

Memo

To: Wairoa Wastewater Stakeholder Focus Group
From: Neil Cook
Cc: Jamie cox
Date: 30th August 2017
Subject Integrating Wastewater Options and Holistic River Health Approach

Kia ora Koutou,

Joining the Dots – How do we connect Wastewater Management and the Wairoa River Catchment

Purpose

The purpose of this report is to expand upon the concept of integrating WWTP options with wider river catchment management scenarios. This report is to assist with the emerging discussion around the holistic view of the river and expand on the relatively narrow focus of wastewater treatment and discharge.

At the end of the meeting on Monday 4th September, we want to have narrowed down and arrived at a group of scenarios we can discuss with Council. After Council's further endorsement we would work through more detailed examination of a preferred wastewater option(s), develop work programmes, identify costs and cost allocation options.

It should be noted that this paper is intended to generate discussion about viable scenarios and their concepts. Each of the scenarios has multiple variations that could be applied. Once we narrow the focus, the preferred scenario will be refined in more detail, and allow us to arrive at a Best Practicable Option.

General Notes

Reticulation

Wastewater options described below that refer to flow reduction indicate that significant additional investment would be required to reduce Infiltration and Inflow into the wastewater reticulation. All other options assume that Council will continue with their current levels of investment which is aimed at reducing or eliminating overflows during wet weather.

Costs

Costs presented in the options paper (Appendix 1) are preliminary estimates and are developed for the purposes of: a) comparing options against each other; and b) giving a general indication of affordability for the community.

The levels of investment noted for catchment improvements are based on cost to the current connections to wastewater system. Council will need to consider the extent to which catchment improvement investment is supported by the wider ratepayer base. This could result in either a reduced burden on the wastewater ratepayers or an increased investment by the wider district.

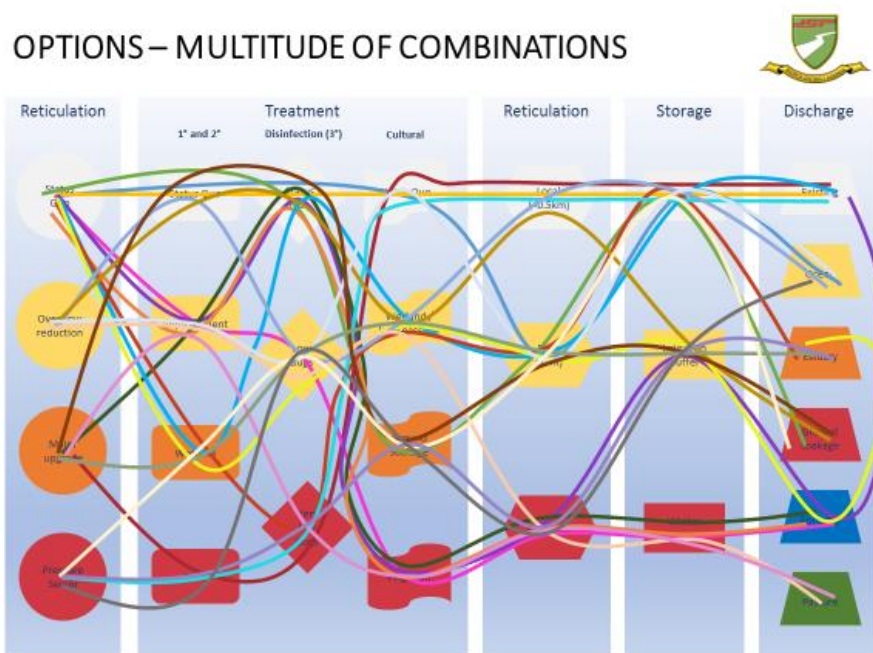
Leveraged Investment

Just as a decision by Council to allocate costs to the wider ratepayer base would allow more investment (or reduced burden on the wastewater ratepayers), external sources are highly likely for investment in catchment

improvements. These sources include private landowners, government departments (MfE, MBIE, Tourism), corporate partners (Eastland, Genesis, AFFCO etc). No assumptions have currently been incorporated to allow for potential additional investment however, this is something that would occur in the detailed development of a single preferred option.

Wastewater Options

Since April the Stakeholder Focus Group has worked through the options available for wastewater reticulation, treatment and discharge. There are numerous combinations of options and members will recall the discussion around the slide below:



From the *multitude of combinations*, 22 representative options were developed, with rough preliminary estimates and the pros and cons for each option documented on a 'one-pager'. These 22 options are detailed in the report included at Appendix 1.

Holistic View

At the meeting of 10th July, the group endorsed the proposal that the project team seek endorsement from Council to widen the scope of the discussion from a narrow focus on the wastewater treatment and discharge, to a holistic view of the river as a whole. This was a response, at least in part, to the emerging body of evidence that suggests there is potentially much greater environmental and cultural benefit to be gained by investing in the health of the river rather than investing in further treatment of the wastewater, or completely changing the treatment or discharge system.

At the Council Forum on 11th July, the Council signalled agreement to taking a more holistic approach and the project team subsequently started developing options around this for discussion with the community.

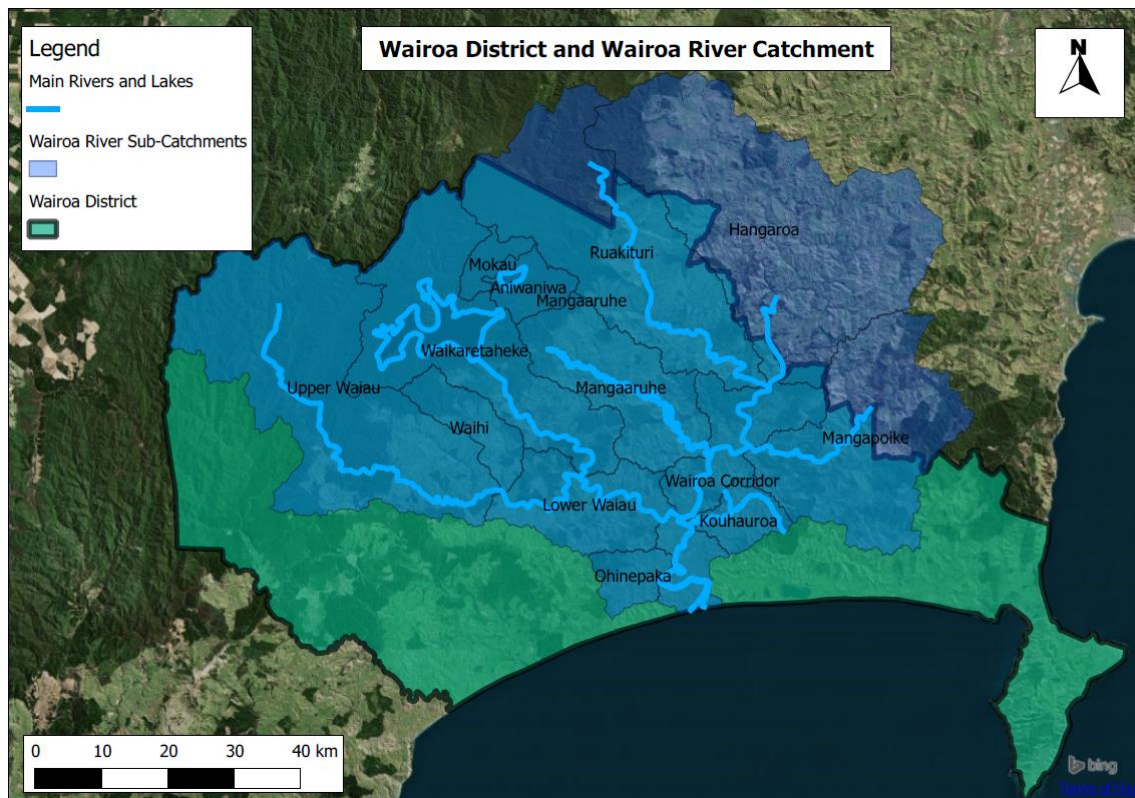
The first 'testing' of the idea was at the hui a iwi at Te Rauhina Marae on 30th July, where it was unanimously supported that the health of the river should be the principal driver for Council. Noting however, that the current discharge directly to the river remains an undesirable outcome.

The views expressed at the hui a iwi were unanimously endorsed by attendees at a public meeting held at the Memorial Hall on 31st July.

