

ACCELERATING TO MEET GROWTH, DELIVERING WATERCARE'S WARKWORTH WASTEWATER PROGRAMME

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ABSTRACT

Watercare is responsible for providing infrastructure to enable population growth and is committed to delivering reliable, safe and efficient water and wastewater services across the Auckland region. The challenge for Watercare is to deliver quality infrastructure in time to meet deadlines under pressure from development without sacrificing on cost.

The Warkworth area, in the northern part of the Auckland Region, is experiencing significant growth. The population has grown from 3,900 in 2013 to 8,400 today, and is expected to more than triple to 28,000 by 2050.

In response to the future urban growth areas identified in the Auckland Unitary Plan, Watercare developed the Warkworth Wastewater Servicing Strategy which presents an overall concept for servicing future developments.

As part of the Warkworth Wastewater Servicing Strategy, Watercare is investing \$190 million over the next four years in the area's wastewater network to ensure local communities continue to have reliable, resilient wastewater services that will also meet the needs of Warkworth's growing population well into the future. The improvements to the area's wastewater network include: 8.5km of new transfer pipeline and three pump stations, an advanced Wastewater Treatment Plant (WWTP), and an upgraded ocean outfall.

This paper focusses on the new wastewater pipeline and pump station project, Warkworth to Snells Transfer Pipeline, and the accelerated delivery strategy employed by Watercare to meet essential deadlines. Key to the success of the accelerated delivery strategy are:

- **Early buy-in from key stakeholders:** Frequent and targeted engagement with key stakeholders and the community led to broad support for the project.
- **Route optimisation to reduce consent and construction timelines:** Achieved using a comprehensive multi-criteria decision support framework, which considered multiple objectives, but prioritised programme as a key driver.
- **Advanced land acquisition and agreements.** Early discussions and negotiations with landowners led to timely access and sale/purchase agreements and affected party sign-off.
- **Early investigation programme.** Early contracts were let for geotechnical, contaminated land, and survey to facilitate an efficient design process. A consenting strategy and User Requirement Specification were developed early to provide a basis for subsequent design; and

- **Advanced physical works.** The project was divided into packages with advanced physical works taking place for the outfall and WWTP earthworks.

Combined, these efforts have placed Watercare in a strong position to deliver the transfer pipeline project within the required timeframe to support growth and meet consenting deadlines.

KEYWORDS

Growth, Wastewater, Pipeline, Project Delivery, Stakeholder

PRESENTER PROFILE

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Matt Tolcher is a Senior Project Manager and Design Manager with Tonkin & Taylor. He has over fifteen years' experience developing and delivering infrastructure projects in the US and NZ. Over his career, Matt has led multi-disciplinary teams to deliver large and complex water, transport, and power projects.

1 INTRODUCTION

Warkworth has been identified through the Auckland Unitary Plan (AUP) to accommodate a portion of the significant growth projected in Auckland. Approximately 1000 hectares of land surrounding Warkworth has been zoned as future urban, and it is expected that the population will more than triple from 8,400 today to 28,000 in 2050 (Auckland Council, 2019).

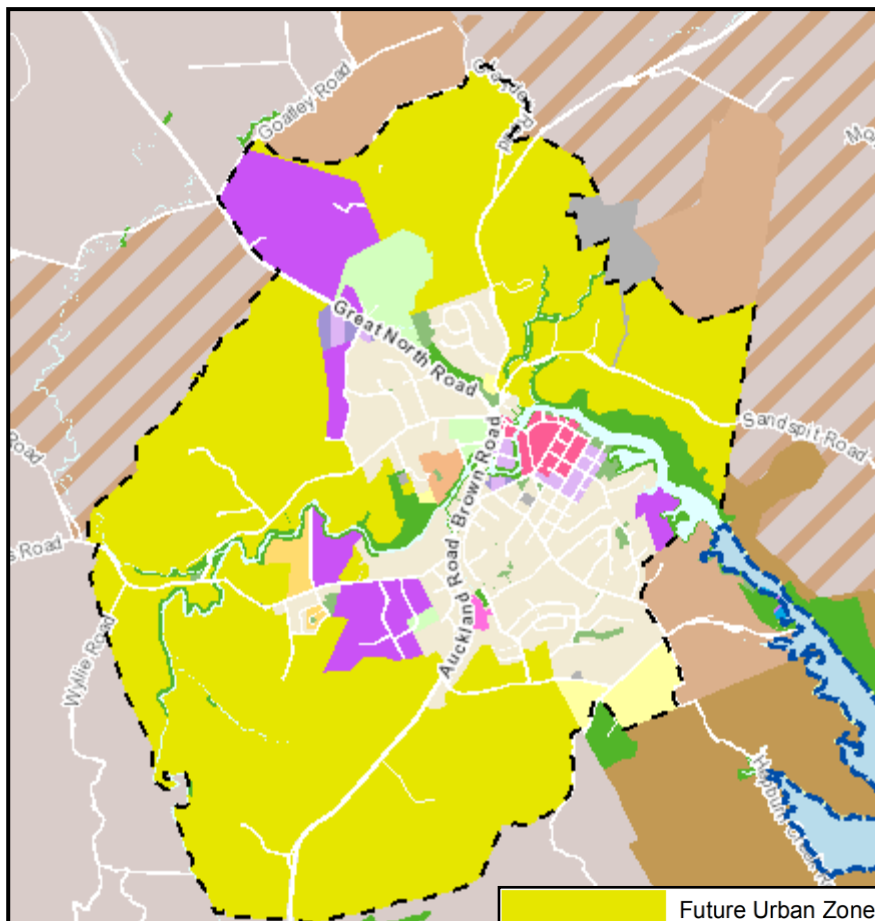


Figure 1: Future urban growth areas in Warkworth identified in the Auckland Unitary Plan.

