CONSENTING OF THE NORTH EAST SUB-REGIONAL WASTEWATER SCHEME

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ABSTRACT

Watercare currently operates two wastewater treatment plants (WWTPs) at Warkworth and Snells Beach, both of which required new consents to discharge. There were many factors to be considered in applying for new consents. This paper outlines some of the major drivers for the project and how they were addressed in developing the proposed scheme. These drivers include population growth, environmental constraints, short and long term effects, and the impact on the local community.

The existing plants service a combined equivalent population of approximately 10,000. The Auckland Unitary Plan forecasts significant growth in the area of consideration, particularly in and around Warkworth. Over the 35 year term of the consent sought, the population was projected to increase to a total of approximately 30,000 with 80% located in Warkworth. This represented a 6-fold increase in capacity requirement for Warkworth WWTP.

Warkworth WWTP currently discharges into the Mahurangi River. The Mahurangi estuary is classified as a degraded waterway. Within the estuary, there are oyster farms which could be affected by wastewater discharges if they are not of a very high quality. The existing wastewater treatment plant provides a high level of treatment, producing relatively low nutrient and bacteriological concentrations in its discharge. To maintain, or reduce the loads discharged, for the projected increased flows would be very difficult with existing technology. These factors combined give technical, environmental and social drivers for stopping the discharge of wastewater to the Mahurangi River.

Snells-Algies WWTP is an oxidation pond system which discharges to the coastal marine area via an ocean outfall. There is capacity at the plant to service the local population if the same discharge standards were retained. However, with pressure to improve the discharge quality upgrades would have been required for improved ammonia removal and disinfection.

A scheme was identified to transfer the wastewater from Warkworth to Snells Beach. A new wastewater treatment plant will be constructed at Snells Beach WWTP site producing a very high quality effluent. The existing ocean outfall will be replaced to enable a larger discharge flow for the combined scheme. Consents were applied for and granted, for the discharge to the coastal marine area, construction of the new outfall, land use at proposed pump station locations emergency discharges from the pump stations. This has paved the way for the implementation of the North East Sub-Regional Wastewater Scheme.

KEYWORDS

wastewater, consenting, growth, environment

PRESENTER PROFILE

Mark Bourne is the Head of Servicing and Consents for Watercare. Mark was the project director for this phase of the work. He has over 25 years' experience in the water industry, with particular emphasis on planning and operations.

Ban Najim-Aldin was a Senior Consent Planner for Watercare. Ban was the project manager for the consenting of the North East Sub-regional Wastewater Scheme and led the consultation process.

Luke Faithfull is an Associate at Mitchell Daysh Ltd with over 10 years' experience in consenting and advisory roles. In his current role, Luke is involved in or leads all aspects of the statutory planning process including being the lead planner for Watercare in multiple successful WWTP consenting projects.

Mark James is a marine and freshwater ecologist who has 40 years' experience as a researcher, science manager and independent consultant. He has led and managed large multidisciplinary research and consulting programmes in the areas of aquaculture, marine and freshwater ecology and the effects of discharges and other anthrogenic activities.

Nick Berry is a Technical Director at Beca Ltd with over 20 years' experience in wastewater engineering. Nick has worked with Watercare to provide engineering input to a number of successful consenting projects.

Aslan Perwick is the Groundwater Services Leader at Pattle Delamore Partners Ltd. Aslan led the technical aspects for land application and managed aquifer recharge assessments and discharge options appraisal.

1 INTRODUCTION

Watercare Services Ltd (Watercare) provides the majority of Auckland's urban area and satellite townships with wastewater services in the form of a public wastewater network and associated wastewater treatment facilities. Auckland is expected to experience significant urban growth over the next 30 to 50 years, including areas such as Warkworth and Snells Beach, and surrounding areas.

Growth projections for the Warkworth and Snells Beach area combined are forecast to grow to at least 28,000 over the next 35 years (2050) and possibly 50,000 beyond that. This growth will need to be supported by infrastructure, and Watercare will be responsible for ensuring that potable water can be supplied and wastewater is collected and disposed of in a manner that protects human health, the environment and that is culturally appropriate.

Watercare recently developed a strategic wastewater servicing framework and associated implementation programme to address this need. The key features of this framework include addressing requirements on a geographic basis, short-to medium term servicing in the satellite locations to enable servicing of areas identified for significant growth as soon as possible, infrastructure requirements and the need to obtain long-term 35 year consents. This paper presents the approach taken to obtaining a 35 year consent for the North East Sub-regional Wastewater Scheme, servicing the communities of Warkworth, Snaells Beach and Algies Bay.

2 GROWTH IN WARKWORTH AREA

2.1 UNITARY PLAN GROWTH AREAS

The future urban growth areas identified in the Proposed Auckland Unitary Plan (PAUP) for the Warkworth and Snells Beach areas are shown in Figure 1. This shows significant potential growth around the existing town of Warkworth and, to a lesser extent at Algies Bay.

