I hereby give notice that a hearing by commissioners will be held on:

Date:	**Mondays through Thursdays from 18 September until 12 October 2023**
Time:	**9:30am**
Meeting Room:	**Council Chambers**
Venue:	**Level 2, Henderson Civic, 3 Smythe Road, Henderson, Auckland 0612**

NOTIFICATION MATERIAL

VOLUME 02

NORTH-WEST STRATEGIC PROJECTS

TE TUPU NGĀTAHI SUPPORTING GROWTH

AUCKLAND TRANSPORT & WAKA KOTAHI NZ TRANSPORT AGENCY

COMMISSIONERS

Chairperson	**Richard Blakey**
Commissioners	**Mark Farnsworth**
	Vaughan Smith

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Note: The reports contained within this agenda are for consideration and should not be construed as a decision of Council. Should Commissioners require further information relating to any reports, please contact the Team Leader Hearings.

VOLUME 01 **TABLE OF CONTENTS** **PAGE NO.**
STR-PART 1
North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 1

VOLUME 02 STR-PART 2	**TABLE OF CONTENTS**	**PAGE NO.**

North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 2

VOLUME 03 STR-PART 3	**TABLE OF CONTENTS**	**PAGE NO.**

North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 3

VOLUME 04 STR-PART 4	**TABLE OF CONTENTS**	**PAGE NO.**

North-West Strategic: Whenuapai, Kumeū, Huapai and Redhills – Part 4

ATTACHMENT 36

NORTH-WEST STRATEGIC ASSESSMENT OF ALTERNATIVES

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Strategic Appendix A – Assessment of Alternatives

December 2022

Version 1

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

Responsibility	Name
Author	Jade Ansted
Reviewer	John Daly
Approver	Chris Scrafton

Revision Status

Version	Date	Reason for Issue
0.1	06-12-2022	Issued for lodgement

Table of Contents

Figures

Tables

Glossary

Acronym / Term	Description
ASH	Alternative State Highway
AT	Auckland Transport
Auckland Council, Council or the Council	Auckland Council
AUP:OP	Auckland Unitary Plan – Operative in Part
BCI	Brigham Creek Interchange
CFAF	Corridor Form and Function
DBC	Detailed Business Case
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
IBC	Indicative Business Case
ISTN	Indicative Strategic Transport Network
KiwiRail	KiwiRail Holdings Limited
LOS	Level of Service
MCA	Multi-Criteria Assessment
NAL	North Auckland Line
NOR	Notice of Requirement
North West Transport Network	The wider north west transport network proposed by Te Tupu Ngātahi, being the NW Strategic Package and NW Local Arterials Package
NW Local Arterials Package	North West Local Arterials Package which is the subject of a separate Te Tupu Ngātahi package
NW Spatial Strategy	North West Spatial Land Use Strategy
NW Strategic Package	North West Strategic Network Package, which comprises the following projects: • Alternative State Highway • SH16 Main Road • Rapid Transit Corridor including Kumeū Station and Huapai Station • Access Road
ONL	Outstanding Natural Landscape
Partners	Collectively refers to Auckland Transport, Waka Kotahi NZ Transport Agency, Manawhenua and Auckland Council

Acronym / Term	Description
RAMC	Regional Active Mode Corridor
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
SEA	Significant Ecological Area
SH16	State Highway 16
SME	Subject Matter Expert
TFUG	Transport for Future Urban Growth
Waka Kotahi	Waka Kotahi NZ Transport Agency

1 Introduction

1.1 Purpose of this Report

This report supports Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport's (AT) Notices of Requirements (NORs) to designate land for the North West Strategic Package (NW Strategic Package). The NW Strategic Package includes six NORs within the North West area of Kumeū-Huapai connecting to Brigham Creek interchange (BCI) as detailed in Table 1-1 and Figure 1-1. The project seeks to protect land for the construction, operation and maintenance of transport infrastructure.