(Source: <https://unitaryplanmaps.aucklandcouncil.govt.nz/upviewer/>)

Watercare is responsible for providing infrastructure to enable population growth and is committed to delivering reliable, safe and efficient water and wastewater services across the Auckland region. The challenge for Watercare is to deliver quality infrastructure in time to meet deadlines under pressure from development without sacrificing on cost. Alternative project delivery methods have been explored to achieve this in Warkworth and may be applicable across New Zealand.

In response to the future urban growth areas identified in the Auckland Unitary Plan, Watercare developed the Warkworth Wastewater Servicing Strategy which presents an overall concept for servicing future developments and integration with the existing network. The strategy focuses on the following outcomes:

- Definition of catchment boundaries and associated population estimates;
- Staged implementation approach to service short term flows and prioritize immediate development needs as well as the design horizon flows to 2050;
- Interface strategies with future water and wastewater supply requirements and other infrastructure providers such as NZTA (e.g. Puhoi to Warkworth Motorway) and Auckland Transport (e.g. Matakana Link Road);
- Identification of pump station sites to commence land acquisition early; and
- Cost estimates and optimization of capital spend with consideration of developer contributions.

As part of the Servicing Strategy, Watercare will invest \$190 million over the next four years into Warkworth, Snells Beach and Algies Bay wastewater networks through delivery of a programme of works known as the North East Sub-regional Wastewater Scheme.

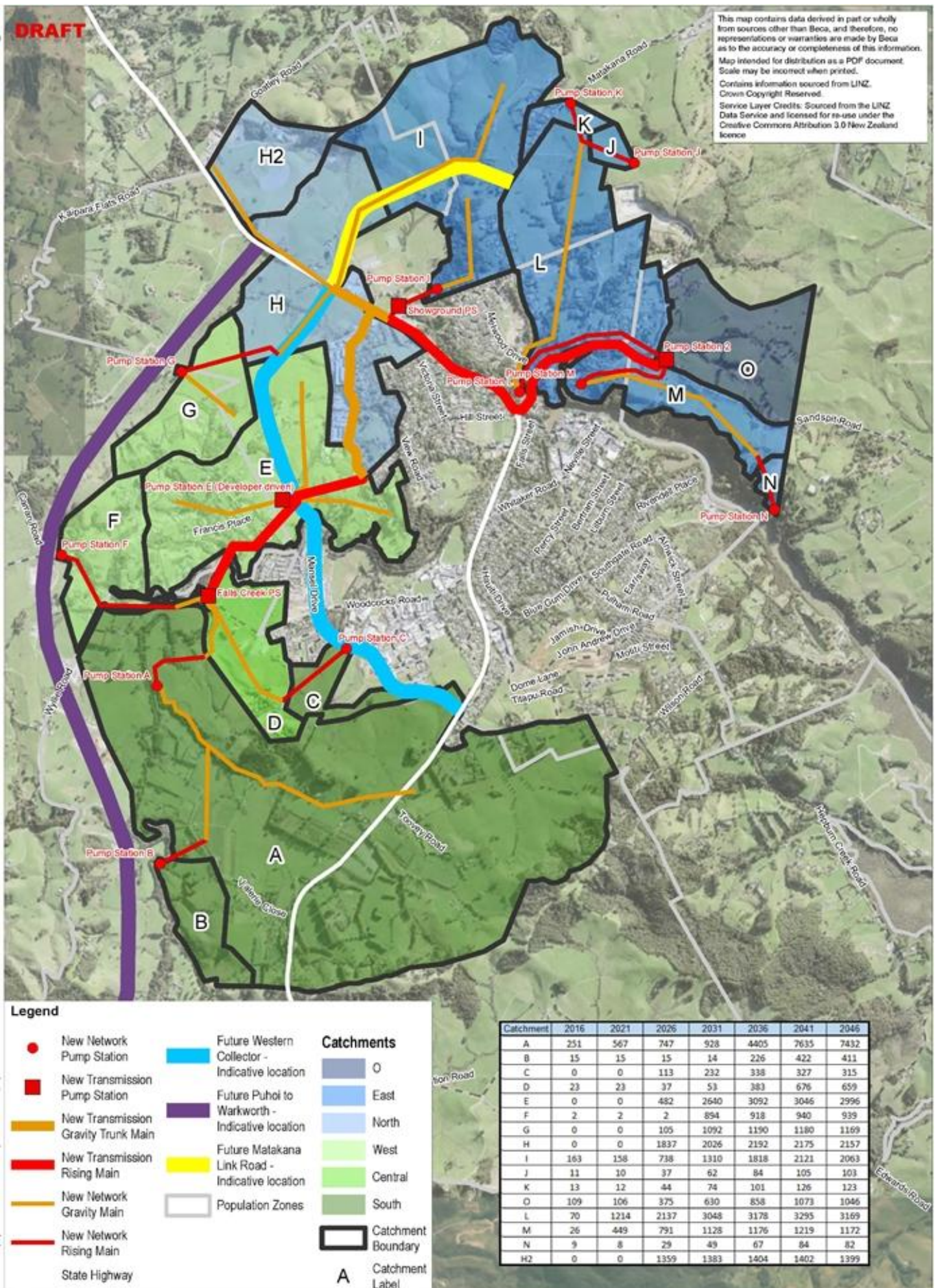


Figure 2: Watercare’s proposed Warkworth Wastewater Servicing Strategy to collect flows from the future urban growth areas and connection to the Warkworth to Snells Transfer Pipeline at Pump Station 2.

