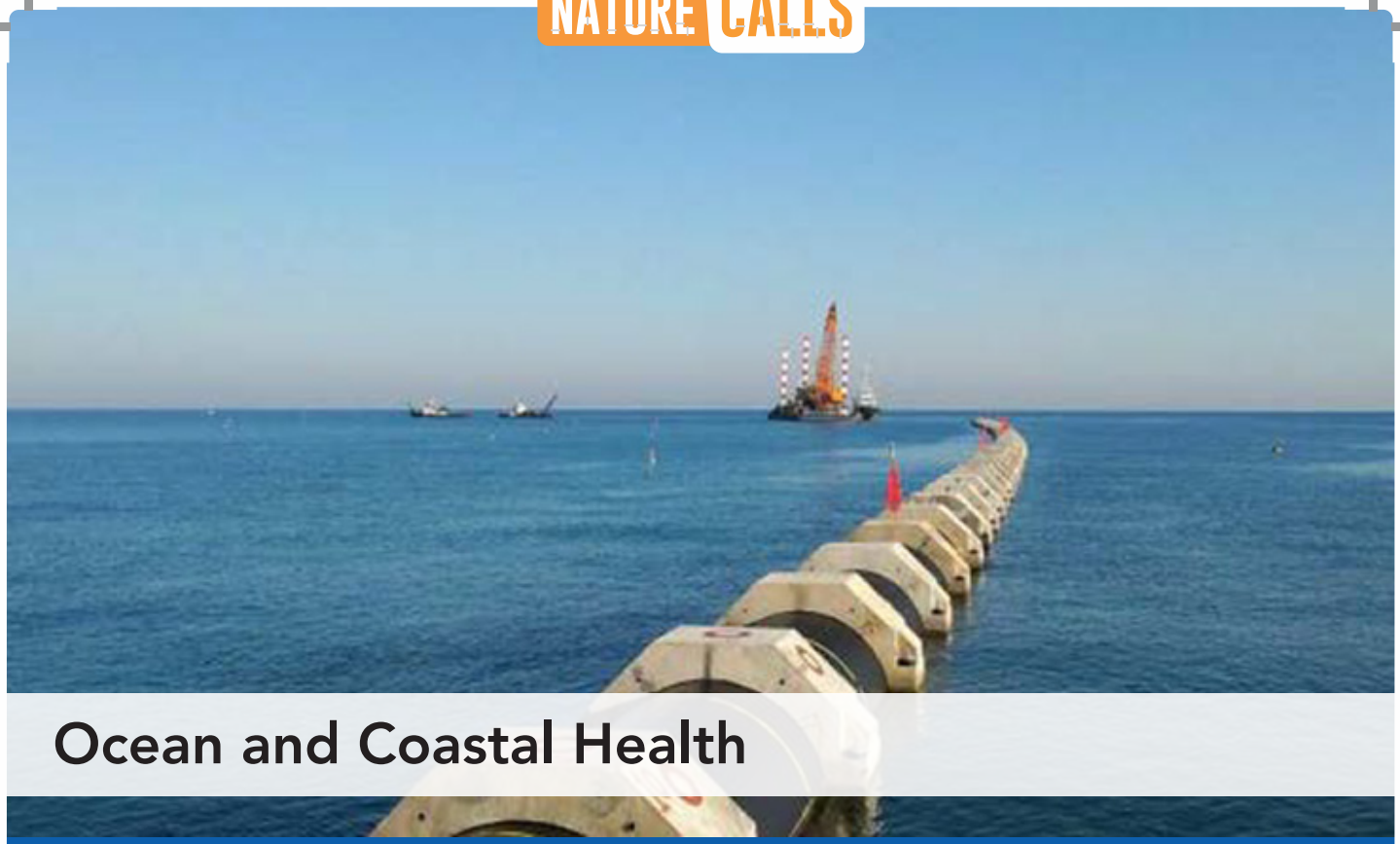
PALMERSTON NORTH NATURE CALLS



Ocean and Coastal Health

Option 6 proposes discharge of treated wastewater by ocean outfall - a pipeline structure that carries wastewater into the sea and disperses it through a diffuser.

- Variant A proposes 50% of wastewater into the ocean and 50% to land during dry months (November to April) with 100% into the ocean during the rest of the year.
- Variant B proposes wastewater discharge into the ocean at all times.

