PALMERSTON NORTH NATURE CALLS

Treatment Options

The treatment function begins when wastewater arrives at the treatment plant and ends with discharge into the environment.

Nearly half (48%) of the community and stakeholders who participated in the Nature Calls public feedback during June and July 2020 prioritised environmental outcomes over cost for their preferred shortlist option. The wastewater treatment option we choose will drive environmental outcomes because it determines the quality of the treated wastewater we're returning to the environment, whether it's to land, river, or ocean, or a combination of these.

Nature Calls aims for good environmental outcomes and best value by making the most of the assets we already have and treating all waste streams as potential resource streams.This factsheet discusses the issues around wastewater treatment, the treatment requirements for each receiving environment and how well each option is able to meet these requirements.

Once we understand the treatment alternatives, we then consider the costs, sustainability, innovation and where best value for treatment can be found within the shortlist options.

Treatment matters

Treatment removes contaminants from wastewater before it is returned to the environment. The first step to minimising contaminant loads is reducing the amount contaminants entering wastewater at source. The treatment function includes what happens to wastewater from arrival at the treatment station until discharge into the environment.

Our existing treatment system puts wastewater through several physical and biological processes over a four day period to remove organic compounds and reduce nitrogen, phosphorus and pathogen levels. This limits damage to the receiving environment and hazardous impacts to animals and humans. We divert settled solids for energy production and compost biosolids to create soil improvement material.

The five shortlist options are:

Option 1
River discharge at the existing point (2 variants)

Option 2
River discharge at two points (2 variants)

Option 3
Land discharge, 97% and river discharge, 3% (2 variants)

Option 4
Land discharge, 45-55% and river discharge, 45-55% (4 variants)

Option 6
Ocean discharge, 97% and land or river, 3% (2 variants)

Option 5 has been removed due to its cost and environmental impacts.

Parts of the puzzle

There are several parts to the puzzle of finding the best treatment option. First, the requirements for construction and operation of the treatment system and the impacts, opportunities and challenges associated with each treatment option. Secondly, we need to ensure the options we're considering can be consented and meet city and planning regulations, and third is assessing our existing treatment plant and processes to see how we can get the best value from those assets under any treatment option.

1. Our requirements

These are the features we require of our treatment system:

Reliability – The system should be proven, enduring and consistently meet the quality and capacity requirements seasonally and over time.

Flexibility – The system needs to handle peak wet weather flows, keep our options open for future upgrades and land use options.

Constructibility – The system needs to fit within the existing site and provide for operation of the current plant during construction.

Affordability – The system needs to offer great value, considering both capital (construction) and lifetime operating and maintenance costs.

Neighbour friendly – The system needs to minimise potential noise and odour impacts for neighbours and surrounding communities.

2. Our constraints

Construction and operation need to comply with current and future consents and planning regulations and possible future development of the Waste Water Treatment Plant (WWTP) site.

- The WWTP site and immediately adjoining sites to the east and west are zoned industrial under the District Plan. These sites include the Awapuni Transfer Station and landfill and a former quarry site. Land to the north of the WWTP is zoned for the racecourse.
- The nearest residential properties are approximately 170m from the entrance of the WWTP.
- The area to the south of the WWTP site is earmarked for residential growth requiring provision for future wastewater servicing and buffers to avoid negative odour and noise effects.

The Palmerston North City Council Spatial Plan allows for future upgrades of the WWTP site and provides for investigation into requirement for odour consent.

3. Our existing assets

Site and space

We've assessed the Totara treatment plant site and found that while there is sufficient space for any upgrades required to deliver the Best Practicable Option (BPO), space is limited for construction within the existing site while maintaining existing treatment operations. Extensive desludging of the lagoons on site will be essential for all options.

Infrastructure

Our existing infrastructure consists of inlet works, primary sedimentation tanks, liquid stream treatment and solids stream treatment. We will reuse this infrastructure to the greatest extent possible considering asset condition, capacity and expected remaining life. Some equipment will require replacement due to age and some will need to be upgraded with improved design for increased capacity and easier maintenance.

Critical renewal and upgrades are underway ahead of the treatment decision, and some components may be decommissioned after the decision is made. All of these factors have been taken into account in scoping and estimating the cost of each option.

Process

The current treatment process uses physical screening and settling, use of microorganisms and bacteria to transform the organic material into biosolids, fine filtration, chemical nutrient removal (alum) and UV disinfection.

Water quality requirements are different for discharge to land, river and ocean, and depending which shortlist option is chosen, parts of the current process may be unnecessary, may require improving, or may be replaced by more stringent, cost effective, or sustainable processes.