The North East Sub-regional Wastewater Scheme forms the backbone of the wastewater servicing strategy in Warkworth, Snells Beach and Algies Bay, and consists of the following projects:

- Short term upgrades at Warkworth WWTP to enable growth in the existing catchment to 2022;
- A new 8.5km wastewater pipeline and three pump stations to transfer wastewater from Warkworth to a new WWTP at Snells Beach Beach (Warkworth to Snells Transfer Pipeline);
- A new WWTP adjacent to the existing Snells-Algies WWTP; and
- A new treated wastewater outfall discharging off Martins Bay.

Initially the scheme will receive flows from the existing wastewater networks only. A staged approach will be implemented to accommodate the low initial flows and subsequent increased flows until 2050. New assets collecting flows in the future urban growth areas will connect to the North East Sub-regional Wastewater Scheme via the main transfer pipeline, be conveyed for treatment at Snells Beach WWTP, and discharged via the new ocean outfall. Definition of the North East Sub-regional Wastewater Scheme involved a structured options analysis and on-going consultation with key stakeholders to determine the best practicable options for servicing the region now and in future.

A package of consents was applied for and granted in March 2017 based on the best practicable option for the scheme. The consents consisted of two short-term discharge limits enabling operation of the existing Warkworth and Snells-Algies WWTP to treat current flows and interim growth to 2022, a 35 year discharge limit for the new Snells Beach WWTP requiring significantly improved effluent quality, and land-use consents for three wastewater conveyance pump stations.

The short-term discharge consents expire in April 2022 at which point the North East Sub-regional Wastewater Scheme must be operational. Meeting this deadline is a key success factor and is the driver for the accelerated delivery model implemented on the Warkworth to Snells Transfer Pipeline project.

The Warkworth to Snells Transfer Pipeline will divert existing and future wastewater flows from the Warkworth catchment to a new wastewater treatment plant at Snells Beach. In addition to enabling growth in the region the project will allow discharges from the existing Warkworth WWTP to the Mahurangi River to be discontinued, and decommissioning of the Warkworth WWTP.

The project consists of the following components:

- Diversions of the local network in Warkworth from the existing WWTP to a new pump station;
- Three new pump stations ranging from 140 to 287L/s;
- 5.2km of dual HDPE rising main ranging from 400 to 500mm outer diameter, including a 500m trenchless installation underneath Mahurangi River connecting the first two pump stations; and
- 3km of 800mm diameter FRP gravity sewer connecting to the new Snells Beach WWTP.

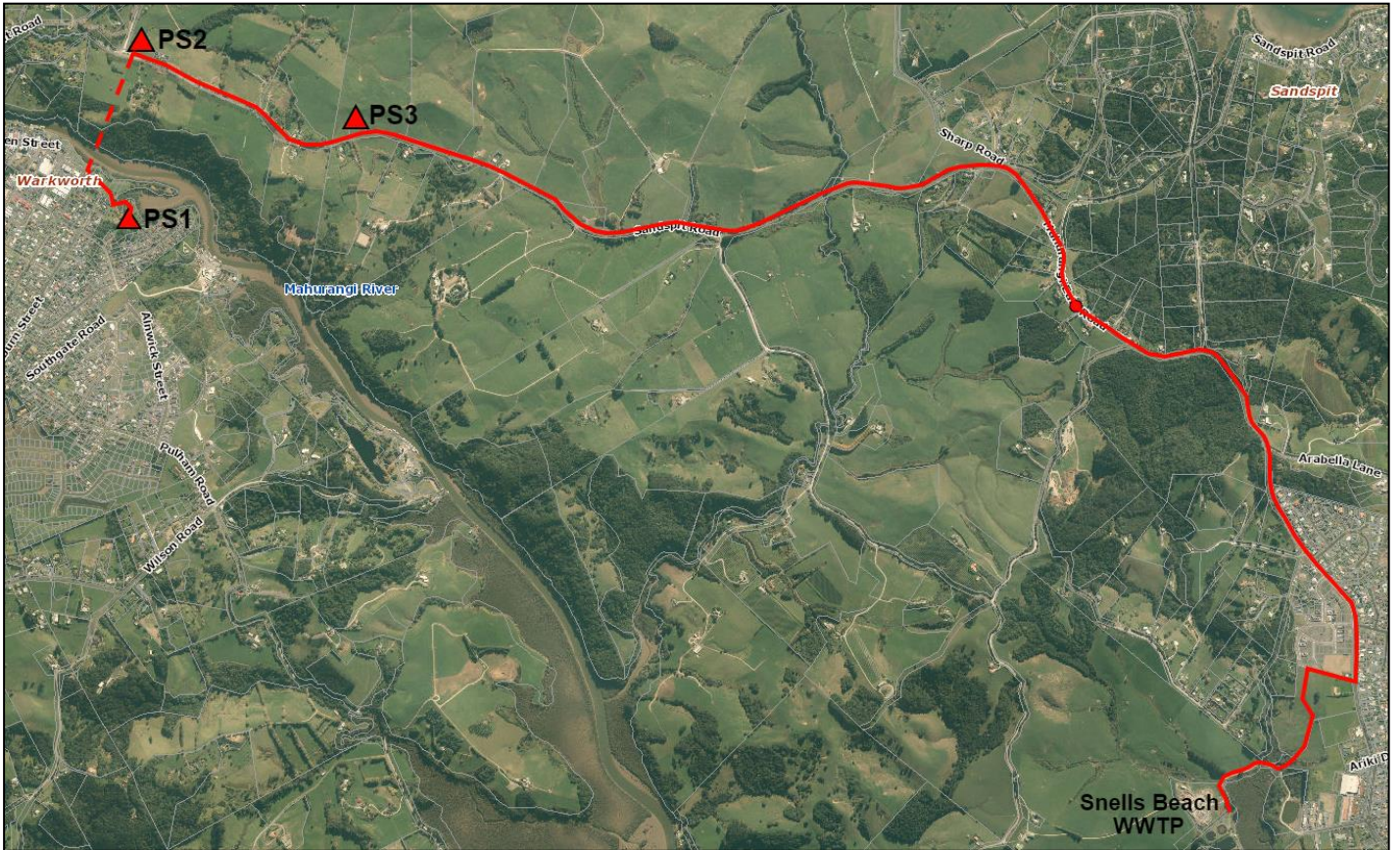


Figure 3: Warkworth to Snells Transfer Pipeline reference design alignment.