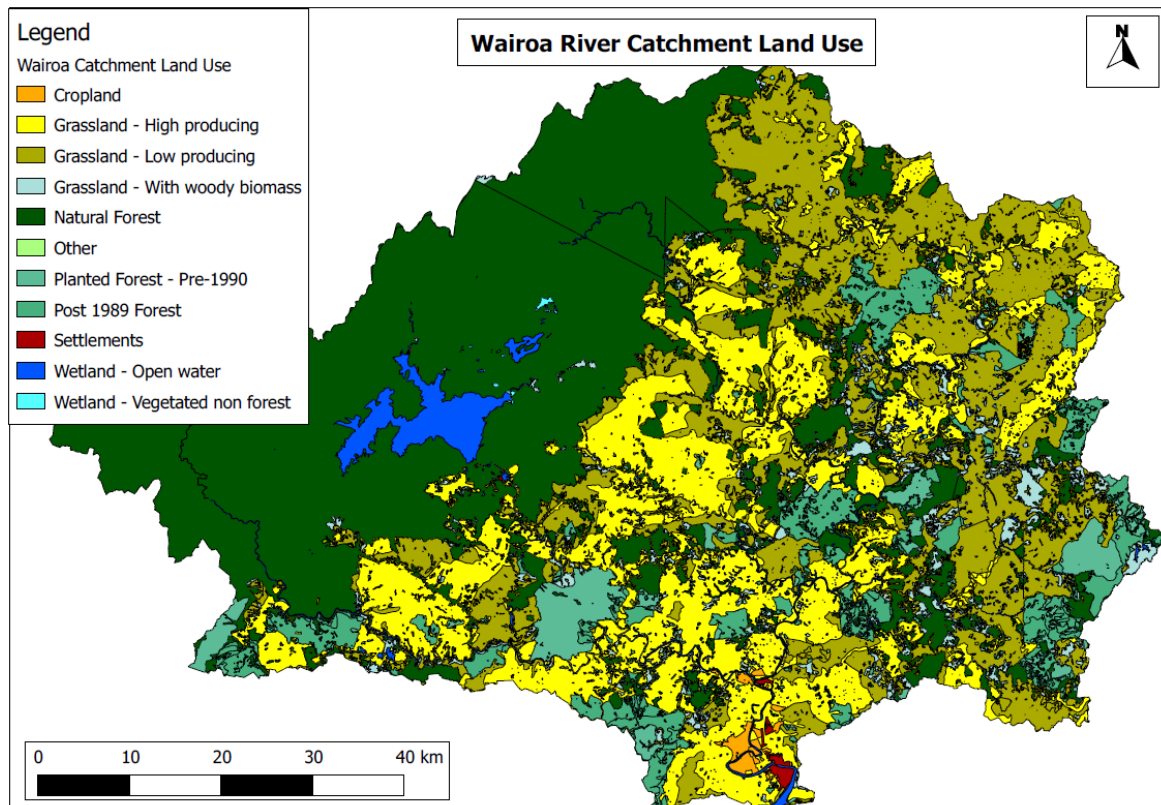
Wairoa River Catchment

The Wairoa River is the Hawke's Bay region's largest with an area of 3,563 square kilometres. The land-use in the catchment is mostly farming, predominantly hill country sheep and beef farming. Forestry is the

second largest land-use. The catchment includes the majority of the Wairoa district as well as having a significant land holding (much of the Hangaroa sub-catchment) in the Gisborne District.



The map below highlights the land use throughout the catchment:



Catchment Improvement

For the purposes of developing scenarios, we have made a distinction between the management/co-ordination aspects of catchment improvement and the actual improvement works. These are explained further below:

Management

This describes a co-ordination and administration function that may extend to monitoring, research, preparing funding applications to support improvement works and range of other 'enabling' activities. It is our experience that having dedicated resource to lead a project of this nature is critical to sustainability of catchment programmes over the longer term.

Improvement Works Programme

Improvement works are the physical interventions on the land or in the stream and rivers that will directly influence the health of the river. They include, but are not necessarily limited to:

- Retirement from grazing
- Planting for erosion control
- Fencing to exclude stock from waterways
- Riparian planting for water quality
- Farm management plans
- Stock crossings (to keep stock out of waterways)

Integrating the Holistic River Approach with the Wastewater Options

The challenge following the Council meeting, community meetings and stakeholder meeting has been to develop scenarios for consideration that integrate the desire for a holistic approach to river management with all the information provided and feedback received about the wastewater treatment and discharge.

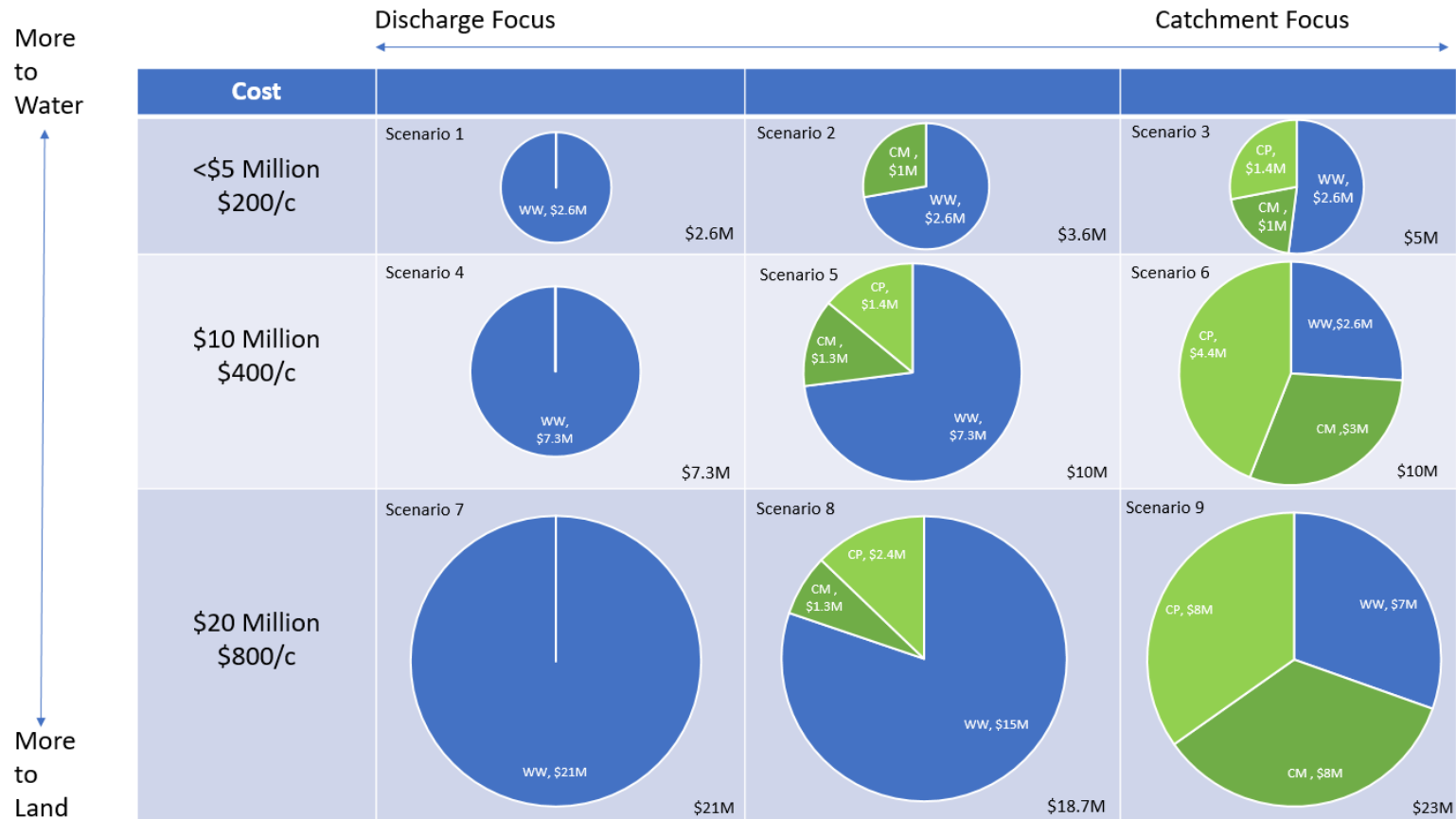
The matrix on the following page presents 9 generic scenarios, each of which could be modified in a number of ways. The matrix is based on trying to find the right balance of water discharge vs land treatment, wastewater vs catchment improvement (river health) focus; and doing this in the context of affordability for the community.

The 9 scenarios combine a scale of wastewater options with varying degrees of catchment management and works programmes. These 9 scenarios are generic and there is plenty of scope for them to be modified in some way, with what is shown being a continuum of two foci – increasing dollars (moving towards land) and a shift from a wastewater to catchment focus.

Summary of Scenarios for the Integration of Wastewater investment and Holistic Catchment Improvement

Notes to assist with reading the chart:


1. The size of the pie chart gives an indication of the scale of investment (e.g. the 'pie' or 'circle' in scenario 3 indicating \$5 Million is approximately ¼ the size of the one in scenario 9 which indicated \$20 Million)
2. WW – indicated by Dark blue, is the proportion of investment in wastewater for the scenario. Note that the scenarios in the left hand column are 100% blue indicating all the investment is going towards improving the wastewater discharge.
3. CM – indicated by dark green, is the investment in management/co-ordination/administration of catchment initiatives (monitoring, research etc)
4. CP – indicated by light green, is the investment in actual improvement works in the catchment (fencing, planting etc)

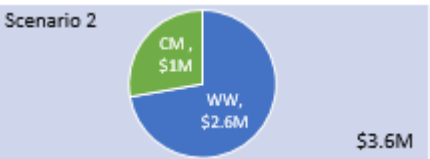


Detail of each Scenario

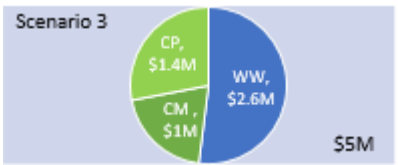
Notes:

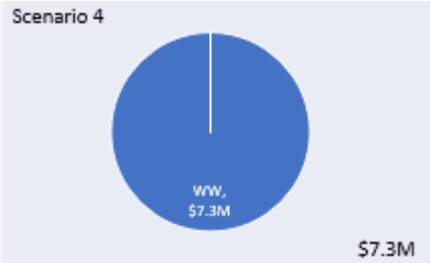
1. All costs and amount of improvements achievable are estimates only.
2. The proportion of various improvements can be modified to respond to changing needs.