The BPO will reuse, to the greatest extent possible, the existing treatment plant site and assets.

How clean does our wastewater need to be?

Each shortlist option includes discharge to at least two different environments, so the treatment option chosen must meet requirements for both or all of them with the most sensitive environment determining the minimum standard.

Ocean discharge: The existing treatment system without chemical removal of phosphorus but with improved removal of solids is considered sufficient.

Land discharge: Wastewater discharged to land must comply with nitrogen leaching and application limits. Coastal soils drain more freely, making them more sensitive to nitrogen loading. 10mg N/L is required for coastal soils to stay within leaching limits, compared with 30 - 35mg N/L for inland areas. The rate and depth of irrigation is another limiting factor for application to land. Coastal soils can accept higher application rates and depths than inland soils.

River discharge: Requirements for discharge to river are the most stringent. Horizon's One Plan sets a maximum level for periphyton biomass in the river, and this is influenced by nitrogen and phosphorus levels, river flows, and the mixing and location of wastewater discharge. The current wastewater system is a major contributor to levels of nitrogen and phosphorus in the Manawatū River particularly during the low flow periods. A very high level of treatment will be required if discharge to river at all times is to continue with the new wastewater system.

Water is held in these tanks where solid material sinks and clean water flows on to the next stage of treatment

Air is pumped into water to provide oxygen to microorganisms that consume any remaining solid material in the wastewater.

Solid material removed from wastewater is broken down by bacteria in these tanks for 20 days and is then taken off site.

After alum dosing and UV disinfection, 99.9999% or more of the pathogen have been removed from the wastewater discharge.

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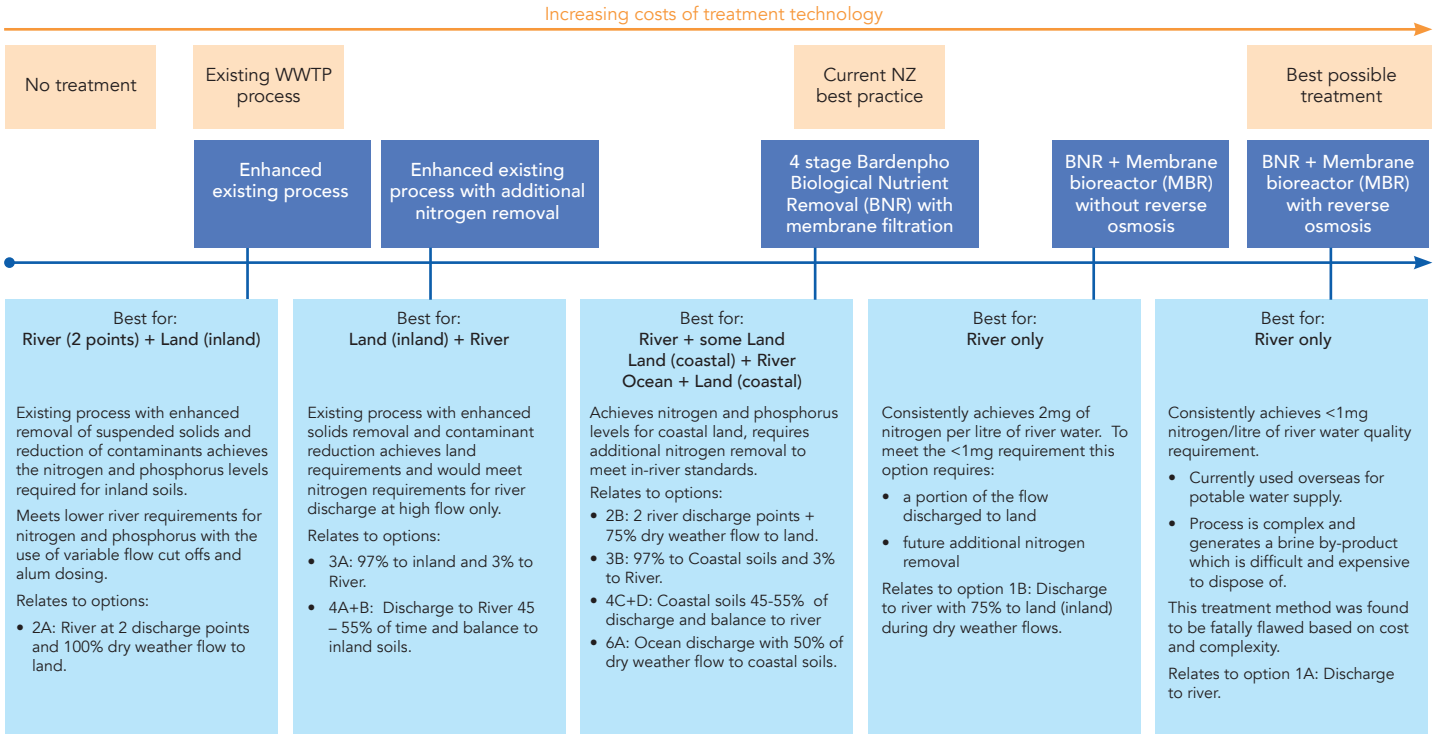
What treatment options would achieve these requirements?