Table 1-1: NW Strategic Package projects

Ref	Project	Requiring Authority
Highway Connections		
S1	Alternative State Highway (ASH)	Waka Kotahi
S2	SH16 Main Road	Waka Kotahi
Rapid Transit		
S3	Rapid Transit Corridor (RTC)	Waka Kotahi
KS	Kumeū Station	Waka Kotahi
HS	Huapai Station	Waka Kotahi
Roading upgrades		
S4	Access Road	Auckland Transport

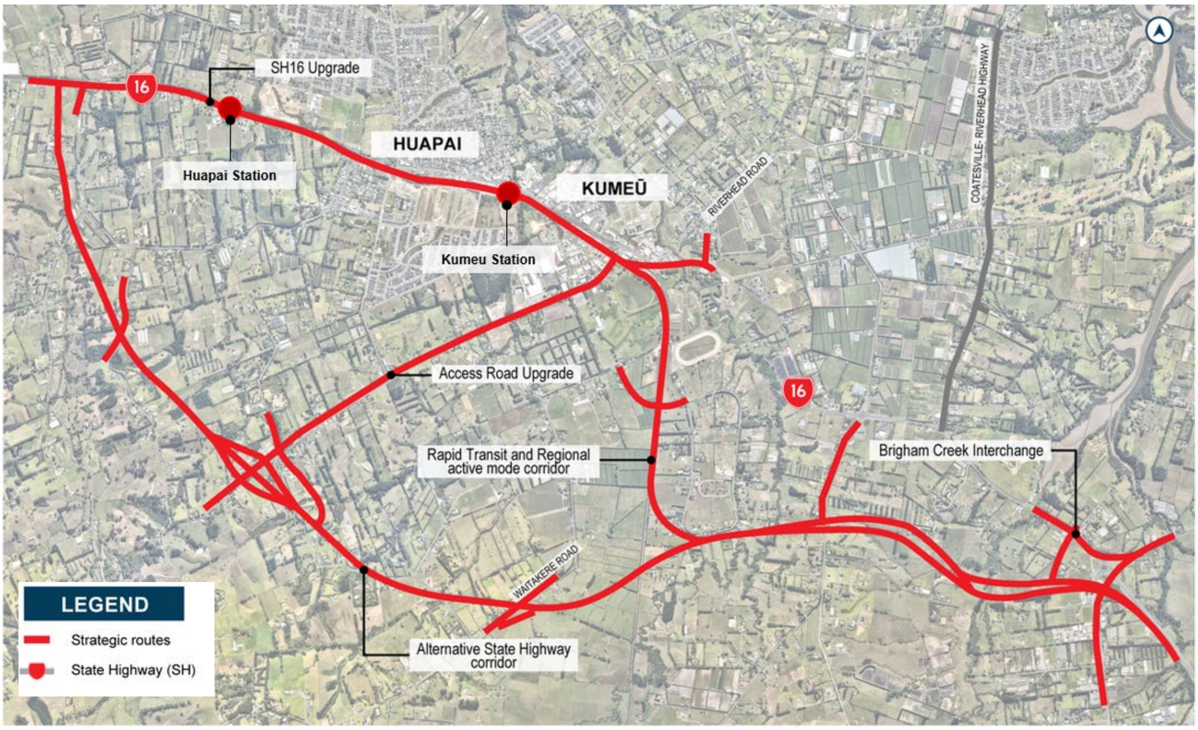


Figure 1-1: NW Strategic Package Overview

Under section 171(1)(b) of the Resource Management Act 1991 (RMA), a territorial authority making a recommendation on a NOR must consider whether adequate consideration has been given to alternative sites, routes or methods of undertaking the work if the requiring authority does not have an interest in the land sufficient for undertaking the work, or it is likely that the work will have a significant adverse effect on the environment.

Waka Kotahi and AT do not currently have an interest in all of the land required for the construction and operation of the NW Strategic Package of projects and so consideration of alternative sites, routes and methods has been undertaken. The purpose of this report is to document the development of alternative options to undertake the works and the process used to assess and compare those options.

This report provides an overview of the corridor options considered during the North West Indicative Business Case (IBC) (as it relates to the NW Strategic Package) including the long list and short list phases and describes the assessment of alternative alignment options undertaken during the Detailed Business Case (DBC) and for the NORs including the route refinement process through to recommendation of a preferred transport network. This report also provides a summary of the alternative statutory methods considered for implementing the NW Strategic Package. Figure 1-2 outlines the process undertaken through the corridor and route refinement assessment of alternatives.