<i>Scenario 1: Discharge Focus, Low Cost</i>					
<i>Wastewater Option 2.2 (Appendix 1)</i>					
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)		-	
	Treatment	Filtration and UV added to current treatment system.		\$2.6M	
	Discharge	Constructed land passage prior to existing discharge			
Catchment Improvement	Co-ordination and management	Nil		-	
	Projects	Riparian fencing and planting	Nil		-
		Erosion control planting	Nil		
		Land retirement	Nil		
		Farm management plans	Nil		
Cost/connection/year (30 year loan period)	\$100/connection/year	Total Cost	\$2.6 M		

<i>Scenario 2: Discharge 'weighted', Low Cost</i>					
<i>Wastewater Option 2.2 (Appendix 1)</i>					
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)		-	
	Treatment	Filtration and UV added to current treatment system.		\$2.6M	
	Discharge	Constructed land passage prior to existing discharge			
Catchment Improvement	Co-ordination and management	Manager/co-ordinator employed to facilitate projects, develop funding proposals. Allow \$100k/yr for 10 years (after which it is anticipated the position can become self-sustaining).		\$1.0M	
	Projects	Riparian fencing and planting	Nil		-
		Erosion control planting	Nil		
		Land retirement	Nil		
		Farm management plans	Nil		
Cost/connection/year (30 year loan period)	\$150/connection/year	Total Cost	\$3.6 M		

Integrating Wastewater Options and Holistic River Health Approach

Scenario 3: <i>Balanced approach, Low Cost</i>				
Wastewater Option 2.2 (Appendix 1)				
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)	-	
	Treatment	Filtration and UV added to current treatment system.	\$2.6M	
	Discharge	Constructed land passage prior to existing discharge		
Catchment Improvement	Co-ordination and management	Manager/co-ordinator employed to facilitate projects, develop funding proposals. Allow \$100k/yr for 10 years (after which it is anticipated the position can become self-sustaining).	\$1.0M	
	Projects	Riparian fencing and planting	32 km	\$1.4M
		Erosion control planting	648 ha	
		Land retirement (native)	160 ha	
		Afforestation (pines etc)	180 ha	
	Farm management plans	3,733 ha		
	Cost/connection/year (30 year loan period)	\$200/connection/year	Total Cost \$5.0 M	


Scenario 4: <i>Discharge Focus, Mid-range Cost</i>				
Wastewater Option 4.9 (Appendix 1)				
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)	-	
	Treatment	Filtration and UV added to current treatment system.	\$7.3M	
	Discharge	Rapid infiltration into coastal gravels (whakamahia)		
Catchment Improvement	Co-ordination and management	Nil	-	
	Projects	Riparian fencing and planting	Nil	-
		Erosion control planting	Nil	
		Land retirement (native)	Nil	
		Afforestation (pines etc)	Nil	
	Farm management plans	Nil		
	Cost/connection/year (30 year loan period)	\$300/connection/year	Total Cost \$7.3 M	

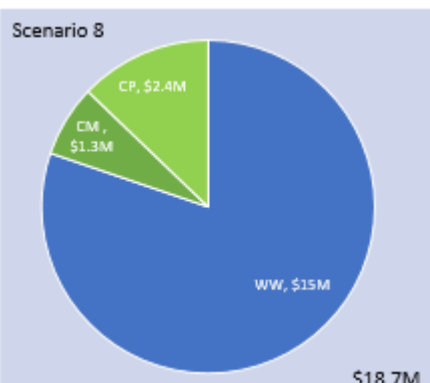
Integrating Wastewater Options and Holistic River Health Approach

Scenario 5: <i>Discharge 'weighted', Mid-range Cost</i>				
Wastewater Option 4.9 (Appendix 1)				
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)	-	
	Treatment	Filtration and UV added to current treatment system.	\$7.3M	
	Discharge	Rapid infiltration into coastal gravels (whakamahia)		
Catchment Improvement	Co-ordination management and	Manager/co-ordinator employed to facilitate projects, develop funding proposals. Allow \$100k/yr for 10 years (after which it is anticipated the position can become self-sustaining.)	\$1.3M	
	Projects	Riparian fencing and planting	32 km	\$1.4M
		Erosion control planting	648 ha	
		Land retirement (native)	160 ha	
		Afforestation (pines etc)	180 ha	
	Farm management plans	3,733 ha		
	Cost/connection/year (30 year loan period)	\$400/connection/year	Total Cost \$10.0 M	

Scenario 6: <i>Balanced approach, Mid-range Cost</i>				
Wastewater Option 2.2 (Appendix 1)				
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)	-	
	Treatment	Filtration and UV added to current treatment system.	\$2.6M	
	Discharge	Constructed land passage prior to existing discharge		
Catchment Improvement	Co-ordination management and	Management team. Manager/co-ordinator employed to facilitate projects, develop funding proposals. Field staff for monitoring and assistance with projects. Possible specialist support. Allow \$200k/yr for 10 years (after which it is anticipated the team can become self-sustaining.)	\$3.0M	
	Projects	Riparian fencing and planting	100 km	\$4.4M
		Erosion control planting	2,000 ha	
		Land retirement (native)	500 ha	
		Afforestation (pines etc)	575 ha	
	Farm management plans	11,700 ha		
	Cost/connection/year (30 year loan period)	\$400/connection/year	Total Cost \$10.0 M	

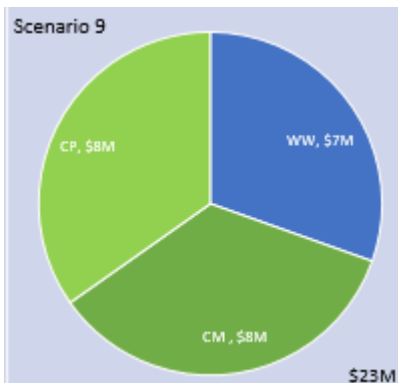
Integrating Wastewater Options and Holistic River Health Approach

Scenario 7: <i>Discharge Focus, High Cost</i>				
Wastewater Option 5.2 (Appendix 1) (90 days storage)				
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)	-	
	Treatment	Filtration and UV added to current treatment system.	\$21.0M	
	Discharge	Land discharge Some discharge to existing outfall during high rainfall (winter months) – constructed high rate land passage.		
Catchment Improvement	Co-ordination and management	Nil	-	
	Projects	Riparian fencing and planting	Nil	-
		Erosion control planting	Nil	
		Land retirement (native)	Nil	
		Afforestation (pines etc)	Nil	
	Farm management plans	Nil		
	Cost/connection/year (30 year loan period)	\$850/connection/year	Total Cost \$21.0M	

Scenario 8: <i>Discharge 'weighted', Mid-range Cost</i>				
Wastewater Option 5.2 (Appendix 1) (30 days storage)				
Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)	-	
	Treatment	Filtration and UV added to current treatment system.	\$15.0M	
	Discharge	Land discharge Some discharge to existing outfall during high rainfall (autumn - spring) – constructed high rate land passage.		
Catchment Improvement	Co-ordination and management	Management team. Manager/co-ordinator employed to facilitate projects, develop funding proposals. Field staff for monitoring and assistance with projects. Possible specialist support. Allow \$200k/yr for 10 years (after which it is anticipated the team can become self-sustaining.)	\$1.3M	
	Projects	Riparian fencing and planting	100 km	\$2.4M
		Erosion control planting	2,00 ha	

Integrating Wastewater Options and Holistic River Health Approach

		Land retirement (native)	500 ha	
		Afforestation (pines etc)	575 ha	
		Farm management plans	11,700 ha	
	Cost/connection/year (30 year loan period)	\$750/connection/year	Total Cost	\$18.7M

Scenario 9: Discharge 'weighted', Mid-range Cost		
Wastewater Option 5.2 (Appendix 1) (Variation on option 5.2 with minimal storage)		

Wastewater	Reticulation	Status quo (I&I reduction continues at current levels = no additional cost)	-	
	Treatment	Filtration and UV added to current treatment system.	\$7.0M	
	Discharge	Land discharge Some discharge to existing outfall during high rainfall (throughout the year) – constructed high rate land passage.		
Catchment Improvement	Co-ordination management and	Management team. Manager/co-ordinator employed to facilitate projects, develop funding proposals. Field staff for monitoring and assistance with projects. Possible specialist support. Allow \$200k/yr for 10 years (after which it is anticipated the team can become self-sustaining.)	\$8.0M	
	Projects	Riparian fencing and planting	183 km	\$8.0M
		Erosion control planting	3,700 ha	
		Land retirement (native)	900 ha	
		Afforestation (pines etc)	1,000 ha	
	Farm management plans	21,000 ha		
	Cost/connection/year (30 year loan period)	\$950/connection/year	Total Cost	\$23.0M

Discharge Options

(LEI, 2017: A7D1)

Prepared for

Wairoa District Council

Prepared by

L W E
Environmental
I m p a c t

August 2017

Discharge Options

Wairoa District Council

This report has been prepared for **Wairoa District Council** by Lowe Environmental Impact (LEI). No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other parties.