Ocean outfalls can be an economical and reliable discharge method with minimal impacts on recreation, fishing and local ecosystems when the outfall is located and designed to provide good levels of treated wastewater assimilation into the receiving ocean waters.

Approximately 75% of New Zealand's treated wastewater is currently discharged into the ocean through 19 significant outfalls. A national focus on improving freshwater health means more cities and towns may look to move their wastewater discharge from river environments to ocean environments. This reflects a global trend towards ocean discharge as cities take advantage of the ocean's higher assimilative capacity matched to wastewater treatment requirements, resulting in cheaper construction and lower carbon emissions.

There are also challenges to address. It is essential that we understand ocean water hydrodynamics, marine and coastal environments and the interactions between habitats, species and water quality to manage the physical processes and biological reactions between discharge water and receiving water.

This factsheet summarises the findings of our investigations. We set out to understand the ecology and constraints of our receiving environment, model the likely effects of the ocean discharge on water quality and how these could impact ecosystems. We discuss the implications of these findings for the ocean discharge option and next steps if this option is selected as preferred.

What does Option 6 propose?

Option 6 provides two variants for discharging treated wastewater into the ocean.

Both variants allow for discharge into the Manawatū River on the 3% of days with the highest wastewater flow and to provide resilience at times of exceptional circumstances.

Both variants will require upgrades to the inlet works and UV treatment facilities at the existing Totara treatment plant, construction of approximately 38km of pipeline to carry the treated wastewater to the coast and 2km out to sea where it will be discharged at a depth of approximately 20 metres.

Variant A involves purchase of 1230 hectares of land for irrigation, storage and a lagoon area. The land would be used productively for forestry, creating income to offset some costs.

Variant B requires no land. For the 3% discharge to river wastewater would be discharged through the existing wetland pond and diffuse land passage.

Where would the outfall go?

Three potential locations have been investigated for the pipeline and ocean outfall, each adjacent to one of three potential land application sites.

The locations are:

- Approximately 2.5km south of the Manawatū River mouth with land application within the forest behind.
- Approximately 4km south of the Himatangi Beach with land application within the forest behind.
- Approximately 2.5km north of the Himatangi Beach with land application within the forest behind.

Geography for the outfall locations

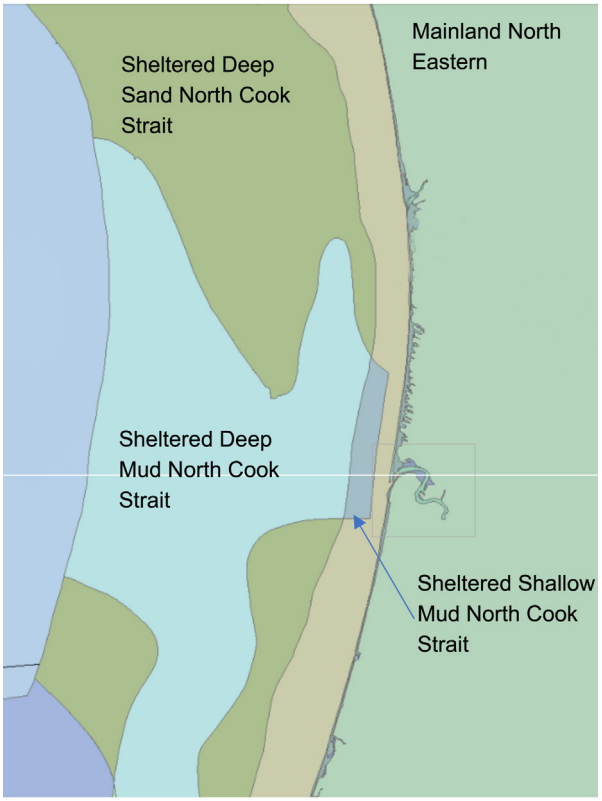
The study area includes coastline and ocean, from the Rangitikei River mouth to south of the Manawatū River mouth. Sandy beaches (except some mud offshore of the Manawatū River) run north to south in a gentle sweep. The Manawatū River estuary is not expected to be directly affected by any of the three outfall locations. More detailed studies of effects on the estuary including those from the 3% discharge into the river will be carried out if Option 6 proceeds.

The seabed around the outfall sites features muddy sand with low diversity and quantities of fauna. This area of seabed contains no features of ecological or conservation importance.