The project is currently in the procurement phase, expecting the final consent decision before September 2019 and a contractor appointed in Q4 2019. Construction is expected to take two years with completion at the end of 2021.

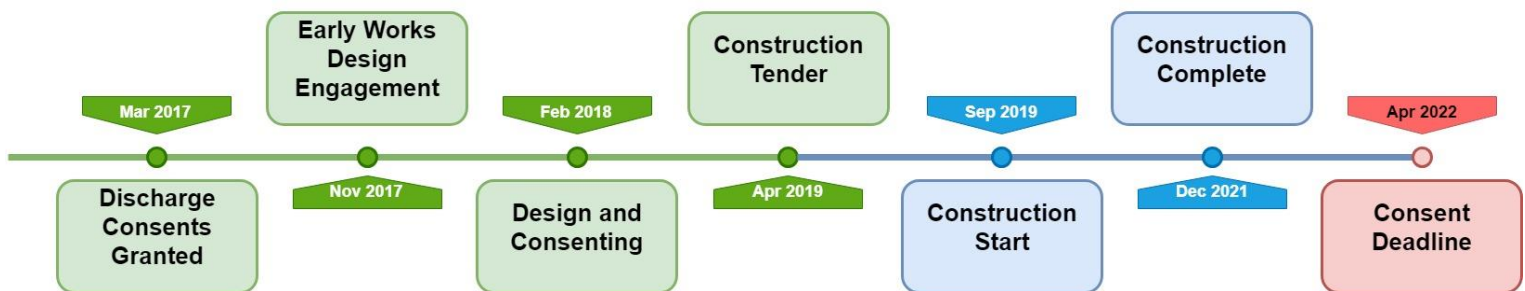


Figure 4: High-level Warkworth to Snells Transfer Pipeline project programme.

2 ACCELERATED DELIVERY STRATEGY

To meet the project objectives of supporting growth and alignment with consenting deadlines, Watercare employed an accelerated delivery strategy which included multiple work faces. These work faces are described in more detail in the following sections.

2.1 ROUTE OPTIMISATION WITH PROGRAMME AS A KEY DRIVER

Watercare determined early in the project's feasibility and concept design phase that route selection would be a key factor in delivery of the project to the required timelines. With that in mind, Watercare considered the following in route selection:

- Optimizing the route to avoid significant environmental effects, thus minimising the likelihood of the Resource Consent being Notified or Partially Notified (reducing consenting timeline and overall programme by approximately 9 months);
- Eliminating deep open cut sections through the Snells Beach township;
- Reducing the length of pipeline through developed urban centres (Warkworth Town Centre and Snells Beach township);
- Avoiding interference with Puhoi to Warkworth and the Hill St. Intersection (one of Auckland's most notorious intersections); and
- Re-alignment of the route through Lucy Moore Park to avoid high-amenity trees.

The key savings in programme were in the consenting and construction durations.

To assist in decision making on route selection, Watercare developed and followed a Multi-Criteria Analysis (MCA) framework. The MCA framework prioritized programme, but also considered other project objectives (refer Table 2 below). The MCA framework was developed collaboratively with the project team, this included technical, property, RMA planning, design, communications, environmental, construction and operations team members. After the framework was agreed, the team worked in collaboration to assess the options, through discussion and analysis, ultimately resulting in weighting and scoring the options.

The MCA process was especially useful when considering options for the first few kilometres of the route where the options were trenchless across the Mahurangi River or open cut through the Warkworth Town Centre and Hill St Intersection. Both routes had their challenges and therefore an MCA decision support process allowed the team to consider the key criteria and objectively analyse the routes against those criteria. The framework and results from the MCA analysis on this route decision are presented below (detail and commentary removed).

Table 1: MCA Route Analysis – Town Centre v. Mahurangi River Crossing

Criteria	Commentary		Weighting	Score (1- 5), 1 is poor	
	Town Centre	River Crossing		Town Centre	River Crossing
Programme			30%	1.5	4.5
Community Disruption			20%	2	4
Operations and Maintenance			50%	3	2
Environmental Risk			20%	3	2
Health & Safety			20%	2	4
Cost			20%	3	3
Non-weighted Summary (without cost)				11.50	16.50
Non-weighted Summary (with cost)				14.50	19.50
Weighted Summary (without cost)				2.39	3.11
Weighted Summary (with cost)				2.47	3.09

In combination, these decisions to optimize the route avoided a notified consent and associated programme delays, but equally provided the overall best project outcomes by reducing cost, minimizing effects on the environment and community, and delivering great community outcomes such as protecting trees with high amenity value in Warkworth’s waterfront park.

2.2 EARLY STAKEHOLDER ENGAGEMENT

Watercare’s pro-active approach to stakeholder engagement was centered on frequent and targeted consultation. This approach ultimately resulted in broad support for the project with a number of key stakeholders having input to the project outcomes. Figure 5 illustrates the complexity of the stakeholder environment, key stakeholders, and their primary interests in the project.



Figure 5: Stakeholder Map for the North East Sub-Regional Wastewater Scheme

Further information on the key interests, needs, and Watercare’s approach to each of the key stakeholders is presented in Table 2 below.

Table 2: Key stakeholder interests and needs.