Quality Assurance Statement		
Task	Responsibility	Signature
Project Manager:	Hamish Lowe	
Prepared by:	Angela Lane	
Reviewed by:	Hamish Lowe	
Approved for Issue by:	Hamish Lowe	
Status:	Draft/Preliminary/Final	

Prepared by:

Lowe Environmental Impact
P O Box 4467
Palmerston North 4442

Ref: RE-10292-WDC-
A7D1_Discharge_Options_170829-DRAFT

Job No.: 10292

| T | [+64] 6 359 3099
| E | office@lei.co.nz
| W | www.lei.co.nz

Date: August 2017

Revision Status			
Version	Date	Author	What Changed and Why
1	24/8/2017	AL	Initial outline of 22 Discharge Options



TABLE OF CONTENTS

1	INTRODUCTION	1
1.1	Background	1
1.2	Purpose	1
1.3	Scope	1
2	OVERVIEW	2
2.1	General	2
2.2	Key Option Components	2
2.3	Option Combination Summary	3
2.4	Assumptions	4
3	DISCHARGE OPTIONS	6
3.1	Status Quo	6
3.2	River	8
3.3	Ocean	13
3.4	Land	15
3.5	Combination	24
4	SUMMARY OF COSTINGS	28

1 INTRODUCTION

1.1 Background

The Wairoa wastewater treatment system requires a replacement consent by May 2019. All discharge options, including the status quo and any preferred option, will have implications for the Wairoa District Council (WDC) and its ratepayers. Consideration of the cultural, recreational, environmental and financial values for a range of discharge options will help determine the best practicable option (BPO) for the Wairoa community.

1.2 Purpose

This report summarises and brings together combinations of generic reticulation, treatment, storage and discharge options. The summary of the discharge options shows how they are interdependent with storage volumes, treatment options, and the scale of inflow and infiltration (I & I) improvements.

The report is intended to provide a wide range of options which reflects the aspirations of the community (i.e. in particular the removal of the discharge from the river). This report is not intended to provide any recommendations for modifications to the current system, but merely identify a range of potential options which could be considered. The impact on the four pillars of social, recreational, cultural and financial are considered.

1.3 Scope

A range of practical options for treatment of Wairoa's wastewater are presented. Costs for each of the options are presented along with consideration as to the impact on the pillars of cultural, economic, recreational and environment.

The assessment is a very high level and the costs are approximate. While the costs include a contingency factor, they are more for relative comparison than absolute quantification.

2 OVERVIEW

2.1 General

This summary of options presents 22 reticulation, treatment, storage and discharge combinations. These options have been chosen based on knowledge of wastewater practices and are a very high level view of options.

The storage, treatment, and I & I options include the status quo and appropriate (but limited) upgrade options. This is not an exhaustive list, but it essentially encompasses the full spectrum of options and provides an indication of what is available and potentially suitable for the future of Wairoa's wastewater discharge.

2.2 Key Option Components

The following options for each component have been considered:

- **Discharge** options have been categorised as either:
 1. Status Quo;
 2. River;
 3. Ocean;
 4. Land; or
 5. Combination.
- **Reticulation:**
 - No changes (current flows - 6,500 m³/d peak, 4,000 m³/d winter average, and 2,700 m³/d mean flow); and
 - 50% of current flow (improved reticulation 50 % reduction in flow - 3,250 m³/d peak, 2,000 m³/d winter average, and 1,800 m³/d mean flow).
- **Treatment:**
 - No changes;
 - Filtration + UV;
 - Filtration only;
 - High Rate Land Passage – Overland Flow (HRLP-OLF); and
- **Storage:**
 - 2 – 3 days (current);
 - 14 days;
 - 90 days; and
 - 120 days.
- **Discharge:**
 - River – existing outfall;
 - River – new outfall;
 - Ocean;
 - Irrigation rate 1 – 5 mm application depth per day;
 - Irrigation rate 2 – 0.8 mm application depth per day; and
 - Rapid Infiltration – 200 mm application depth per day.

Each option is presented in the following section and has a detailed description of what is included and the reasons behind its inclusion as an option. Additionally, estimated costings of each option have been identified. These are shown as both the total cost and the breakdown of annual cost per connection if the capital investment is financed over a 30-year loan period.

The key benefits and disadvantages are outlined and link to the pillar assessment of the cultural, environmental, financial, and recreational values. An explanation of the effect of each discharge on these values is included.

2.3 Option Combination Summary

The following table sets out a summary of the 22 option combinations.

Table 2.1: Option Combinations

Option Code	Option Description
1.1	Status Quo
1.2	River-low bugs/24-hour continuous discharge
2.1	River-lowbugs
2.2	River-low bugs/HRLP-OLF
2.3	River-HRLP-OLF
2.4	River-50% flow/low bugs/HRLP-OLF
2.5	River(new)-low bugs -HRLP-OLF
3.1	Ocean
3.2	Ocean-HRLP-OLF
4.1	Land-90 day storage buffer/irrigation rate 1
4.2	Land-150 day storage buffer/irrigation rate 1
4.3	Land-50% flow/90 day storage buffer/irrigation rate 1
4.4	Land-50% flow/150 day storage buffer/irrigation rate 1
4.5	Land-90 day storage buffer/irrigation rate 2
4.6	Land-150 day storage buffer/irrigation rate 2
4.7	Land-50% flow/90 day storage buffer/irrigation rate 2
4.8	Land-50% flow/150 day storage buffer/irrigation rate 2
4.9	Land-rapid infiltration
5.1	Combo-River/land-HRLP-OLF/10 day storage buffer
5.2	Combo-River/land-HRLP-OLF/90 day storage buffer
5.3	Combo-50% flow/River/land-HRLP-OLF/10 day storage buffer
5.4	Combo-50% flow/River/land-HRLP-OLF/90 day storage buffer

2.4 Assumptions

The development of options, and in particular costs for the options, requires a series of assumptions to be made. These include:

Costs:

All costings are preliminary estimates, and costs generated from detailed design assessments could be less or perhaps significantly more expensive than the ranges indicated in this preliminary option assessment process.

Storage:

Storage pond sizing has been based on average daily winter flows of 4,000 m³/d currently and 2,000 m³/d for options where major reticulation improvements are included. These flows were used because elevated winter flows will generally drive storage volumes while summer flows will generally be discharged continuously when used for irrigation.

Discharge to river options 1.2 and 2.1-2.5 did not include any increased storage volume options because there is no benefit gained from larger storage. It is noted that, regardless of river flows being high or low, the tides and river flows provide good dilution and flushing volumes in the estuary.

All combo options 5.1-5.4 have assumed that storage of 120 days is not necessary, as the river should be able to receive wastewater more frequently during winter and the land can receive wastewater frequently during summer.

Disinfection:

UV treatment to reduce pathogen concentrations requires filtration as a pre-treatment, so this is included in all discharge to river options except 2.3 and in all discharge to land or combo options.

All combo options 5.1-5.4 include filtration and UV only for the irrigated wastewater component. It is not necessary for the river discharge and also reduces the size of the filtration/UV units and consequently reduces costs.

Land Passage:

HRLP works best for stable flow rates. Multiple HRLP beds could be used to expand the system to cope with storm flows. OLF could be a wetland or a vegetated swale - there are many potential design options.

The residual wastewater from HRLP-OLF will need to be collected and then pumped through the pipeline to the river or ocean discharge location, as pressure will be needed to force it out into the river or ocean environment.

All combo options 5.1-5.4 have assumed that the river discharge will require HRLP-OLF in order to address cultural values prior to the wastewater entering the river.

Potential New River Discharge:

A new river discharge location could be further up the main river stem, within the estuary, or within the lagoons east and west of the estuary. For cultural and environmental reasons (poor dispersion and flushing), the lagoons must be discounted as a viable option. Other river and estuary locations are unlikely to be assessed as any better than the existing location.

Discharge to Ocean Considerations:

Discharge to ocean options 3.1 and 3.2 did not include any increased storage volume or reticulation improvement options because there is no benefit gained from larger storage or reduced flows. It is noted that the ocean provides very high dilution regardless of wastewater flows and quality.

Discharge to ocean options do not require filtration or UV for pathogens because the ocean will rapidly disperse the discharge without adverse effects and is unlikely to form a visible plume. The only reason for any treatment improvement (land passage) is to address cultural values.

Discharge to ocean could remain restricted to overnight, but without out-going tide time restrictions. However, there is no environmental or recreational reason why it couldn't occur continuously on a 24 hour basis.

Discharge to ocean location could be near shore (500 m from the Hawke Bay side of the spit) or further off-shore (1 km or more off-shore). The advantages and disadvantages of near shore should be considered before considering the more expensive far shore option.

Discharge to Land Considerations:

Discharges to land options 4.1-4.8 require 90-120 days of storage due to the reasonably wet climate, poor soil drainage, and low soil water holding capacities. Only the rapid infiltration option can cope with smaller storage, but this is dependent upon the drainage from the rapid infiltration basin entering surface water in an environmentally sustainable manner and rate.

Land uses for options 4.1-4.8 could be pasture or forestry, but the actual type of land use is not critical to the assessments of values. The key factor is the daily application rate, as this determines the area of land required which affects the cost of purchasing or leasing land and the extent and cost of irrigation infrastructure.

Irrigation requires filtration to prevent nozzle blockages. Irrigation of pasture may require UV treatment, so this has been included in all land discharge options.

Discharges to land are very unlikely to be able to cope with the largest emergency storm flows, so a relief valve of discharging to the river or ocean must be included for such rare events.

Rapid infiltration option 4.9 requires dunes for highly porous and free-draining soils. There is a narrow strip of dune soils along the coast, but the availability of suitable sites close to the WWTP is limited. The coast and ocean processes are highly active/dynamic, so any site will need to be protected from coastal erosion. Rapid infiltration can also destabilise the dunes and be lost in storm erosion.

3 DISCHARGE OPTIONS

3.1 Status Quo

Option: 1.1 Status Quo
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes or additional treatment technologies.
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: No changes (current river discharge location and timing controls - out-going tides during 6 pm-6 am)

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$1.8M to \$2.4M Annual rates range: \$ 73.70 to \$ 97.80

Detailed Description:

Existing reticulation renewal programme. No changes to treatment, storage, discharge location or discharge regime.