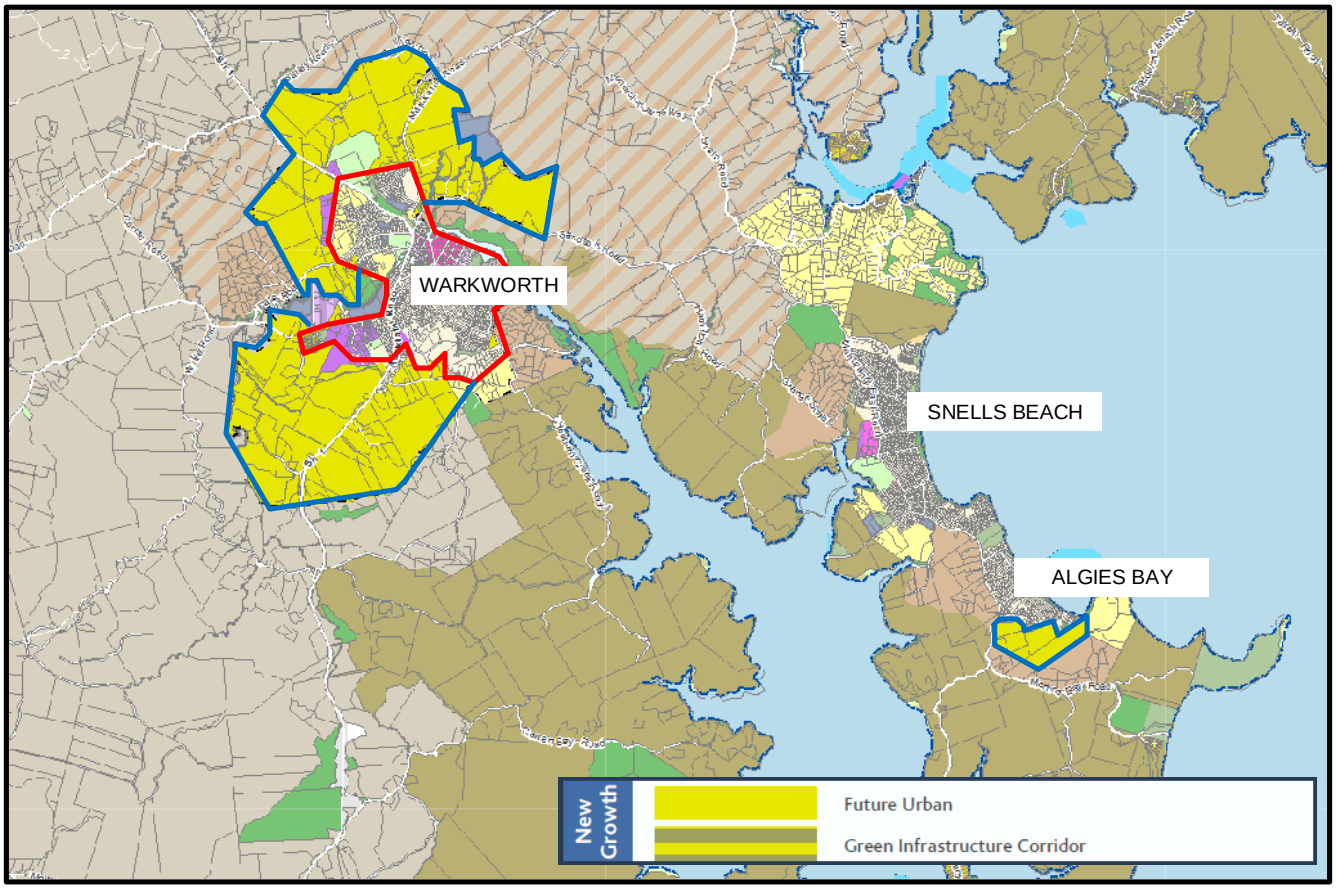

Figure 1: Future urban growth areas around Warkworth in PAUP

(Source: http://acmaps.aucklandcouncil.govt.nz/unitaryplan/FlexViewer/index.html)

2.2 POPULATION PROJECTIONS

Based on regional growth models for the future urban zones identified, the population was projected forward to the end of the proposed 35-year consent period (2050). To assess futureproofing of the proposed scheme, the "Ultimate" design capacity is to allow for growth beyond current projections to a potential future population of 50,000. The population projections are presented in Table 1, and were used as the basis for assessing future servicing requirements.

Table 1: Population projections for the Warkworth, Snells Beach and Algies Bay areas over a 35 year period from 2015

Area of Service		2014	2024	2034	2050	Ultimate
Warkworth WWTP	PE	4,126	7,110	12,254	21,600	40,000
Snells-Algies WWTP	PE	3,737	4,423	5,418	6,574	10,000
Combined	PE	7,863	11,533	17,672	28,174	50,000

3 EXISTING WASTEWATER SERVICING

3.1 WARKWORTH

3.1.1 EXISTING PLANT

The existing plant has capacity to service approximately 5,000 PE. Following 3 mm screening, secondary treatment is provided in an oxidation ditch provides an extended aeration environment for microorganisms to uptake organic matter from the wastewater. The oxidation ditch is kept under aerobic conditions with two sets of two brush aerators that mix air into the wastewater, and propel it around the channel (total of four aerators). Two additional Aire-O_2 aerators provide additional aeration to meet peak loads. The brush aerators are situated at two locations approximately equidistant apart on the hydraulic circuit.

There are two secondary clarifiers at the Warkworth WWTP. Following the secondary clarifiers, the secondary effluent is treated in upward flow pebble filters comprising a single layer of pebbles. The filter polishes effluent before it is passed on to the effluent storage tank. The pebble filter is washed manually.

The effluent storage tank receives filtered effluent, providing some balancing effect during normal flows. From the effluent storage tank flows are pumped to UV disinfection. Disinfected effluent passes over a discharge weir and is discharge to the Mahurangi River via gravity flow outfall pipework and diffusers.

Warkworth WWTP has a peak flow treatment device installed that, in conjunction with the oxidation ditch can manage the highly variable inflow during a storm event. The peak flow treatment system is activated during sustained peak flow events which exceed the capacity of the biological treatment. An enclosed pipe medium pressure UV system is installed to treat peak flows downstream of the peak flow treatment.

Waste sludge generated at the site is dewatered using a decanter (centrifuge). The dewatered solids are disposed to an approved landfill.

3.1.2 CURRENT PERFORMANCE OF WARKWORTH WWTP

Plant monitoring data for the period July 2012 through April 2016, showed the plant to be fully compliant with its discharge consent conditions. The average concentrations over the monitoring period considered were 1.3 mg/L for carbonaceous five day biochemical oxygen demand ($cBOD_5$), 5.2 mg/L for total suspended solids (TSS) and 1.6 mg/L for ammoniacal nitrogen. The median faecal coliform count for the same period was 1.6 cfu/100 mL.

Although the average concentration for ammoniacal nitrogen is significantly less than the consented 92nd percentile limit, there were elevated concentrations during the colder months. The elevated ammonia concentrations observed in winter could be indicative of the sludge age being limiting at the lower temperatures or insufficient aeration capacity (or a combination of both). This situation would get worse with increased loads to the existing system.

There are currently no consent conditions around total nitrogen or phosphorus in the discharge from Warkworth WWTP. The effluent loads for total inorganic nitrogen (sum of ammoniacal nitrogen, nitrate nitrogen and nitrite nitrogen) between July 2012 and April

2016 had an average of 8.0 kg/d. The effluent loads for total phosphorus for this period was 1.9 kg/d.

3.2 SNELLS BEACH AND ALGIES BAY

3.2.1 EXISTING SNELLS-ALGIES WWTP

The existing Snells-Algies WWTP has a current capacity of approximately 6,500 PE. Raw sewage flow is evenly split between two lagoons where aerators provide oxygen for aerobic microorganisms to degrade soluble organic matter. Each lagoon has dissolved oxygen probes to monitor the residual oxygen concentration. The DO may be controlled by the DO instruments or timer controls, as selected by the operator, depending on the condition and status of the plant.

Aerobic partially treated flow from each lagoon is transferred to Pond 1 via a pipeline inclusive of several chambers. The ponds operate in-series to polish and partially disinfect treated wastewater to a standard suitable for discharge within the area of sea generally described as Martins Bay. Each pond has an aerator/mixer unit to assist with control of algae, prevent flow short-circuiting and to circulate the pond contents.

The ponds also can be managed to buffer the outflow by using part of the freeboard to temporarily store wastewater during storm events. The outfall pump station comprises pump sets operated in series, i.e. lift pump and booster pump arrangement. These pumps deliver treated effluent to the discharge point, approximately seven kilometres away at Martins Bay.

3.2.2 CURRENT PERFORMANCE OF SNELLS-ALGIES WWTP

Plant monitoring data for the period July 2012 through April 2016 showed the plant to be compliant with the discharge consent conditions. The current consent conditions include effluent quality limits for $cBOD_5$, TSS, faecal coliforms, E. Coli and dissolved oxygen which are summarised in Table 2.

