone, a 250 m radius from the mouth of Te Arikiroa Thermal Channel is proposed. This is based on analysis of the 3-D modelling; water quality data collected along a transect in Sulphur Bay, with consideration of the dispersion/dilution of analytes of geothermal origin, and; expert opinion, with consideration of the projected discharge and the morphology of the receiving bay. The RNRP requires that a reasonable mixing zone be determined having regard to the following criteria. Comments are set out below each of the criteria. (a) The best practicable option to minimise the length or radius of the reasonable mixing zone. With regard to Te Arikiroa Thermal Channel, Section 7.3 of this AEE states that mass balance dilution calculations were carried out to predict the water quality of Te Arikiroa Thermal Channel following implementation of the preferred option. No mixing zone was considered in these calculations, reflecting the high projected volume of treated wastewater relative to baseline discharge in the thermal channel. For mass balance dilution calculations, it was assumed that mean baseline discharge (flow rate) of the thermal channel was 0.01 $m^3 s^{-1}$ and the mean daily discharge of treated wastewater is 0.2756 $m^3 s^{-1}$. With regard to the 250 m mixing zone in Sulphur Bay, as set out in Sections 7.3 to 7.5 of this AEE this was determined through analysis of the 3-D modelling; water quality data collected along a transect in Sulphur Bay, with consideration of the dispersion/dilution of analytes of geothermal origin, and; expert opinion, with consideration of the projected discharge and the morphology of the receiving bay.

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				(b) The water quality classification of the receiving water body (refer to the Water Quality Classification Map), and the relevant water quality classification standard in Schedule 9. Sulphur Bay (Lake Rotorua) is classified as managed state in Schedule 9 and therefore the water quality in the lake shall not deteriorate. In terms of the assessment carried out in Sections 7.3 to 7.5 of this AEE, analysis was undertaken against the Attribute States set out in the NPS-FW 2017. As stated in Section 7, the modelled concentration of ammoniacal-nitrogen for Lake Rotorua is at the low end of the range for Attribute State B, which corresponds to conditions associated with occasional impacts on the most sensitive species. The proposed discharge is not predicted to substantively increase ecological risks associated with ammonia toxicity. Further the proposed discharge is not expected to increase ecological risk in the lake due to nitrate toxicity. The projected mean pH of the treated wastewater (6.94) is higher than the baseline pH Sulphur Bay (4.16 at Site 4). Therefore the proposed discharge was assessed to cause a small localised increase in pH in Sulphur Bay; modelled pH was 4.24 in Sulphur Bay. Projected E. coli concentrations in the treated wastewater are very low, reflecting the high level of proposed treatment. Projected concentrations are lower than background concentrations in Sulphur Bay (c) The flow regime of the receiving water. As discussed in section 7.3 and 7.5 of this AEE, the mean baseline discharge (flow rate) of the thermal channel is 0.01 m^3 s^{-1} and the mean daily discharge of treated wastewater is 0.2756 m3 s-1. Thus, following implementation of the proposed option, the

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				flow in the thermal channel was assumed to comprise 275.6 parts treated wastewater to 1 part baseline thermal channel water. In terms of dilution within the zone of reasonable mixing in Sulphur Bay, modelling has shown that the treated wastewater was assumed to mix in the lake to yield a mixture that comprises three parts wastewater to 97 parts ambient lake water. (d) The ambient concentrations of contaminants in the receiving water. This matter is covered in detail in Section 7 of AEE and Support Document No. 4. In summary the projected concentrations of E. coli are lower than background concentrations in Te Arikiroa Thermal Channel and Lake Rotorua. (e) Effluent discharge flow rate and contaminant concentrations. Section 7.4 of the AEE states that the treated wastewater was assumed to mix in the lake to yield a mixture that comprises three parts wastewater to 97 parts ambient lake water. This approach is conservative because it was based on the 95th percentile (i.e., the modelling predicted that the proportion of treated wastewater would be lower than 3% for 95% of the time) and the concentration of treated wastewater is expected to be considerably lower in the main body of the lake, relative to conditions at Site 4. (f) Existing discharge and abstraction consents. Consent 60739 is for an LTS to the Whakarewarewa Forest and not relevant to this Policy. (g) Fish migration and aquatic ecosystems requirements. As set out in Support Document No. 4, the assessment concludes that the wastewater discharge

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				will not transform the aquatic habitat of Sulphur Bay (severe geothermal influence) sufficiently to allow tāonga species to exist there. (h) Maori cultural values (refer to DW P5). Refer to discussion on Policy DW P5 with regard to effects on the mauri of water. In summary, the April 2018 CIA (Companion Document No. 2) notes that: The land contact bed has incorporated Mātauranga and Matapono Māori in its concept. There are potential positive effects on the mauri of the treated wastewater. (j) Proximity to bathing sites, especially those listed in Schedule 10. It is noted that Puarenga Stream and Lake Rotorua are both listed in Schedule 10. The proposed discharge point is to Te Arikiroa Thermal Channel, adjacent to Puarenga Stream. Te Arikiroa Thermal Channel flows through to Sulphur Bay (Lake Rotorua). No adverse effects on bathing sites in Lake Rotorua are anticipated. (k) Adverse environmental effects of the discharge, including cumulative effects in relation to (a) to (j). With regard to criteria (a) to (j) above, it is considered that adverse effects of the discharge of treated wastewater can be mitigated through a suite of volunteered consent conditions set out in section 14 of this AEE. (l) The location of the discharge and position of the outfall. This discharge is located at the point treated wastewater leaves the land contact bed via the discharge structure to Te Arikiroa Thermal Channel, which then flows to the Sulphur Bay (Lake Rotorua). (m) Outfall diffuser design criteria.

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				As discussed in the Companion Documents, a land contact bed, discharge structure and earth bund concept has been developed in conjunction with tāngata whenua. This will form the discharge point and is not considered an outfall diffuser. (n) Information provided by the applicant. Extensive reporting, modelling and information has been provided as part of this application, including the companion and supporting documents. (o) Any other information relevant to the nature of the discharge and the site characteristics. Refer to section 7.3 – 7.6 of this AEE. It is considered that the mixing zone described above and set out in Section 7 of this AEE is 'reasonable' and regard has been had for the criteria specified in Method 115.
	RDP	Objective 1.3.1	The enhancement of water quality and management of Rotorua's water bodies and the lake and riverside environments to improve the environmental, cultural, social and economic well-being of Rotorua.	As set out above, the proposed discharge will contribute to meeting the RPS's limit on the total amount of nitrogen that enters the lake of 435 t/yr by 2032. This will assist with the enhancement of water quality in Lake Rotorua improving environmental, cultural, social and economic well-being of Rotorua. It is considered It is considered that the Preferred Scheme will achieve this Objective and is consistent with the Policy.
		Policy 1.3.1.1	Manage subdivision, use and development where the proposal will contribute to the improvement of lake water quality within Lake Rotorua.	

Table I-3: Tāngata Whenua

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Recognise and provide for the relationship of tāngata whenua with	RPS	Objective D1	To provide for the involvement of iwi and hapu, and to ensure that tāngata whenua values and interests are identified and reflected in the management of fresh water including associated ecosystems, and decision- making regarding freshwater planning, including on how all other objectives of this national policy statement are given effect to.	In recognising the role of tāngata whenua as kaitiaki and the relationship of tāngata whenua with the environment, the RLC has engaged with tāngata whenua in the selection of the Preferred Scheme. Throughout the assessment of options, the
		Policy D1	Local authorities shall take reasonable steps to:	

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the environment, the role of tāngata whenua as kaitiaki and avoid, remedy or mitigate significant adverse effects on ancestral lands, water (including the mauri of water), sites, wāhi tapu and other taonga			involve iwi and hapu in the management of fresh water and freshwater ecosystems in the region; work with iwi and hapu to identify tāngata whenua values and interests in fresh water and freshwater ecosystems in the region; and reflect tāngata whenua values and interests in the management of. and decision-making regarding fresh water and freshwater ecosystems in the region.	principles of the Treaty of Waitangi have been taken into account in selecting the Preferred Scheme (refer to the April 2017 CIA Companion Document No. 1). A CAS was established by the RPSC to facilitate discussions among potentially affected iwi and hapu regarding cultural aspects of the proposed options and Preferred Scheme. A cultural assessment expert was appointed to assist the CAS in its input of cultural advice to the RPSC and to oversee the preparation of a CIA. Two CIAs have been prepared, the first, which looked at the proposed options and the second, which further developed the land contact bed. Both CIAs consider the effects of the Preferred Scheme on cultural values and recommend appropriate measures to avoid, remedy or mitigate adverse cultural effects. The April 2017 CIA confirmed that the proposed upgrade to the WWTP is the most preferred option. However, this CIA sought further information on the land contact bed. That is, the detail of the contact, what materials might be utilised, what will be the resident time and what will be the type(s) of cultural treatments applied. Following further development of the land contact bed concept, the April 2018 CIA concluded that there is both broad support and local condemnation for the discharge proposal. Among those who support the proposal are significant entities with important roles in the well-being of Lake
		Objective 13	Kaitiakitanga is recognised and the principles of the Treaty of Waitangi (Te Tiriti o Waitangi) are systematically taken into account in the practice of resource management.	
		Policy IW 3B	Exercise the functions and powers of local authorities in a manner that: (a) Takes into account the principles of the Treaty of Waitangi; (b) Recognises that the principles of the Treaty will continue to evolve and be defined; (c) Promotes awareness and understanding of councils' obligations under the Act regarding the principles of the Treaty, tikanga Māori and kaupapa Māori, among council decision makers, staff and the community; (d) Recognises that tāngata whenua, as indigenous peoples, have rights protected by the Treaty and that consequently the Act accords iwi a status distinct from that of interest groups and members of the public; and (e) Recognises the right of each iwi to define their own preferences for the sustainable management of natural and physical resources, where this is not inconsistent with the Act.	
		Objective 14	Partnerships between Bay of Plenty Regional Council, district and city councils and iwi authorities	
		Policy IR 4B	Encourage the timely exchange, consideration of, and response to, relevant information by all parties with an interest in the resolution of a resource management issue by: (a) Consulting as widely as practicable in the preparation, implementation and review of policy statements and plans; (b) Consulting all potentially affected parties and interest groups in the planning, implementation and review of councils' own operational activities in relation to the use, development and protection of natural and physical resources; and	

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			(c) Encouraging all parties undertaking resource use, development and protection activities to consult with others who may be affected.	Rotorua and its people. These include Te Arawa Lakes Trust, Te Tatau o Te Arawa, Te Pukenga Koeke o Te Arawa and Pukeroa-Oruawhata Trust. Wider iwi and hapū groups are either neutral, supportive or opposed to the proposal. It is understood that the support or neutrality of most parties is based on the effort to find an 'innovative cultural' solution for the proposed discharge. There is, however, strong opposition to the proposal from hapu who have primary or close relationships with the land on which the WWTP is located and the areas proposed for the discharge. The group of opposition includes Ngāti Hurunga Te Rangi, Ngāti Uenukukopako, Ngāti Te Roro-o-Te-Rangi and Ngāti Te Rangiaorere. These hapu have marae and resident communities at Ngapuna, Puarenga and Ohinemutu, all within close proximity to the WWTP. The April 2018 CIA concludes that the proposal to discharge treated wastewater to Lake Rotorua will have some significant adverse effects. Those effects are deemed to be: • *A loss of mana among local hapū who are strongly opposed to the discharge to the Rotorua-nui-a-Kahumatamomoe as a matter of principle. This loss of mana could be described as a belittling of Rangātiratanga (authority of chiefs) by perpetuating an unacceptable activity.*
		Objective 15	Water, land, coastal and geothermal resource management decisions have regard to iwi and hapu resource management planning documents.	
		Policy IW 4B	Ensure iwi and hapū resource management plans are taken into account in resource management decision making processes.	
		Policy IW 6B	Encourage tāngata whenua to recommend appropriate measures to avoid, remedy or mitigate adverse environmental effects on cultural values, resources or sites, from the use and development activities as part of consultation for resource consent applications and in their own resource management plans.	
		Objective 17	The mauri of water, land, air and geothermal resources is safeguarded sustained or improved and where it is degraded, where appropriate, it is enhanced over time.	
		Policy IW 2B	Proposals which may affect the relationship of Māori and their culture and traditions must: Recognise and provide for: (a) Traditional Maori uses and practices relating to natural and physical resources such as mahinga mataitai, waahi tapu, papakainga and taonga raranga; (b) The role of tāngata whenua as kaitiaki of the mauri of their resources; (c) The mana whenua relationship of tāngata whenua with, and their role as kaitiaki of, the mauri of natural resources; (d) Sites of cultural significance identified in iwi and hapu resource management plans; and (e) Recognise that only tāngata whenua can identify and evidentially substantiate their relationship and that of their culture and traditions with their ancestral lands, water, sites, waahi tapu and other taonga.	
		Policy IW 5B	When considering proposals that may adversely affect any matter of significance to Māori recognise and provide for avoiding, remedying or mitigating adverse effects on: (a) The exercise of kaitiakitanga;	

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			(b) Mauri, particularly in relation to fresh, geothermal and coastal waters, land and air; (c) Mahinga kai and areas of natural resources used for customary purposes; (d) Places sites and areas with significant spiritual or cultural historic heritage value to tāngata whenua; and (e) Existing and zoned marae or papakāinga land	*• A loss of mana resulting from the discharge of a wastewater regardless of the quality of treatment to an ancestral icon, Rotorua-nui-a-Kahumatamomoe. The lake is synonymous with Te Arawa ancestors. The association of the lake with wastewater is perceived as an offense.* *• Effects on the relationship between local resident hapu members and the lake expressed through the activities of fishing and harvesting, cooking and healing. The association of wastewater and the lake as a food basket is anathema to having a kitchen in the toilet/bathroom. This affects the perception of Te Arawa whanau, in particular local resident hapu members to discontinue harvesting of kai and cooking in the lake in proximity to the discharge area (Puarenga). This effect does not extend to the abundance of kai or the quality of the kaimoana.* Further, there are also some negative effects of a low to moderate nature that are likely. These include: *• Effects on the natural character of the Puarenga environment. The introduction of some 20 Million litres of treated wastewater a day represents a significant change to the natural environment.*
		Objective 21	Recognition of and provision for the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga.	
	RNRP	KT O1 (Objective 1)	The principles of the Treaty of Waitangi (Te Tiriti o Waitangi) are recognised and taken into account in the management of water, land and geothermal resources.	
		KT O3 (Objective 3)	Consultation with tāngata whenua that recognises their societal structures, practices, protocols, and procedures, and status under the Act.	
		KT O4 (Objective 4)	The water, land and geothermal concerns of tāngata whenua are taken into account and addressed as part of resource management processes, while recognising that different iwi and hapu may have different concerns or practices.	
		KT O5 (Objective 5)	Water, land and geothermal resource management decisions have regard to iwi resource management planning documents.	
		KT O6 (Objective 6)	Maintain the biological and physical aspects of the mauri of water, land and geothermal resources; and where practicable achieve the ongoing improvement of the biological and physical aspects of the mauri where it has been degraded, as it relates to: (a) Water quality meeting the specified water quality classifications. (b) Water flows not breaching the instream minimum flow requirements. (c) The life-supporting capacity of soils are sustained.	
		KT O7 (Objective 7)	The extent of the spiritual, cultural and historical values of water, land and geothermal resources (including waahi tapu, taonga and sites of traditional activities) to tāngata whenua are identified.	
		KT P5 (Policy 5)	To ensure that resource management issues of concern to tāngata whenua are taken into account and addressed, where these concerns are relevant and within the functions of the Regional Council	

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		KT P9 (Policy 9)	To have particular regard to kaitiakitanga, including customary use and management practices relating to water, land and geothermal resources, including mahinga kai whenua and mahinga kai awa. waahi tapu and taonga raranga, in accordance with tikanga Maori, and the mana and responsibilities of Nga Tangata Pukenga, where this is consistent with the Act.	The April 2018 CIA also concludes that the proposal to discharge treated wastewater to Lake Rotorua will have some significant positive effects. These are deemed to be: • *Positive effects on the mauri of the treated wastewater. This will involve the spiritual cleansing of the treated wastewater as it passes through the various experiences and contexts within the land contact bed and be in a state of 'mauri tau'.* • *Positive effects on water quality at the point of discharge, Puarenga Bay. The water and environment is toxic to most aquatic life and hazardous to humans. The water being discharged is a higher quality than the receiving environment.* • *Positive effects on the quality of the amenity of the local area. The contact bed and the discharge point will be a high quality landscaped area that will improve public access, education and visual attractiveness.* • *Positive effects on the Whakarewarewa Forest through reductions in water inundation and nutrient saturation resulting in improved growth of trees. This will provide increased economic returns to Māori landowners.* • *Positive effects on the mana of Te Puarenga Stream, through the cessation of discharge to the tributaries of the Puarenga.*
		KT P11 (Policy 11)	To recognise and provide for the mauri of water, land and geothermal resources when assessing resource consent applications.	
		KT P13 (Policy 13)	To advise and encourage resource consent applicants to consult directly with tāngata whenua where it is necessary to identify the relationships of Maori and their culture and traditions with their ancestral lands, waters, sites, waahi tapu and other taonga, and the actual and potential adverse effects of proposed activities on that relationship.	
		KT P14 (Policy 14)	To consult tāngata whenua on water, land and geothermal resource management issues according to the requirements of the Act, tikanga Maori methods of consultation, and in a manner consistent with case law.	
		KT P15 (Policy 15)	To consult all appropriate tāngata whenua holding mana whenua in circumstances where rohe (tribal boundaries), or areas of ancestral or historic interest overlap.	
		KT P17 (Policy 17)	To: (a) Take into account iwi resource management planning documents, when preparing or changing a regional plan, where such documents exist. (b) Have regard to iwi resource management planning documents when considering resource consent applications, where such documents exist.	