Five different treatment levels have been identified and the most appropriate level has been assigned for each shortlist option. The diagam below shows these levels and the shortlist options for each on a continuum, starting with "no treatment" on the left progressing to the current best technically possible treatment on the right. The level of treatment technology, complexity and cost increases from left to right.

Treatment options and costs continuum



Best for:
River (2 points) + Land (inland)

Existing process with enhanced removal of suspended solids and reduction of contaminants achieves the nitrogen and phosphorus levels required for inland soils.

Meets lower river requirements for nitrogen and phosphorus with the use of variable flow cut offs and alum dosing.

Relates to options:

- 2A: River at 2 discharge points and 100% dry weather flow to land.

Best for:
Land (inland) + River

Existing process with enhanced solids removal and contaminant reduction achieves land requirements and would meet nitrogen requirements for river discharge at high flow only.

Relates to options:

- 3A: 97% to inland and 3% to River.
- 4A+B: Discharge to River 45 – 55% of time and balance to inland soils.

Best for:
River + some Land
Land (coastal) + River
Ocean + Land (coastal)

Achieves nitrogen and phosphorus levels for coastal land, requires additional nitrogen removal to meet in-river standards.

Relates to options:

- 2B: 2 river discharge points + 75% dry weather flow to land.
- 3B: 97% to Coastal soils and 3% to River.
- 4C+D: Coastal soils 45-55% of discharge and balance to river
- 6A: Ocean discharge with 50% of dry weather flow to coastal soils.

Best for:
River only

Consistently achieves 2mg of nitrogen per litre of river water. To meet the <1mg requirement this option requires:

- a portion of the flow discharged to land
- future additional nitrogen removal

Relates to option 1B: Discharge to river with 75% to land (inland) during dry weather flows.

Best for:
River only

Consistently achieves <1mg nitrogen/litre of river water quality requirement.

- Currently used overseas for potable water supply.
- Process is complex and generates a brine by-product which is difficult and expensive to dispose of.

This treatment method was found to be fatally flawed based on cost and complexity.

Relates to option 1A: Discharge to river.

What does this mean for the shortlist options?

The current wastewater treatment system discharges solely to the Manawatū River. The only treatment option that would continue to produce wastewater clean enough to continue this arrangement, Option 1A, has been found to be flawed due to cost and complexity. This means Option 1A cannot proceed. Option 1B proposes 75% of wastewater to land during dry weather flows (inland) which meets river standards for now, but additional nitrogen removal may be required in the future.

There are several options that provide for discharge into river and to inland or coastal soils. These options propose a variety of splits of the discharge to land and river.

Coastal Soils

The Coastal Soils + River discharge options all meet the requirements for discharge to river but require nitrogen reduction through Biological Nutrient Removal (BNR) with membrane filtration to reduce land area requirements and meet nitrogen leaching limits for free-draining sandy soils.

Under Option 3B only 3% of water will discharge to river but all wastewater would still be treated to the higher standard to avoid nitrogen leaching so this option won't provide the best value. The income from productive use of discharge to the land will offset some of the cost.

Options 4C and D propose a more even balance of discharge between coastal soils and the river, 45% to 55% for each. These options offer better value, with upgrades to the existing plant sufficient to to address nitrogen leaching effects.

Inland Soils

There is no requirement for BNR to meet treated wastewater standards for inland soils. Enhancements to the existing wastewater treatment process will achieve the additional nitrogen removal required.

Option 3A is the same as option 3B (3% to river, 97% to land) but with discharge to inland soils rather than coastal. This offers better value through the income from productive use of discharge land (albeit less land), without the cost of BNR.

Options 4A and B discharge to inland soils rather than coastal, and treatment requirements would be the same as with 4C and D - upgrades to existing plant would be sufficient.

What's the difference between Options 4A and B and 4C and D?