Table 2: Current consented effluent quality limits at Snells-Algies WWTP

Parameter	Basis of Limit	Limit	
$cBOD_5$	92nd Percentile	80	g/m^3
TSS	92nd Percentile	100	g/m^3
Faecal coliforms	92nd Percentile	50,000	cfu/100mL
Faecal coliforms	median	7,500	cfu/100mL
E. Coli	92nd Percentile	10,000	cfu/100mL
Dissolved oxygen	92nd Percentile	>2	g/m^3

4 ENVIRONMENTAL CONSIDERATIONS

4.1 CURRENT RECEIVING ENVIRONMENTS

4.1.1 OFF MARTINS BAY

The existing environment off Martins Bay, in the region of the current and future upgraded proposed outfall, can be summarised as:

- A coastal region that supports a diverse and productive intertidal and subtidal ecosystem and is highly valued for its recreational and cultural values, including kai moana. The region is ecologically valued for its uninterrupted ecological sequence that grades from the coastal marine area into an important coastal complex forest;

- Phosphorus (total and dissolved reactive phosphorus - TP and DRP) and nitrogen (nitrate and nitrite) levels have tended to trend downwards in the discharge in recent years while ammonia-N and total suspended solids (TSS) have been variable. Microbial indicators are variable with time but generally show a trend of decreasing levels since 2006;

- The overall rating for receiving waters in the region of the discharge pipe, south of Martins Bay, has been consistently "Good" and consistent with other open coastal sites. There are occasional higher concentrations of phosphorus and biological oxygen demand (BOD) but there is no evidence of consistent impacts on water quality in terms of nutrients from the WWTP discharge off Martins Bay. TSS can be elevated at times but the waters meet all receiving water standards at present;

- Monitoring of microbial indicators in the water and shellfish in the vicinity of the outfall show no effects of the present discharge and are below MFE guidelines for shellfish gathering. Samples from Martins Bay indicate poorer microbial quality and only meet the "C" standard. This has been attributed to inputs other than the WWTP discharge, such as runoff during rainfall events;

- There is a relatively diverse benthic community near the outfall pipe dominated by polychaete worms, molluscs and crustacea; and

- Overall there is no evidence of effects on water quality or the benthic community from the present WWTP discharge.

4.1.2 MAHURANGI RIVER

The existing environment for the Mahurangi River can be summarised as:

- A river that has been classified under the Proposed Auckland Unitary Plan (PAUP) by Auckland Council as "Degraded 1" indicating a high level of degradation but mostly because of the high sediment input, sedimentation and its effect on other values;

- Monitoring upstream and downstream of the discharge indicates that the effects of the discharge, from the existing Warkworth WWTP, are likely to be less than minor and "it is unlikely that any significant changes in receiving water quality would be attributable to the treated wastewater discharge". The source of elevated microbial contaminants in both the upstream and downstream monitoring sites is likely to originate from the surrounding rural landscape and not the treated wastewater discharge.

4.1.3 MAHURANGI HARBOUR

The existing environment for the Mahurangi Harbour can be summarised as:

- A harbour that supports diverse and productive ecosystems with important ecological values for birds and fish and is recognised for its recreation and aquaculture values;

- The Mahurangi Harbour is classified under the PAUP by Auckland Council as "Degraded 2" i.e. a moderate level of degradation. The ongoing monitoring by Auckland Council has shown Dawsons Creek in the upper Mahurangi has consistently been "Good" in terms of water quality and Mahurangi Heads as "Excellent". Trend analyses has generally shown that total phosphorus and oxidised nitrogen (nitrate and nitrite) concentrations have been decreasing;

- Nutrient loads from the existing WWTP have been estimated as 2.6% for Total Nitrogen (TN) and 4.3% for Total Phosphorus (TP) compared with the total catchment load to the Mahurangi Harbour;

- The discharge from the existing Warkworth WWTP has been consistently very good in terms of microbial contaminants in recent years and meet the recreation standards for marine coastal waters;

- Input of sediment is a major concern for the harbor at present. There is some evidence that benthic health scores for the inner- and mid-harbour sites have been improving, but have declined at the outer harbour sites; and the harbour contains good examples of saline-terrestrial and saline-freshwater sequences including mangroves and seagrass that support a diverse and productive aquatic and shoreline biota, including several threatened bird species.

The major concerns with the discharge of treated wastewater to either the Mahurangi River and Harbour or off Martins Bay are deteriorating water quality, increased risk for recreation and shellfish gathering from microbial contaminants, risk of nuisance phytoplankton and microalgal growth, and changes to the benthic environment that could lead to oxygen depletion, sulphide build up and the flow-on effects to higher levels in the food web.

4.2 POTENTIAL EFFECTS DUE TO GROWTH

4.2.1 OFF MARTINS BAY

In the short term, the discharge from the existing Snells-Algies WWTP would continue until the proposed long term solution is implemented. The small increase in population predicted over the next 5-7 years for Snells-Algies WWTP (approximately 18%) would mean that even with the increase towards the end of the interim period there would not be an adverse effect on the receiving environment off Martins Bay. This is because concentrations would be the same as the existing discharge and the small increase in loadings would not have an impact downstream.

In the longer term, the effects were assessed for an initial combined population of 28,000 and a future population (beyond the consent period) of up to 50,000. For a population of 28,000, a discharge with an annual median of 10 mg TN/L through a pipe off Martins Bay on the open coast will result in concentrations similar to at present, but loadings would increase longer term.

The rapid dilution (>250x within a few meters of the pipe with a 10 port diffuser and for average flow) mean that the increases in contaminants (nutrients, emerging contaminants, heavy metals), including increased loads, would not be expected to have adverse effects on water quality, phytoplankton or macroalgae away from the pipe. An appropriate mixing zone is 200 m and at this point a dilution of at least 1000x is expected, concentrations would be the same as background levels, and below acceptable guidelines for coastal environments;

A quantitative microbial risk assessment (QMRA) has been carried out and shows:

- Infection risks for shellfish gathering are greatest for norovirus, followed by rotavirus and then enterovirus and for contact recreation are greatest for rotavirus followed by norovirus, enterovirus and adenovirus.

- Risk is greatest closest to the discharge point and decreases significantly by the time the water moves towards Mahurangi Heads or Martins Bay. Most of the dispersal is likely to be the south-west and thus away from Martins Bay.

- The QMRA shows small health risks at sites used for contact recreation and shellfish harvesting with the latter being a greater risk because of bioaccumulation. These risks can be mitigated with appropriate treatment.

- With a 10 port diffuser recreational risks are never over 0.15% and fall below a "no observable effects level" of 1% for a 100-fold (2 log) removal efficacy between influent and effluent at the plant for the four viruses assessed.

- With a 10 port diffuser risks would fall below the "no observable effects level" of 1% for a 100-fold removal efficacy for both recreation and shellfish gathering. 3 log removal would be required to achieve a <1:10,000 risk for >95% of the time.

There is no evidence that benthic aquatic habitats and communities are significantly adversely affected at present and any effects of the future discharge would only be in the immediate vicinity of the discharge pipe, if they did occur and would be within the bounds of the natural variability in the area. Birds and fish in the coastal environment are highly mobile and would not be adversely affected.

Similarly, for a potential longer term population of 50,000, there is no evidence that benthic aquatic habitats and communities are significantly adversely affected at present and any effects under the future scenario would only be in the immediate vicinity of the discharge pipe, if they did occur and would be within the bounds of the natural variability in the area. Birds and fish in the coastal environment are highly mobile and would not be adversely affected.