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				Of importance, the April 2018 CIA notes that: *The mixing of water is often viewed by Māori as offensive and affecting the mauri (life-force) of a water body. Examples given are where there is a visual and material effect to the mixing, such as changing of colour, effects on special fauna, and changes in physical character of the water body. The mixing needs to have a practical and material effect. It is understood that the quality of the water will be higher than the receiving environment.* *The land contact bed has incorporated Mātauranga and Matapono Māori in its concept. There may be positive effects on the mauri of the treated wastewater. This will involve the spiritual cleansing of the treated wastewater as it passes through the various experiences and contexts within the land contact bed. The state of the water following the land contact bed will be 'mauri tau', still, calm and tranquil.* Both CIAs included a number of recommendations which have been incorporated into the suite of volunteered

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				consent conditions in Section 14 and Appendix K of this AEE. Iwi and Hapu management plans have been considered in Section 3.5 and Appendix A of the April 2017 CIA and in section 12.2.5.1 of this AEE. With regard to the discussion above, it is considered that the Preferred Scheme is not inconsistent with the identified objectives and policies.
		KT 18 (Policy 18)	To avoid, remedy or mitigate adverse effects on water. land and geothermal resources or sites of spiritual, cultural or historical significance to tāngata whenua, where these resources and sites have been identified by tāngata whenua.	In terms of the Sulphur Flats and the District Plan consents sought, a thorough assessment of alternatives has been undertaken in this AEE to ensure that treated wastewater does not reach the Puarenga Stream in recognition of the significance placed by local tangata whenua on the Puarenga Stream. Extensive hydraulic modelling (refer to Support Document No. 7) has been undertaken to identify the capacity of Te Arikiroa Thermal Channel and to understand how the discharge will behave with the varying lake levels during different events. The modelling confirms that, under all circumstances, the treated wastewater will not enter the Puarenga Stream with the construction of five small bunds. The Sulphur Flat area will be flooded in the high lake level scenario; however, this currently occurs without the discharge. It is noted in the April 2018 CIA that the overall assessment of cultural effects of this proposal do not sit nicely on one side or the

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				other. The proposal cannot be neatly described as having effects less than minor or having significant adverse effects. That would be simplistic and convenient. The proposal exhibits a number of positive and negative cultural effects. The assessment contained in the CIAs has endeavoured to articulate accurately the concerns of tangata whenua and provide an assessment of the cultural effects within the context of the RMA. It is considered that that the Preferred Scheme is not entirely consistent with these provisions.
		KT 19 (Policy 19)	To encourage tāngata whenua to recommend appropriate measures to avoid, remedy or mitigate the adverse environmental effects of the use and development of water, land and geothermal resources.	As discussed above the cultural values have been assessed and a number of mitigation measures have been recommended through the two CIAs and these have been included in the volunteered suite of conditions in Appendix K. It is considered that the Preferred Scheme is not consistent with these policies.
		KT 20 (Policy 20)	To assess effects of proposed development activities on the cultural and historic values and sites of water, land and geothermal resources in consultation with tāngata whenua.	
	RDP	Objective 3.3.1	Sites of importance to tāngata whenua are protected so that their cultural values are maintained and not adversely affected by new activities.	In terms of the Sulphur Flats and the District Plan consents sought, a thorough assessment of alternatives has been undertaken in this AEE to ensure that treated wastewater does not reach the Puarenga Stream in recognition of the significance placed by local tangata whenua on the Puarenga Stream. Extensive hydraulic modelling (refer to Support Document No. 7) has been undertaken to identify the capacity of Te Arikiroa Thermal Channel and to understand how the discharge will interact with the
		Policy 3.3.1.1	Avoid activities that will adversely affect the spiritual and cultural heritage values of sites of importance to tāngata whenua.	
		Policy 3.3.1.2	Enable activities on sites of importance to tāngata whenua that do not adversely affect the spiritual or cultural values of the site.	

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				varying lake levels during different events. The modelling confirms in all scenarios that the treated wastewater will not enter the Puarenga Stream with the construction of five small bunds. The Sulphur Flat area will be flooded in the high lake level scenario; however, this currently occurs without the discharge. It is noted in the April 2018 CIA (Companion Document No. 2) that the overall assessment of cultural effects of this proposal do not sit nicely on one side or the other. The proposal cannot be neatly described as having effects less than minor or having significant adverse effects. That would be simplistic and convenient. The proposal exhibits a number of positive and negative cultural effects. The assessment contained in the CIAs has endeavoured to articulate accurately the concerns of tangata whenua and provide an assessment of the cultural effects within the context of the Resource Management 1991. It is considered that that the Preferred Scheme is not consistent with these provisions.
		Policy 3.3.1.3	Encourage consultation with tāngata whenua where applications may affect identified and unidentified sites of spiritual and cultural significance of the land, water, wāahi tapu and tāonga.	As discussed above, extensive consultation has been undertaken with tāngata whenua. It is considered that the Preferred Scheme is consistent with this policy.
		Policy 3.3.1.4	Manage effects of subdivision, use and development on those lands, water, wāahi tapu, tāonga and other areas of importance to tāngata whenua.	As discussed, a number of mitigations measures have been suggested in the two CIAs (Companion Documents No.1 and 2) to manage the effects on areas of importance to tāngata whenua.

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				It is considered that the Preferred Scheme is consistent with this Policy.
		Objective 3.3.2	Resource management decisions that give appropriate weighting to the relationship of tāngata whenua with water, the lakes, rivers, and streams of the district.	As discussed above. It is considered that the Preferred Scheme will achieve this Objective.
		Policy 3.3.2.1	Recognise the Te Arawa Lakes Trust as a partner in the management of the effects of activities on the district's water bodies, through requiring affected party approval, particularly in relation to the activities that may affect the beds of the lakes that the Trust is the owner of.	Te Arawa Lakes Trust has been involved throughout the process in arriving at the Preferred Scheme. It is considered that the Preferred Scheme is consistent with the identified policies.
		Policy 3.3.2.2	Recognise the Te Arawa River Iwi Trust, Ngāti Tūwharetoa and Raukawa Settlement Trust as partners in the management of the effects of activities on the Waikato River and its catchment.	
		Policy 3.3.2.3	Consider Iwi and Hapu management plans, or memoranda of understanding between Iwi and the council (available on the Council's website) when making decisions on resource consents and plan changes.	Iwi and Hapu management plans have been considered in section 12.2.5.1 of this AEE. It is considered that the Preferred Scheme is consistent with this Policy.

Table I-4: Te Arikiroa Thermal Channel Disturbance and Bund Construction

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Structures in, on, under or on the beds of stream, rivers and lakes and bed disturbance of Te Arikiroa Thermal Channel	RPS	Policy WL 7B:	Achieve regional consistency by controlling land and soil disturbance activities to: (a) Avoid accelerated erosion and soil loss; and (b) Minimise silt and sediment runoff into water, or onto or into land that may enter water, so that healthy aquatic ecosystems are sustained.	As set out in the Construction Methodology (included in Support Document No. 7) for the widening and minor deepening of Te Arikiroa Thermal Channel and the construction of five small bunds, approximately 660 m^3 of earthworks is required for all the works. The Construction Methodology states that sediment control measures should be installed across the thermal channel at a practical distance downstream of the excavator to minimise the effects of the bed disturbance.
	RNRP	BW O1 (Objective 55)	Aquatic ecosystems, aquatic habitats of indigenous species, spawning areas and migratory pathways of fish, and significant aquatic vegetation are maintained and enhanced.	
		BW O4 (Objective 58)	Activities in, on, under or over the beds of streams, rivers and lakes: (a) Do not significantly impede the flow of flood waters, except where the activity is necessary for flood control purposes.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			(b) Provide for water flow and volume requirements in downstream areas, including authorised water abstractions and non-consumptive uses. (c) Avoid, remedy or mitigate adverse effects on natural hydrological processes of the stream, river or lake, or downstream areas. (d) Do not lead to accelerated erosion of the beds and banks of streams, rivers and lakes. (e) Maintain existing public access to and along the margins of rivers and lakes, where appropriate. (f) Avoid or mitigate the contamination of water by sediment. (g) Avoid adverse effects on areas of significant natural character. (h) Avoid, remedy or mitigate adverse effects on ecological values.	Sediment and erosion control measures are also a requirement of the Construction and Environmental Management Plan condition set out in the volunteered consent conditions in Appendix K. The purpose of the bunds is to prevent flow from Te Arikiroa Thermal Channel entering the Puarenga Stream. The bunds will be designed by a suitably qualified and experienced engineer. Public access to the Sulphur Flats will not be impacted by the widening and minor deepening of Te Arikiroa Thermal Channel or construction of the five small bunds. The Construction Methodology states that Te Ara Ahi trail may need to be temporarily closed for short periods to allow construction vehicles to access the Sulphur Flats. In terms of aquatic ecosystems in Te Arikiroa Thermal Channel, Section 7.3.3.5 of this AEE states that tāonga species (fish, kōura and kākahi) are expected to be currently absent Te Arikiroa Thermal Channel. The large geothermal-influence is assessed to eliminate the potential for tāonga species to colonise the channel. Accordingly, there is assessed to be no effect of the proposed wastewater discharge on these taxa in Te Arikiroa Thermal Channel. In terms of natural character, it is noted that this has not been assessed for the Rotorua District Plan however Sulphur Bay, the Geothermal terraces and associated geothermal vegetation are considered to
		BW O5 (Objective 59)	Structures in, on, under or over the beds of streams, rivers and lakes are: (a) Designed to commonly accepted design standards (including flood design standards) in relation to the use and location of the structure. (b) Constructed to a standard to withstand flood events. (c) Designed and used to account for natural lake level fluctuations.	
		BW P1 (Policy 98)	To require activities in the beds of rivers, streams and lakes to be undertaken in a comprehensive and integrated manner that recognises and provides for the water quality, water quantity (including flood hazards), soil conservation, aquatic ecosystem issues in the water body, and areas of significant natural character.	
		BW P2 (Policy 99)	All new activities in the beds of streams, rivers and lakes, reconstruction of existing structures, re-planting of plants, and existing activities upon renewal of consents, are required to comply with the following…	
		BW P3 (Policy 100)	To avoid, remedy or mitigate adverse effects on aquatic ecosystems, the aquatic habitats of indigenous fauna, important trout habitats, and fish migration. This is to be achieved by designing, planning, constructing or undertaking, and maintaining activities to: (a) Avoid undertaking significant instream bed disturbance activities at spawning sites during relevant spawning periods of fish species present in the water body.	

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			(b) Avoid, remedy or mitigate the adverse effects of instream works on: i. The aquatic habitats of indigenous aquatic fauna and flora, including spawning sites. ii. The important aquatic habitats of trout, including spawning sites. (c) Provide for fish passage for migration, recruitment, and habitat range in areas where there are no natural barriers to fish passage. Where fish passage is necessary it is not to be impeded by new structures, or beyond the duration of any instream works. Manual transference will be considered to be the provision of fish passage for existing structures. (d) Remediate aquatic habitat characteristics at the activity site that have been degraded by the activity, except where restoration or enhancement of aquatic habitats at other locations is more appropriate.	have very high to outstanding natural character. It is considered that the Preferred Scheme will achieve these objectives and is consistent with these policies with the exception of BW O4(g). As stated in Section 7 of this AEE, adverse effects on the significant natural character cannot practicably be avoided but will be minimised to the extent achievable. The Preferred Scheme is inconsistent with this particular of policy.
		BW P4 (Policy 101)	New structures in, on, under or over the beds of rivers, streams and lakes, and the reconstruction of existing structures, are to be designed, constructed and maintained to comply with the requirements of BW P2 and BW P3, and the following environmental standards: (a) Designed to flood design standards that are appropriate to the Bay of Plenty region (refer to BW M6), and to the site of the structure. This does not apply to flood control structures (refer to WQ R15 and BW R1). (b) Designed, constructed and maintained to appropriate standards to: i. Withstand flood events. ii. Ensure the integrity of the structure is maintained for its specified use. (c) Located, designed, constructed and used a manner that accounts for the effect of natural lake water level fluctuations. For the purpose of this regional plan, gabion baskets and rock riprap are considered to be structures.	
		LM O3 (Objective 19)	Protect vulnerable areas from erosion.	