Sand dunes along the coastline provide habitats for birds and invertebrates. Adverse effects to sand dunes must be avoided and if the ocean option proceeds, a detailed investigation and risk assessment of sand dune habitats will be completed.

The map in Figure 1 shows the marine and coastal habitats of the study area.

Figure 1: Marine habitats



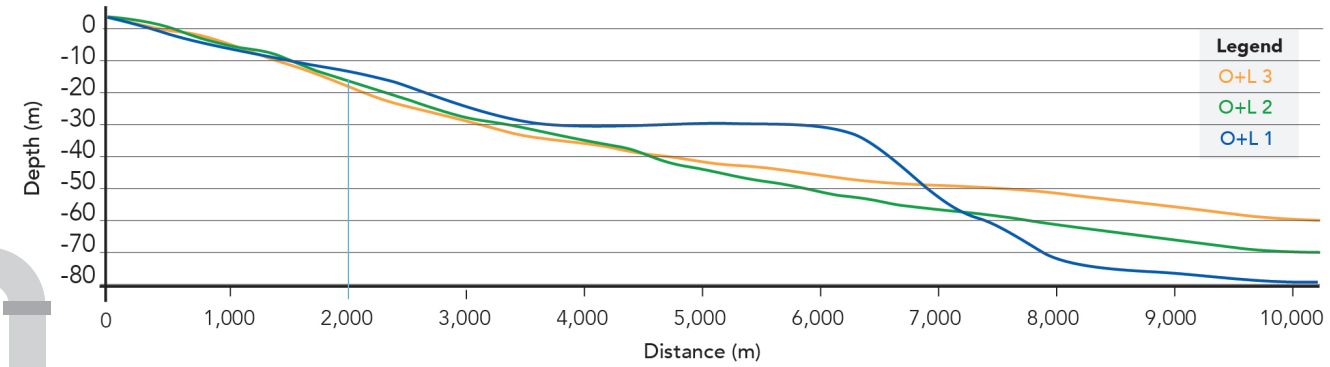
Understanding our coastal and ocean environments

To minimise effects of the discharge on plants and animals, we need to understand the physical, ecological and environmental constraints of these environments, and their cultural, recreation and leisure values.

Seabed

Ocean bathymetry data (water depths, currents and winds) shows us that the three potential outfall locations are very similar, with no differences in how the treated wastewater will mix with the receiving ocean water.

Cross section of bathymetry depths from coast 0m to 10km perpendicular from coast



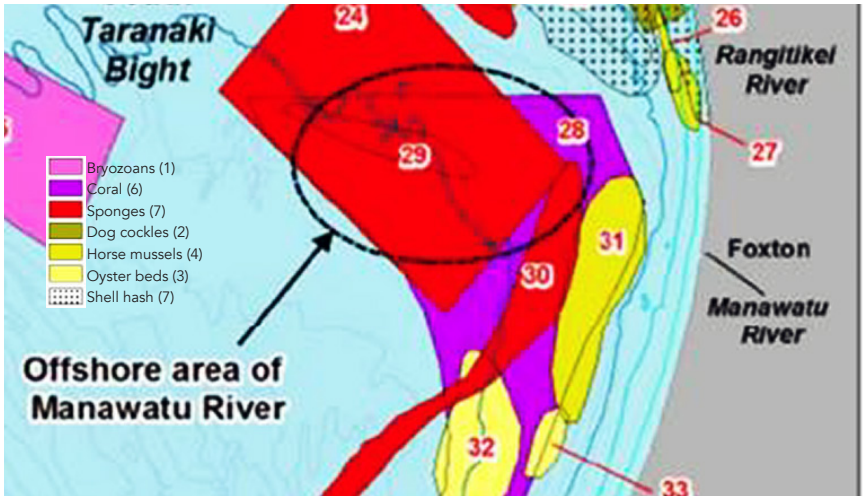
Ocean current, tides and winds

The ocean currents within the study area are mostly tide driven. Wind waves created by the prevailing north westerly create a shadow zone with reduced currents in the South Taranaki Bight. The Foxton and Manawatū River mouths are slanted to the south with a sand spit on the northerly banks indicating a southerly current direction. The wastewater plume could be pushed towards the shore by a strong westerly. To mitigate this the outfall length would be modelled to ensure any wastewater is thoroughly

Flora and fauna

Figure 2 shows the results of a survey of local knowledge of the area's flora and fauna. Most of the bacteria, plants and algae are found near the shore, and seabed fauna is fairly homogeneous across all three outfall locations.