Reasons for Inclusion in Option Assessment:

Baseline against which other options need to be assessed. Current environmental effects and treatment performance are acceptable, but it is culturally unacceptable.

Key Benefits:

Minimal costs due to a lack of any upgrades or changes to any aspects of the wastewater system.

Key Disadvantages:

No environmental, cultural, or recreational improvements for the river. May be unacceptable for consenting.

Pillar Assessments

Recreational Values	Environmental Values
The time of discharge should not impact river users, but could impact on public perception. Potential for public health concern due to limited pathogen treatment.	No more than minor impact on receiving environment from discharge, however in-river biota counts are low due to upstream silt sources. Discharging on out-going tides ensures good flushing and protects estuary except when river mouth is closed.
Cultural Values	Financial Values
Direct discharge to water without land passage is culturally offensive.	Consenting will be the only cost because nothing else is being changed or upgraded. The consent for this option is likely to be more expensive than all others due to cultural and community opposition.

Option: 1.2 River-low bugs/24-hour continuous discharge
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: Filtration and UV to reduce pathogens
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: No change to river discharge location, but allowing for continuous 24-hour discharges.

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$1.6M to \$2.2M Annual rates range: \$ 62.66 to \$ 86.09

Detailed Description:

Existing reticulation renewal programme. Filtration & UV to reduce pathogens. No additional storage. Continuous discharge to river. If necessary, summer discharges could be restricted to overnight out-going tides.

Reasons for Inclusion in Option Assessment:

Simpler discharge regime, but still addresses public health concerns.

Key Benefits:

Simplified discharge regime that helps keep the river discharge outlet clear of silt and needs no storage. UV treatment ensures that public health and recreational values are addressed.

Key Disadvantages:

No cultural improvements for the river, and minimal environmental improvement. May be unacceptable for consenting due to 24-hour direct river discharge without any cultural mitigation.

Pillar Assessments

<p>Recreational Values Will impact on public perception (24-hour discharges may be less acceptable than overnight restrictions), but UV treatment of pathogens ensures there is no risk to public health despite 24 hour discharge.</p>	<p>Environmental Values Low pathogens protects the river biota. Could have minor impact on upstream environment during incoming tides. May have more of a dilution effect if discharging at lower rates over 24 hours.</p>
<p>Cultural Values Direct discharge to water without land passage is culturally offensive. UV treatment of pathogens does not address this cultural value.</p>	<p>Financial Values Consenting will be more expensive due to cultural and community opposition; 24-hour discharges may be contentious. Incorporation of UV treatment will be higher due to its capacity requirement for current flows. Costs of major reticulation upgrades, storage, and land expansion have been avoided.</p>

Option: 2.2 River-low bugs/HRLP-OLF
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: HRLP or overland flow, then filtration and UV to reduce pathogens.
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: No changes to river discharge location or timing.

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$2.M to \$3.2M Annual rates range: \$ 79.71 to \$ 129.83

Detailed Description:

Existing reticulation renewal programme. HRLP/OLF to address cultural and environmental values. Filtration & UV to reduce pathogens (probably after HRLP/OLF). No additional storage. Current discharge regime & location.

Reasons for Inclusion in Option Assessment:

Additional treatment to address pathogens and cultural and environmental values while maintaining current river discharge to minimise costs.

Key Benefits:

Additional treatments address public health and cultural values while also improving the river environment.

Key Disadvantages:

Large modular HRLP and UV systems will be needed to handle the highly variable and large daily flows. May be unacceptable for consenting due to reliance on river receiving environment.

Pillar Assessments

Recreational Values	Environmental Values
The time of discharge should not impact river users, but could impact on public perception. HRLP design could be visually appealing, but position of HRLP could impact on current land users. Pathogen treatment ensures there is no health risk for contact recreation.	HRLP allows for some nutrient recycling and benefit to artificial wetland environment. Low pathogens and HRLP protect river biota and ensures a less than minor impact on receiving environment from discharge. Discharging on outgoing tides ensures good flushing and protects estuary except when river mouth is closed.
Cultural Values	Financial Values
Favourable. Treated wastewater passes over papatuanuku before discharge to water. Pathogen treatment improves acceptability of kaimoana for consumption.	The costs of HRLP and UV treatment will be higher to cope with current flows, but the costs of major reticulation upgrades and storage have been avoided. Cost of consenting could be lower in recognition of the design addressing cultural and environmental values.

Option: 2.3 River-HRLP-OLF
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: HRLP or overland flow.
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: No changes to river discharge location or timing.

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$1.7M to \$3.M Annual rates range: \$ 68.67 to \$ 118.12

Detailed Description:

Existing reticulation renewal programme. HRLP/OLF to address cultural and environmental values. No filtration & UV to reduce pathogens. No additional storage. Current discharge regime & location.

Reasons for Inclusion in Option Assessment:

Additional treatment to address cultural and environmental values while maintaining current river discharge to minimise costs.

Key Benefits:

HRLP treatment addresses cultural values and contributes to improving the river environment.

Key Disadvantages:

Does not address the public health risk of pathogens in the river. A large modular HRLP will be needed to handle the highly variable and large daily flows. May be unacceptable for consenting due to reliance on river receiving

Pillar Assessments

<p style="text-align: center;">Recreational Values</p> <p>Lack of pathogen treatment after HRLP could increase pathogen counts at outlet to river, but time of discharge should not impact river users, but could impact on public perception. HRLP design could be visually appealing, but position of HRLP could impact on current land users.</p>	<p style="text-align: center;">Environmental Values</p> <p>HRLP protects river biota and ensures a less than minor impact on receiving environment from discharge. HRLP allows for some nutrient recycling and could be an attractant for wildlife, but could increase pathogen counts at outlet to river.</p>
<p style="text-align: center;">Cultural Values</p> <p>Favourable, as treated wastewater passes over papatuanuku before discharge to water, but the lack of pathogen treatment does not improve the acceptability of kaimoana for consumption.</p>	<p style="text-align: center;">Financial Values</p> <p>The cost of HRLP will be higher to cope with current flows, but the costs of major reticulation upgrades, storage, and UV have been avoided. Cost of consenting could be lower in recognition of the design addressing cultural and environmental values.</p>

Option: 2.4 River-50% flow/low bugs/HRLP-OLF
Reticulation: Major upgrades (flows of 1,800 m³/d average and 3,500 m³/d peak)
Treatment: HRLP or overland flow, then filtration and UV to reduce pathogens.
Storage: No changes (5,400 m³ for 3-4 days of inflows).
Discharge: No changes to river discharge location or timing.

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$15.6M to \$34.4M Annual rates range: \$ 623.04 to \$ 1,379.12

Detailed Description:

Intensive reticulation renewal programme to reduce flows. HRLP/OLF to address cultural and environmental values. Filtration & UV to reduce pathogens (probably after HRLP/OLF). No additional storage. Current discharge regime & location.

Reasons for Inclusion in Option Assessment:

Intensive reticulation to improve flow management, which will reduce the sizes and improve the stability of UV and HRLP systems. Additional treatment to address public health, cultural and environmental values.

Key Benefits:

Filtration and UV units can be smaller than would be needed for current flows. HRLP will receive more consistent gentle flows and can be smaller than would be needed for current flows. Additional treatments address public health and cultural values while also improving the river environment.

Key Disadvantages:

Significant reticulation upgrade costs may be unaffordable for the community or less efficient expenditure than treating and discharging the current flows. May be unacceptable for consenting due to reliance on river receiving environment.

Pillar Assessments

<p>Recreational Values The time of discharge should not impact river users, but could impact on public perception. HRLP design could be visually appealing, but position of HRLP could impact on current land users, however the smaller size for smaller flows will mitigate this. Pathogen treatment ensures there is no health risk for contact recreation.</p>	<p>Environmental Values Lower flow reduces effects on environment. HRLP allows for some nutrient recycling and benefit to artificial wetland environment. Low pathogens and HRLP protect river biota and ensures a less than minor impact on receiving environment from discharge. Discharging on outgoing tides ensures good flushing and protects estuary except when river mouth is closed.</p>
<p>Cultural Values Favourable, as treated wastewater passes over papatuanuku before discharge to water. Pathogen treatment improves acceptability of kaimoana for consumption.</p>	<p>Financial Values The costs of HRLP and UV treatment will be lower due to reduced flows, but the cost of major reticulation upgrades has been incurred instead. The cost of storage has been avoided too. Cost of consenting could be lower in recognition of the design addressing cultural and environmental values.</p>

Option: 2.5 River(new)-low bugs -HRLP-OLF
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: HRLP or overland flow, then filtration and UV to reduce pathogens.
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: New river discharge location but perhaps retain existing discharge timing.

Impracticable, no suitable sites with any environmental gains

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$3.2M to \$5.2M Annual rates range: \$ 129.16 to \$ 207.91

Detailed Description:

Existing reticulation renewal programme. HRLP/OLF to address cultural and environmental values. Filtration & UV to reduce pathogens (probably after HRLP/OLF). No additional storage. Current discharge regime but at a new location within the river.

Reasons for Inclusion in Option Assessment:

A new river discharge location has been discussed previously and needs to be considered as a potential option.

Key Benefits:

A different river discharge location might be more acceptable to the community, ensure faster dispersion and flushing out to sea, and less prone to siltation problems than the current river discharge location. Additional treatments address public health and cultural values while also improving the river environment.