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Table I-5: Air Quality

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Avoidance, remediation and mitigation of adverse effects of discharges to air	RPS	Objective 1	The adverse effects of odours, chemical emissions and particulates are avoided, remedied or mitigated so as to protect people and the environment.	Section 7.6 of this AEE concludes that there are unlikely to be any odour nuisance effects at any sensitive receptor locations providing that odour mitigation measures are implemented at the WWTP. As outlined in Section 14 and Appendix K of this AEE, the RLC proposes to develop and implement an Odour Management Plan as a volunteered condition of consent. It is therefore considered that the RLC will maintain existing amenity values and can effectively avoid, remedy or mitigate the adverse effects of discharges to air. It is considered that the Preferred Scheme will achieve the identified objectives and is consistent with the identified policies.
		Policy AQ 2A	Protect people's health and the amenity values of neighbouring areas from discharges of offensive and objectionable odours, chemical emissions and particulates.	
	RAQP	Objective 2	Avoid, remedy or mitigate the adverse effects of all discharges of contaminants into air on the environment which includes the effects on: ecosystems, human health and safety, crops and livestock, amenity values, cultural values, the mauri of natural and physical resources and the global environment.	
		Policy 6	Disposal and storage of waste should be undertaken in a manner that avoids, remedies or mitigates adverse effects on air quality.	
	RNRP (PC13)	Objective AQ O3	Local air quality — Te pai o te hau o te rohe Manage discharges of contaminants to air according to their adverse effects on human health, cultural values, amenity values and the environment.	The BOPRC notified Plan Change 13 to the RNRP on 27 February 2018 and submissions closed on 18 April 2018. The summary of decisions requested has been notified and further submissions are being called for until 31 July 2018. Given that Plan Change 13 has not proceeded to a hearing at this stage, more weight has been given to the provisions of the Operative RAQP. The assessment contained in Section 7.6 of this AEE concludes that there are unlikely to be any odour nuisance effects at any sensitive receptor locations,
		Policy AQ P3	Management of discharges — Te whakahaere i ngā tukunga Activities that discharge contaminants to air must be managed, including by use of the best practicable option, to: (a) safeguard the life supporting capacity of the air, avoid adverse effects on human health, and manage adverse effects on cultural values, amenity values, and the environment (b) avoid the discharge of contaminants at a rate or volume that may contribute to, or cause an exceedance or breach of the ambient air quality standards of the NESAQ or exceed the health-based values of the AAQGs (c) avoid reduction in visibility where it may cause adverse effects on vehicle, aircraft, or ship safety	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			(d) avoid the discharge of contaminants that may cause adverse effects on regionally significant infrastructure (e) minimise the discharge of contaminants into areas beyond the boundary of the subject property where it may cause adverse effects on human health, cultural values, amenity values, or the environment.	providing that odour mitigation measures are implemented at the WWTP. As outlined in Section 14 and Appendix K of this AEE, the RLC propose to develop and implement an Odour Management Plan as a volunteered condition of consent. It is therefore considered that the RLC will maintain existing amenity values and can effectively avoid, remedy or mitigate the adverse effects of discharges to air. It is considered that the Preferred Scheme will achieve the identified Objective and is consistent with the identified policies.
		Policy AQ P4	Matters to consider — Ngā take hei whiriwhiri When considering the acceptability of any discharge of contaminants to air, regional plan users must have particular regard to the following matters: (a) The proximity of sensitive activities to the discharge. (b) The location of any Gazetted airsheds, or areas where the discharge may cause an exceedance or breach of the ambient air quality standards of the NESAQ or exceed the health-based values of the AAQGs. (c) Adverse effects on air quality values identified in the relevant iwi and hapū resource management plans. (d) The effect of the prevailing weather conditions, including rainfall, wind speed and wind direction. (e) The effect of the discharge on human health, cultural values, amenity values, the environment, and regionally significant infrastructure. (f) Cumulative effects. (g) The effect of new activities discharging contaminants into air near established sensitive activities.	

Table I-6: Significant Indigenous Biodiversity andSignificant Natural Areas

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Protect, maintain or enhance the full range of ecosystem types, significant indigenous	RPS	Objective 20	The protection of significant indigenous habitats and ecosystems, having particular regard to their maintenance, restoration and rehabilitation of natural communities and habitats of significant indigenous flora, fauna and ecosystems, and intrinsic values.	As set out in Section 6 of this AEE the RLC has prepared an Ecological Management Plan that will guide the restoration and enhancement of approximately 70 hectares of the Sanatorium Reserve. This is separate from these applications for resource consents however it shows the
		Policy MN 4B:	Encouraging ecological restoration Encourage ecological restoration and rehabilitation through:	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
vegetation and the significant habitats of indigenous fauna and those areas identified as Significant Natural Areas			(a) Retention or establishment of vegetation corridors linking otherwise isolated habitats and greater use of buffer zones; (b) A co-ordinated and co-operative approach; (c) The protection of remaining habitats from further fragmentation, degradation and invasion by pests; (d) Non-regulatory initiatives for the restoration or rehabilitation of degraded habitats; and (e) The protection of ecosystems and habitats identified by the National Priorities for Biodiversity Protection on Private Land (Ministry for the Environment 2006).	commitment of the RLC in terms of restoring the Sanatorium Reserve which includes Te Arikiroa Thermal Channel and the Sulphur Flats. Further, planting of geothermal indigenous species has been put forward in the suite of volunteered consent conditions in Appendix K. It is considered that the Preferred Scheme will achieve the outcome of this Objective and is consistent with these policies.
		Policy MN 8B	Managing effects of subdivision, use and development Avoid and, where avoidance is not practicable, remedy or mitigate any adverse effects of subdivision, use and development on matters of national importance assessed in accordance with Policy MN 1B as warranting protection under section 6 of the Act.	In terms of the works in Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream it is considered that these works will have significant adverse ecological effects which are unavoidable in terms of the required vegetation clearance and effects on the habitat. The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on the Significant Natural Area. Planting of indigenous geothermal specific species is proposed to remedy the effects of the Preferred Scheme as set out in the volunteered conditions in Appendix K of the AEE, on top of the work the RLC are already undertaking the restore the Sanatorium Reserve. It is therefore considered that the Preferred Scheme is not consistent with this Policy.

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
	RDP	Objective 1.3.11	Maintain or enhance indigenous biodiversity and the continued functioning of ecological processes	In terms of the works in Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream it is considered that these works will have significant adverse ecological effects which are unavoidable in terms of the required vegetation clearance and effects on the habitat. A thorough assessment of alternatives has been undertaken in Section 9 of this AEE. Through this process the extent of works and size of the bunds have been reduced considerably to minimise the amount of vegetation required within the Significant Natural Area. The hydraulic modelling shows that bunding is required in order to prevent treated wastewater flowing across to the Puarenga Stream which is culturally unacceptable. The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on the Significant Natural Area. Planting of indigenous geothermal specific is proposed to remedy the effects of the Preferred Scheme as set out in the volunteered conditions in Appendix K of the AEE, on top of the work the RLC are already undertaking the restore the Sanatorium Reserve. It is therefore considered that the Preferred Scheme is not consistent with this Objective and Policy
		Policy 1.3.11.1	Manage activities that have the potential to adversely affect indigenous biodiversity and the continued functioning of ecological processes, with a particular focus on activities that affect the following: (a) The cumulative loss or degradation of indigenous habitats and ecosystems; (b) Fragmentation and isolation of indigenous habitats and ecosystems; (c) Extent and quality of indigenous habitats and ecosystems; (d) Corridors or connections linking indigenous habitats and ecosystems; (e) Ecological sequences; (f) Migratory pathways; (g) Water quality for the purpose of maintaining indigenous biodiversity and ecosystems; (h) Buffering of indigenous habitats and ecosystems; (i) Ecosystem services; (j) Animal and plant pests; or Noise, visual and physical disturbance on indigenous habitats and ecosystems.	
		Policy 1.3.11.2	Promote positive indigenous biodiversity outcomes, including through:	As set out in Section 6 of this AEE the RLC has prepared an Ecological Management Plan that will guide the

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			(a) working towards achieving no net loss of indigenous biodiversity at a regional scale; (b) encouraging enhancement, restoration and re-vegetation of habitats and connectivity between habitats; (c) maintaining those areas/ecosystems that support (including through buffering and/or linking) habitats and areas identified as significant natural areas; (d) providing for ecosystem services; (e) restoring and protecting the health and wellbeing of the Waikato River and its catchment; (f) the contribution to natural character and amenity values; (g) tangata whenua relationships with indigenous biodiversity including their holistic view of ecosystems and the environment; (h) managing the density, range and viability of indigenous flora and fauna; and the consideration and application of biodiversity offsets, where significant residual adverse effects are unable to be avoided, remedied or mitigated.	restoration and enhancement of approximately 70 hectares of the Sanatorium Reserve. This is separate from these applications for resource consents however shows the commitment from the RLC in terms of restoring the Sanatorium Reserve which includes Te Arikiroa Thermal Channel and the Sulphur Flats. Further, planting of geothermal indigenous species has been put forward in the suite of volunteered consent conditions in Appendix K. It is noted however that the planting proposed will not achieve a 'no net loss' of indigenous biodiversity. It is considered that the Preferred Scheme is not consistent with this Policy.
		Policy 1.3.11.3	Provide for activities that have a minor adverse effect on the maintenance of indigenous biodiversity (excluding SNAs), including: (a) the maintenance and operation of lawfully established infrastructure and utilities; (b) the continuation of existing lawfully established uses of land where the effects of such land use remain the same or similar in character, intensity, and scale; (c) activities undertaken for the purpose of maintenance or enhancement of indigenous biodiversity; (d) the collection of material for maintaining traditional Maori cultural practices; and actions necessary to avoid loss of life, injury or serious damage to property.	The majority of vegetation removal is within a Significant Natural Area and adverse effects have been assessed to be significant. Therefore, it is considered that this Policy is not relevant.
		Objective 2.3.5	A network of healthy functioning areas of significant indigenous vegetation and significant habitats of indigenous fauna with a high degree of ecological integrity, intactness, interconnectivity, and cohesiveness.	As discussed previously the RLC has prepared an Ecological Management Plan that will guide the restoration and enhancement of approximately 70 hectares of the Sanatorium Reserve

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				which is separate to these applications for resource consents. Further, planting of geothermal indigenous species has been put forward in the suite of volunteered consent conditions in Appendix K. The Ecological Management Plan and proposed planting will contribute to a network of healthy functioning areas of significant indigenous vegetation and significant habitats of indigenous fauna with a high degree of ecological integrity, intactness, interconnectivity, and cohesiveness. It is considered that the Preferred Scheme will achieve the outcome of this Objective.
		Policy 2.3.5.1	Avoid, remedy or mitigate, the adverse effects of subdivision, use and development in areas of significant indigenous vegetation or habitat where the criteria in Section 11A of the Waikato Regional Policy Statement or Appendix F of the Bay of Plenty Regional Policy Statement are triggered by ensuring that (a) The clearance of indigenous vegetation or ground disturbance for any activity does not reduce the ecological sustainability or values and characteristics of the Significant Natural Area; and (b) Any loss of indigenous vegetation or habitat that cannot be avoided is remedied or mitigated to achieve no net loss of biodiversity. (c) The health and functioning of Significant Natural Area is maintained through building and development setbacks where appropriate. (d) Activities that enhance or restore buffers around Significant Natural Areas and ecological connections and corridors between Significant Natural Areas are encouraged. (e) All practical options for locating the activity outside of the Significant Natural Areas have been considered.	In terms of the works in Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream it is considered that these works will have significant adverse ecological effects which are unavoidable in terms of the required vegetation clearance. The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on the Significant Natural Area. Planting of indigenous geothermal specific species is proposed to remedy the effects of the Preferred Scheme as set out in the volunteered conditions in Appendix K of the AEE, on top of the work the RLC are already undertaking the restore the Sanatorium Reserve.

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			The Māori, historical and community association with the Significant Natural Area is maintained.	It is therefore considered that the Preferred Scheme is not consistent with this Policy.
		Policy 2.3.5.2	Support the integrity of Significant Natural Areas and habitat of indigenous fauna by maintaining or enhancing indigenous vegetation and biodiversity where this enables the establishment and maintenance of ecological corridors and provision of buffers around Significant Natural Areas.	As discussed previously the RLC has prepared an Ecological Management Plan that will guide the restoration and enhancement of approximately 70 hectares of the reserve which is separate to these applications for resource consents. Further, planting of geothermal indigenous species has been put forward in the suite of volunteered consent conditions in Appendix K. It is noted that this Preferred Scheme will not maintain or enhance the ingenious vegetation and therefore it is considered that the Preferred Scheme is not consistent with this Policy.
		Policy 2.3.5.3	Provide for the reasonable use and enjoyment of land within Significant Natural Areas through: (a) the maintenance and operation of lawfully established infrastructure and utilities (b) the continuation of existing lawfully established land uses of where the effects of such land use remain the same or similar in character, intensity and scale (c) activities undertaken for the purpose of maintenance or enhancement of indigenous biodiversity (d) the collection of material for maintaining traditional Māori cultural practises; and actions necessary to avoid loss of life, injury or serious damage to property.	The Preferred Scheme will not impact on the reasonable use and enjoyment of land within the Significant Natural Area. As discussed previously the RLC has prepared an Ecological Management Plan that will guide the restoration and enhancement of approximately 70 hectares of the reserve which is separate to these applications for resource consents. Further, planting of geothermal indigenous species has been put forward in the suite of volunteered consent conditions in Appendix K. It is considered that the Preferred Scheme is consistent with this Policy.

Table I-7: Natural Character, Outstanding Natural Features, Landscape and Amenity

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
The natural character values of rivers, wetlands and their riparian margins are preserved and enhanced (including Outstanding Natural Features and amenity values).	RPS	Objective 18	The protection of historic heritage and outstanding natural features and landscapes from inappropriate subdivision, use and development.	It is considered that this Objective and Policy is directed at territorial authorities to protect natural and physical resources which warrant protection for as matters of national importance including Outstanding Natural Features. It is considered that this Objective and Policy is not relevant to the Preferred Scheme.
		Policy MN 1B	Recognise and provide for matters of national importance (a) Identify which natural and physical resources warrant recognition and provision for as matters of national importance under section 6 of the Act using criteria consistent with those contained in Appendix F of this Statement; (b) Recognise and provide for the protection from inappropriate subdivision, use and development of those areas, places, features or values identified in accordance with (a) in terms of natural character, outstanding natural features and landscapes, and historic heritage; (c) Recognise and provide for the protection of areas of significant indigenous vegetation and habitats of indigenous fauna identified in accordance with (a); (d) Recognise and provide for enhancing and maintaining public access to and along those areas identified in accordance with (a); (e) Recognise and provide for the relationship of Māori and their culture and traditions identified in accordance with (a) and Policy IW 2B; and (f) (f) Recognise and provide for protection to recognised customary activities	
		Objective 19	The preservation of the natural character of the region's coastal environment (including coastal marine areas) wetlands, lakes and rivers and their margins	In terms of the works in Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream it is considered that these works will have significant adverse effects on the natural character of the Sulphur Bay. A thorough assessment of alternatives has been undertaken in Section 9 of this AEE. Through this process the extent of works and size of the bunds have been reduced considerably to minimise the
		Policy MN 8B	Managing effects of subdivision, use and development Avoid and, where avoidance is not practicable, remedy or mitigate any adverse effects of subdivision, use and development on matters of national importance assessed in accordance with Policy MN 1B as warranting protection under section 6 of the Act.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
				impact on natural character. Currently the hydraulic modelling shows that bunding is required in order to prevent treated wastewater flowing across to the Puarenga Stream which is culturally unacceptable. The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on natural character of the Sulphur Flat and Te Arikiroa Thermal Channel Whilst regard has been had for these provisions, it is considered that the Preferred Scheme is not consistent with this Objective and Policy
	RNRP	LM O2 Objective 17	Riparian margins are appropriately managed to protect and enhance their soil conservation, water quality and heritage values.	As discussed above, works are required to the construct five small bunds adjacent to the Puarenga Stream. These will be in the riparian margin. A Construction and Environmental Management Plan is required by the volunteered consent conditions in Appendix K. It is considered that this management plan will appropriately manage the effects from the works in the riparian margin and will achieve the outcome of this Objective.
	RDP	Objective 2.3.1	The natural character of the district's lakes, rivers, streams, wetlands and their margins is protected from inappropriate subdivision, use and development.	As set out in the assessment of alternatives, consideration has been given to the size of the required bunds and these have been reduced and relocated so that effects on natural character are minimised whilst still ensuring the objective of preventing treated wastewater reaching the Puarenga Stream is achieved.
		Policy 2.3.1.1	Ensure the design, location and form of subdivision, use and development adjacent to waterbodies (outside of the Lakes A zone) is appropriate to the level of natural character of the area and avoids, remedies or mitigates potential adverse effects on the natural character of lakes, rivers and streams and their margins.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
				The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on natural character of Te Arikiroa Thermal Channel. Whilst regard has been had for these provisions, it is therefore considered that the Preferred Scheme is not consistent with this Objective and Policy
		Objective 2.3.2	Management of riparian margins and waterbodies to protect natural conservation values, aquatic habitats, and improve water quality.	As part of the suite of volunteered conditions in Appendix K, planting of indigenous geothermal species is required. This is in addition to the work being undertaken by the RLC in restoring the Sanatorium Reserve and removing weed species. It is considered that the Preferred Scheme will achieve the outcome of this Objective.
		Policy 2.3.2.1	Avoid, remedy or mitigate adverse effects of subdivision use and development on riparian margins and water bodies to maintain or enhance natural character, ecological functions, biodiversity, water quality, and aquatic habitats.	Water quality and ecological and aquatic habitat matters are addressed in Tables I-2 and I-5 above. The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on natural character of riparian margins or Te Arikiroa Thermal Channel. Whilst regard has been had for these provisions, it is considered that the Preferred Scheme is not consistent with this Policy.
		Objective 2.3.3	A strategic esplanade network adjoining Lake Rotorua and other lakes, rivers and streams for the purpose of public access, recreation and conservation.	As discussed in Section 4.4.3 of this AEE, the Preferred Scheme includes the conversion of the existing ponds into a