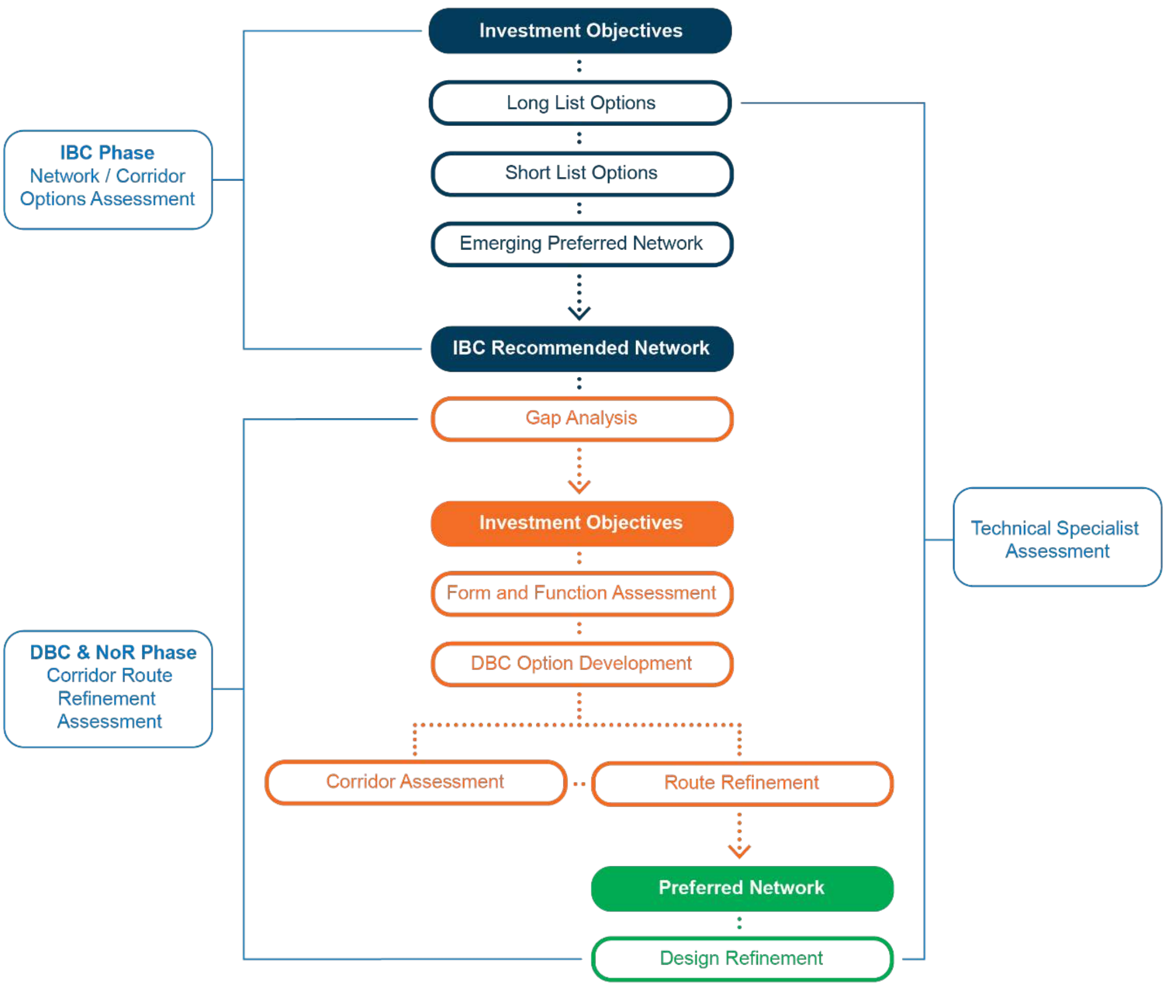


Figure 1-2: Summary of Assessment of Alternatives Process

1.2 Background

Auckland is New Zealand's largest city, home to approximately 1.69 million people and is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and from other parts of New Zealand. In 2017, Auckland attracted 36,800 new residents; more than the rest of the country combined. The Auckland Plan Development Strategy (2050) signals that Auckland could grow by another 720,000 people to reach 2.4 million over the next 30 years.

The Auckland Plan anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities. In response to this demand, the Auckland Unitary Plan – Operative in Part (AUP:OP) identified 11,000 hectares of predominantly rural land for future urbanisation. This land is equivalent to an area 1.5 times the size of urban Hamilton.