Figure 2: Local knowledge map of ocean flora and fauna



Fish, birds and mammals

Data suggests 12 – 20 fish species may be present in the study area and 33 bird species have been identified on Foxton Beach. Some bird species sighted at the Manawatū River mouth are threatened or at risk. The marine environment is of low to moderate suitablility for whales, orcas and dolphins and there is no indication that this area is of special importance for marine mammals.

The marine environment, ecology, flora and fauna are uniform across all three potential outfall locations.

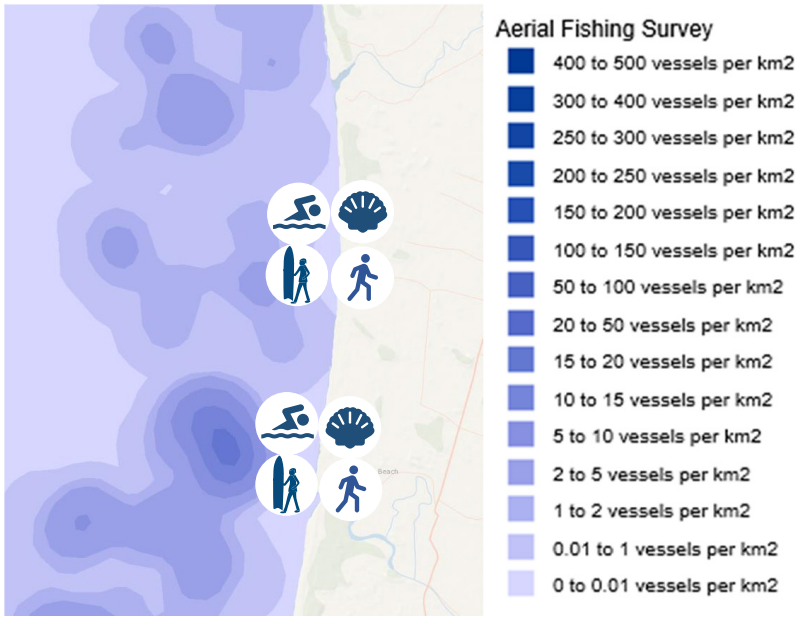
Recreation and amenity values

Foxton and Himatangi Beaches are popular for swimming, surfing, walking and dog walking, canoeing/kayaking, horse riding and use of motor or wind powered recreational vehicles, especially during summer.

Shellfish gathering is a traditional activity that continues today around the Manawatū River at Foxton Heads and near Himatangi Beach. Middens can still be found, providing an archaeological record of the area.

An aerial survey by NIWA in 2008 found fishing, boating, sailing and diving off boats were popular marine activities around the Manawatū and Rangitikei river mouths and at Himatangi Beach. These results are shown in figure 3.

Figure 3: Aerial fishing and coastal recreation survey
Darker areas show more intensive fishing



PALMERSTON NORTH NATURE CALLS

How will ocean discharge affect these environments?

Using hydrodynamic modelling software, we predicted the effects of treated wastewater discharge on the quality of ocean water at the edge of the mixing zone - 200m out from the outfall.

Modelling results

The model predicted the dilution and dispersion rates of the discharged wastewater using high, low and average seawater currents and found the wastewater would behave in a similar way in all of these scenarios. Under typical wastewater flow rates, the dilution would be greater than 800:1 (800 parts sea water to one part treated wastewater).

Potential effects on the coastal environment

Discharge by ocean outfall could impact birdlife, marine microorganisms and phytoplankton through changes to sediment and water quality.

While pipe and outfall construction will have some short term effects, the impact on habitats and organisms will be negligible.

The impact on sea birds could be higher if critical activities such as breeding are affected. While pipe and outfall construction will have some short term effects, the impact on habitats and organisms will be negligible.

Long term impacts of the outfall structure are less significant.

Organisms are likely to colonise the pipeline and outfall surfaces on a small scale, not sufficient to effect marine life or water quality.