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
		Policy 2.3.3.1	Require esplanade reserves or esplanade strips where appropriate on sites that adjoin lakes, rivers, or streams of the district including those on Planning Map 203 to provide a connected esplanade network.	land contact bed, with a discharge structure and associated earth bunds to prevent an overflow discharge to Puarenga Stream. The contact beds and the discharge structure will be a high quality landscaped area that will improve public access, education and visual attractiveness. Public access to the Sulphur Flats, including Te Ara Ahi trail will not be impacted by the modifications of Te Arikiroa Thermal Channel and the five small bunds adjacent to the Puarenga Stream. The RLC are also carrying out restoration work to the Sanatorium Reserve to improve public access, recreation values and conservation of the Reserve. It is considered that the Preferred Scheme will achieve this Objective and is consistent with this Policy.
		Objective 2.3.4	Outstanding Natural Features and Landscapes that are managed and protected from the adverse effects, including cumulative effects, of inappropriate subdivision, use, and development.	As discussed in Section 7 of this AEE, in terms of the works in Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream, it is considered that these works will have significant adverse effects on the Outstanding Natural Feature being Lake Rotorua and amenity values. A thorough assessment of alternatives has been undertaken in Section 9 of this AEE. Through this process the extent of works and size of the bunds have been
		Policy 2.3.4.1	Avoid, remedy or mitigate adverse effects, including cumulative effects, of subdivision, use and development where the following landscape qualities and characteristics of Outstanding Natural Features and Landscapes may be impacted: • Natural science factors such as representativeness, diversity, resilience, vulnerability and rarity • Aesthetic values • Shared and recognised values such as historical, scientific or educational values	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
			• Expressiveness, transient values and Māori values	reduced considerably to minimise the impact on the Outstanding Natural Feature and amenity values. Currently the hydraulic modelling shows that bunding is required in order to prevent treated wastewater flowing across to the Puarenga Stream which is culturally unacceptable. The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on the Outstanding Natural Feature and amenity values. It is therefore considered that the Preferred Scheme is not consistent with the identified Objective and identified policies.
		Policy 2.3.4.3	Enable recreational opportunities within areas identified as Outstanding Natural Features and Landscapes where they: • maintain existing amenity values including ambient noise levels consistent with amenity values; • are serviced by appropriate access and facilities to meet the needs of residents and visitors	
		Policy 2.3.4.4	To maintain and enhance the lake catchments as Outstanding Natural Features and Landscapes each with its unique character.	

Table I-8: Natural Hazards

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Land use and development, including discharge activities, shall be managed to reduce any risks to people, property and the environment in relation to natural hazard events such	RNRP	Objective 31	Avoidance or mitigation of natural hazards by managing risk for people's safety and the protection of property and lifeline utilities.	As discussed in Section 9.3 of this AEE, the TAG was established to consider the technical aspects of each of the proposed options. The TAG developed a list of minimum standards to in order to select the Preferred Scheme. One of the minimum standards was engineering resilience, which includes natural hazards and climate change. It is considered that the Preferred Scheme will achieve the identified objectives and is consistent with the identified Policy.
	RDP	Objective 1.3.9	Minimise or reduce the level of risk to life, property and the environment from the subdivision, use and development of land in areas subject to a natural hazard.	
		Policy 1.3.9.1	Require the design and location of activities to avoid or mitigate natural hazards to an acceptable level of risk to life, property and the environment.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
as erosion and flooding				

Table I-9: Public Access

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Protect and enhance public access to rivers and their riparian margins to enable a range of opportunities	RPS	Objective 22	The coastal marine area, lakes and rivers are generally accessible to the public	Through engagement with pūkenga (cultural experts) and following consultation with Lake Rotorua iwi and hapū and stakeholders during June, July, August, September and November 2017, a contact bed concept was developed (refer section 4.8 of this AEE). The concept includes a public walking platform which will improve access to Te Arikiroa Thermal Channel and Sulphur Bay (Lake Rotorua). The April 2018 CIA (Companion Document No.2) considers that the contact beds and discharge point will have positive effects on the quality of the amenity of the local area. Further the CIA states that the contact bed and the discharge point will be a high quality landscaped area that will improve public access, education and visual attractiveness. In terms of works on the Sulphur Flats and widening and deepening of Te Arikiroa Thermal Channel, works will be located away from Te Ara Ahi trail. However, the trail may need to be temporarily closed for short periods in order to move construction materials and vehicles. This is to ensure public safety. It is considered that the Preferred Scheme will achieve the identified
		Policy MN 5B	Retain or establish public access to and along the coast, lakes and rivers, giving priority to public access rights where: (a) Connections between existing public areas can be provided; (b) Improving access would promote outdoor recreation; (c) Physical access for people with disabilities is desirable; (d) The long-term availability of public access is threatened by erosion or sea level rise; (e) Walking access to the coastal marine area, lakes and rivers can be provided; (f) Access to areas or sites of cultural significance is important to tāngata whenua; and (g) Subdivision, use, or development of land adjacent to the coastal marine area, lakes and rivers has reduced public access, or has the potential to do so	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
				Objective and is consistent with the identified Policy.

Table I-10: Contaminated Land

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Prevent or mitigate adverse effects and significant risk from contaminated land on human health and the receiving environment.	RNRP	DW O16 (Objective 38)	The significant adverse effects of existing contaminated land are remedied or mitigated.	The Contamination Assessment Report included in Support Document No. 7 found that there were no exceedances of the relevant NES human health soil contaminant standards (for the 'Parks / recreational' land use category) in any of the soil/sediment samples analysed, indicating that the risk posed to human health from the disturbance of soil and sediment associated with the upgrade of Te Arikiroa Thermal Channel is low. However, the ANZECC ISQG-Low trigger values at all sites were exceeded for a number of heavy metals. Additionally, the ANZECC ISQG-High value for zinc was exceeded at the two sites draining the historic landfill. This indicates that there may be an environmental risk if the excavated soil/sediment material is not appropriately managed. A Site Management Plan (SMP) has been prepared and is included in Support Document No. 7 which sets out management measures for the handling, storage and disposal of excavated soil and sediment material arising from the works.
		DW P22 (Policy 58)	To encourage remediation of contaminated land, where such land poses a significant risk of adverse effects to water, ecosystems, the life-supporting capacity of soil or public health.	
		DW P23 (Policy 59)	To use nationally accepted environmental and health guidelines, standards for soil and water contamination, and standards for discharges from contaminated land, when undertaking contaminated land investigations in order to determine whether a site poses a significant risk of adverse effects.	
	RDP	Objective 16.3.4	Prevent or mitigate adverse effects and significant risk from contaminated land on human health and the receiving environment.	
		Policy 16.3.4.1	Ensure use, subdivision and development of contaminated land is managed or restricted in such a way to prevent or mitigate adverse effects and significant risk on human health and the environment.	
		Policy 16.3.4.2	Ensure contaminated land is managed or remediated or contained or disposed off-site, to prevent or mitigate adverse effects and significant risk from contaminated land on human health and the receiving environment, so that the land is fit for the purpose intended.	
		Policy 16.3.4.3	Ensure potentially contaminated land is identified and investigated, to determine if the piece of land is contaminated, and what level of risk is posed to human health and the receiving environment for the proposed use, subdivision or development.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
				It is considered that the Preferred Scheme will achieve the identified objectives and is consistent with the identified policies.

Table 1-11: Geothermal

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
The protection of geothermal surface features, and the avoidance or mitigation of natural geothermal hazards.	RPS	Objective 8	Holistic and sustainable management of the regional geothermal resource by providing for: (a) protection of some systems with Significant Geothermal Features; (b) enabling use and development of other geothermal systems; in accordance with each system's management purpose as specified in Table 12	An assessment of the significance of the geothermal features on the Sulphur Flats was undertaken by GNS Science. Its Geothermal Assessment Report is included in Support Document No. 7. The assessment concluded that the area has a degree of significance that is just above average. The Geothermal Assessment Report states that the Sulphur Flats would be an area of thermal features that perhaps deserve protecting from significant threats, but not necessarily that require absolute preservation. The Geothermal Assessment Report concludes that some minor thermal features (weakly degassing vents and warm to hot acid sulphate seeps) are located within or adjacent to Te Arikiroa Thermal Channel, but these, on their own are not considered of sufficient significance to be specifically protected. However, measures to minimise adverse effects and enhance their aesthetic appeal would be advisable. It is proposed to keep works within in Te Arikiroa Thermal Channel and on the Sulphur Flat to a minimum. This was
		Objective 9	Development and use of land and non-geothermal water is compatible with protection, development and use of geothermal systems in accordance with each system's classification management purpose	
	RGRP	13.5.1	The protection of geothermal surface features, the restoration of geothermal surface features outflow activity and the avoidance or mitigation of natural geothermal hazards.	
		13.5.2(c)	To avoid, remedy or mitigate natural hazard caused by interference with geothermal activity or geothermal surface features, formal resource consent assessments and tests are to be applied on the effects of development on geothermal surface features present in a development area, with particular regard to the effects of development on geothermal hazard risk.	

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Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
				explored through the assessment of alternatives where the option with the least amount of bunding was selected. Further the silica sinter identified in the Geothermal Assessment Report will be avoided by not excavating below 0.6 m. This potentially avoids the hazard risk of a hydrothermal eruption in the specific area identified in the Geothermal Assessment Report. It is considered that the Preferred Scheme will achieve the identified objectives and is consistent with the identified policies.
	RDP	Objective 2.3.7	Significant Geothermal Features are protected from inappropriate subdivision, use, and development in accordance with the regional geothermal classification system, so that a unique element of Rotorua's environment and identity is available for future generations and tourism.	Not relevant. The geothermal features are not identified in the RDP as significant.
		Policy 2.3.7.2	Avoid, remedy or mitigate in accordance with the regional geothermal classification system, the adverse effects of subdivision, use and development on the qualities and characteristics that contribute to the uniqueness and importance of the Significant Geothermal Features within the Rotorua and Limited/Conditional Development Geothermal Systems as shown on Planning Map 212.	Not relevant. The geothermal features are not identified in the RDP as significant.
		Policy 2.3.7.4	In the Bay of Plenty Region, remedy or mitigate significant adverse effects on Significant Geothermal Features located within Development Geothermal Systems as shown on Planning Map 212	Not relevant. The geothermal features are not identified in the RDP as significant.
		Policy 2.3.7.6	Recognise and provide for tangata whenua as Kaitiaki when assessing land use and subdivision proposals that may impact Significant Geothermal Features.	Not relevant. The geothermal features are not identified in the RDP as significant.

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Table I-12: Reserve Zone

Theme	Planning Instrument	Provision Number/Reference	Provision Text	Comment
Maintain the high amenity, natural, cultural and historical values of reserves and provide for public recreation and access.	RDP	Objective 10.3.1	Maintain the high amenity, natural, cultural and historical values of reserves and provide for public recreation and access, whilst managing the adverse effects of activities, buildings and structures.	In terms of the works in Te Arikiroa Thermal Channel and the construction of five small bunds adjacent to the Puarenga Stream which is within the Sanatorium Reserve it is considered that these works will have significant adverse effects on the natural character of the Sulphur Bay and amenity values. A thorough assessment of alternatives has been undertaken in Section 9 of this AEE. Through this process the extent of works and size of the bunds have been reduced considerably to minimise the impact on natural character. Currently the hydraulic modelling shows that bunding is required in order to prevent treated wastewater flowing across to the Puarenga Stream which is culturally unacceptable. The Preferred Scheme cannot practicably avoid, remedy or mitigate the significant adverse effects on natural character of the Sulphur Flat and Te Arikiroa Thermal Channel. Whilst regard has been had for these provisions, it is considered that the Preferred Scheme is not consistent with these objectives and policies.
		Objective 10.3.5	Recognising the value of lake structures and activities on the surface of the water, whilst the adverse effects are avoided, remedied or mitigated, including cumulative effects on the natural character and functioning of water bodies and their margins, as well as Māori culture and traditions.	
		Policy 10.3 1.1	Manage the adverse effects of buildings, structures and activities on the amenity of the reserve environment and ensure that it is consistent with the purpose for which the land is held or the relevant reserve management plan.	
		Policy 10.3.1.2	Restrict new buildings and structures on conservation reserves within 25 metres from water bodies, whilst allowing activities and minor structures for reserve management and public access, as well as the operation, maintenance and upgrade of existing structures.	
		Policy 10.3.1.3	Manage adverse effects of activities on ancestral land, water, sites, wāhi tapu and other tāonga through recognition of the relationship of tangata whenua with the land and associated resources.	
		Policy 10.3.5.1	Enable recreational and commercial activities, structures and buildings to occur on the surface of lakes and rivers, where adverse effects on the natural character and functioning of water bodies and their margins and Māori culture and traditions are avoided, remedied and mitigated, ensuring that, in particular: 1. Existing lake structures continue to be used in a manner that does not increase adverse effects on the lake and lakeside settlements. 2. New lake structures are enabled where: (a) Reasonable need can be demonstrated for the lake structure, having regard to: • The existing provision and availability of similar facilities in the surrounding area. • The contribution of the new lake structure to the social wellbeing of the community, the recreational values and use of the lakes, as well as environmental wellbeing.	

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			(b) The public use of the lake and adjoining public areas are not (c) unduly affected. (d) The design of the lake structure takes into account shore morphology and lake depth, and functional needs of water craft using the lake structure. (e) The lake structure is in keeping with the character and amenity of the surrounding land, water and environment. (f) It will not adversely affect sites of cultural significance to tangata whenua.	
		Policy 10.3.5.2	Activities on the surface of water are managed to minimise any potential conflict between those activities.	

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Appendix J Rotorua Sustainable Living Strategy

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Table J-1: Rotorua Sustainable Living Strategy – Summary of Objectives Startegies, End Actions and Relevance to the Preferred Scheme – Refer Section 3.10.2 of AEE

Note: the first three columns are from the Rotorua Sustainable Living Strategy. The fourth column has been added to indicate how well the Preferred Scheme fits the Objectives, Strategies and Action of the Rotorua Sustainable Living Strategy.