The effects of the discharge for the larger population would be slightly greater because of higher flows. Although the dilution would be lower in the near-field (>160 cf. >250 for a population of 28,000 with a 10 port diffuser and for average flow) increases in contaminants (nutrients, emerging contaminants, heavy metals), including increased loads would not be expected to have significant adverse effects on water quality, phytoplankton or macroalgae away from the pipe. An appropriate mixing zone is 200 m and at this point a dilution of at least 1000x is expected, concentrations would be the same as background levels, and below acceptable guidelines for coastal environments.

Based on a QMRA for off Martins Bay, the higher population of 50,000 would require a log 4 reduction (10,000) under peak flows to be <1:10,000 risk for >95% of the time;

4.2.2 MAHURANGI RIVER AND HARBOUR

The increase in population predicted between 2014 and 2024 for Warkworth is 72%. Without improved treatment installed in the short-term, there would potentially be a significant increase in the loadings of both nitrogen and phosphorus in the river and harbour. To address this, a short term upgrade is proposed, to limit the impact of growth such that there would not be further significant, irreversible effects on the receiving environment or the biological communities in the Mahurangi Harbour, compared to the present situation.

In the longer term, an increase in population to 28,000, even with reduced total nitrogen and phosphorus concentrations in the discharge would result in increasing loads in the discharge to the Mahurangi River and Harbour. Even for a total nitrogen concentration of 5 mg/L in the discharge, the increased loadings (potentially increasing from 3 to 9 T/y and 2.6% to 8.5% of the total TN coming into the catchment) would very likely result in greater risk of higher levels of nutrients being retained in the upper harbour and increased risk of increased algal growth, including nuisance species. Increases in TP from the plant would be small but could also be of concern. Further increases in population to 50,000 PE would exacerbate this with increases in load from 3T to 20T/y and 2.6% to

13% of the total TN coming into the catchment. Increases in TP from the plant would increase from 0.6 to 6 T/y and 4.3 to 24% of total TP load for Scenario 2 and this would also be of concern to the overall health of the harbour.

Water quality may still meet the ANZECC and NOF guidelines and standards and Auckland Council classifications for receiving waters, however the overall water quality would not improve. Requirements under the Proposed Auckland Unitary Plan for "Degraded 1" waters, which apply to the Mahurangi River, are for an improvement in water quality. The Mahurangi Harbour is classified as "Degraded 2" which means water quality must at least be maintained. Neither of these environments would meet these requirements for a population of 28,000 and with an increased population by 2050 and there is a risk that water quality would decline further because of the higher nutrient loads.

A quantitative microbial risk assessment (QMRA) has been carried out and shows:

- There are potential health risks at sites used for contact recreation and shellfish farming with the latter being a greater risk because of bioaccumulation. The risks are associated with limited dilution in the Mahurangi River downstream of the discharge, but could be addressed with a high level of treatment.

- Recreational risks fall below a "no observable effects level" of 1% for a 10,000-fold (4 log) removal efficacy between influent and effluent at the plant for the four viruses assessed.

- With additional dilution in the Mahurangi Harbour through dispersion and mixing risks associated with shellfish consumption also fall below the "no observable effects level" of 1% for a 10,000-fold (4 log) removal efficacy.

Benthic aquatic habitats and communities are unlikely to be significantly adversely affected unless there were substantial changes in sediment characteristics or nuisance macroalgal growths but there would be added risk because of the higher loadings; and

Birds and fish in the Mahurangi Harbour would not be impacted unless there were substantial changes in the habitats and their food resources (sediment composition and sedimentation, macroalgal growths, macroinvertebrate communities, seagrasses).

4.3 IMPLICATIONS FOR FUTURE PROVISION OF WASTEWATER SERVICES

Based on a weight-of-evidence approach and the predicted effects, a precautionary approach is recommended for future expansions with reduced nutrient concentrations and minimal increases in loadings being the target if the health of the Mahurangi were to be maintained.

A BPO off Martins Bay would have no significant adverse effects on the receiving environment outside the near-field, even at the predicted loads for a future Scenario 2, because of the rapid dispersion and dilution. An annual median discharge of not greater than 10 mg TN/L into the marine environment off Martins Bay should still be a target which would provide an improvement in concentrations over the existing discharge. The addition of UV to the treatment will improve the microbial quality compared with current concentrations where there is no UV treatment and concentrations can be highly variable. For the reasons above the preferred option overall is for a discharge south of Martins Bay.

5 APPROACH TO CONSENTING

5.1 KEY PLANNING CONSIDERATIONS

From a planning perspective this project presented multiple challenges as the Project needed to provide for:

- short-term treatment and discharges at both the Warkworth and Snells-Algies WWTPs;
- long-term treatment and discharges at Snells-Algies WWTP;
- the conveyance network and pump stations from Warkworth to Snells, and
- construction of a new coastal outfall into the Hauraki Gulf.

Additionally, given that both of WWTPs were located within the Auckland region, at the time of preparing the application the Auckland Unitary Plan was not yet operative so the Operative District Plan (Rodney Section 2011), the Auckland Council Regional Plan: Coastal 2011, and the Auckland Council Regional Plan: Air, Land and Water were also relevant for consideration alongside the Proposed Auckland Unitary Plan (PAUP).

Further, of relevance to the planning considerations of the Project were the numerous overlays and values associated with the two receiving environments of the Mahurangi Harbour and the Hauraki Gulf off Martins Bay.

In this regard the primary issue was that the existing Warkworth WWTP discharged into the Mahurangi River which flowed into the Mahurangi Harbour which are both classified as a 'Degraded' environment as classified under the PAUP. Therefore, the Regional Policy Statement (RPS) requires that any discharge activities do not result in further decline, and must avoid further degradation, of the 'water quality and ecological function' of these environments and must also restore water quality where opportunities present themselves.

Regarding the degraded environment, the objectives and policies were very important in the development of the Preferred Option for the project. Due to the high population growth forecast for Warkworth, removing the discharge of treated wastewater was necessary to avoid further degradation of water quality but given there was lag time required to construct and implement the Snells / Algies WWTP, the Warkworth WWTP needed to provide for a short-term upgrade to avoid degradation of water quality in order for the Project to be consistent with the policy direction. However, as the Hauraki Gulf does not have any water quality issues, there was only the requirement to 'maintain' water quality for the new WWTP at the Snells-Algies WWTP site. Watercare proposed improvements to the discharge quality in order to balance the increase in nutrient loads that will result from the increase in volume of treated wastewater being discharged to the Hauraki Gulf. Further, while the discharge was not found to have any adverse effects on the receiving environment, the dilution immediately encountered at the end of the outfall following discharge would further reduce any effects associated with the discharge itself.

Regarding the coastal outfall, the shoreline environment and coastal marine area (CMA) were located within the both the 'Outstanding Natural Landscape' and 'Coastal Natural Character Area - High' overlays under the PAUP therefore, the policies of both the PAUP and the New Zealand Coastal Policy Statement ("NZCPS") were relevant. The location within these overlays meant that specific consideration needed to be given to any effects, both short-term and long-term, on the values associated with the overlays. The structure and construction methodology were designed to minimise any impacts. While there were

some short-term adverse effects identified locally in the vicinity of the outfall works, when considered in relation to the extent of the overlays and that, as far as practicable, the disturbed areas would be restored to their natural state, these effects were considered minimal. Therefore, the outfall works were consistent with the policies under the PAUP and NZCPS that related to preservation of natural character and landscapes.