Stakeholder	Key Interest	Key Need	Watercare’s Approach
Internal Clients	Operations & Maintenance	Standards, Reliability, Ease of Maintenance	User Requirement Specificaiton developed during early works. Site visits to similar sites. Regular touch points and review, involvement in decision making.
Rodney Local Board	Community outcomes & impacts	Regular updates, ability to influence outcomes	Quarterly updates to the Local Board.
Community at Large	Community outcomes & impacts	Regular updates	Bi-Annual newsletter (Warkworth Matters)
Mana Whenua	Environmental	Assurance and discussion related to risk of effects on environment, particularly at two trenchless water crossings (river/estuary)	Multiple Hui onsite. Letters responding to specific concerns and queries.
Auckland Council Regulatory	Regulatory	Compliance	Early engagement. Robust technical assessments and AEE.
Auckland Transport	Regulatory & Community Disription	Understanding of impacts on Hill St intersection and Puhoi to Warkworth (traffic impacts to Warkworth)	Regular meetings and updates. Route optmisation to address their concerns.
NZTA	Community Disruption	Understanding of impacts on Hill St intersection and Puhoi to Warkworth (traffic impacts to Warkworth)	Regular meetings and updates. Route optimisation to address their concerns.
Landownerss	Land Agreements	Fair commercial outcomes. Minimising impact on future development opportunities	Frequent and targeted engagement by Senior and experienced Watercare staff.

Stakeholder consultation for this project was intentionally aligned with the wider servicing scheme, keeping in mind the significant additional infrastructure proposed in the near future. Establishing relationships early and maintaining on-going consultation with mana whenua, Auckland Council, Rodney Local Board, utility providers and affected landowners will streamline project delivery as demand ramps up over the next few years.

Watercare's approach to stakeholder engagement on the project is best illustrated by the 'extra-mile' effort with a particular landowner near the Mahurangi River Trenchless Crossing. Twin 450 diameter pipelines are to be constructed under approximately 300m of private land, at a depth of 10-40m to connect Pump Station 1 with Pump Station 2. This trenchless section of the alignment is critical to the success of the project, as the alternative route would result in significant public disruption and would not meet the project deadlines.

The property is zoned as Future Urban and the landowner expressed intentions to develop the land in future. In addition, provision for a deep shaft and extensive geotechnical investigations were required on the property.

Watercare required a License to Occupy Agreement for Geotechnical Investigations, License to Occupy Agreement for physical works, and Affected Party Approval for resource consent.

There was a real risk that the landowner could oppose the project rather than support it (or at the least participate benevolently) if her questions and concerns were not listened and responded to. Watercare's approach to this critical stakeholder/landowner was:

- Frequent engagement by a senior person at Watercare early in the project, including multiple face-face meetings.
- Engagement with the landowner's advisors - legal and personal.
- Providing the landowner with information on potential development scenarios based on zoning, and commenting on impact of pipeline under her property.
- Tailoring access improvements required for works, so they provided ongoing access for the landowner into the future.

The result of this engagement was that the landowner was satisfied that her concerns had been listened to and addressed and she signed off on Affected Party Approval and the required land agreements.

"Made contact with [landowner] about the proposal. Fair to say she was delighted, with the approach, the thought and hopefully the result."

In addition to this landowner, several other stakeholders were engaged as part of the Mahurangi River Trenchless evaluation process, such as constructability specialists, operations and maintenance, mana whenua, Department of Conservation and Auckland Council. Critical stakeholders were consulted early and feedback was incorporated into the multi-criteria options analysis. Following the decision to proceed with the trenchless option, specific concerns from each stakeholder were addressed.

An example of this was consultation with mana whenua, in particular Ngāti Manuhiri, Te Rūnanga o Ngāti Whātua, and Ngāti Whātua o Kaipara, who expressed concerns regarding wastewater leakage into the sensitive Mahurangi River environment. A technical memo was prepared and circulated explaining how the project is addressing the concerns and a presentation to the Watercare Kaitiaki Forum took place to explain

Watercare's approach to trenchless crossings in a wider context. Through this process mana whenua concerns were addressed and their support was obtained.

Consultation with key stakeholders continues throughout the project lifecycle including construction, commissioning and reinstatement.

2.3 ADVANCED LAND ACQUISITION AND AGREEMENTS

2.3.1 LAND ACQUISITION

Pump station locations were evaluated early in the concept design phase, and land-use consents were sought for three sites (refer to Figure 6) in addition to the treatment plant discharge consents. This was a key driver in determining the best practicable option for the pipeline alignment.



Figure 6: Map of reference design pump station locations and Mahurangi River Crossing alignment.

Several factors were evaluated in determining the preferred pump station sites, some key factors included:

- **Public or private land** – Watercare prefer to position pump stations on public land wherever possible, which was achieved for Pump Station 1 (PS1) in Lucy Moore Memorial Park. The new pump station is located adjacent to the existing Lilburn Pump Station which will be decommissioned upon completion of the project. Auckland Council and Rodney Local Board were consulted during preliminary design, providing input into the layout and architectural aspects of the above ground structures. Watercare has agreed to purchase the land from Auckland Council.
- **Unitary Plan zoning** – Pump Station 2 and 3 are located on private land in areas identified for future urban growth under the Proposed Auckland Unitary Plan. When development occurs the surrounding areas will require wastewater infrastructure.

The pump stations are strategically located to service the future urban growth zones north of Sandspit Road.

- **Integration with future infrastructure** – A key driver for the location of Pump Station 2 (PS2) was integration with the wider Warkworth Servicing Strategy that outlines how the future urban growth areas to the south and north-west of Warkworth will be managed. The Warkworth to Snells Transfer Pipeline will be sized to accommodate this growth; however additional infrastructure is required to enable it. PS2 was identified early as a key connection point and will receive the vast majority of flows from the future urban growth areas shown in Figure 1.
- **Pipeline route in road corridors** – Installation of pipelines within road corridors is preferred as access to the asset during operation is safer and easier, and approval from a single stakeholder is required, in this case Auckland Transport. Pump Station 2 and 3 are located to facilitate installation of the pipeline along Sandspit Road, the main arterial into Snells Beach.
- **Geotechnical conditions** – Existing geotechnical data was analyzed and additional ground investigations were undertaken at the proposed pump station sites to inform the early options analysis. Common features encountered include presence of Mahurangi Limestone, fractured muds and clays, slope instabilities. Geotechnical features among all proposed sites were similar in nature; however there were variances in groundwater levels, slope stability risk and extent which were evaluated against constructability and safety during options analysis.