Objective (From Sustainable Strategy)	Strategies (From Sustainable Strategy)	Actions (From Sustainable Strategy)	Relevance to the "Preferred Scheme" and AEE Cross Reference
Objective 1 He hapori pūmanawa, He hapori ngāwari People are resilient to change, and able to adapt and thrive	• Promote social and economic inclusion through collective impact approaches	• Work towards becoming an age-inclusive community with a wide range of community partners • Partners collaborate to develop a Rotorua Children's Strategy with a key focus on the first 1000 days of a child's life • Support initiatives which increase public access to digital connectivity and participation • Provide regular forums for all people and communities to be informed and participate in democratic processes and debate, including children, youth, people with disabilities, aged and vulnerable populations	• The Preferred Scheme has been developed with extensive community, tāngata whenua and other stakeholder input (refer Section 10 of this AEE and Support Document No. 8) • Section 6 of this AEE covers Social, Cultural, Business and Tourism in terms of Project Context. This Section highlights the importance of the Wastewater Scheme to the people and communities of Rotorua District and wider Bay of Plenty Region

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Objective (From Sustainable Strategy)	Strategies (From Sustainable Strategy)	Actions (From Sustainable Strategy)	Relevance to the "Preferred Scheme" and AEE Cross Reference
Objective 4 Toitū te papa, Toitū te wai, he tuarā mo te taiao Our land and water is sustainably managed and supports the natural environment	• Treat our wastewater to a high standard and discharge safely	• Recognise the importance of Te Arawa perspectives on wastewater treatment and water use • Identify options to reduce water volume and contaminants • Implement the Rotoiti - Rotomā Sewage Reticulation Programme • Implement the WWTP Plan to upgrade with an alternative discharge location	• Te Arawa representatives have been actively involved in the project through representation on RPSC and in the hui and other activities • RLC's Wastewater Strategy by the RLC is to further include water conservation and reduction measures (refer Section 4.2) of this AEE • A separate RLC project is in progress of implementing a sewerage scheme for Rotoiti and Rotomā • The Proposed Upgrade Wastewater Scheme includes an alternative discharge location into Te Arikiroa Thermal Channel and thence to Lake Rotorua. Refer Section 4.2 and for the alternatives consider for discharge Section 9.6 of this AEE.
	• Review and implement a water conservation plan	• Review Council operations' water uses and identify opportunities to reduce, set goals and lead community by example • Consider opportunities to reuse water within infrastructure networks	• The RLC's Wastewater Strategy includes the implementation Water Strategy's Water Conservation Plan. Refer Figure 9-1 and Section 4.5 of this AEE • Beneficial reuse of the highly treated Wastewater has been a priority of the RPSC,

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Objective (From Sustainable Strategy)	Strategies (From Sustainable Strategy)	Actions (From Sustainable Strategy)	Relevance to the "Preferred Scheme" and AEE Cross Reference
			consultation and the RLC's own considerations. Refer Sections 2.9, 4.2, 4.8.11 and Appendix G (for the Beneficial Reuse Management Plan of this AEE
Objective 5 Mimiti atu ai ngā para, ka whai tikanga te wāriu We minimise our waste and recover its value	• Resource recovery	• Wastewater biosolid recovery system continues to divert biosolids from the landfill and maximises beneficial uses	• The RLC's biosolids management system will continue to operate and be further developed as set out in Section 4.8.4 of this AEE.
		• Investigate food and organic waste collection and processing • options to reduce landfill emissions • Support development of a resource recovery park	• Outside the Wastewater Scheme considerations
Objective 6 Kei te takatū a Rotorua mo te ao hōu, mai te mahi tiaki, me te mahi whakakorengia ngā hau 'greenhouse' Rotorua will be ready for the approaching post-carbon economy through greater energy efficiency and reduction in greenhouse gas emissions	• Develop a carbon abatement plan	• Comprehensive energy use and emission inventory for all Council operations • Identify cost-effective energy efficiency measures, move to renewable energy sources and reduce emissions	• The Preferred Scheme concepts, design and operation will also focus on greater energy efficiency. By not pumping and spray irrigating in the LTS this will save approximately $900,000 pa (2016 figures) that will more than outweigh additional energy costs for the full MBR and UV treatment processes that are incorporated in the Preferred Scheme (refer to Sections 4.6.6 (which also refers to requirements of RMA) and 4.8.7 of this AEE)

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Table J-2: Rotorua Sustainable Living Strategy Appendix 1 Excerpts relevant to the Preferred Scheme highlighting how the Scheme is most compatible with these actions

Actions	Timeline		
	Underway	Next LTP 1-3 years	Next LTP beyond 3 years
Invest in community leadership development through training and mentorship	■		
Recognise the importance of Te Arawa perspectives to wastewater treatment and water use	■		
Identify options to reduce water volume and contaminants		■	
Seek partners for the restoration of Sanatorium Reserve	■		
Review Council operations water uses and identify opportunities to reduce, set goals and lead community by example			■
Consider opportunities to reuse water within infrastructure networks			■
Identify waste stream values and optimum practicable options		■	
Wastewater biosolid recovery system continues to divert biosolids from the landfill and maximises beneficial uses	■		
Identify cost-effective energy efficiency measures, move to renewable energy sources and reduce emissions		■	
Consider material life-cycle, impact on carbon and cost-benefit analysis for all council procurement and infrastructure development/ replacement		■	

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Appendix K Volunteered Consents Conditions

Pursuant to section 104B of the Resource Management Act 1991 ("the Act"), the Bay of Plenty Regional Council ("the Council" or "BOPRC") hereby grants resource consents to:

Rotorua District Council

(hereinafter referred to as "the Consent Holder")

Activities authorised by these consents:

A) Consents associated with the ongoing operation and maintenance of the Rotorua Wastewater Treatment Plant:

AAAAAA: Discharge Permit – To discharge treated wastewater to land in a manner that it may enter an unnamed tributary (referred to as Te Arikiroa Thermal Channel) of Lake Rotorua
BBBBBB: Discharge Permit – To discharge treated wastewater to land via reuse
CCCCCC: Discharge Permit – To discharge contaminants (primarily odour) to air

B) Consents associated with construction of a discharge channel, widening of Te Arikiroa Thermal Channel (being an unnamed tributary of Lake Rotorua), and construction of bunds adjacent to the Puarenga Stream:

DDDDDD: Water Permit - For temporary damming and diversion of geothermal water
EEEEEE: Land Use Consent – To undertake works in the bed of an unnamed tributary (referred to as Te Arikiroa Thermal Channel) of Lake Rotorua
FFFFFF: Discharge Permit – To discharge sediment to water
GGGGGG: Land Use Consent – The disturbance of land and soil as a result of earthworks
HHHHHH: Land Use Consent – The disturbance of land and soil disturbance as a result of vegetation clearance
IIIIII: Land Use Consent – For interference with the natural geothermal fluid outflow from a geothermal surface feature; For interference with the physical structure of a geothermal surface feature; For destruction of a geothermal surface feature including excavation; For placement or deposition of any substance, including fill or waste material on, into or under any geothermal surface feature

Location details:

Address of property: Te Ngae Road, Rotorua
Legal description: Pt Sec 3 SO25860
Certificate of title: CT XXXXX
Co-ordinates:

Wastewater Treatment Plant: Easting: 1886212E Northing: 5773059N (NZTM)
Discharge to Land Contact Bed: Easting: 1886291E Northing: 5773165N (NZTM)

Pursuant to section 108 of the Act, these consents are issued subject to the following conditions:

GENERAL CONDITIONS THAT APPLY TO ALL RESOURCE CONSENTS

General Accordance

1. The Consent Holder shall ensure that the activities authorised by these consents are undertaken in general accordance with the information provided with the application entitled 'Rotorua Wastewater Treatment Plant – Resource Consent Applications and Assessment of Environmental Effects' prepared by the Rotorua Lakes Council and its consultant advisors dated August 2018 and also in accordance with the latest certified management plans required by the conditions of

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these consents. In the event that there is any conflict between these documents and any condition(s) of these consents, the conditions shall prevail.

Lapsing and Duration

2. These consents lapse ten (10) years after the date of commencement of the consents unless they are given effect to before that date.

3. These consents shall expire on the following dates:

Consent Number	Details	Expiry Date
AAAAAA	Discharge Permit – To discharge treated wastewater to land in a manner that it may enter an unnamed tributary (referred to as Te Arikiroa Thermal Channel) of Lake Rotorua	X XXXXX 2054
BBBBBB	Discharge Permit – To discharge treated wastewater to land via reuse	X XXXXX 2054
CCCCCC	Discharge Permit – To discharge contaminants (primarily odour) to air	X XXXXX 2054
DDDDDD	Water Permit - For temporary damming and diversion of geothermal water	X XXXXX 2034
EEEEEE	Land Use Consent – To undertake works in the bed of an unnamed tributary (referred to as Te Arikiroa Thermal Channel) of Lake Rotorua	X XXXXX 2034
FFFFFF	Discharge Permit – To discharge sediment to water	X XXXXX 2034
GGGGGG	Land Use Consent – The disturbance of land and soil as a result of earthworks	Unlimited
HHHHHH	Land Use Consent – The disturbance of land and soil disturbance as a result of vegetation clearance	Unlimited
IIIIII	Land Use Consent – For interference with the natural geothermal fluid outflow from a geothermal surface feature; For interference with the physical structure of a geothermal surface feature; For destruction of a geothermal surface feature including excavation; For placement or deposition of any substance, including fill or waste material on, into or under any geothermal surface feature.	Unlimited

Annual Report

4. The Consent Holder shall prepare an Annual Report and provide it, no later than 31 March of each year, to the Council and the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group required by Condition 6. The Report shall cover the period from 1 January to 31 December and include, but not necessarily be limited to, the following:

   (a) Collate, analyse, and interpret the monitoring results required by the conditions of these consents. This assessment shall include an analysis of the previous monitoring data and identification of any trends in the results;

   (b) The results of the cultural monitoring required by Condition 18;

   (c) Progress on the implementation of the cultural mitigation and environmental enhancement activities set out in the Cultural Mitigation and Environmental Enhancement Plan required by Condition 19;

   (d) Copies of any records required by any condition(s) of these consents, including the records required to be maintained for any wastewater reuse required by Condition 56; and

   (e) A summary of complaints, if any, received by the Consent Holder.

Monitoring and Technology Review

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5. The Consent Holder shall submit a Monitoring and Technology Review Report to the Council by the 9th, 18th, and 27th anniversaries of the date of commencement of these consents. The Monitoring and Technology Review Report shall include the following:

   (a) An assessment of ongoing compliance with the requirements of these consents particularly in relation to any reported non-compliance with consent conditions;

   (b) An assessment of compliance/consistency with any relevant national or regional water quality policies, environmental standards or guidelines in effect at the time;

   (c) An assessment of the results of the Consent Holder's monitoring undertaken in accordance with these consents, including the adequacy and scope of such monitoring;

   (d) A summary of any residual actual or potential adverse effects of the treated wastewater discharge, irrespective of whether the discharge complies with the conditions of these consents;

   (e) An outline of significant technological changes and advances in relation to wastewater management, treatment, discharge, and beneficial reuse technologies that could be of relevance for possible future use in the Rotorua wastewater treatment and discharge facilities;

   (f) A summary of actions/measures, and an assessment of their successfulness, implemented as part of the Rotorua Wastewater Strategy (or any document that replaces this Strategy) during the preceding period; and

   (g) An assessment of whether any newly available technology option(s) or combination of options identified through (e) above represent the Best Practicable Option (BPO) to minimise the potential and actual adverse effects of the treated wastewater discharge and whether the Consent Holder intends to adopt that BPO and incorporate such technologies.

Rotorua Tangata Whenua Wastewater Treatment Monitoring Group

6. The Consent Holder shall, within three (3) months of the date of commencement of these consents, invite one representative from each of the following to establish, in association with the Consent Holder, the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group:

   (a) Te Arawa Lakes Trust;

   (b) CNI Iwi Land Management Limited;

   (c) Ngati Whakaue;

   (d) Ngati Rangiwewehi;

   (e) Tuhourangi/Ngati Wahiao;

   (f) Ngati Pikiao;

   (g) Ngati Makino;

   (h) Tapuika;

   (i) Ngati Uenukukopako/Te Roro-o-te-rangi, Ngati Rangiteaorere; and

   (j) Two representatives from Ngati Hurunga Te Rangi

7. The purpose of the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group shall be:

   (a) To recognise and provide for the kaitiakitanga of manawhenua who have a hungatiaki relationship with Puarenga Bay, within the framework of these resource consents;

   (b) To recognise and provide for the importance of Puarenga Bay to manawhenua, within the framework of these resource consents;

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(c) Provide a forum for liaison between manawhenua and the Consent Holder regarding the exercise of these resource consents;

(d) To facilitate the involvement of manawhenua in monitoring, providing advice and guidance in the exercise of these resource consents; such as: monitor and periodically review the implementation of the consent conditions; oversee conditions of consent and undertakings, the adoption of new technology, opportunities to conduct rituals, ceremonies and activities associated with the establishment, completion of works and start of operations;

(e) To facilitate the incorporation of hungatiaki responsibilities and values in the exercise of these resource consents; and

(f) To receive and make comment on reports.

8. The functions of the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group shall include, but not necessarily be limited to, the following matters:

(a) Reviewing the performance of the wastewater treatment plant and discharge facilities in relation to the quality of the treated wastewater discharge and compliance with the consent conditions;

(b) Reviewing the results of monitoring and the associated assessment of monitoring information carried out in accordance with the conditions of these consents;

(c) Receiving and commenting on the following documents:
i. Cultural Monitoring Plan required by Condition 16;
ii. Cultural Mitigation and Environmental Enhancement Plan required by Condition 19;
iii. Annual Report required by Condition 4;
iv. Construction and Environmental Management Plan required by Condition 69;
v. Wastewater Treatment Plant Management Plan required by Condition 45;
vi. Odour Management Plan required by Condition 62;
vii. Monitoring and Technology Review Report required by Condition 5; and
viii. Beneficial Reuse Management Plan required by Condition 57.

(d) Making suggestions to the Consent Holder and/or the Council as to any practical physical measures and other initiatives further needed to address actual or potential adverse cultural effects of the treated wastewater discharge;

(e) Receiving any reports on investigations (including feasibility reports) relating to alternative discharge locations and methods;

(f) Making suggestions as to any additional investigations the Consent Holder might undertake in respect of actual or potential adverse cultural effects of the treated wastewater discharge;

(g) Advising the Consent Holder of opportunities to conduct rituals, ceremonies, and activities associated with the establishment, completion of works and start of operations;

(h) Recommending and advising on the content of cultural interpretation at the Land Contact Bed; and

(i) Considering any other issues of concern to the Group relating to the treated wastewater discharge

Any comments or suggestions provided for under (c), (d), (f), (g), or (h) above shall be provided to the Consent Holder and the Council within 60 working days of the meeting at which such comments or suggestions have been decided.

9. The Consent Holder shall support the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group to prepare a terms of reference that shall include:

(a) Confirmation of the members and composition of the Group;

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(b) The process to replace representatives; and

(c) Procedural matters for the running and recording of meetings including quorums, voting, appointing a chair, and consensus or majority recommendations.

10. The Consent Holder shall provide reasonable organisation and administrative support to facilitate the development and on-going role of the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group for the duration of these consents. This shall include ensuring that an independent expert is available to the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group to assist it in fulfilling its functions that are specified in Condition 8.

11. The Rotorua Tangata Whenua Wastewater Treatment Monitoring Group shall be invited to meet at least six-monthly to exercise the functions set out in Condition 8. Upon agreement between the Group and the Council, the meeting frequency may be reduced. All reports required by the conditions of these consents to be provided to the Group shall be provided in electronic format unless specified otherwise.

12. The Consent Holder shall provide minutes of each Rotorua Tangata Whenua Wastewater Treatment Monitoring Group meeting to the Council and the members of the Group within 20 working days of each meeting. The minutes shall include:

(a) A record of discussions and attendance at the meeting;

(b) A summary record of discussions; and

(b) A record of any suggestions provided or issues raised by the members of the Group including:
   i. What actions are proposed by the Consent Holder to respond to suggestions made or issues raised by the Group as they relate to the functions of the Group as set out in Condition 8; and
   ii. Where no actions are proposed to respond to suggestions or issues, the reasons why not.

Te Hunga Mātauranga Māori

13. The Consent Holder shall, within three (3) months of the date of commencement of these consents, invite 12 Te Arawa cultural experts to establish, in association with the Consent Holder, Te Hunga Mātauranga Māori. For the purpose of this condition a "Te Arawa cultural expert" is a person with relevant experience and skills in Mātauranga Māori and/or a recognised tertiary qualification in a related field.

14. The purpose of Te Hunga Mātauranga Māori shall be to provide guidance and advice to the detailed design, construction, operation and performance of a Land Contact Bed.

15. The Consent Holder shall support Te Hunga Mātauranga Māori to prepare a terms of reference for the group that includes the frequency of meetings, members, and general conduct of meetings.

16. The Consent Holder shall, in consultation with Te Hunga Mātauranga Māori, within 12 months of being established, prepare a Cultural Monitoring Plan to monitor the performance of the Land Contact Bed and the mauri of the receiving water in Puarenga Bay. The Cultural Monitoring Plan shall include appropriate cultural performance indicators, a programme of cultural monitoring, and details of appropriate native aquatic species to be used in the Land Contact Bed.

***Advice Note**: This monitoring programme should link to Te Tūāpapa o ngā wai o Te Arawa -the Te Arawa Cultural Values Framework, include relevant Mātauranga Māori indicators and involve the participation of Hungatiaki from directly affected hapū.*

17. The Consent Holder shall submit the Cultural Monitoring Plan required by Condition 16 to the Council for information within 3 months of its preparation.