Overall, provisions within the relevant planning documents identified the Warkworth and Snells-Algies WWTP as significant pieces of Auckland infrastructure, and directed that their continued operation and upgrading be enabled, provided any adverse effects on the environment were managed in an appropriate manner. With respect to any adverse effects, their nature and the manner in which they were to be avoided, remedied or mitigated is consistent with the direction contained in the relevant planning documents for the proposed activities.

5.2 PREFERRED OPTION SELECTION PROCESS

As part of the investigations to determine the most appropriate, practical and sustainable long-term wastewater treatment servicing option ("the Preferred Option") for the Warkworth, Snells Beach and Algies Bay communities, Watercare undertook a comprehensive assessment of the options available ("the Process"). Watercare's overall goal for the Process was to use a robust and transparent selection process, incorporating relevant technical assessments, financial implications, and community and iwi input, to ensure that the Preferred Option selected was consistent with the best practicable option (BPO) requirements under the RMA and subsequently consented for the Project.

To inform the Process, Watercare undertook a targeted consultation process engaging with iwi, community groups, key stakeholders and the wider public. The feedback from the various meetings, open days and workshops were then feed into the different project workshops ahead of selection of the Preferred Option. This engagement process and the feedback received was imperative to ensuring that the Preferred Option was reflective of not only Watercare's objectives and goal but also the community, mana whenua and stakeholders.

The Process included input from a range of technical experts (including science, engineering, cultural, and statutory / planning expertise) and stakeholders to assess the viable long–term options for the Project and determine the 'Preferred Option'. The Process was characterised by:

- An approach that progressively provides a more detailed level of assessment as feasible options are identified;
- The application of 'Evaluation Criteria' based on applicable technical, environmental, planning and legal requirements; and
- Stakeholder and iwi engagement throughout the Process.

This process has been summarised in Figure 2 below.

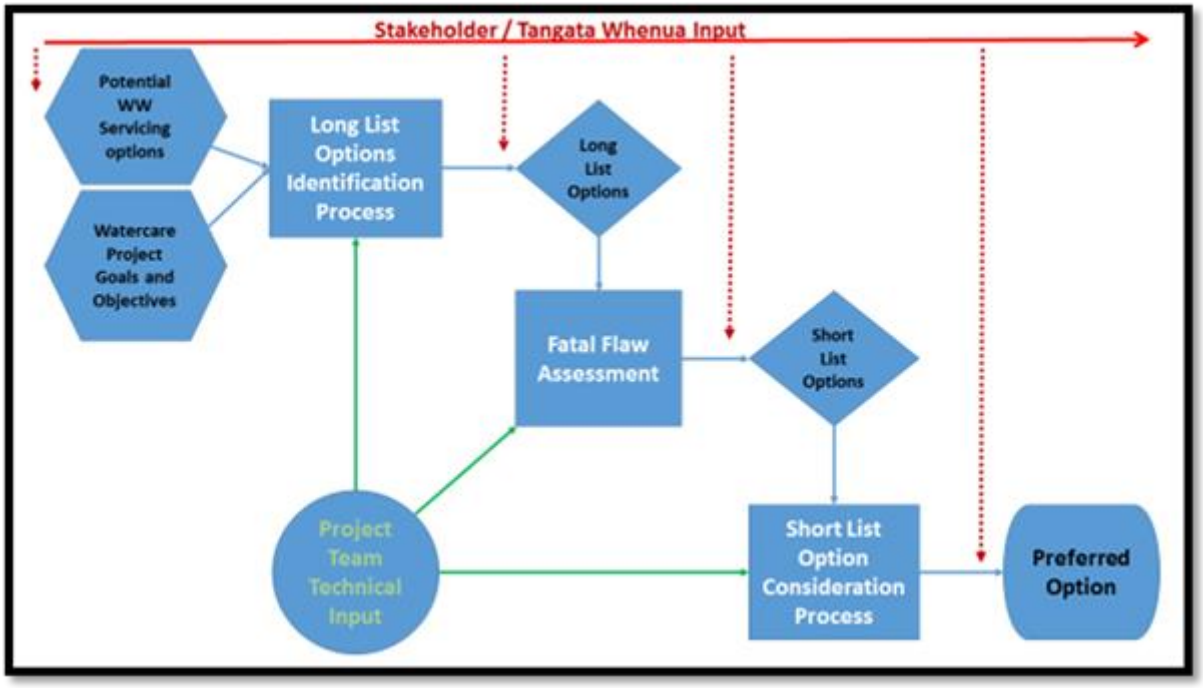

Figure 2: Flow Chart of the Preferred Option Consideration process

6 SELECTION OF PREFERRED OPTION

6.1 LONG LIST OPTIONS CONSIDERED

The long list of possible options for servicing growth in the Warkworth and Snells Beach area, identified in a workshop, is summarized in Table 3.

Table 3: Long list of potential options for servicing wastewater in the Warkworth and Snells Beach areas

No.	Option
1	"Status-Quo" – maintain existing WWTPs in their current form without upgrades, all new developments must provide their own wastewater treatment and disposal
2	Connect to existing networks, e.g. Army Bay or Rosedale
3	Expand both existing wastewater treatment plants in a "like for like" manner, keeping the same treatment standards and discharge locations
4a	Expand both existing treatment plants to provide the required capacity, improving the treated water quality in line with environmental assessments
4b	Expand both existing treatment plants to provide the required capacity, improving the treated water quality, with all discharge via Snells outfall
5a	A combined treatment facility located at Snells with discharge to the Hauraki Gulf
5b	A combined treatment facility located at Snells with Aquifer discharge
6a	A combined WWTP at Warkworth with discharge to the Mahurangi River.
6b	A combined WWTP at Warkworth with discharge via the Snell's Ocean Outfall
7	Combined WWTP at a new location, with capacity for servicing both townships, using technology to produce high-quality treated wastewater suitable for discharge via the Snells Ocean Outfall.
8	Reuse - one combined plant at either site, or upgrade of the two existing WWTPs – to allow reuse of the treated effluent.
9	Land Disposal - Upgrade Warkworth and Snells Beach WWTPs (can be a combined plant or two separate plants) to give increased capacity and an effluent quality suitable for land treatment.

Following the initial review of the long list, a number of options were ruled out as they did not meet the project objectives, were technically infeasible or did not have a clear driver for implementation in the short to medium term. The options ruled out following the initial review were Option 1; Option 2; Option 3; Option 6b; Option 5b and Option 8. The remaining options were considered in more detail before selection of the best practicable option.

6.2 EVALUATION OF SHORT LIST OPTIONS

Following the initial evaluation of the long list of options, the options summarized in Table 4 remained for further assessment. Some of the key drivers for selection of the best practicable option are outlined below, without presenting the full MCA assessment for each option.