Effects on ocean water quality

Horizons One Plan sets target levels for water quality to ensure ecosystem health is maintained. The model predicted how the wastewater stream would impact these variables in the sea water around the outfall and how compliance with targets could be affected.

The model used a typical flow of 446 litres of wastewater per second, with a peak wet weather flow of 2,200 litres per second. The table below shows target levels for contaminants and the estimated concentrations of each. More information about these and other contaminants is available in the contaminants factsheet.

Findings indicate that in peak wet weather flow, all contaminant levels will comply except total nitrogen and total phosphorus, which could be removed with additional treatment when required. More information about treatment for nitrogen and phosphorus is provided in the treatment options factsheet. Concentrations of faecal coliforms are expected to stay well below target levels at typical and peak flow rates as shown in the table below.

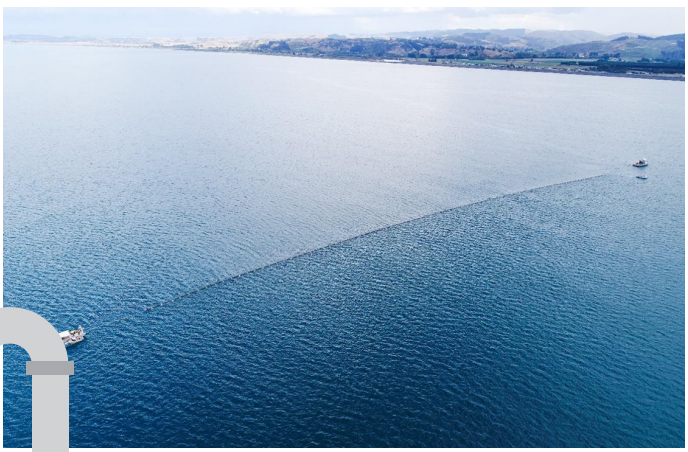
Estimated concentrations of contaminants 200m down current from the ocean outfall

Variable (mg/litre)	Typical wastewater flow		Peak wastewater flow		One Plan Target
	Slow current	Fast current	Slow current	Fast curent	
Biochemical oxygen demand (BOD)	0.04	0.01	0.18	0.06	Not defined
Total suspended solids	0.04	0.01	0.18	0.06	Not defined
Total nitrogen	0.04	0.01	0.18	0.06	<0.06
Ammoniacal nitrogen	0.03	0.01	0.10	0.03	<0.06
Total Phosphorus	0.005	0.001	0.02	0.007	<0.01
Variable (per 100ml)					
Faecal coliforms (median)	0.38	0.11	1.5	0.50	<14
Faecal coliforms (90th percentile)	1.5	0.43	6.0	2.0	<43

Seabed sediments and biota

The discharge of wastewater may enrich the sediment around the diffuser creating a change in the levels of algae, bacteria and plants but this is unlikely to impact on the water quality or environment.

The likelihood of organic matter and trace elements accumulating locally is high but it is unlikely to spread and affect the surrounding ecology.



PALMERSTON NORTH NATURE CALLS

Conclusions and implications for Option 6

We set out to investigate the coastal and ocean environments, assess the constraints and estimate the likely effects of treated wastewater discharge into the ocean as proposed in Option 6, comparing three potential sites for the ocean outfall. We found that the coastal and ocean environments are fairly similar with no significant ecological differences. We also identified several areas that require further investigation or consideration if Option 6 is chosen.

Coast

- Investigate ways to minimise disturbance of the Foxtangi dunes during construction and restore them after construction.
- There may be undiscovered archaeological sites around the Manawatū River mouth.
- Ornithological studies are recommended to minimise impacts on sea and shore birds, particularly for the location around the Manawatū River.
- Ensure recreation activities along the coast are not impacted by an ocean outfall.
- Determine any significance of shellfish gathering activities on margin of the Manawatū River at Foxton Heads and near Himatangi Beach.

Ocean

- Concentrations of phosphorus and nitrogen are currently above targets in seawater and the dispersal and dilution of treated wastewater will not have a significant impact on these concentrations.
- Hydrodynamic modelling of the mixing of treated wastewater into the receiving seawater found no significant reason for one location to be preferred. Findings by the model will need to be verified by in situ monitoring if Option 6 is selected.