Following options analysis and agreement of preferred locations land-use consents were applied for and granted in mid-2017. Additional investigations and design of the pump stations was undertaken immediately to inform discussions with landowners and Rodney Local Board. After on-going engagement, landowner approvals were obtained prior to lodgment of the Resource Consent.

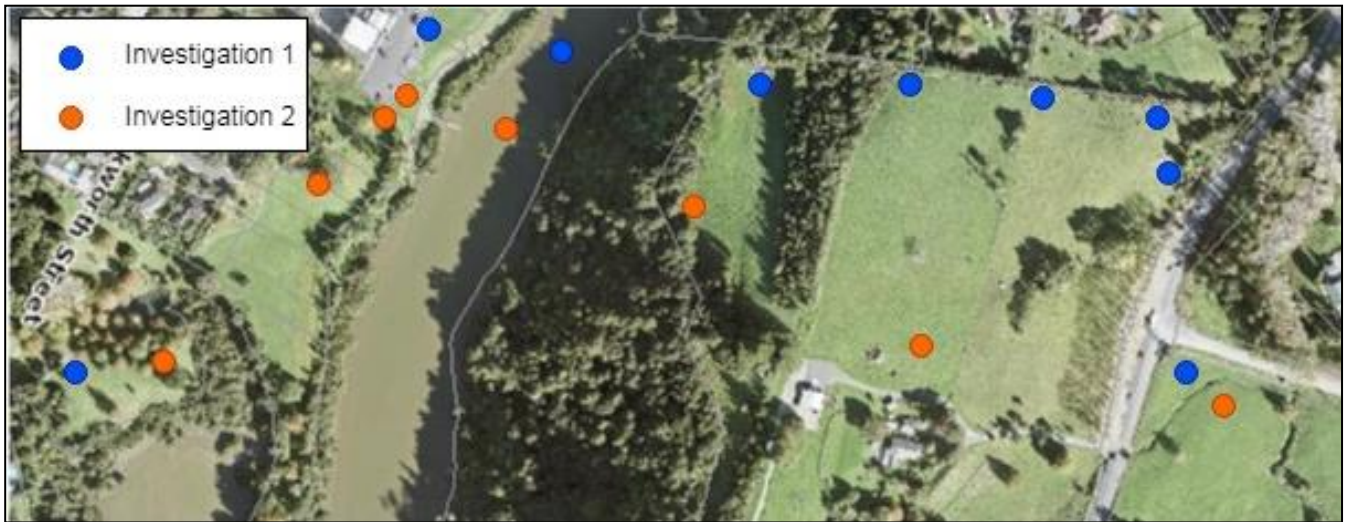
The process of advancing land-use consents and site acquisition meant that detailed investigations and design could be completed early contributing to the accelerated project programme.

2.3.2 LANDOWNER APPROVALS

Agreements were sought from landowners to undertake ground investigations and physical works associated with the main contract. These were obtained in the form of License to Occupy and Affected Party agreements.

License to Occupy agreements from private landowners were required in order to undertake the significant programme of geotechnical investigations along the pipeline route. Performing these investigations causes disruption to landowners and other users of the property, therefore it was important that these stakeholders fully understood the impacts and had plenty of opportunity to voice their concerns. An example of this is the private landowner affected by the Mahurangi Trenchless Crossing. As discussed in section 2.2, early and frequent interfacing with the landowner resulted in development of a trusting relationship with Watercare, allowing the investigations to take place quickly, and helped with a second round of investigations on the land at a later date. This also led to written approval of affected persons meaning that the effects associated with construction activities on the land did not require notification through the Resource Consent process.

A similar approach was taken with Auckland Council Community Facilities to undertake investigations in Lucy Moore Memorial Park, and private landowners adjacent to Hamatana Road in Snells Beach.



At the Snells Beach end of the project the pipeline will be installed along Hamatana Road where it will eventually connect to the new Snells Beach WWTP. Hamatana Road is a narrow gravel road which serves as the only point of access to the existing WWTP. The road is shared with a timber processing business who own a section of the road and have the majority of vehicle movements. A recently installed walkway connection has introduced pedestrian traffic along the northern extent of the road.