Key Disadvantages:

A changed location within the river may be seen as providing no benefit to the river while adding unnecessary costs. Large modular HRLP and UV systems will be needed to handle the highly variable and large daily flows. May be unacceptable for consenting due to reliance on river receiving environment.

Pillar Assessments

<p style="text-align: center;">Recreational Values</p> <p>The time of discharge should not impact river users, but could impact on public perception. HRLP design could be visually appealing, but position of HRLP could impact on current land users. Pathogen treatment ensures there is no health risk for contact recreation. New location of discharge may impact on where existing recreational activities are pursued.</p>	<p style="text-align: center;">Environmental Values</p> <p>HRLP allows for some nutrient recycling and benefit to artificial wetland environment. Low pathogens and HRLP protect river biota and ensures a less than minor impact on receiving environment from discharge. Discharging on outgoing tides ensures good flushing and protects estuary except when river mouth is closed.</p>
<p style="text-align: center;">Cultural Values</p> <p>Favourable, as treated wastewater passes over papatuanuku before discharge to water. Pathogen treatment improves acceptability of kaimoana for consumption.</p>	<p style="text-align: center;">Financial Values</p> <p>The costs of HRLP and UV treatment will be higher to cope with current flows, but the costs of major reticulation upgrades and storage have been avoided. Cost of consenting could be lower in recognition of the design addressing cultural and environmental values.</p>

3.3 Ocean

Option: 3.1 Ocean
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: New ocean discharge location but perhaps retain existing discharge timing.

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$7.5M to \$27.M Annual rates range: \$ 300.31 to \$ 1,081.11

Detailed Description:

Existing reticulation renewal programme. No changes to treatment or additional storage. New ocean outfall (either 500 m off-shore or 1 km off-shore). Current overnight out-going tide or continuous 24-hour discharge regime.

Reasons for Inclusion in Option Assessment:

Discharge uses a nearby receiving environment with the highest capacity to receive and disperse the discharge without adverse effects.

Key Benefits:

The ocean has the greatest capacity to receive the discharge without timing or volume restrictions. No need to upgrade reticulation, treatment, or storage.

Key Disadvantages:

No cultural improvements for effects on water, potentially culturally offensive pipeline route through estuary/lagoon and spit, and installing a pipeline to the ocean outfall will be expensive and technically difficult to

Pillar Assessments

Recreational Values	Environmental Values
Less than minor impact except close to the discharge structure, may impact on public perception due to lack of pathogen treatment and/or if discharge is visible in the ocean.	Very low impact on receiving environment due to very large and rapid dispersion.
Cultural Values	Financial Values
Direct discharge to water without land passage is culturally offensive, but discharge to the ocean seems preferable to using the river.	Construction of an ocean outfall is expensive due to its technical design and installation requirements. Costs of major reticulation upgrades, additional treatment, storage, and land expansion have been avoided. Consenting costs will depend on the level of public support or opposition.

Option: 3.2 Ocean-HRLP-OLF
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes except HRLP-OLF on outlet.
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: New ocean discharge location but perhaps retain existing discharge timing.

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$8.2M to \$28.3M Annual rates range: \$ 326.34 to \$ 1,133.16

Detailed Description:

Existing reticulation renewal programme, and no additional storage. HRLP to address cultural values prior to new ocean outfall (either 500 m off-shore or 1 km off-shore). Current overnight out-going tide or continuous 24-hour discharge regime.

Reasons for Inclusion in Option Assessment:

HRLP addresses cultural values and discharges to a nearby receiving environment with the highest capacity to receive and disperse the discharge without adverse effects.

Key Benefits:

HRLP addresses cultural values while discharging to the ocean has the greatest capacity to receive the discharge without timing or volume restrictions. No need to upgrade reticulation, treatment, or storage.

Key Disadvantages:

Large modular HRLP system will be needed to handle the highly variable and large daily flows. Potentially culturally offensive pipeline route through estuary/lagoon and spit, and installing a pipeline to the ocean outfall will be expensive and technically difficult to achieve.

Pillar Assessments

Recreational Values	Environmental Values
Less than minor impact except close to the discharge structure, may impact on public perception due to lack of pathogen treatment and/or if discharge is visible; HRLP design could be visually appealing; position of HRLP could impact on current land users.	Very low impact on ocean receiving environment due to very large and rapid dispersion; HRLP could be an attractant for wildlife, but could increase pathogen counts prior to discharge to ocean.
Cultural Values	Financial Values
Favourable, as treated wastewater passes over papatuanuku before discharge to water, and the ocean seems preferable to using the river.	Construction of an ocean outfall is expensive due to its technical design and installation requirements. The cost of constructing an HRLP is an additional cost, which will be reasonably significant for managing the current flows. Costs of major reticulation upgrades and storage have been avoided. Consenting costs will depend on the level of public support or opposition.

3.4 Land

Option: 4.1 Land-90 day storage buffer/irrigation rate 1
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 90-day storage (360,000 m³).
Discharge: New land irrigation system, applying an average of 5 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$12.8M to \$27.5M Annual rates range: \$ 511.68 to \$ 1,101.67

Detailed Description:

Existing reticulation renewal programme. Irrigation at a daily average of 5 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 90 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at highest daily rate possible with minimal storage and avoiding expensive reticulation upgrade.

Key Benefits:

River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients. Avoids reticulation upgrade costs.

Key Disadvantages:

Large and expensive storage. Large irrigation area. May not be feasible during winter due to high soil moisture and wastewater flows.

Pillar Assessments

Recreational Values	Environmental Values
Any current land use will be affected by when and where irrigation is applied. River discharge is avoided.	Low impact on environment; restricted storage may result in irrigation above soil moisture deficit
Cultural Values	Financial Values
Favourable, as all wastewater passes over and through papatuanuku and some nutrients will be used to grow pasture.	Large storage and large irrigation area are costly, but costs of major reticulation upgrades have been avoided. Cost of consenting could be modest.

Option: 4.2 Land-120 day storage buffer/irrigation rate 1
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 120-day storage (480,000 m³).
Discharge: New land irrigation system, applying an average of 5 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$16.M to \$34.M Annual rates range: \$ 639.80 to \$ 1,362.72

Detailed Description:

Existing reticulation renewal programme. Irrigation at a daily average of 5 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 120 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at highest daily rate possible with large storage while avoiding expensive reticulation upgrade.

Key Benefits:

River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients. Avoids reticulation upgrade costs.

Key Disadvantages:

Very large and expensive storage. Large irrigation area. May not be feasible during winter due to high soil moisture and wastewater flows.

Pillar Assessments

<p>Recreational Values Any current land use will be affected by when and where irrigation is applied. River discharge is avoided.</p>	<p>Environmental Values Med-low impact on environment, extra storage lowers risk of irrigating above soil moisture deficit</p>
<p>Cultural Values Favourable, as all wastewater passes over and through papatuanuku and some nutrients will be used to grow pasture.</p>	<p>Financial Values Large storage and large irrigation area are costly, but costs of major reticulation upgrades have been avoided. Cost of consenting could be modest.</p>

Option: 4.3 Land-50% flow/90 day storage buffer/irrigation rate 1
Reticulation: Major upgrades (flows of 1,800 m³/d average and 3,250 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 90-day storage (180,000 m³).
Discharge: New land irrigation system, applying an average of 5 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$21.6M to \$48.1M Annual rates range: \$ 864.98 to \$ 1,927.91

Detailed Description:

Intensive reticulation renewal programme to reduce flows. Irrigation at a daily average of 5 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 120 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at highest daily rate possible with large storage and reduced flows.

Key Benefits:

Storage size and irrigated land area have been minimised by upgrading reticulation. River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients.

Key Disadvantages:

Large and expensive storage. Large irrigation area. May not be feasible during winter due to high soil moisture and wastewater flows.

Pillar Assessments

<p style="text-align: center;">Recreational Values</p> <p>Any current land use will be affected by when and where irrigation is applied. River discharge is avoided.</p>	<p style="text-align: center;">Environmental Values</p> <p>Very low impact on environment and smallest irrigation land area; reduced flow and large storage ensure irrigation occurs at suitable rates and when most beneficial to soils and pasture; high safety margin with large storage volume.</p>
<p style="text-align: center;">Cultural Values</p> <p>Favourable, as all wastewater passes over and through papatuanuku and some nutrients will be used to grow pasture.</p>	<p style="text-align: center;">Financial Values</p> <p>Large storage and large irrigation area are costly, and costs of major reticulation upgrades have also been incurred. Cost of consenting could be modest.</p>

Option: 4.4 Land-50% flow/120 day storage buffer/irrigation rate 1
Reticulation: Major upgrades (flows of 1,800 m³/d average and 3,250 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 120-day storage (240,000 m³).
Discharge: New land irrigation system, applying an average of 5 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$23.2M to \$51.4M Annual rates range: \$ 929.28 to \$ 2,059.25

Detailed Description:

Intensive reticulation renewal programme to reduce flows. Irrigation at a daily average of 5 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 120 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at highest daily rate possible with large storage and reduced flows.

Key Benefits:

Storage size and irrigated land area have been minimised by upgrading reticulation. River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients.

Key Disadvantages:

Large and expensive storage. Large irrigation area. May not be feasible during winter due to high soil moisture and wastewater flows.