To enable urban development on this land, appropriate infrastructure needs to be planned and enabled. To provide clarity and certainty about when the land identified in the AUP:OP will be 'development ready', Auckland Council (the Council) developed the Future Urban Land Supply Strategy (FULSS) in 2015. The FULSS provides for sequenced and accelerated greenfield growth in the following areas of Auckland:

- Warkworth
- North: Orewa-Silverdale, Dairy Flat
- North-West: Whenuapai-Redhills, Westgate, Kumeū, and Huapai (subject area of this report)
- South: Takaanini, Drury – Ōpāheke and Pukekohe – Paerata.

In July 2017, the FULSS was updated in line with the AUP:OP zoning, with an increase to 15,000 hectares of land allocated for future urbanisation.

In response to the FULSS, AT, Waka Kotahi and the Council (collectively referred to as the partners) identified a need to determine the most appropriate transport responses to support this envisioned urban growth. A tripartite governance group was formed to develop a response to two key issues:

1. Inability to respond in a timely way to the pace and scale of greenfield development will restrict access to jobs, education and other core services around and in growth areas.
2. Inability of the regional transportation system to cope with the growing demand of greenfield expansion will reduce travel choice and efficient movement of people and goods.

This joint approach recognised that:

> *The proposed growth is likely to require significant new additions to the arterial, local, and public transport network, and integration of such networks with new and existing urban form and will likely have impacts on and require improvements to the existing arterial, public transport, and state highway network, and to planning frameworks and / or policy.*

The Te Tupu Ngātahi Programme is a collaboration between AT and Waka Kotahi to plan transport investment in Auckland's future urban zoned areas over the next 10 to 30 years. AT and Waka Kotahi have partnered with Auckland Council, Manawhenua and KiwiRail Holdings Limited (KiwiRail) and are working closely with stakeholders and the community to develop the strategic transport network to support Auckland's growth areas. The NW Strategic Package is within the North West growth area. Auckland's growth areas including the North West growth area are shown in Figure 1-3.