1. Cost: Inland options (A+B) are lower cost because they don't require the infrastructure investment and extra land that the coastal options (C+D) do.
2. Environment: All four variants meet environmental requirements for water quality for discharge to river and land.

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What do the other options propose?

River discharge at two points - Option 2

By spreading the discharge into the river between two points, we reduce the impact on the river at each discharge point, so water quality requirements are less stringent.

2A proposes 100% of discharge to land at dry weather flows and 2B proposes 75%.

- 2A is cheaper, provides a lower water quality output but achieves the desired level of improvement to river water quality.
- 2A relies more on active management of treated wastewater through variable flow cut offs and alum dosing.
- 2B requires the extra investment of BNR.

2A provides a lower cost solution than 2B. Both meet water quality requirements.

Discharge to Ocean – Option 6

Option 6A proposes 100% of wastewater discharged into the ocean from May to October and during the six dry months (Nov to April), 50% of wastewater would discharge to land. Improved treatment without the need for nitrogen removal is sufficient. While the treatment costs are less when compared with options 4C and D, the income from this option is also lower.

6B proposes discharge to ocean with river discharge on 3% of the days. Enhancement of the existing treatment process is adequate for this option.

6A provides better environment outcomes than 6B.

Finding sustainable value in our wastewater treatment options

With the principle that all waste streams are value streams, opportunities to offset treatment system operating costs by resource recovery can create economic and environmental benefits for the wastewater system and the community.

High quality wastewater could be used for industrial or municipal purposes - for example irrigating golf courses and playing fields. With additional treatment, wastewater process byproducts can be converted to biosolids for re-use or used to generate biogas for onsite energy or heat generation to reduce imported energy demand and costs.

Good outcomes for environment and cost

When we consulted in June and July 2020, 48% of the community valued environmental outcomes above cost, 16% chose cost ahead of environment and 28% selected both as equally important! The good news for 100% of our community is that we don't have to choose between cost and environment. The options provide a spread of costs, technologies and treatment outcomes appropriate to each receiving environment. Every treatment option delivers an improvement on the current level of treatment and provides opportunities to create sustainable value through resource recovery.

After four days of treatment, the water is ready to be released into wetland.

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Key outcomes for the Best Practicable Option (BPO).

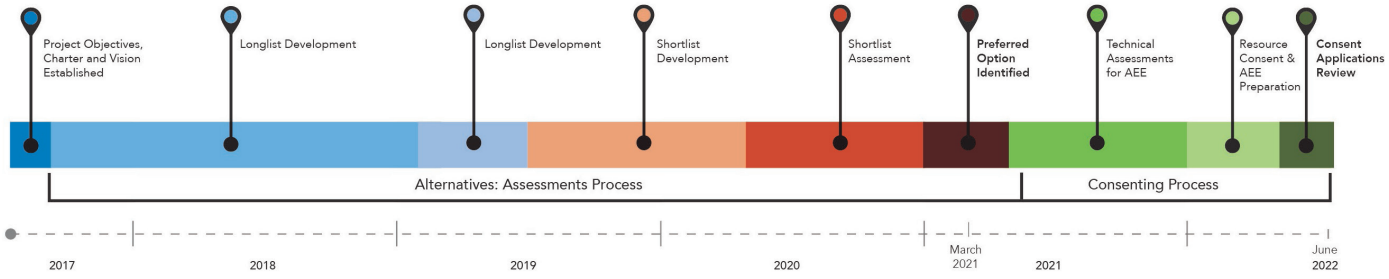
The preferred shortlist option will:

- Protect public health and minimise public health risks.
- Minimise environmental effects on air, land and water, minimise whole-of-life carbon emissions and optimise resource recovery.
- Contribute to improving the health and mauri of the Manawatū River.
- Be developed with the active engagement of the community and key stakeholders.
- Be affordable and cost effective.
- Be innovative and evidence based.
- Be sustainable, enduring, and resilient. Take an integrated approach to the management and cumulative effects on the Manawatū River catchment.
- Facilitate long term growth and economic development.
- Enhance people's use and enjoyment of the Manawatū River.

About this project

The Nature Calls project takes a fresh look at how we manage wastewater in Palmerston North and what we need to achieve before 2022 to future-proof our wastewater management and infrastructure. The process involves engagement with iwi, the community and stakeholders as well as technical investigations, including this one. The timeline below shows expected project progress through to June 2022 when the consent applications for the preferred option will be lodged.

Project timeline



For more information, contact us.

For more information about wastewater, the Nature Calls project and the shortlist options:

Visit www.pncc.govt.nz/naturecalls

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