Pillar Assessments

<p>Recreational Values Any current land use will be affected by when and where irrigation is applied. River discharge is avoided.</p>	<p>Environmental Values Very low impact on environment and smallest irrigation land area; reduced flow and large storage ensure irrigation occurs at suitable rates and when most beneficial to soils and pasture; high safety margin with large storage volume.</p>
<p>Cultural Values Favourable, as all wastewater passes over and through papatuanuku and some nutrients will be used to grow pasture.</p>	<p>Financial Values Large storage and large irrigation area are costly, and costs of major reticulation upgrades have also been incurred. Cost of consenting could be modest.</p>

Option: 4.5 Land-90 day storage buffer/irrigation rate 2
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 90-day storage (360,000 m³).
Discharge: New land irrigation system, applying an average of 0.8 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$22.M to \$59.8M Annual rates range: \$ 880.60 to \$ 2,392.92

Detailed Description:

Existing reticulation renewal programme. Irrigation at a daily average of 0.8 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 90 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at low daily rate with minimal storage and avoiding expensive reticulation upgrade.

Key Benefits:

River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients. Avoids reticulation upgrade costs.

Key Disadvantages:

Very large land area required for irrigation and large storage pond. Unlikely to be feasible within soil moisture limits for more than a few dry months each year.

Pillar Assessments

<p align="center">Recreational Values</p> <p>Any current land use will be affected by when and where irrigation is applied. This option has one of the largest land area requirements, so potentially elevates the perception of effects on more neighbours and landowners. River discharge is avoided.</p>	<p align="center">Environmental Values</p> <p>Low impact on environment but discharges to a larger land area; restricted storage may result in irrigation above soil moisture deficit more frequently than desirable, and this causes adverse effects on soils and pasture.</p>
<p align="center">Cultural Values</p> <p>Favourable, as all wastewater passes over and through papatuanuku and most of the nutrients will be used to grow pasture.</p>	<p align="center">Financial Values</p> <p>Very large storage and very large irrigation area are costly, but costs of major reticulation upgrades have been avoided. Cost of consenting could be modest.</p>

Option: 4.6 Land-120 day storage buffer/irrigation rate 2
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 120-day storage (480,000 m³).
Discharge: New land irrigation system, applying an average of 0.8 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$25.2M to \$66.3M Annual rates range: \$ 1,008.73 to \$ 2,653.97

Detailed Description:

Existing reticulation renewal programme. Irrigation at a daily average of 0.8 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 120 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at low daily rate with large storage and avoiding expensive reticulation upgrade.

Key Benefits:

River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients. Avoids reticulation upgrade costs.

Key Disadvantages:

Very large land area required for irrigation and very large storage pond. Unlikely to be feasible within soil moisture limits for more than a few dry months each year.

Pillar Assessments

<p>Recreational Values Any current land use will be affected by when and where irrigation is applied. This option has one of the largest land area requirements, so potentially elevates the perception of effects on more neighbours and landowners. River discharge is avoided.</p>	<p>Environmental Values Med-low impact on environment, extra storage lowers risk of irrigating above soil moisture deficit</p>
<p>Cultural Values Favourable, as all wastewater passes over and through papatuanuku and most of the nutrients will be used to grow pasture.</p>	<p>Financial Values Very large storage and very large irrigation area are costly, but costs of major reticulation upgrades have been avoided. Cost of consenting could be modest.</p>

Option: 4.7 Land-50% flow/90 day storage buffer/irrigation rate 2
Reticulation: Major upgrades (flows of 1,800 m³/d average and 3,250 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 90-day storage (180,000 m³).
Discharge: New land irrigation system, applying an average of 0.8 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$27.7M to \$69.6M Annual rates range: \$ 1,110.94 to \$ 2,788.75

Detailed Description:

Intensive reticulation renewal programme to reduce flows. Irrigation at a daily average of 0.8 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 90 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at low daily rate with minimal storage and reduced flows.

Key Benefits:

Storage size and irrigated land area have been minimised by upgrading reticulation. River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients.

Key Disadvantages:

Very large land area required for irrigation and moderate storage size. Unlikely to be feasible within soil moisture limits for more than a few dry months each year. Expensive reticulation upgrades.

Pillar Assessments

<p>Recreational Values Any current land use will be affected by when and where irrigation is applied. River discharge is avoided.</p>	<p>Environmental Values Very low impact on environment; reduced flow concentrates wastewater but will decrease risk of reduced storage during times of soil saturation</p>
<p>Cultural Values Favourable, as all wastewater passes over and through papatuanuku and most of the nutrients will be used to grow pasture.</p>	<p>Financial Values Large storage and very large irrigation area are costly, and costs of major reticulation upgrades have also been incurred. Cost of consenting could be modest.</p>

Option: 4.8 Land-50% flow/120 day storage buffer/irrigation rate 2
Reticulation: Major upgrades (flows of 1,800 m³/d average and 3,250 m³/d peak)
Treatment: No changes except filtration and UV on outlet.
Storage: 120-day storage (240,000 m³).
Discharge: New land irrigation system, applying an average of 0.8 mm/d

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$29.4M to \$72.9M Annual rates range: \$ 1,175.23 to \$ 2,920.08

Detailed Description:

Intensive reticulation renewal programme to reduce flows. Irrigation at a daily average of 0.8 mm/d. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 120 days of flows.

Reasons for Inclusion in Option Assessment:

100 % land discharge at low daily rate with large storage and reduced flows.

Key Benefits:

Storage size and irrigated land area have been minimised by upgrading reticulation. River discharge is avoided if discharges to land exceed soil moisture limits in winter. Pasture benefits from water and nutrients.

Key Disadvantages:

Very large land area required for irrigation and moderate to large storage size. Unlikely to be feasible within soil moisture limits for more than a few dry months each year. Expensive reticulation upgrades.

Pillar Assessments

<p>Recreational Values Any current land use will be affected by when and where irrigation is applied. River discharge is avoided.</p>	<p>Environmental Values Very low impact on environment; reduced flow concentrates wastewater but less to apply; high safety margin with storage buffer</p>
<p>Cultural Values Favourable, as all wastewater passes over and through papatuanuku and most of the nutrients will be used to grow pasture.</p>	<p>Financial Values Very large storage and very large irrigation area are costly, and costs of major reticulation upgrades have also been incurred. Cost of consenting could be modest.</p>

Option: 4.9 Land-rapid infiltration
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: No changes
Storage: No changes (5,400 m³ for 2-3 days of inflows).
Discharge: New rapid infiltration to land discharge location but perhaps retain existing discharge timing.

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$4.3M to \$9.9M Annual rates range: \$ 172.68 to \$ 394.48

Detailed Description:

Existing reticulation renewal programme. Rapid infiltration to address cultural and environmental values, and to minimise required land area. No filtration & UV to reduce pathogens. No additional storage.

Reasons for Inclusion in Option Assessment:

Rapid infiltration is a very compact 100 % land discharge option that avoids some infrastructure and land costs.

Key Benefits:

Smallest land area and low to moderate cost if close to WWTP.

Key Disadvantages:

Difficult to find a suitable site that will be safe from erosion and away from cultural sites. Discharge contaminates groundwater. May need to install several km of reticulation from WWTP to discharge location.

Pillar Assessments

Recreational Values	Environmental Values
Any current land use will be affected by when and where irrigation is applied, but this is likely to be small and coastal (it needs sandy soils) and may only concern a couple of neighbours or recreational areas.	There is no beneficial nutrient recycling through plants due to speed and large volumes of drainage. It will cause groundwater contamination adjacent to the shore, but occupies a very small land area and avoids the river.
Cultural Values	Financial Values
Favourable, as all wastewater passes over and through papatuanuku, but its rapid and large drainage close to open water may be less acceptable than irrigation. The site will need to avoid culturally significant areas along the coastline.	The cost of rapid infiltration will be higher to cope with current flows, but the costs of major reticulation upgrades, storage, and UV have been avoided. Long reticulation to a distant site could be costly. Cost of consenting could be lower in recognition of the design addressing cultural and environmental values.

3.5 Combination

Option: 5.1 Combo-River/land-HRLP-OLF/14 day storage buffer
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: HRLP-OLF for river discharges, and filtration and UV for irrigation only
Storage: 14-day storage (56,000 m³).
Discharge: New irrigation to land system and existing river discharge (perhaps retain existing river discharge timing).

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$5.4M to \$12.8M Annual rates range: \$ 214.50 to \$ 514.15

Detailed Description:

Combined land and river discharge system. Existing reticulation renewal programme. Irrigation at a daily average of 5 mm/d when soils allow. Filtration and UV to avoid irrigator blockages and public health risks. Small storage for 14 days of flows. Only discharge to river when irrigation is not possible and storage is nearly full. River discharges pass through HRLP-OLF to address cultural values.

Reasons for Inclusion in Option Assessment:

Summer irrigation and small storage to reduce river discharge while avoiding expensive reticulation upgrade.

Key Benefits:

Diverts most wastewater from the river to benefit pasture instead during summer. Addresses cultural values for river discharge. Avoids reticulation upgrade costs and keeps storage costs lower.

Key Disadvantages:

Is not capable of discharging all wastewater to land during summer due to limited storage and elevated flows during storms. Moderate land area required for irrigation. Complex discharge management and monitoring could be a burden.