Table 4: Shortlisted options for servicing of wastewater in the Warkworth and Snells Beach areas

No.	Option
4a	Expand both existing treatment plants to provide the required capacity, improving the treated water quality in line with environmental assessments
4b	Expand both existing treatment plants to provide the required capacity, improving the treated water quality, with all discharge via Snells outfall
5a	A combined treatment facility located at Snells with discharge to the Hauraki Gulf
6a	A combined WWTP at Warkworth with discharge to the Mahurangi River.
7	Combined WWTP at a new location, with capacity for servicing both townships, using technology to produce high-quality treated wastewater suitable for discharge via the Snells Ocean Outfall.
9	Land Application - Upgrade Warkworth and Snells Beach WWTPs (can be a combined plant or two separate plants) to give increased capacity and an effluent quality suitable for land application.

6.2.1 LAND APPLICATION

A custom Multi-Criteria Analysis (MCA) tool was utilised during assessment of potential land application feasibility in the Warkworth-Snells region. The objective was to identify land parcels considered technically suitable for discharge of treated wastewater to land.

Eleven (11) land parcels considered potentially usable as LA sites, were identified within the 5 km search radius of Warkworth WWTP. A potential suitability rank was also assessed. The terms 'useable' and 'suitable' encompasses the technical aspects of:

- Sufficient usable land area per lot (33 ha) – determined as 5% of required area (excluding buffer zones) required for total 50,000 PE flow.
- Proposed Auckland Unitary Plan zoning compatibility.
- Physical suitability - topographic slope, soil characteristics, hydrology/flood prone areas, proximity to receptors, distance.

Due to the soil types in the area, which are characterised by relatively poor drainage potential, all land application options were expected to require a dual discharge set-up. The dual-discharge approach incorporates discharge to an ocean outfall during peak wet weather flow and wet weather periods i.e. winter, and land discharge during fair weather

and suitable soil moisture conditions. This was to minimise potential environmental effects, namely; impacting soil structure, runoff, and nutrient leaching.

Land application operability for the region was estimated to be feasible for a maximum of between 7 months to 9 months of the year (during fair weather). Additionally, it was not considered feasible to store and then discharge the volume of wastewater generated by these populations for the remaining 3 – 5 months of the year (plus greater capacity allowance for wetter than average years).

A desktop assessment of potential nutrient uptake / leaching was completed for the 9 land parcels, totalling 471 ha, associated with Option 9. It was estimated that nutrient leaching would increase under the required future loading rates, for both grazed and cut and carry land use systems, compared to existing land use. Hence, although the Watercare nitrogen and phosphorus loads discharged to the Mahurangi River would decrease from current loads, they would not be completely removed. There would also be an increase in loads discharged to the Matakana River catchment.

As a result of the assessment, land application was ruled out as the preferred option as it could not provide a viable, standalone year-round solution or sufficient net benefits as part of a dual-discharge option. Land application could, however, be considered in the future as an option to reduce the loads discharged to the coastal marine environment, or if beneficial irrigation opportunities were identified – but would likely be limited to seasonal discharge.

6.2.2 DISCHARGE TO THE MAHURANGI RIVER

Based on the environmental assessments, for a discharge to the Mahurangi River, the expected effluent quality required is anticipated to be significantly better than that required for the ocean outfall. On the basis of maintaining the current nutrient loads discharged, the median effluent quality required for the end of the consent period is summarized in Table 5. The total nitrogen limit is lower than can be achieved using current wastewater treatment technology. This would pose a significant operational risk to Watercare around future compliance.

Table 5: Effluent quality required for a discharge to the Mahurangi River to maintain existing nutrient loads through term of consent

Parameter	Units	2050
$cBOD_5$	g O_2/m^3	2
TSS	g/m^3	2
NH_4-N	g N/m^3	0.5
Total N	g N/m^3	1.6
Total P	g P/m^3	0.4
E. Coli	cfu/100 mL	10

The environmental driver to improve the water quality in the Mahurangi River and Harbour; and the associated operational risk of improving the discharge quality, combined with a community preference for discharges of treated wastewater to the Mahurangi River to stop, resulted in options involving a discharge to the Mahurangi River not being preferred.

6.2.3 SITE CONSTRAINTS

There is no available land on the existing Warkworth WWTP site to upgrade the plant to service the future population. There is a site adjacent to the treatment plant site that is designated for wastewater (Figure 3) which could have been used. The area is sufficient to construct a wastewater treatment plant of the size required, however, there were a number of risks identified relating to the ground conditions. Furthermore, the site is close to existing housing, resulting in greater impact visually and greater risk of complaints due to odour and noise. The proposed site elevation would have limited effects due to climate change, e.g. high tide levels.

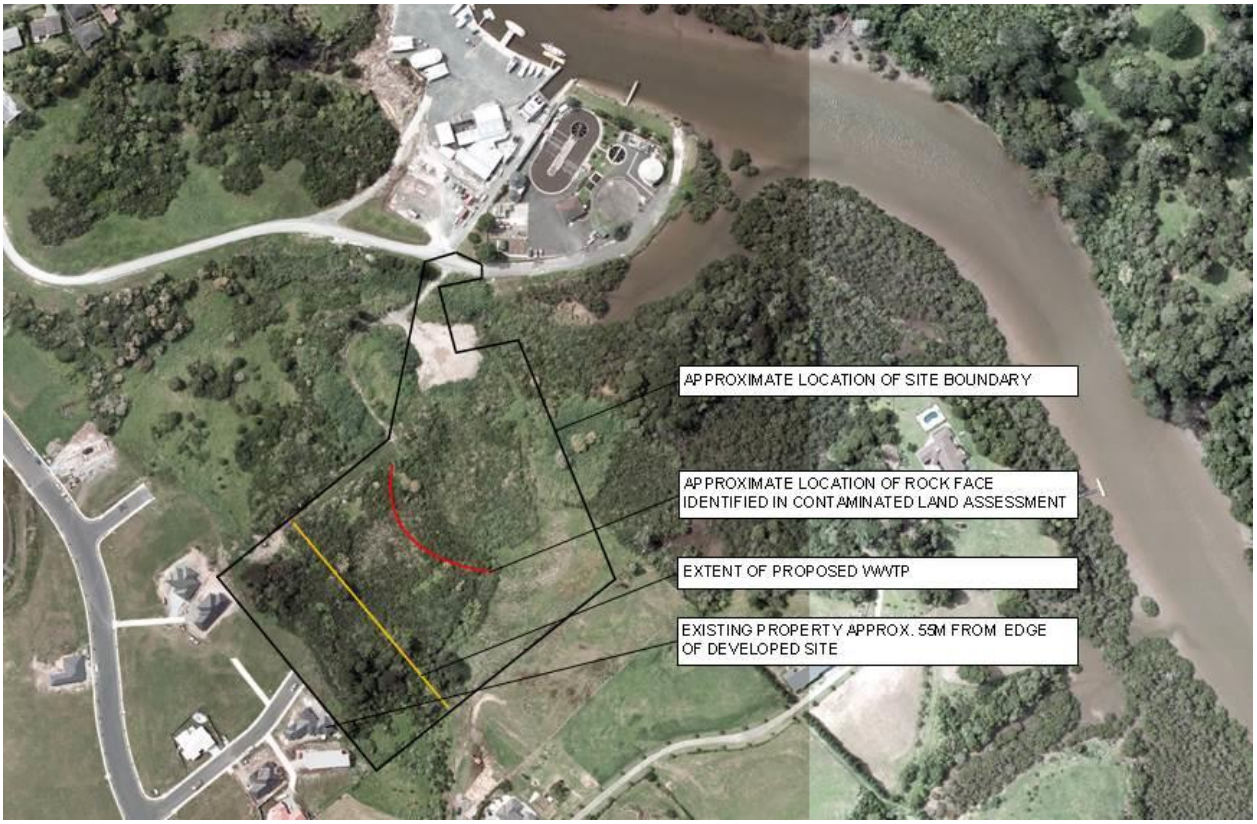

Figure 3: Designated site available for wastewater treatment plant upgrades in Warkworth

The existing Snells-Algies WWTP site had sufficient space to construct a new treatment plant (Figure 4), however, the construction sequence needed careful consideration as existing process capacity would have to be taken out of service to free up space. Consideration was given to temporary plant requirements to enable construction to take place.