18. The Consent Holder shall undertake the cultural monitoring set out in the Cultural Monitoring Plan required by Condition 16 and shall report the results of this monitoring to the Council and the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group annually within the Annual Report required by Condition 4.

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Cultural Mitigation and Environmental Enhancement Plan

19. The Consent Holder shall, in consultation with the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group, prepare a Cultural Mitigation and Environmental Enhancement Plan (CMEEP). The CMEEP shall be prepared within twelve (12) months of the date of commencement of these consents and shall set out the cultural mitigation and environmental enhancement activities that will be implemented by the Consent Holder, including a timetable for their implementation. The cultural mitigation and environmental enhancement activities shall include, but not necessarily be limited to, the following:

    (a) Revegetation of areas adjacent to the wastewater treatment plant with native species endemic to the area;

    (b) Riparian planting at the mouth of Puarenga Stream, Lake Rotorua edge and areas adjacent to the discharge channel;

    (c) Landscaping of areas immediately adjacent to the wastewater treatment plant;

    (d) Local water conservation projects;

    (e) Local community water infrastructure projects and programmes; and

    (f) Environmental and cultural enhancement projects identified by the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group.

20. The Consent Holder shall submit the CMEEP required by Condition 19 to the Council for its information within 12 months of the date of commencement of these consents.

21. The Consent Holder shall undertake the cultural mitigation and environmental enhancement activities set out in the CMEEP required by Condition 19 and shall report progress on the implementation of the CMEEP to the Council and the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group annually within the Annual Report required by Condition 4.

Decommissioning of Redundant Infrastructure

22. Within five years of the date of commencement of these consents the Consent Holder shall take all practicable steps to decommission infrastructure including pipes, ponds, tanks and plant at the wastewater treatment plant that the Consent Holder determines is redundant.

Complaints Register

23. The Consent Holder shall maintain a Complaints Register for the activities authorised by these consents. All complaints received by the Consent Holder in relation to the activities authorised by these consents shall be logged immediately in the Complaints Register. The Complaints Register shall record:

    (a) The date, time, location, duration, and nature of the alleged event/ incident;

    (b) Name, phone number and address of the complainant unless the complainant wishes to remain anonymous;

    (c) Any remedial action taken by the Consent Holder in response to the complaint and when it was undertaken;

    (d) The possible cause of the relevant event/ incident that lead to the complaint;

    (e) The weather conditions at the time of the relevant event/ incident including estimates of wind direction, wind strength, temperature and cloud cover;

    (f) The date and name of the person making the entry; and

    (g) Details of any complaints received that may indicate non-compliance with the conditions of these consents shall be provided to the Council within 24 hours of receipt of the complaint or on

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the next working day. All other complaints shall be included in the Annual Report required by Condition 4.

24. The Council may, in accordance with section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of any or all of these consents annually between 1 June and 1 August for any one or more of the following purposes:

(a) To deal with any adverse effect on the environment arising from the exercise of these consents which was not foreseen at the time the application was considered and which is appropriate to deal with at the time of review; or

(b) To require the Consent Holder to adopt the best practicable option to remove or reduce any adverse effect on the environment resulting from the exercise of these consents.

Advice Note: *The Council may, in accordance with section 128 of the Resource Management Act 1991, serve notice on the Consent Holder of its intention to review the conditions of these consents:*

(a) To enable standards set by a new rule(s) in any regional plan that has been made operative since the granting of these consents to be met;

(b) When relevant national environmental standards have been made; or

(c) If the information made available to the Council by the Consent Holder for the purposes of the application contained inaccuracies which materially influenced the decision on the application and the effects of the exercise of the consent(s) are such that it is necessary to apply more appropriate conditions.

CONDITIONS FOR AAAAAA – To Discharge Treated Wastewater to Land in a Manner that it may enter an Unnamed Tributary (referred to as Te Arikiroa Thermal Channel) of Lake Rotorua

25. The wastewater treatment plant shall be designed and operated to ensure that the wastewater always receives at least the following before being discharged to the Land Contact Bed:

(a) Filtration through a membrane with a nominal pore size of no greater than 0.04 micrometres (µm) and an absolute pore size of no greater than 0.1 µm; and

(b) A validated ultraviolet (UV) light dose of at least 35 milli-Watt seconds per square centimetre (mWs/cm^2) is delivered for 99% of the time (calculated on the basis of a 15-minute average) over each calendar month. The 'validated dose' shall be a biodosimetrically validated UV dose established according to the procedures described in the United States Environmental Protection Agency Ultraviolet Disinfection Guidance Manual, 2006. Biodosimetric work shall have been conducted with multiple test organisms (minimum two) and shall include the sensitivity of the target organism within the dose prediction equation. The validated UV dose shall be reported utilising the predicted sensitivity of MS2 bacteriophage within the dose prediction equation and shall be limited, where appropriate, to the boundaries of validation envelope.

26. The Consent Holder shall, in consultation with the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group required by Condition 6, establish appropriate performance standards for the Land Contact Bed and monitoring of its performance. The performance standards and proposed monitoring shall be provided to the Council prior to the construction of the Land Contact Bed. Once operational, the Consent Holder shall, in consultation with the Group, monitor the performance of the Land Contact Bed in accordance with the established monitoring programme. The Consent Holder shall keep records of the results of this monitoring and make it available to the Council upon written request.

27. The Consent Holder shall notify the Council, in writing, no less than five working days prior to the commissioning of the discharge authorised by this consent. Notification at this time shall include details of who is responsible for on site management and compliance with consent conditions.

28. The Consent Holder shall install and maintain a measuring device(s) to ±5% accuracy to continuously record rates of discharge of treated wastewater to the Land Contact Bed. These records are to be

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supplied electronically to the Council monthly, upon written request, and included in the Annual Report required by Condition 4.

29. The accuracy of the measuring device(s) referred to in Condition 28 shall be tested at least once every five years and confirmation of the accuracy shall be included in the Annual Report required by Condition 4 for the year the testing is undertaken.

30. The Consent Holder shall, at least once every 15 minutes, measure the turbidity of the treated wastewater discharged from each discrete membrane unit required by Condition 25(a).

31. The turbidity of the treated wastewater discharged from each discrete membrane unit shall be maintained below a nominated Upper Control Limit. On exceedance of the Upper Control Limit for two consecutive readings, the discrete membrane unit shall, where possible, be immediately removed from service and Direct Integrity Testing and Diagnostic Testing shall be undertaken as necessary. Where any discrete membrane unit cannot be removed from service, the treated wastewater shall not be made available for beneficial re-use, as provided for by Condition 56.

32. The Upper Control Limit for turbidity and the requirements associated with the Direct Integrity Testing and Diagnostic Testing referred to in Condition 31 shall be provided in the Wastewater Treatment Plant Management Plan required by Condition 45.

33. The Consent Holder shall keep a written record (electronic is acceptable) of the exceedances above the nominated Upper Control Limit for turbidity referred to in Condition 31. A summary of the exceedances shall be provided to the Council every three months.

34. The annual mass load of total phosphorus discharged to the Land Contact Bed, based on a rolling 52 week period, shall not exceed three (3) tonnes.

35. The annual mass load of total nitrogen discharged to the Land Contact Bed, based on a rolling 52 week period, shall not exceed 32.4 tonnes or any greater mass as calculated in accordance with the latest certified Nitrogen Allocation Transfer Plan required by Condition 36.

Advice Note: *The wastewater treatment plant will, over the term of this consent, receive additional wastewater and therefore total nitrogen as the wastewater reticulation system is expanded into the Rural Area and where urban infill occurs. The Nitrogen Allocation Transfer Plan required by Condition 36 outlines how total nitrogen allowances from land within the Rural Area that is subdivided (with the built development being connected to the wastewater treatment plant) is to be transferred to this resource consent – meaning that the annual mass of total nitrogen authorised to be discharged can increase over time. The Nitrogen Allocation Transfer Plan is to be based on a Memorandum of Understanding (MoU) entitled 'Nitrogen Accounting Approach for Rotorua Waste Water Treatment Plant Discharge' signed by the Rotorua Lakes Council, the Bay of Plenty Regional Council, and the Te Arawa Lakes Trust. The Council has calculated that the wastewater-derived total nitrogen over the 2001-2004 baseline period to Lake Rotorua was 30 tonnes per year and, accounting for changes that have already occurred since this baseline period, the MoU states that a discharge limit of 32.4 tonnes per year represents no increase in total nitrogen load to the lake.*

36. The Consent Holder shall, within six (6) months of the date of commencement of these consents, submit a Nitrogen Allocation Transfer Plan (NATP) to the Council for certification. The purpose of the NATP is to give effect to Condition 37. The Council's certification shall be limited to confirming that the NATP:

    (a) Complies with all conditions of this resource consent; and

    (b) Contains provisions that are enforceable.

37. The objective of the NATP required by Condition 36 is to provide detailed information on how total nitrogen allocations from Rural Land that is to be subdivided and connected to the wastewater treatment plant will be calculated and transferred to the annual mass load limit specified in Condition 35. For the purposes of this condition 'Rural Land' is defined as all land within the Lake Rotorua Groundwater Catchment that is not Urban Reticulated Area under the Rotorua District Plan. The NATP shall be based on the purpose, principles, and approach of the Memorandum of Understanding (MoU) entitled '*Nitrogen Accounting Approach for Rotorua Waste Water Treatment*

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Plant Discharge' signed by the Rotorua Lakes Council, the Bay of Plenty Regional Council, and the Te Arawa Lakes Trust.

38. The Consent Holder may amend the NATP at any time. Any amendments to the NATP shall be forwarded to the Council for certification in accordance with Condition 36.

39. The Consent Holder shall collect a time-proportional weekly composite sample of the treated wastewater immediately prior to the point of discharge to the Land Contact Bed. The concentration of total phosphorus and total nitrogen shall be measured in each sample. All samples shall be collected in laboratory supplied containers and using appropriate procedures and preservative(s) as directed by the accredited environmental testing laboratory and shall be transported to the laboratory under chain of custody.

40. For the purposes of determining compliance with Conditions 34 and 35, the concentration of total phosphorus and total nitrogen in the weekly sample required by Condition 39 shall be multiplied by the weekly discharge volume (required to be measured by Condition 28) to determine the weekly mass of total phosphorus and total nitrogen discharged. Compliance with Condition 34 and 35 shall be based on the sum of the latest 52 calculated weekly mass loads discharged to the Land Contact Bed.

41. The average concentration of total nitrogen in the treated wastewater discharged to the Land Contact Bed, based on a rolling 52 week period, shall not exceed 4.3 milligrams per litre (mg/L). Compliance with this condition shall be based on the concentration of total nitrogen in the latest 52 weekly samples required by Condition 39.

42. The results of the monitoring specified in Condition 39 and the calculations required by Condition 40 shall be included in the Annual Report required by Condition 4. Notwithstanding the above, the Consent Holder shall report any exceedance of any of the limits specified in Conditions 34, 35, or 41 to the Council within five working days of any exceedance being detected.

43. The discharge shall not cause any of the following effects outside the zone of reasonable mixing shown in Figure 1 included in Appendix 1 (attached to these consents):

    (a) The production of any conspicuous oil or grease film, scums or foams, or floatable or suspended material;

    (b) Any conspicuous change of colour or visual clarity;

    (c) Any emission of objectionable odour; or

    (d) Any significant adverse effect on aquatic life.

44. The Consent Holder shall undertake monitoring of the receiving environment in accordance with the monitoring programme(s) contained in Appendix 2 attached to these consents, including complying with any reporting requirements specified. The Consent Holder may amend the monitoring programme(s), including determinands to be monitored/analysed and frequencies of monitoring provided this is first agreed to in writing by the Council.

45. The Consent Holder shall, within six (6) months of the date of commencement of these consents, submit a Wastewater Treatment Plant Management Plan (WTPMP) for the wastewater treatment plant and discharge system to the Council for certification. The purpose of the WTPMP is to give effect to Condition 46. The Council's certification shall be limited to confirming that the WTPMP:

    (a) Complies with all conditions of this resource consent.

    (b) Contains provisions that are enforceable.

46. The objective of the WTPMP required by Condition 45 is to detail the procedures that will be implemented to ensure that:

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(a) The operation of the wastewater treatment plant and the discharge to the Land Contact Bed complies with the conditions of this consent;

(b) The wastewater is treated to an appropriate standard prior to discharge;

(c) The wastewater treatment plant is effectively maintained to ensure treatment capacity;

(d) There is sufficient contingency within the wastewater treatment plant in the event of a failure; and

(e) The Land Contact Bed is adequately maintained.

47. The WTPMP required by Condition 45 shall be in general accordance with the information supplied in support of the application and shall include, but not necessarily be limited to, the following:

(a) Location and design
   i. Plans detailing the components and location of the wastewater treatment plant and Land Contact Bed; and
   ii. Detailed design drawings of the wastewater treatment plant and Land Contact Bed;
   iii. An explanation of the operation of the wastewater treatment plant; and
   iv. Process flow diagram.

(b) Operation and Maintenance
   i. Detail of onsite responsibilities, including names and contact telephone numbers for operational staff and a 24 hour contact telephone number. This shall include a clear staff structure diagram with names and contact details (reviewed and updated 6 monthly) and a description of their respective responsibilities;
   ii. Inspection and maintenance plan for both the wastewater treatment plant, Land Contact Bed, and any monitoring and measuring equipment;
   iii. The procedures for recording routine maintenance and all repairs that are undertaken;
   iv. Key operation requirements and key performance requirements for each stage of treatment and inter-relationships with other processes, where applicable. This section shall include identification and rationale for the nominated Upper Control Limit for turbidity, and the requirements associated with the Direct Integrity Testing and Diagnostic Testing referred to in Condition 31;
   v. Waste management procedures, including screening waste and biosolids;
   vi. A wastewater treatment plant risk register and contingency plan, including spill and breakdown Response Procedures to deal with unusual events. The Response Procedures shall include:
      - a clear and concise description of potential issues which could arise;
      - potential effects;
      - mitigation measures/remedial actions required;
      - responsibilities;
      - timeframes to fix the issues; and
      - any other actions required.

(c) Monitoring
   i. Identify suitably qualified and experienced persons to undertake the monitoring and analysis;
   ii. A Monitoring Plan outlining how conditions 25(b), 28, 30, 39, and 44 will be complied with. In addition, the Monitoring Plan shall include treatment plant performance

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monitoring in respect of total suspended solids, chemical oxygen demand, and *Escherichia coli*;

iii. A map of all monitoring points.

(d) Recordkeeping: Identification of the records to be kept and how these are maintained.

(e) Reporting

i. A process for reporting monitoring data, including how the annual plan requirements will be met;

ii. A process for non-compliance reporting;

iii. A process for reporting operational performance and environmental monitoring results to the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group required by Condition 6;

iv. A process for audit and review of the WTPMP; and

v. Statistical methods for analysing wastewater and water quality trends over time.

48. Prior to submission of the WTPMP under Condition 45, the Consent Holder shall seek feedback from the Medical Officer of Health and the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group required by Condition 6. The submission of the WTPMP shall include a summary of the feedback received and how the feedback has been incorporated into the WTPMP and/or reasons for not incorporating certain feedback.

49. Any significant amendments to the WTPMP shall be forwarded to the Council for certification in accordance with Condition 45. Notwithstanding the requirement to certify any significant change as and when required, the Consent Holder shall review the WTPMP at least every three years to ensure it accurately reflects the operation of the wastewater treatment plant and Land Contact Bed.

Advice Note: *For the purposes of this condition a 'significant' amendment is one which has the potential to impact the quality of the treated wastewater discharged.*

50. The Consent Holder shall ensure that the latest certified WTPMP is complied with at all times and that the Council has a copy of the most current WTPMP.

51. Notwithstanding the procedures set in the WTPMP, all screening wastes and biosolids shall be taken to a facility approved to accept this type of waste and shall be transported in sealed trucks to ensure no spillage or odour en-route.