Pillar Assessments

<p style="text-align: center;">Recreational Values</p> <p>Any current land use will be affected by when and where irrigation is applied, including HRLP. Negative public perception of discharge to water still occurring at times.</p>	<p style="text-align: center;">Environmental Values</p> <p>Small land area for pond and moderate area for irrigation. Pasture will benefit from nutrients and water during summer. Most wastewater will discharge to land during summer, but the small storage volume and lack of reticulation upgrade will force the occasional discharge to the river during summer storms and will not significantly reduce the winter discharges to the river.</p>
<p style="text-align: center;">Cultural Values</p> <p>Favourable, as some wastewater will be discharged to land during summer, while the discharge to the river will pass over and through papatuanuku (HRLP-OLF) first.</p>	<p style="text-align: center;">Financial Values</p> <p>Land area for irrigation and HRLP will be costly, but small storage minimises costs. Costs of major reticulation upgrade have been avoided. Complex discharge management and monitoring could be a burden.</p>

Option: 5.2 Combo-River/land-HRLP-OLF/90 day storage buffer
Reticulation: No changes (current flows of 2,700 m³/d average and 6,500 m³/d peak)
Treatment: HRLP-OLF for river discharges, and filtration and UV for irrigation only
Storage: 90-day storage (360,000 m³).
Discharge: New irrigation to land system and existing river discharge (perhaps retain existing river discharge timing).

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$13.5M to \$29.5M Annual rates range: \$ 540.30 to \$ 1,179.75

Detailed Description:

Combined land and river discharge system. Existing reticulation renewal programme. Irrigation at a daily average of 5 mm/d when soils allow. Filtration and UV to avoid irrigator blockages and public health risks. Moderately large storage for 90 days of flows. Only discharge to river when irrigation is not possible and storage is nearly full. River discharges pass through HRLP-OLF to address cultural values.

Reasons for Inclusion in Option Assessment:

Summer irrigation and moderate storage to reduce river discharge while avoiding expensive reticulation upgrade.

Key Benefits:

Diverts almost all wastewater from the river to benefit pasture instead during summer and shoulder seasons. Addresses cultural values for river discharge. Avoids reticulation upgrade costs.

Key Disadvantages:

Large storage volume is expensive. Moderate to large land area required for irrigation. Complex discharge management and monitoring could be a burden.

Pillar Assessments

<p>Recreational Values Any current land use will be affected by when and where irrigation is applied, including HRLP. River discharges will only occur during large summer storms and winter when recreation is low or nil.</p>	<p>Environmental Values Moderate land area for pond and moderate to large area for irrigation. Pasture will benefit from nutrients and water during summer. Almost all wastewater will discharge to land during summer. However, the lack of reticulation upgrade will force occasional discharges to the river during large summer storms and will not significantly reduce the winter discharges to the river.</p>
<p>Cultural Values Favourable, as most summer flows of wastewater will be discharged to land, while the discharge to the river at other times will pass over and through papatuanuku (HRLP-OLF) first.</p>	<p>Financial Values Land area for irrigation and HRLP and large storage increases costs. Costs of major reticulation upgrade have been avoided but have forced the construction of larger storage and irrigation areas. Complex discharge management and monitoring could be a burden.</p>

Option: 5.3 Combo-50% flow/River/land-HRLP-OLF/14 day storage buffer
Reticulation: Major upgrades (flows of 1,800 m³/d average and 3,250 m³/d peak)
Treatment: HRLP-OLF for river discharges, and filtration and UV for irrigation only
Storage: 14-day storage (28,000 m³).
Discharge: New irrigation to land system and existing river discharge (perhaps retain existing river discharge timing).

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$17.9M to \$41.M Annual rates range: \$ 716.63 to \$ 1,643.44

Detailed Description:

Combined land and river discharge system. Intensive reticulation renewal programme. Irrigation at a daily average of 5 mm/d when soils allow. Filtration and UV to avoid irrigator blockages and public health risks. Small storage for 14 days of flows which have been reduced by reticulation upgrade. Only discharge to river when irrigation is not possible and storage is nearly full. River discharges pass through HRLP-OLF to address cultural values.

Reasons for Inclusion in Option Assessment:

Summer irrigation and small storage with reduced flows to reduce river discharge.

Key Benefits:

Diverts almost all wastewater from the river to benefit pasture instead during summer. Addresses cultural values for river discharge. Reduced flows resulting from reticulation upgrade have reduced storage volume and land area for irrigation and HRLP. Very small storage minimises this cost.

Key Disadvantages:

Very small storage and moderate irrigation area. Expensive reticulation upgrades. Complex discharge management and monitoring could be a burden.

Pillar Assessments

<p>Recreational Values Any current land use will be affected by when and where irrigation is applied, including HRLP. River discharges will only occur during large summer storms and winter when recreation is low or nil.</p>	<p>Environmental Values Very small land area for pond and moderate area for irrigation. Pasture will benefit from nutrients and water during summer. Almost all wastewater will discharge to land during summer, but the small storage volume will force rare discharges to the river during large summer storms and will not significantly reduce the winter discharges to the river.</p>
<p>Cultural Values Favourable, as most wastewater will be discharged to land during summer, while the discharge to the river will pass over and through papatuanuku (HRLP-OLF) first.</p>	<p>Financial Values Land area for irrigation and HRLP will be more modest and small storage minimises costs. Costs of major reticulation upgrade have been incurred but have reduced the storage and irrigation costs. Complex discharge management and monitoring could be a burden.</p>

Option: 5.4 Combo-50% flow/River/land-HRLP-OLF/90 day storage buffer
Reticulation: Major upgrades (flows of 1,800 m³/d average and 3,250 m³/d peak)
Treatment: HRLP-OLF for river discharges, and filtration and UV for irrigation only
Storage: 90-day storage (180,000 m³).
Discharge: New irrigation to land system and existing river discharge (perhaps retain existing river discharge timing).

Approximate Cost Ranges and Associated Increases in Annual Rates

Total cost range: \$22.M to \$49.4M Annual rates range: \$ 880.60 to \$ 1,979.97

Detailed Description:

Combined land and river discharge system. Intensive reticulation renewal programme. Irrigation at a daily average of 5 mm/d when soils allow. Filtration and UV to avoid irrigator blockages and public health risks. Storage for 90 days of flows which have been reduced by reticulation upgrade. Only discharge to river when irrigation is not possible and storage is nearly full. River discharges pass through HRLP-OLF to address cultural values.

Reasons for Inclusion in Option Assessment:

Summer irrigation and small storage with reduced flows to reduce river discharge.

Key Benefits:

Best combination to maximise irrigation and minimise river discharges. Diverts all wastewater from the river to benefit pasture during summer and shoulder seasons. Addresses cultural values for river discharge. Reduced flows resulting from reticulation upgrade have reduced storage volume and land area for irrigation and HRLP.

Key Disadvantages:

Moderate storage volume and moderate to large irrigation area. Expensive reticulation upgrades. Complex discharge management and monitoring could be a burden.

Pillar Assessments

<p align="center">Recreational Values</p> <p>Any current land use will be affected by when and where irrigation is applied, including HRLP. River discharges will only occur during very large summer storms and winter when recreation is low or nil.</p>	<p align="center">Environmental Values</p> <p>Small to moderate land area for pond and moderate to large area for irrigation. Pasture will benefit from nutrients and water during summer. The large storage volume and reduced flows will avoid discharges to the river during summer except during very large summertime storms, and will help to reduce the winter discharges to the river.</p>
<p align="center">Cultural Values</p> <p>Favourable, as almost all summer flows of wastewater will be discharged to land, while the discharge to the river at other times will pass over and through papatuanuku (HRLP-OLF) first.</p>	<p align="center">Financial Values</p> <p>Land area for irrigation and HRLP and moderate-large storage increases costs. Costs of major reticulation upgrade have been incurred but have reduced the storage and irrigation costs. Complex discharge management and monitoring could be a burden.</p>

4 SUMMARY OF COSTINGS

The 22 option combinations are summarised below and are ranked based on their cost.

Table 4.1: Option combination costs

Option Code	Option Description	Average Total Cost (\$)	Average rate increase (\$/year)
1.1	Status Quo	1,857,500	74
1.2	River-low bugs/24-hour continuous discharge	2,141,550	86
2.1	River-lowbugs	2,141,550	86
2.3	River-HRLP-OLF	2,332,500	93
2.2	River-low bugs/HRLP-OLF	2,616,550	105
2.5	River(new)-low bugs -HRLP-OLF	4,209,050	169
4.9	Land-rapid infiltration	7,082,172	284
5.1	Combo-River/land-HRLP-OLF/10day storage buffer	9,098,713	364
3.1	Ocean	17,250,000	691
3.2	Ocean-HRLP-OLF	18,225,000	730
4.1	Land-90 day storage buffer/irrigation rate 1	20,146,100	807
5.2	Combo-River/land-HRLP-OLF/90 day storage buffer	21,478,600	860
2.4	River-50% flow/low bugs/HRLP-OLF	25,001,250	1001
4.2	Land-150 day storage buffer/irrigation rate 1	25,005,800	1001
5.3	Combo-50% flow/River/land-HRLP-OLF/10 day storage buffer	29,470,583	1180
4.3	Land-50% flow/90 day storage buffer/irrigation rate 1	34,875,340	1396
5.4	Combo-50% flow/River/land-HRLP-OLF/90 day storage buffer	35,720,340	1430
4.4	Land-50% flow/150 day storage buffer/irrigation rate 1	37,318,176	1494
4.5	Land-90 day storage buffer/irrigation rate 2	40,877,037	1637
4.6	Land-150 day storage buffer/irrigation rate 2	45,736,738	1831
4.7	Land-50% flow/90 day storage buffer/irrigation rate 2	48,695,965	1950
4.8	Land-50% flow/150 day storage buffer/irrigation rate 2	51,138,801	2048

2024