Construction and cost considerations

- Initial cost estimates indicate Location 2 (4km south of Himatangi Beach with land application in the forest behind) and Location 3 (2.5km north of Himatangi Beach with land application in the forest behind) would have lower conveyance costs than Location 1.
- Horizontal directional drilling is preferable to open trenching for the construction of the ocean outfall through the seaward dunes, to minimise impact on the environment regardless of the location chosen.

Overall, we've found that none of the three outfall locations stands out as offering significant advantage over another and that constraints associated the land application sites will drive the decision on the ocean outfall site, should that variant be preferred.

Location 1 is nearest to, but still approximately 3.4 km south of the Manawatū River where there is a likelihood of undiscovered archaeological sites. This location has higher estimated conveyance costs over the other two.

What happens next for Option 6?

If the ocean discharge option is selected for the BPO (Option 6), we'll need to do further investigations to help us plan and design the ocean outfall to meet consent requirements and manage any impacts on the environment. These studies could include:

- Oceangraphic hydrodynamics to determine treated wastewater dilution and dispersion modelling.
- Identifying the appropriate treated wastewater quality.
- Assessing the beach profile, how it changes over time and locating required depth of the pipe burial.
- Maori cultural assessment to identify any cultural impacts on customary rights.
- Ecological effects of discharges into the ocean receiving environment including sampling of existing sediment and water quality; and field studies of invertebrates to support current knowledge of the area.
- Consideration of any effects on commerical and recreational fishing.
- Quantitative Microbial Risk Assessment (QMRA) for shellfish and water contact recreation activities.
- Human health risk assessment for the ocean outfall over and above the QMRA.

FAQs

How would we construct the ocean outfall?

While it's too early to decide on a construction methodology, our approach to construction of an ocean outfall (if Option 6 is selected as the BPO) would consider the coastal and marine environment, technology available and lessons from other similar projects that have been successful In New Zealand and overseas.

The surrounding land is flat, offering the possibility of fabricating long continuous pipe lengths onshore which could then be pulled across the beach and towed offshore to form the outfall. A "float and sink" method has been used successfully in other New Zealand outfall installations. The outfall is proposed to be 2000 metres long so could, for example, be installed with four separate float and sink operations each with 500m lengths as shown in Images 1 and 2..

Two options for connecting the outfall at the shore are an open cut inside a sheet piled trench or using horizontal directional drilling with a borehole. The latter would help avoid disruption to the sand dunes.

How would the outfall be held in place?

The pipepine can be laid directly on the seabed and allowed to sink through the surf zone. Beyond the surf zone, concrete ballast weights could be used to hold it in position. Further studies will determine if piles are needed to secure the pipeline.

Will there be a "cloud" of wastewater at the end of the outfall?

Wastewater would be dispersed through a 300m long diffuser which is a separate structure on the end of the pipeline. It will have ports along either side, alternating sides, so rather than entering the sea water at one point, the wastewater will be discharged along a 300m length. The studies we've done enable us to design the outfall and diffuser to take advantage of the seawater depths and flows, currents, tides and winds to get the best dispersion and dilution of wastewater we can for minimal to no impact on the environment.

PALMERSTON NORTH NATURE CALLS

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)

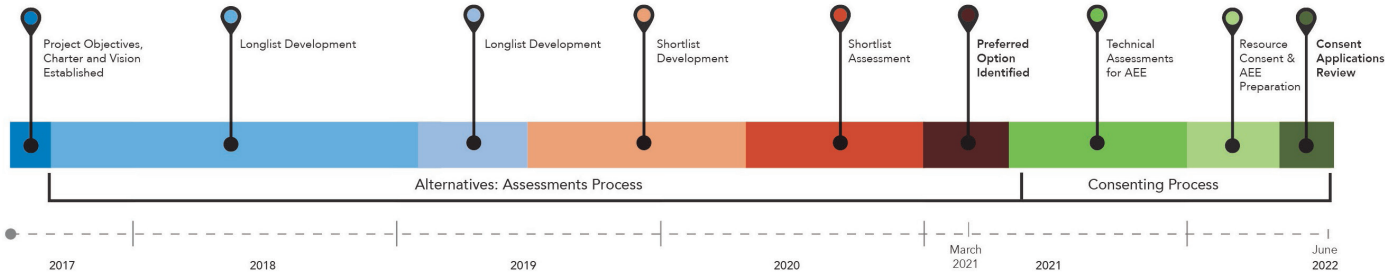
Option 6

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

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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