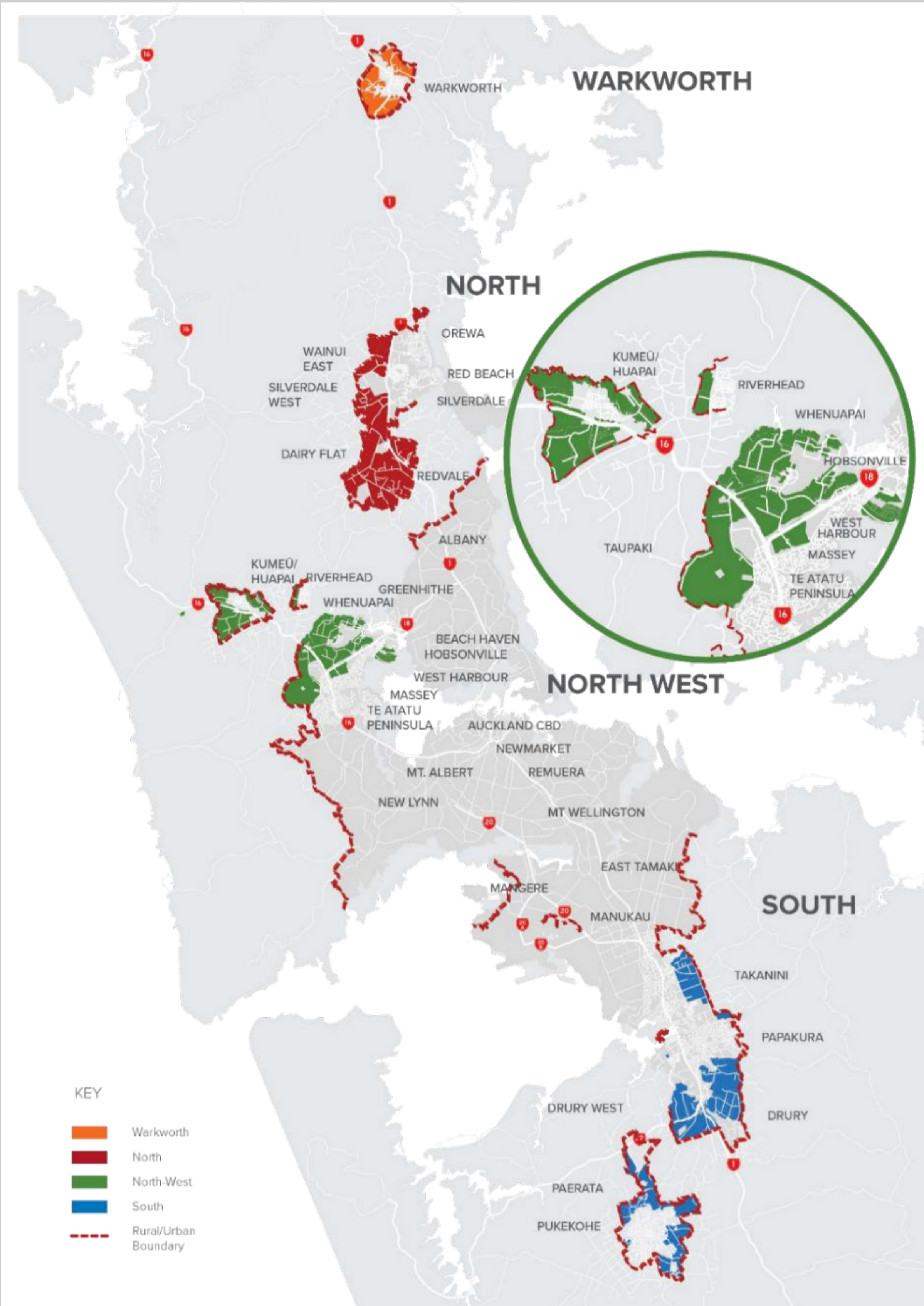


Figure 1-3: Future Urban Areas of Auckland, Highlighting the North West Growth Area

1.3 North West – Overview and Issues

The North West growth area is approximatively 30 kilometres north west of Auckland's central city. It makes a significant contribution to the future growth of Auckland's population by providing for approximately 42,355 new dwellings and employment activities that will contribute 13,000 new jobs across the North West.

A summary of planned growth, timing and the current AUP:OP zoning status for each growth area in the North West is set out in Table 1-2 below.

Table 1-2: Summary of North West Strategic planned growth

Area	Growth Summary (approx.)	AUP:OP Zoning	FULSS Development Timing
Kumeū-Huapai	1,400 dwellings	Live zoned	Stage 1 – Is being developed (2012-2017)
Kumeū-Huapai Riverhead	8,000 dwellings	Future Urban Zone (FUZ)	Decade Two 1st half 2028 – 2032

The urgency to route protect the preferred transport network in the North West area is driven by the rate and scale of committed development within live zoned areas of Kumeū-Huapai and the rate of release of land under pressure from developers who are submitting resource consents on live zoned land adjacent to existing urban corridors.

Failure to protect the network ahead of these development plans risks a combination of fragmentation of preferred transport connections, prohibitively expensive property acquisition costs for transport connections, a lack of certainty around private development investment, and a loss of ability to influence good urban form. Over-reliance on the existing strategic transport corridors combined with rapid population growth in and around the North West growth area will reduce the ability of the transport system to move people and goods safely and efficiently.

Specifically, existing demand causes network constraints during peak periods indicating that as future rapid growth in population occurs in the North West, the network will be unable to sustain an acceptable level of service. If not addressed, the existing transport system will constrain the levels of access for residents in both the existing and future urbanised areas, limit development potential, decrease regional productivity and undermine the quality of life for residents and employees in the area. Failure to integrate transport planning with pace, scale and form of urban development will limit the opportunity for the transport system to positively contribute to quality, connected urban and natural environments in the North West growth area as a whole.

2 Methodology for Assessing Alternatives

The following sections provide an overview of the alternative sites and routes that have been considered for undertaking the works.

In developing options, the project team and specialists first considered options that integrated with land use planning and reduced the need to travel. Options that increased network capacity were considered last. This approach aligns with the intervention hierarchy approach of prioritising lower impact and cost-effective options first, see Figure 2-1.