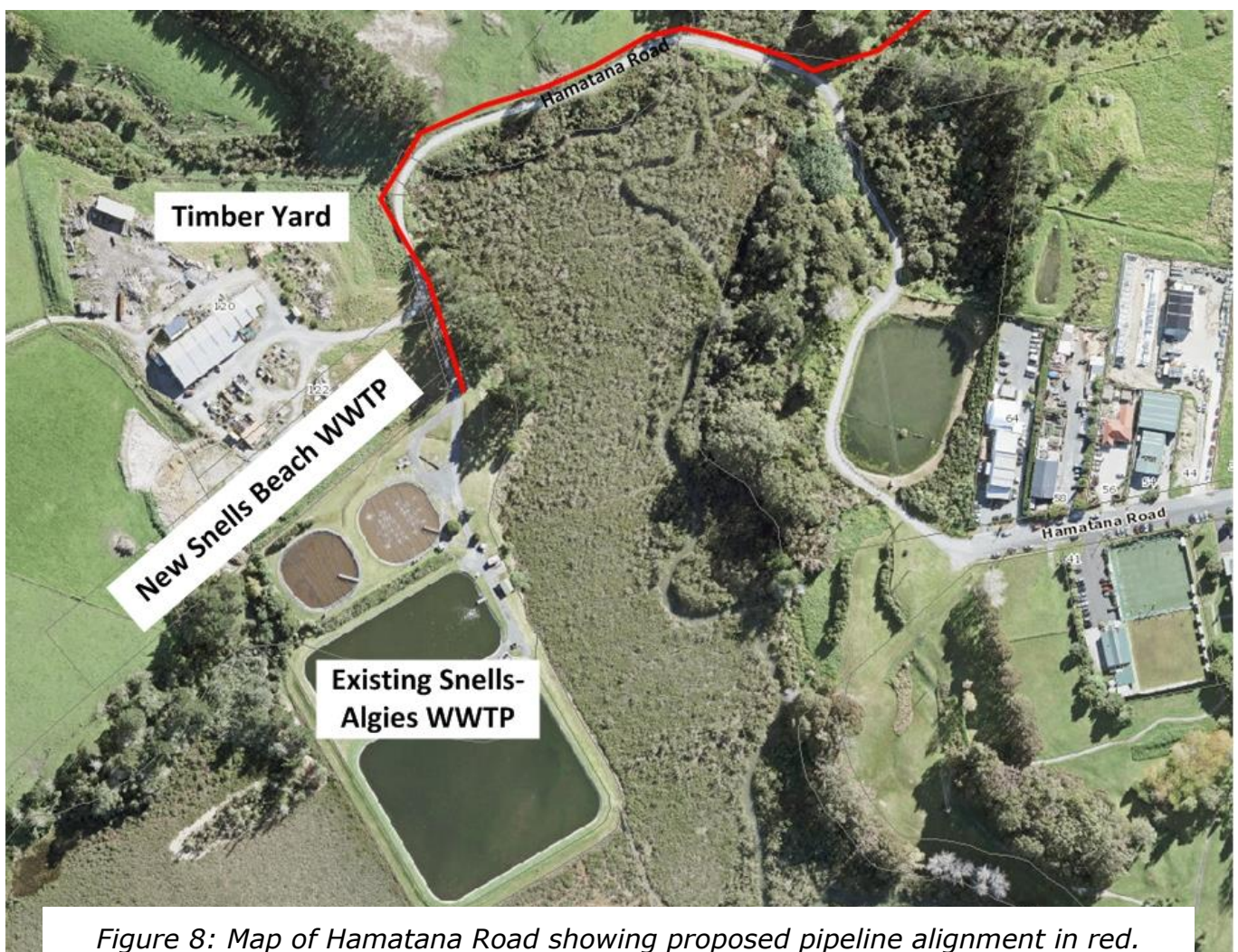


Figure 8: Map of Hamatana Road showing proposed pipeline alignment in red.

Due to the narrow width of Hamatana Road, construction of the pipeline along the existing road would result in significant traffic restrictions or full road closures that would have severe impacts on the timber business, operation of the existing WWTP, and construction of the new Snells Beach WWTP. This was established early in the preliminary design phase and taken forward for consultation to the timber yard owner and WWTP operations team.

The key outcome of this consultation was agreement to widen the road, allowing access to be maintained to all properties throughout construction of the pipeline. New culverts will also be installed at two low points along the road to remedy flooding issues experienced in recent years which has prevented access to the properties. This additional road width impinges on the timber yard property; however the landowner agreed to sacrifice part of their property due to the overall access benefits.