Reclaiming the existing ponds for construction of a new plant also presents geotechnical risks. A desktop study identified that the sludge ponds will need to be backfilled with engineering/structural fill material compacted to an acceptable level. This work will need to include the excavation of any sludge and underlying estuarine sediments in the ponds. In areas where the engineered fill has been placed directly over the stiff to very stiff weathered Northland Allochthon soils (approximately 2m below the bund level), shallow foundations may be adopted for structures with some tolerance for settlement. For the more sensitive structures the pile foundations within the rock at a depth of around 8m - 9m may be required. Alternatively, preloading may reduce settlements to acceptable levels, if there is sufficient time for this option.

One of the key findings of a climate change assessment include a possible slow onset sea level rise of up to 1.35 m by 2100, with surge increasing the sea level further during

storm conditions. It was noted during a site visit that current king tides currently come up the outer bank of the ponds at Snells-Algies WWTP to a level approximately 1.5 m below the top of the banks. To mitigate against this, in the assessment of options for upgrading Snells-Algies WWTP an allowance was made for raising the building platform and finished ground level in the Pond 2 area by 1.5 m relative to the existing finished ground level. Other measures could be used, such as a sea wall or raising sensitive equipment.

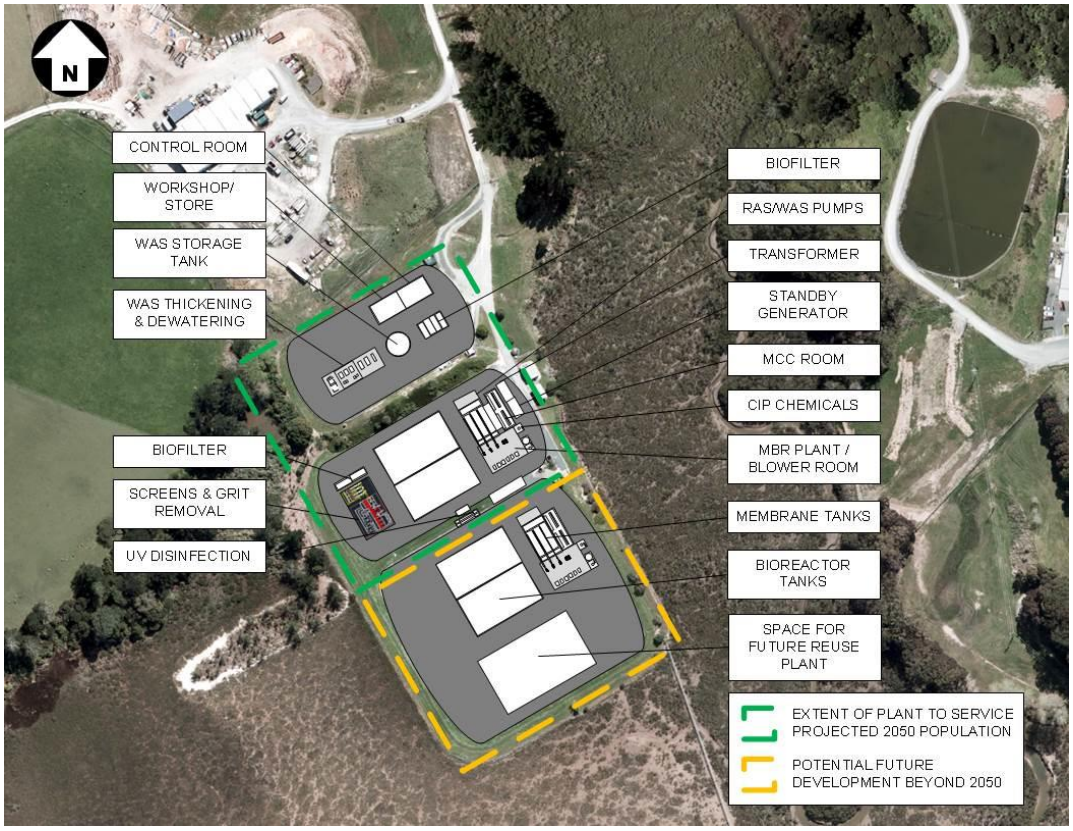

Figure 4: Possible layout of 50,000 PE plant at existing Snells-Algies WWTP site

A preliminary odour assessment was carried out for the two wastewater treatment sites, assuming that best practice odour treatment would be applied at the two sites. The conclusion drawn was that Snells-Algies would be a more preferable location for a plant due to the greater distance to the nearest receptors and the buffer zone around the site that is included in the designation.

Although the nature of the plant at Snells-Algies WWTP would change from the current low lying ponds, it is behind the commercial area of the township with fewer immediate neighbours overlooking the site. The nearest neighbour is a commercial property and the nature of the buildings could be designed with a similar look.

6.2.4 INTERIM OPERATIONAL REQUIREMENTS

For construction of the plant at Warkworth, no temporary plant is required as the new works can be constructed off line. However, the existing treatment plant has limited capacity to cater for growth in the catchment. If there is a requirement to allow growth in the Warkworth catchment prior to the new plant being available, additional temporary plant will be required to increase the capacity at the existing WWTP.

As one of the ponds would have to be taken out of service to enable the first stage of construction, a risk was identified that the plant might not achieve its consent limits for total suspended solids and pathogen indicators. To make provision for this, a temporary membrane filtration plant was included in the scope of works for evaluation purposes.

6.2.5 PREFERRED LOCATION

The two sites were considered in the context of providing two separate plants (one at Warkworth and one at Snells-Algies) or a combined plant at Snells-Algies. The two options were assessed on the basis of technical risk, footprint, future development, ground improvement, temporary plant requirements, visual impact, noise impact, odour impact, capital cost and operating cost. The preferred location was the existing Snells-Algies WWTP site.

6.2.6 SELECTION OF THE PREFERRED SOLUTION

All of the shortlisted options were evaluated in a workshop environment using a multi-criteria approach. The workshop was attended by a range of people with expertise in planning, legal processes, wastewater operations, cultural impacts, engineering, etc. Out of this workshop, the preferred solution identified was to transfer wastewater from Warkworth to Snells Beach and construct a new, combined plant at the existing Snells-Algies site with a discharge to the Hauraki Gulf off of Martins Bay.