52. The Consent Holder shall maintain records of:

(a) The date and description of any significant maintenance work carried out on:

i. The Inlet screens;

ii. The aeration system;

iii. The membranes;

iv. The holding tanks;

v. Pumps;

vi. The Land Contact Bed; or

vii. Any other item critical to maintain treatment capacity or quality.

(b) The details of any spill or incident and mitigation works carried out;

(c) The disposal documentation for any waste taken off-site (volume, type, disposal facility); and

(d) The contact details of the waste pick-up contractor.

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53. The Consent Holder shall keep all records required by Condition 52 for the duration of the consent.

54. Within seven (7) working days of any accidental discharge, major plant break down, or other contingency incident occurring, the Consent Holder shall submit a written report describing the incident, the reasons for it occurring, its consequences (including the nature of any complaints), the measures taken to remedy or mitigate its effects, and any measures taken to prevent recurrence of the incident (including any changes proposed to the WTPMP) to the Council.

55. The Consent Holder shall make documents and records required under conditions of this consent available to the Council upon written request.

CONDITIONS FOR BBBBBB – Discharge Treated Wastewater to Land via Reuse

56. Treated wastewater from the wastewater treatment plant may be discharged to land by another person at a site(s) remote from the wastewater treatment plant, hereafter referred to as 'reuse', provided the following are all met:

(a) The wastewater to be reused is fully treated in accordance with the requirements of Condition 25 and the turbidity does not exceed the nominated Upper Control Limit for turbidity as required by Condition 31;

(b) The reuse is specifically included in the certified Beneficial Reuse Management Plan required by Condition 57;

(c) The treated wastewater is reused in accordance with the certified Beneficial Reuse Management Plan required by Condition 57; and

(d) The Consent Holder maintains a record of the daily volumes and quality of treated wastewater provided and these are provided to the Council in the Annual Report required by Condition 4.

Advice Note: *This consent covers situations where another person(s) wishes to reuse treated wastewater from the wastewater treatment plant and to discharge it to land (e.g. irrigation). This consent does not cover scenarios where the Consent Holder proposes to provide treated wastewater to a person(s) for uses where the treated wastewater is not discharged to land (e.g. as industrial process water) or where the person(s) has obtained a separate resource consent to discharge treated wastewater to land. For those scenarios the Consent Holder and/or the person wishing to reuse the treated wastewater will need to comply with any other relevant laws, by-laws, or regulations.*

57. The Consent Holder shall, prior to providing any treated wastewater for reuse by any other person, submit a Beneficial Reuse Management Plan (BRMP) to the Council for certification. The purpose of the BRMP is to give effect to Condition 58. The Council's certification shall be limited to confirming that the BRMP:

(a) Complies with all conditions of this resource consent; and

(b) Contains provisions that are enforceable.

58. The objective of the BRMP required by Condition 57 is to provide detailed information on the treated wastewater reuse and its management. The BRMP shall include, but not necessarily be limited to, the following:

(a) Details of the proposed location and use of treated wastewater, including:

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i. Details of onsite responsibilities, including names and contact telephone numbers for operational staff;

ii. Inspection and maintenance plan for any monitoring and measuring equipment;

iii. The procedures for recording routine maintenance and all repairs that are undertaken;

vi. A risk register and contingency plan, including spill and breakdown Response Procedures to deal with unusual events. The Response Procedures shall include:

- a clear and concise description of potential issues which could arise;
- potential effects;
- mitigation measures/remedial actions required;
- responsibilities;
- timeframes to fix the issues; and
- any other actions required.

(b) Details of proposed monitoring, record keeping, and reporting, including volumes and treated wastewater quality.

(c) Treated wastewater transport methodology; and

(d) Health and safety requirements for the reuse of treated wastewater.

59. Prior to submission of any BRMP under Condition 57, the Consent Holder shall seek feedback from the Medical Officer of Health and the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group required by Condition 6. The submission of the BRMP shall include a summary of the feedback received and how the feedback has been incorporated into the BRMP and/or reasons for not incorporating certain feedback.

60. The Consent Holder may amend the BRMP at any time to enable additional persons to reuse treated wastewater. Any amendments to the BRMP shall be forwarded to the Council for certification in accordance with Condition 57 and the information specified in Condition 58 shall be provided for each additional reuse proposal. No treated wastewater shall be provided to the additional person(s) for reuse until the amended BRMP is certified by the Council.

CONDITIONS FOR CCCCCC – Discharge Contaminants (primarily Odour) to Air

61. The Consent Holder shall ensure that the operation of the wastewater treatment plant does not give rise to any discharge of contaminants (including odour) at or beyond the property boundary of the wastewater treatment plant, that is deemed by a suitably trained and experienced Enforcement Officer of the Council to be noxious, dangerous, offensive, or objectionable to such an extent that it has, or is likely to have, an adverse effect on the environment. For the purposes of this condition, "property boundary" refers to the boundary (red line) as defined on Figure 2 included in Appendix 1 attached to this consent.

62. Within six (6) months of the date of commencement of this resource consent, the Consent Holder shall prepare an Odour Management Plan (OMP) and provide it to the Council for certification. The purpose of the OMP is to give effect to condition 64. The Council's certification shall be limited to confirming that the OMP:

(a) Complies with all conditions of this resource consent;

(b) Adopts best practicable options for the management of odorous gases; and

(c) Contains provisions that are enforceable.

63. Prior to submission of the OMP under condition 62, the Consent Holder shall seek feedback from the Medical Officer of Health and the Rotorua Tangata Whenua Wastewater Treatment Monitoring

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Group required by Condition 6. The submission of the OMP shall include a summary of the feedback received and how the feedback has been incorporated into the OMP and/or reasons for not incorporating certain feedback.

64. The objectives of the OMP required by Condition 62 are to:

(a) Ensure that on-site activities (wastewater treatment, disposal, and the management of solid wastes) achieve compliance with the conditions of this resource consent and avoid or minimise potential odour;

(b) Remedy or mitigate the effects of any offensive or objectionable odours that occur at or beyond the site boundary; and

(c) Implement industry best practices for odour control for this type of operation (being community wastewater treatment).

65. The OMP required by Condition 62 shall document all relevant site management, monitoring and operational procedures and contingency plans. Prior to submitting the OMP to the Council, the Consent Holder shall have the OMP reviewed by an independent appropriately experienced and qualified practitioner(s) to verify that:

(a) The OMP adopts the mitigation measures identified in the application documentation, or as otherwise required by the conditions of this consent;

(b) The implementation of the OMP will appropriately avoid, remedy, or mitigate the occurrence of offensive or objectionable odours beyond the property boundary or at any sensitive receptor; and

(c) The OMP gives effect to Condition 64 of this resource consent.

66. The OMP shall be reviewed annually, in the month of September, by the Consent Holder and, if necessary, updated to reflect any changes to site management, monitoring and operational procedures, contingency plans, and odour remediation or mitigation measures. If the OMP is updated a copy of the new version shall be provided to the Council for certification in accordance with Condition 62 within one month after the update.

67. The OMP shall be in general accordance with the information supplied in support of the application and should as a minimum include, but not necessarily be limited to, the following:

(a) Key personnel contact details, including management personnel and employees responsible for the implementation of the OMP;

(b) Identification of employee responsibilities for the implementation of the OMP;

(c) Employee training (in relation to odour remediation or mitigation procedures);

(d) Description of the wastewater treatment processes, including identification of potential sources of odour;

(e) Odour management, remediation, mitigation and control measures, including inspection, monitoring, maintenance and housekeeping procedures;

(f) Contingency / emergency planning and procedures (including identification of risks and incidences) and remedial actions (including waste product removal);

(g) Management review and reporting procedures;

(h) Complaint response, investigation resolution and reporting procedures; and

(i) Any specific measure required by conditions of this resource consent.

CONDITIONS FOR DDDDDD and IIIIII – Various Consents Associated with Construction of a Discharge Channel, Widening of Te Arikiroa Thermal Channel (being an unnamed tributary of Lake Rotorua), and Construction of Bunds Adjacent to the Puarenga Stream

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68. All works associated with: (i) the new discharge channel; (ii) the existing stormwater drains; and/or (iii) the bed of the unnamed tributary (Te Arikiroa Thermal Channel) of Lake Rotorua and associated bunds shall:

(a) be based on a minimum intervention approach which keeps the loss of geothermal and indigenous habitats to as small as practicable, including retention of as much of the existing vegetation to screen the channel modifications;

(b) be undertaken in a manner whereby machinery use existing accesses/paths wherever practicable;

(c) be undertaken using the smallest plant/machinery necessary to complete the work;

(d) be supervised by a suitably qualified and experienced ecologist to ensure (a) is met and all indigenous pruning shall be carried out by a suitably qualified and experienced arborist who is familiar with the sensitivity of the site;

(e) ensure that visual separation is maintained between Te Ara Ahi trail and the wastewater treatment plant compound and the "Zone 2 drain" referred to in the document entitled "Rotorua Wastewater Treatment Plant Upgrade – Discharge Channel Construction Methodology" prepared by Jacana Consulting (dated July 2018) submitted with the application.

(f) include the use of appropriate native plant species endemic to the area for the purposes of enhancing ecological values of the area. In determining the 'appropriate' native plant species the Consent Holder shall consult with the Rotorua Tangata Whenua Wastewater Treatment Monitoring Group required by Condition 6. Details of this consultation and the selected native plant species shall be included in the Construction and Environmental Management Plan required by Condition 69.

69. The Consent Holder shall, prior to the commencement of any works associated with the construction works for: (i) the new discharge channel; (ii) the existing stormwater drains; and/or (iii) the bed of the unnamed tributary (Te Arikiroa Thermal Channel) of Lake Rotorua and associated bunds, engage a suitably qualified and experienced engineer to prepare a Construction and Environmental Management Plan (CEMP). The CEMP shall be submitted to the Council for certification. The CEMP shall set out the practices and procedures to be adopted in order that compliance with the conditions of these consents is achieved. As a minimum the CEMP shall include the following:

(a) The construction methodology and expected duration (timing and staging) of the works;

(b) Diagrams and/or plans, of a scale suitable for on-site reference, showing the locations of the major operations, disposal sites for unsuitable materials, and erosion and silt control structures/measures;

(c) Measures to prevent spillage of fuel, oil and similar contaminants;

(d) Contingency containment and clean-up provisions in the event of accidental spillage of hazardous substances;

(e) The name and contact telephone number(s) of the person who has overall responsibility for the works;

(f) Contingency provisions for the potential effects of large/high intensity rain storm events;

(g) Health and safety protection measures for the public who may use any area where public access is provided;

(h) The list of native plant species proposed to be planted;

(i) Details on how material excavated as part of the widening of Te Arikiroa Thermal Stream will be managed and disposed of; and

(j) A statement outlining how 'safety in design' elements have been carried through to the CEMP.

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Advice Note: *The Council certification of the CEMP is in the nature of certifying that adoption of the CEMP is likely to result in compliance with the conditions of this consent. The Consent Holder and the principal contractor who will be undertaking the works (and who may be responsible for preparing the CEMP) are encouraged to discuss its proposed CEMP with Council staff prior to finalising this plan.*

70. No works shall be undertaken until the CEMP required by Condition 69 has been certified by the Council.

71. The Consent Holder shall undertake the activities authorised by this consent in accordance with the certified CEMP.

72. The Consent Holder shall notify the Council in writing of the date that the works are intended to commence, at least 10 working days beforehand.

73. In the event of archaeological sites or koiwi being uncovered, activities in the vicinity of the discovery shall cease and the Consent Holder shall contact Heritage New Zealand. Work shall not recommence in the area of the discovery until the relevant Heritage New Zealand approval has been obtained.

Advice Note: The Heritage New Zealand Pouhere Taonga Act 2014 makes it unlawful for any person to destroy, damage or modify the whole or any part of an archaeological site without the prior authority of the Heritage New Zealand.

74. The Consent Holder shall maintain spill kits on site at all times to contain and / or absorb any spilled hazardous substance and / or any other measures necessary to prevent any spills of hazardous substances entering land or water;

75. In the event of a spill of hazardous substances on the site greater than 20 litres, the Consent Holder or its agent shall record and provide to the Council within 24 hours of the spill:

    (a) the date, time and volume of the spill;

    (b) the substance spilt;

    (c) measures taken to contain and absorb the spilt substance; and

    (d) the cause of the spill, and the measures taken since to prevent a repeat of the incident.

76. The Consent Holder shall ensure that any material removed from site for disposal as part of the works, including the material excavated from the bed of Te Arikiroa Thermal Channel as part of its widening, shall be disposed of at a facility authorised to accept such material.

77. The Consent Holder shall provide 'as built' plans of the new discharge channel, discharge structure, Te Arikiroa Thermal Channel and associated bunds to the Council within 20 working days of their construction being completed.

78. The discharge structure and Te Arikiroa Thermal Channel, and associated bunds, shall be maintained in a good and sound condition. Any repairs that are necessary shall be made as soon as reasonably practicable.

79. The Consent Holder shall comply with the "Te Arikiroa Thermal Channel – Site Management Plan" prepared by Stantec New Zealand (dated July 2018).

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APPENDIX 1 – FIGURES REFERRED TO IN CONDITIONS

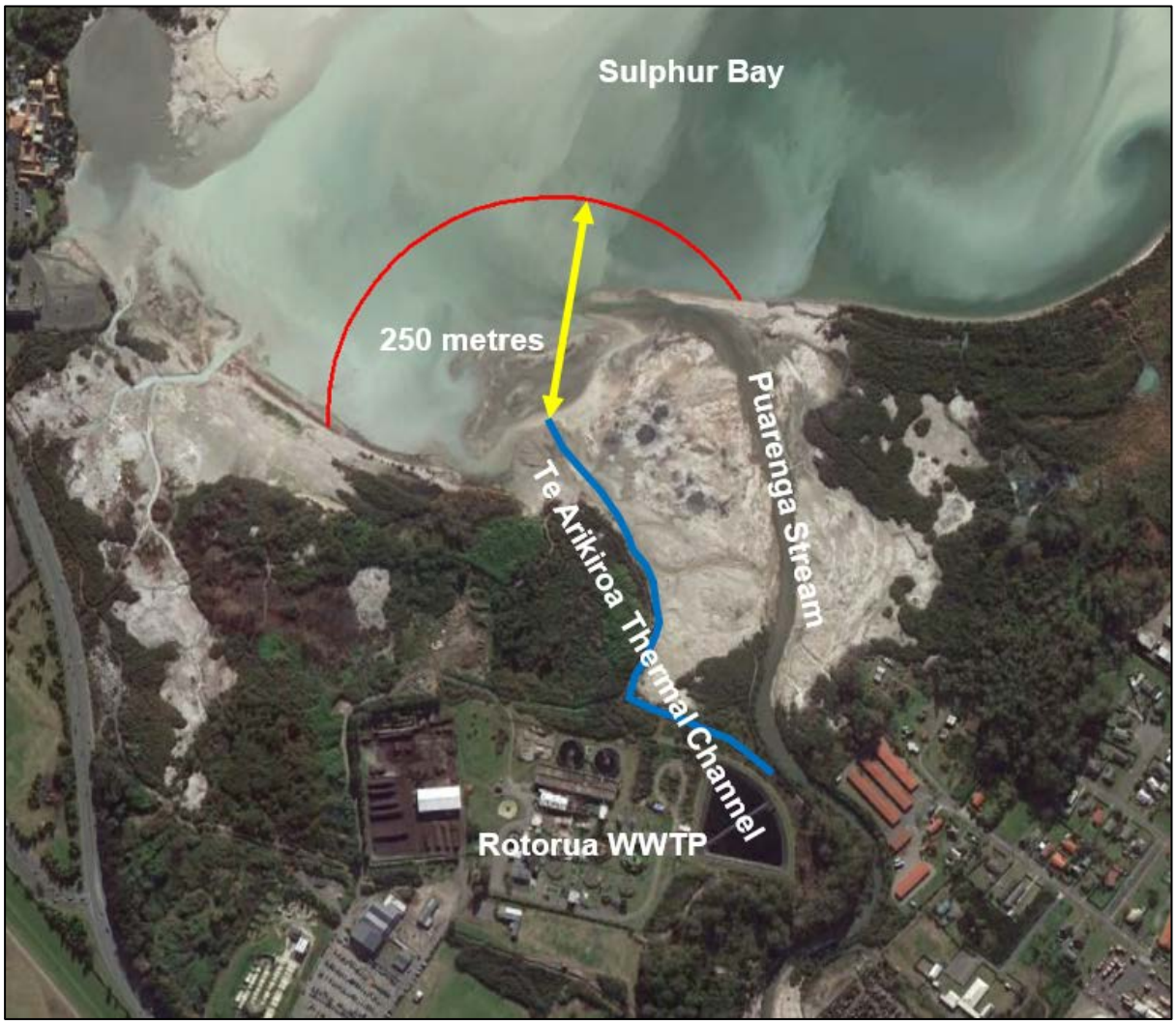


Figure 1. Zone of reasonable mixing (red line) within Sulphur Bay.