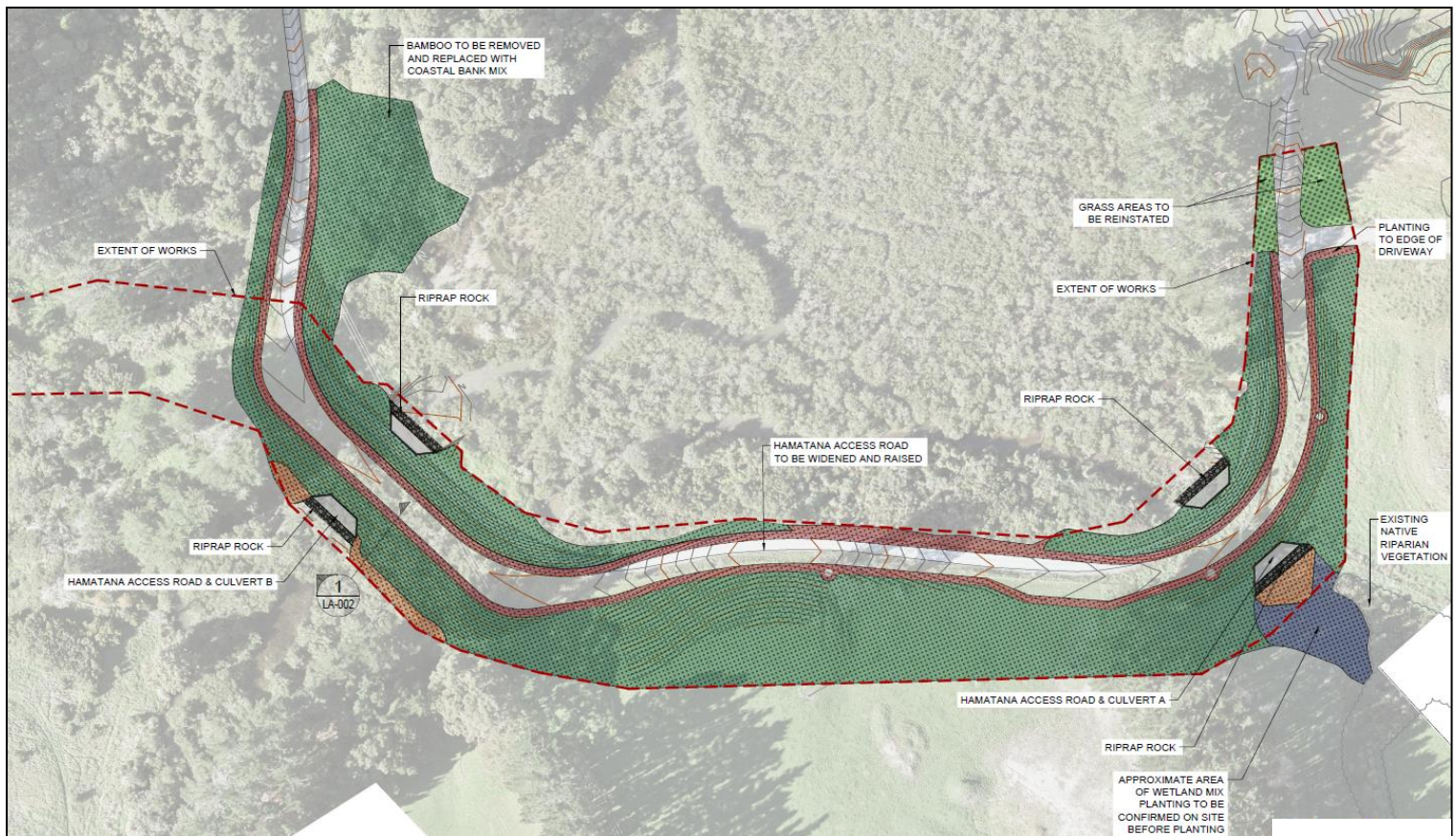


Figure 9: Map showing proposed Hamatana Road upgrades.

During the consultation process with the timber yard alternative access routes were investigated in the event of closures along Hamatana Road. The alternative routes are a contingency plan and follow farm tracks through the timber yard owner's land. This gave assurance to the landowner that access can be maintained at all times during construction.

This approach to stakeholder engagement and design flexibility has led to an accelerated Resource Consent application and reduced risk of a notified consent through written landowner approvals, particularly at critical project areas such as the Mahunrangi River Crossing and Hamatana Road.

2.4 EARLY INVESTIGATIONS AND PLANNING

An early works design, consenting and investigation package was initiated following obtainment of the discharge and land-use consents. This phase of the project comprised of the following:

- Geotechnical investigations of the proposed pipeline route, pump station sites and Mahurangi River to inform future feasibility and options analysis;
- Topographical survey of the proposed network diversions, conveyance pipeline route and pump station sites;
- Preparation of a User Requirement Specification to capture performance and functional requirements of internal Watercare stakeholders; and
- Preparation of Consenting and Consultation Strategies to identify the consents required and approach to stakeholder engagement.

Topographical and ground investigations were required up-front to allow fundamental route alignment options to be analysed and agreed upon early in the design process. These investigations also informed the preliminary design of the pump stations, allowing changes due to ground conditions on-site to be incorporated early, such as optimizing the location of PS1 due to ground stability concerns in proximity to Mahurangi River.

Completion of the User Requirement Specification set the direction for design of the pump stations which were then taken forward to consultation with external stakeholders. A key outcome was a low maintenance architectural design that satisfied the Rodney Local Board's vision for integrating with the surrounding environment.

The Consenting and Consultation Strategy outlined a tailored approach to the consent process for the project, identifying consenting risks and opportunities with a programme-focused lens. Key objectives which influenced the project direction included:

- Significant reduction in project programme by achieving a non-notified consent;
- Developing Auckland Council's understanding of the project and key issues by meeting with key personnel and submitting draft technical reports prior to lodgment;
- Seeking input from key stakeholders through early consultation and engagement, and addressing concerns during development of the preliminary design; and
- Streamlined conditions process by developing a set of draft conditions based on experience from previous projects of similar nature.

2.5 ADVANCED PHYSICAL WORKS

Physical work packages were identified for advanced delivery across the programme of works to provide better outcomes to the community and expedite completion to meet the ultimate consent deadline.

2.5.1 SNELLS-ALGIES OUTFALL

The existing Snells-Algies Outfall currently discharges all treated wastewater flows from the Snells Beach and Algies Bay catchments. Installed in 1975, the outfall is an aging asset requiring major repair works one to two times per year.

The new Snells-Algies Outfall will replace this asset and is sized to cater for the additional Warkworth flows as well. Although the new outfall is not required until April 2022 as per the discharge consent, the project is being advanced to mitigate the risk of uncontrolled treated effluent discharges into the environment from the existing outfall and to accelerate the overall programme. The project is scheduled for completion in mid to late-2020.

2.5.2 SNELLS BEACH WWTP EARTHWORKS

A tender package was developed for ground preparation of the new WWTP site and is scheduled to be undertaken prior to the main contract in the 2019/2020 earthworks season. The work package includes:

- Removal and off-site disposal of all uncontrolled fill across the site;
- Excavation of the site to the working level;
- Construction of a site access road; and
- Installation of stormwater pipework.

A key objective of the early earthworks package is to facilitate fast mobilization on site following award of the main construction contract without impacting on structural and civil detailed design elements required to be completed by the contractor, with particular focus on not affecting the foundations of major above ground structures.

3 CONCLUSIONS

Watercare adopted an accelerated delivery strategy on the Warkworth to Snells Transfer Pipeline project in response to the significant population growth forecast in Warkworth over the next 35 years. The challenge of meeting the discharge consent deadline provided the opportunity for innovative approaches to stakeholder engagement, route optimization, land acquisition, design and consenting focused on overall programme reduction. The strategies and programme focused approach implemented may be beneficial for future projects undertaken by Watercare and other infrastructure providers as we tackle our responsibility of catering for growth across New Zealand.

ACKNOWLEDGEMENTS

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