7 NORTH EAST SUB-REGIONAL WASTEWATER SCHEME

Having identified the preferred solution, this was then developed into an overall scheme to be consented. The scheme comprises four main components:

- A short term upgrade for Warkworth WWTP to enable growth;
- A conveyance system to transfer wastewater from Warkworth to Snells Beach (Figure 5);
- A new combined treatment plant at the existing Snells-Algies WWTP site; and
- A new outfall discharging off of Martins Bay

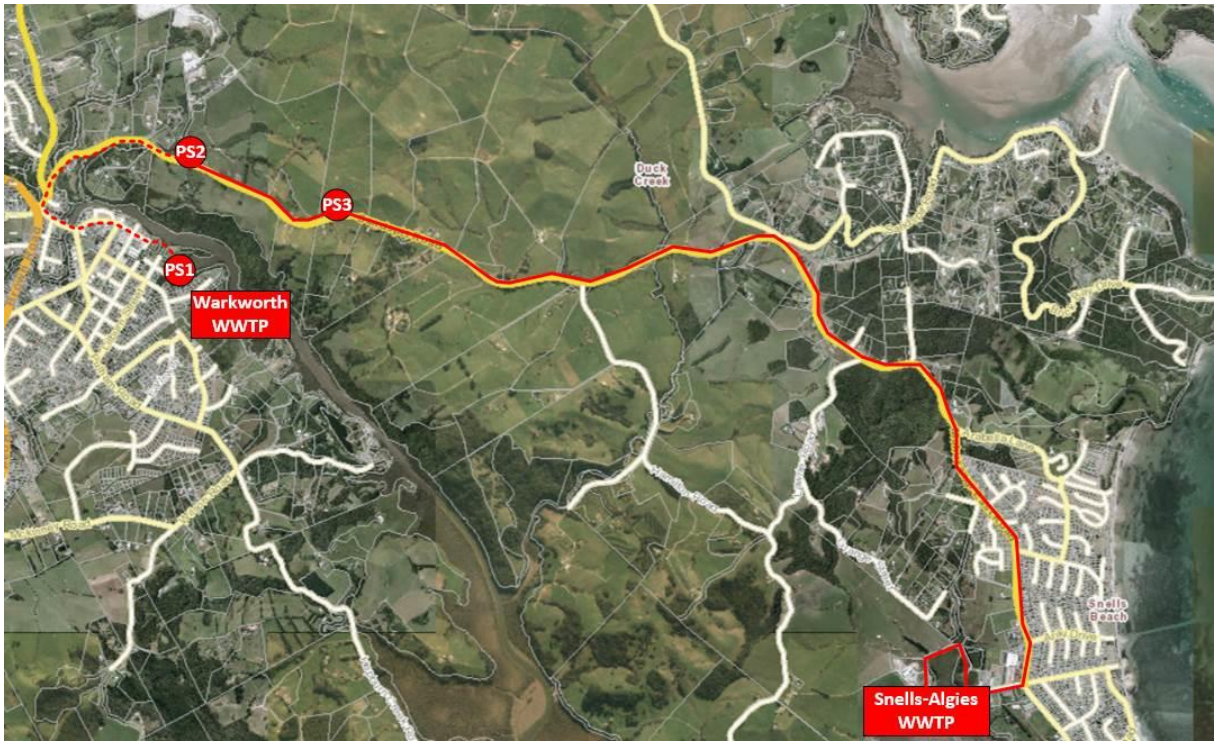

Figure 5: Overview of Warkworth to Snells-Algies transfer pipeline

In considering the consents applied for it was identified that there would need to be an allowance of time to construct the new scheme. As such the consents for discharge to water included short term limits, under which the existing plants could continue to operate during design and construction of the new conveyance and treatment systems. On expiry of the short term discharge limits, the Warkworth WWTP will be decommissioned and there will be no further discharge to the Mahurangi River. The long term discharge limits for the new Snells Beach WWTP offer a significantly improved effluent quality over that currently discharged form Snells-Algies WWTP.

In addition to the discharge consents for the treatment plants, consents were sought for three pump station sites associated with the transfer pipeline. These were for land use and emergency discharges.

8 CONSULTATION AND ENGAGEMENT

Prior to lodging the application, Watercare undertook targeted consultation / engagement with iwi / mana whenua, community groups, key stakeholders, the councillors and local board members, and the wider public. This engagement was run through a combination of focused workshops / hui, public open days and face to face meetings.

This process enabled Watercare to identify and understand the key issues of the concern, and in turn, undertake the necessary technical investigations and assessment required to work through these issues in advance of lodging the application. The key issues raised included the opposition to increases in discharges to the Mahurangi River / Harbour, the need to investigate alternative discharge options, the adverse effects associated with the construction of a new WWTP and the conveyance network from Warkworth to Snells Beach. The feedback from the engagement and conclusions from any resulting technical investigations fed into the option selection process and contributed identifying the Preferred Option for the Project.

Watercare consider that the effectiveness of this pre-lodgement consultation / engagement was demonstrated through the limited number, and nature, of submissions on the Application. Overall, 16 submissions were received with eight in opposition. The main concerns raised through the submissions were related to the location and potential effects of the proposed pump stations and conveyance line. Following the close of submission, Watercare undertook to meet each of the submitters in an attempt to work through their concerns. Through this process Watercare undertook further bodies of work to address submitters' concerns which included redesigning pump station layouts within the proposed footprint and investigating alternative conveyance routes along the Mahurangi River. As a result of this additional engagement, all bar one submitter either withdrew their request to be heard or changed their submission to one of support.

With one remaining submitter, the application went to a Council hearing where it was determined that the submitter's concerns were not directly related to the application itself and, as there had been agreement between Watercare and Council on the resource consent conditions, the Hearing Panel's decision was to grant the application.

9 CONCLUSIONS

Significant population growth has been identified in the Warkworth and Snells Beach areas in the Auckland Unitary Plan. To support this growth, Watercare has to provide and operate water and wastewater infrastructure.

Environmental assessments carried out identified that continued discharge to the Mahurangi River and Harbour should only be pursued if the nutrient loads could be held at current levels. The assessment also indicated that there would be no adverse effects for discharge of increased flows off Martins Bay for the improved effluent quality proposed.

Prior to applying for new consents for the Warkworth and Snells-Algies wastewater treatment plants, a structured options evaluation was carried out to identify the preferred option for servicing growth. The options evaluation process identified a preferred solution that included decommissioning the existing Warkworth WWTP, transferring wastewater to Snells Beach, construction of a new wastewater treatment plant and discharge via a marine outfall.

A targeted consultation and engagement process was implemented which resulted in a Preferred Option being selected that was generally supported by the community and the stakeholders. This contributed to a streamlined Hearing process, due to the limited number of submissions to be heard.

A consent application was submitted for the preferred solution. The proposed consents enabling the short-term operation of the Warkworth and Snells-Algies WWTP and the long-term operation of the new WWTP (at Snells-Algies WWTP) meet the municipal wastewater needs of the local area and had significant and demonstrable positive effects in terms of sustaining the social and economic wellbeing of the community. Additionally, any adverse effects were considered to be appropriately avoided, remedied or mitigated and primarily managed through the implementation of consent conditions.

In conclusion, Watercare's position was that the granting the consents, on the terms sought in the application package, would promote the sustainable management of natural and physical resources, as contemplated by the RMA. This position was shared by Council and the relevant resource consents to provide for the activities were granted in March 2017, for a 35 year term.

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