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Figure 2. Property boundary (red line) of wastewater treatment plant for odour compliance purposes.

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APPENDIX 2

ROTORUA WASTEWATER TREATMENT PLANT RESOURCE CONSENTS – MONITORING PROGRAMME

PART A – RECEIVING ENVIRONMENT MONITORING PROGRAMME

1. Sampling Sites

The sampling sites referred to in this monitoring programme are described in Table 1 and shown in Figure 1.

Table 1. Sample Site Location Details

Site Number	Description	Latitude/Longitude	Comments
Site 1	Point where the Te Arikiroa Thermal Channel enters Sulphur Bay	38° 8'26.91"S; 176°15'53.95"E	New site
Site 2	Puarenga Stream near outlet into Sulphur Bay	38° 8'28.09"S; 176°16'3.83"E	Same sampling site as Alum dosing monitoring Site 7
Site 3	Within mixing zone approximately 150 metres from Te Arikiroa Thermal Channel outlet	38° 8'22.47"S; 176°15'51.16"E	New site
Site 4	One of two sites (the other being Site 5) at edge of mixing zone 250 metres from Te Arikiroa Thermal Channel outlet	38° 8'22.11"S; 176°15'45.46"E	New site but near University of Waikato Site 6. Sites 4 and 5 are along arc of the 250 metre mixing zone out from Site 1
Site 5	One of two sites (the other being Site 4) at edge of mixing zone 250 metres from Te Arikiroa Thermal Channel outlet	38° 8'18.83"S; 176°15'52.32"E	Same sampling site as University of Waikato Site 5. Sites 4 and 5 are along arc of the 250 metre mixing zone out from Site 1
Site 6	Middle of Sulphur Bay	38° 8'9.57"S; 176°15'58.67"E	Same sampling site as Alum dosing monitoring Site 5
Site 7	Sulphur Bay/Lake Rotorua boundary	38° 7'52.07"S; 176°16'9.73"E	Same sampling site as Alum dosing monitoring Site 3
Site 8	Geothermal upflow	38° 8'18.11"S; 176°15'36.35"E	Same sampling site as Alum dosing monitoring Site 6

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Figure 1. Location of Sampling Sites

2. Water Quality Monitoring

Representative water samples shall be collected from Sites 1 to 8 (i.e. from all the listed sites) referred to in Table 1 and shown in Figure 1 every three (3) months. For the purposes of this monitoring programme a 'representative sample' shall consist of a composite sample made up of at least three subsamples collected at least 5 minutes apart.

All samples shall be collected in laboratory supplied containers and using appropriate procedures as directed by the accredited environmental testing laboratory and shall be transported to the laboratory under chain of custody.

Each water sample shall be analysed at an accredited environmental testing laboratory for the following determinands:

- Nitrate nitrogen;
- Nitrite nitrogen;

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- Total ammoniacal nitrogen;
- Total nitrogen;
- Dissolved reactive phosphorus;
- Total phosphorus;
- Alkalinity;
- Turbidity;
- Total suspended solids;
- Volatile suspended solids;
- Colour (reference NEMS 380 nm, 440 nm, 780 nm);
- Chlorophyll a;
- Total antimony;
- Total bismuth;
- Total cadmium;
- Total calcium;
- Total chromium;
- Total cobalt;
- Total copper;
- Total lead;
- Total magnesium;
- Total molybdenum;
- Total nickel;
- Total potassium;
- Total selenium;
- Total silver;
- Total sodium;
- Total strontium;
- Total tin;
- Total uranium;
- Total vanadium; and
- Total zinc

In addition, the following determinands shall be measured in the field at each sampling site using appropriately calibrated instruments:

- pH;
- Temperature;
- Dissolved oxygen (concentration and percentage saturation); and
- Electrical conductivity

3. Sediment Quality Monitoring

Two undisturbed lake bed sediment samples (duplicates) shall be collected annually from each of Sites 4, 5, and 6 referred to in Table 1 and shown in Figure 1. Samples shall be collected from the 0 to 1 centimetre sediment horizon.

All samples shall be collected in laboratory supplied containers and using appropriate procedures as directed by the accredited environmental testing laboratory and shall be transported to the laboratory under chain of custody.

Each sediment sample shall be analysed at an accredited environmental testing laboratory for the following determinands (all on a dry weight basis except water content):

- Total nitrogen;
- Total phosphorus;
- Total carbon;
- Water content;
- *Escherichia coli* (*E coli*);
- Total antimony;

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- Total bismuth;
- Total cadmium;
- Total calcium;
- Total chromium;
- Total cobalt;
- Total copper;
- Total lead;
- Total magnesium;
- Total molybdenum;
- Total nickel;
- Total potassium;
- Total selenium;
- Total silver;
- Total sodium;
- Total strontium;
- Total tin;
- Total uranium;
- Total vanadium; and
- Total zinc

4. Reporting

The results of the receiving environment monitoring outlined above shall be included in the Annual Monitoring Report required by Condition 4.

PART B – EMERGING ORGANIC CONTAMINANTS

The Consent Holder shall, five-yearly during the month of November, collect at least four 24-hour composite samples of treated wastewater immediately prior to the point of discharge to the Land Contact Bed.

The concentration of the following 'emerging organic contaminants' (EOCs) shall be determined in each of the four composite samples:

1. Tri-butylphosphate (TBP)
2. Tris[2-chloro-1-(chloromethyl)ethyl] phosphate (TDCP)
3. Tris-(2-butoxyethyl) phosphate (TBEP)
4. Methyl-triclosan
5. Triclosan
6. Technical-NP equivalents
7. Galaxolide (HHCB)
8. Tonalide(AHTN)
9. Carbamazepine
10. Diclofenac
11. Bisphenol-A
12. Estrone

Sample preparation and analysis shall be in accordance with either:

(a) the details contained in the report entitled "*Analysis of selected emerging organic contaminants in MBR treated effluent and at two sites within and outside the discharge point mixing zone within Lake Rotorua*" prepared by Northcott Research Consultants Limited dated November 2017 and provided with the resource consent application; or

(b) the recommendations of a person who is suitably qualified and experienced person in sampling and testing of EOCs.

The Consent Holder shall prepare a report which summarises the results of the above testing and shall provide the report to the Council within six months of the sampling.

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Appendix L Response to Alternative Proposal for Bunds and Outlet Location at Puarenga Bay

Response to alternative proposal for bunds and outlet location at Puarenga Bay – Rotorua Wastewater Treatment Plant Proposals

Prepared by Antoine Coffin

July 2018

Introduction

This paper sets out a response from the author of the cultural impact assessments to alternative proposals for the discharge outlet location and bunding of the thermal channel as part of the proposals to upgrade the Rotorua Wastewater Treatment Plant.

The original proposal includes:

- An outlet structure, waterfall and building a 5 metre wide channel along the eastern end of the land contact bed. This will involve modification of the natural landscape and removal of native vegetation over an extensive area.
- Constructing a gravel and soil bund up to 950mm high and 140 metres long at the north eastern end of the outlet flow at Puarenga Bay.

The whole of the sulphur flats where the thermal channel runs (called a rivulet in the CIAs) is designated as an Outstanding Natural Features and Landscape (ONFL) area. The ecology and landscape values are high. Landscape and ecology experts have advised that they would have difficulty supporting this extensive modification hence an alternative outlet is being proposed on the north-western end of the pond and an alternative has been developed in response to landscape and ecological concerns of the current bund proposal.

The new alternative outlet proposal involves a new location for the outlet at the north-western edge of the land contact bed. This effectively shortens the distance between the land contact bed discharge and the thermal channel, reducing the footprint of the works in the flats.

The alternative bund proposal involves constructing 5 smaller bunds at discrete points to dam the flow of water across the sinter flats, thereby preventing treated wastewater entering the Puarenga Stream.

Alternative outlet location

As mentioned above the alternative outlet location would involve the outlet of the land contact bed moving from the middle (northern point) to the north-western corner of the land contact bed. The proposed outlet structure at the new location will be the same design as that at the original location.

With this alternative outlet proposal will retain the cascade effect however this would be achieved over a shorter distance. The treated wastewater will follow the existing open drain. This proposal would minimise the modification of the landscape and native planting within the area.

The original location of the outlet was identified in conceptual drawings of the land contact bed developed in consultation with Matauranga Maori experts. There does not appear to be any cultural preference for the location of the discharge point articulated in the original proposal. It is most likely that a logical position was chosen in the middle of the land contact bed structure for aesthetic and proportional reasons.

The implications for this change are believed to be:

- some benefit of the discharge outlet being further away from the Puarenga Stream. The new proposal is 65m away from the Puarenga Stream. The original design was 35m from the Puarenga Stream.
- Reduction in the modification of the landscape and removal of native plants.
- Reduces the footprint of the wastewater treatment plant in the natural environment.
- Will require some amendments to the conceptual drawings and video for the land contact bed.

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- In good faith, changes to conceptual drawings and video may require consultation with Matauranga Maori experts and cultural assessment sub-committee who have supported the current proposal.

Notwithstanding any views from the Matauranga Maori experts and members of the cultural assessment sub-committee, the author of the cultural impact assessments is supportive of the alternative proposal.

Alternative Bund Proposal

The early cultural impact assessment recommended a bund structure be constructed if the Puarenga Bay was chosen as an outlet. This recommendation was made on the assumption that there could be overflows across the bay from the discharge point to the Puarenga Stream. The discharge point was not been confirmed at the time of the cultural impact assessment.

> *If Puarenga Bay is selected as a discharge location, treated wastewater could pool and overflow into the Puarenga Stream. This is quite possible as the gradient across the bay is very low. This would be contrary to the intention to avoid a discharge to the Puarenga Stream. There are a number of geothermal expressions on the eastern side of the Puarenga Stream, which should be avoided. If a discharge here was to proceed, a physical structure such as a bund will need to be constructed to direct flow to Lake Rotorua. The sensitivity of this area to Te Arawa Lakes Trust and tangata whenua would suggest that an 'unobstrusive' and 'natural looking' structure would be required. Equally, geothermal waters in surface expressions (ngawha) may be affected. Again a structure such as a bund may prove useful in avoiding known ngawha with geothermal activity.*[29]

Following confirmation of the discharge location and method, a further cultural impact assessment was completed. The cultural impact assessment confirmed the recommendation for the bund. Once the treated wastewater left the land contact bed, it would flow across the bed of Lake Rotorua. It is likely an earth bund or similar barrier would be required to direct water to the lake and avoid overflow towards the Puarenga Stream.[30]

> *Treated wastewater could pool and overflow into the Puarenga Stream. This is quite possible as the gradient across the bay is very low. This would be contrary to the intention to avoid a discharge to the Puarenga Stream. There are a number of geothermal expressions on the eastern side of the Puarenga Stream, which should be avoided. If a discharge here was to proceed, a physical structure such as a bund will need to be constructed to direct flow to Lake Rotorua. The sensitivity of this area to Te Arawa Lakes Trust and tangata whenua would suggest that an 'unobstrusive' and 'natural looking' structure would be required. Equally, geothermal waters in surface expressions (ngawha) may be affected. Again, a structure such as a bund may prove useful in avoiding known ngawha with geothermal activity.*[31]

The CIA provided recommendations for a natural looking bund to avoid overflows to Puarenga Stream.

> *bunding of the flow in Puarenga Bay (may only require a low but wide bund to retain a natural look to avoid looking like a 'curb'.*[32]

> *The construction of a natural looking bund to direct treated wastewater to lake Rotorua and to avoid overflow to the Puarenga Stream.*[33]

[29] Cultural Impact Assessment of Rotorua Land Treatment System Alternatives. April 2017. Section 6.2 Waters, paragraph 5, p52
[30] Cultural Impact Assessment of a discharge of treated wastewater to Lake Rotorua through a land contact bed at Puarenga Bay, Rotorua April 2018. Section 4.0 Potential Effects, p14
[31] Cultural Impact Assessment of a discharge of treated wastewater to Lake Rotorua through a land contact bed at Puarenga Bay, Rotorua April 2018. Section 4.0 Potential Effects, p15
32 Cultural Impact Assessment of a discharge of treated wastewater to Lake Rotorua through a land contact bed at Puarenga Bay, Rotorua April 2018. Section 5.0, 1st bullet point, p18.
[33] Cultural Impact Assessment of a discharge of treated wastewater to Lake Rotorua through a land contact bed at Puarenga Bay, Rotorua April 2018. Section 8.0, bullet point 9, p22.

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An alternate bunding arrangement has been investigated which would involve “plugging” the connectivity points between the channel and Puarenga stream. This would involve constructing bunds up to about 0.50m height in 5 places:

- Zone 4.1 - 10 metres long
- Zone 4.2 – 8 metres long
- Zone 4.3 – 19 metres long
- Zone 4.4 - 5 metres long and
- Zone 4.5 – 6 metres long.

At each zone the intention (concept design) is to carry out minor excavations below ground level, within the 0.6 metre layer above the silica hardpan, to remove loose material. The excavated material would be mixed with imported gravel, sand (pumice) and clay (ash). Silica from the mine at Tikitere could be considered during the preliminary design process.

These bunds are considered more discrete and could blend more into with the sinter than the current proposal.

With the bunding proposal, concerns were also raised about erosion during high flows at Puarenga Stream and undermining the bund. Further modelling work is currently being done to establish the hydraulic connectivity of the thermal channel and Puarenga stream to establish whether there is any risk of the flow from the thermal channel flowing across the Puarenga stream.

It is understood that the bunds could be located further to the west and further away from the Puarenga Stream, however this would necessitate longer and larger bunds.

The implications of the alternative bunding proposal are believed to be:

- The bunds are reduced in height from 650-950mm to no more than 500mm.
- The bunding is reduced in overall distance from about 140 metres to 48 metres
- The bunding is less visible and likely be more ‘natural looking’
- Treated wastewater discharging to the Puarenga Bay is potentially closer by proximity to the Puarenga Stream
- Reduction in risk of erosion
- Will be an improvement in containing high flows
- The proposed bunds could include an impermeable, flexible, heat resistant rubber sheet imbedded in the bund to prevent any possible infiltration of treated wastewater entering the Puarenga Stream.

Conclusion

The proposals for alternative location of the outlet from the land contact bed and alternative bunds in Puarenga Bay are supported by the author of the cultural impact assessments.

Some amendments are required to the conceptual drawings and video supporting the land contact bed proposal. These changes should be run past the Cultural Impact Assessment sub-committee and the Matauranga Maori experts.

References

Figure 1 – Discharge and Channel Construction Methodology Site Plan, showing alternative outlet structure, 12 July 2018

Figure 2 – HEC RAS interpolated Results, Models 3 and 4, showing 5 bunds, 12 July 2018

Stantec 1 D model western bund reference line, 9 July 2018

Stantec Models 1 and 2 plan, mean lake level, 9 July 2018

Email from Greg Manzano, 13 July 2018

Email from Richard Hunt, 19 July 2018

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