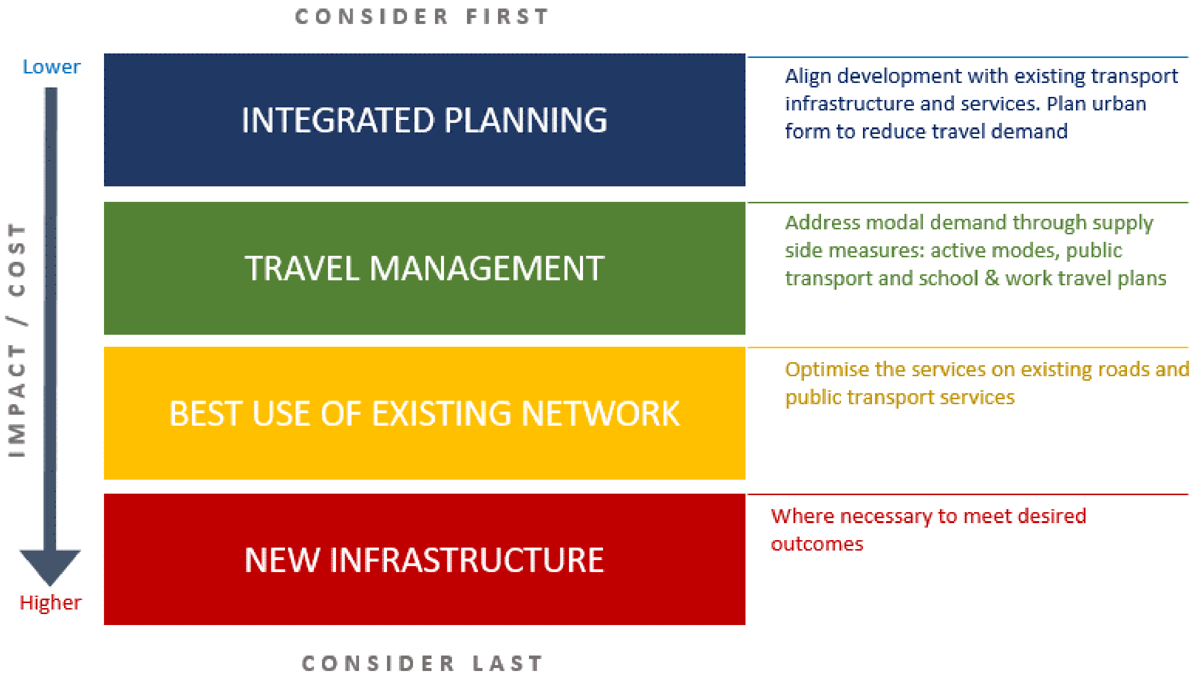


Figure 2-1: Options development – intervention hierarchy approach

2.1 Approach Overview

Optioneering was undertaken for the wider North West growth area, the indicative options were grouped into a Local Arterial Package and a NW Strategic Package (the subject of this report) following the short list stage. Where the North West area is referenced, this includes the wider growth area (e.g., Whenuapai, Riverhead, Redhills) and is not limited to Kumeū-Huapai. The assessment of alternatives for the NW Strategic Package involved the following stages:

Corridor assessment

- The identification of the Indicative Strategic Transport Network (ISTN) (corridors) required to support Auckland's North West growth areas through the IBC
- Grouping the corridors within the North West ISTN into eight initial packages, including subsequent grouping into a strategic and local set
- Undertaking a gap analysis of the IBC, a constraint mapping exercise, an AUP:OP map review and form and function assessment to develop options for the DBC Local and Strategic Package

Route refinement

- Consideration of alternative route alignment options for the NW Strategic Package

Preferred alignment refinement

- Further refinement of each route in the NW Strategic Package in order to determine the extent of the designations necessary for each Project
- Confirmation of the Projects for route protection.

In summary, use of the existing network was considered first, however in order to achieve the identified transport outcomes, new infrastructure was identified as being required for two of the projects. Upgrades to the existing network were considered to be viable for the remainder of the projects.

For options where new infrastructure was required, corridor development and assessment was undertaken to identify a preferred route alignment, which was then refined in further detail (route refinement). Where an existing network was to be utilised and upgraded, corridor development considered where upgrades may be accommodated, generally widening to the left, right or both sides of the corridor. A summary of the long list and short list approach is set out in Section 3. The route refinement option development and evaluation process is described in Section 4 and described in each project chapter of this report.

2.2 Assessment Framework

In order to evaluate and compare options, a programme wide assessment framework for the alternatives assessment which included a Multi-Criteria Assessment (MCA), was developed by the Project Team in consultation with AT, Waka Kotahi and Manawhenua, for use in the corridor and route refinement assessment processes.

The MCA was developed for use across the Te Tupu Ngātahi Programme and has been used in both the IBC and DBC option evaluation process. At the route refinement phase, this option evaluation process was tailored to make it specific to the requirements of the North West area.

The MCA framework is a common tool that is often used to assist in the alternatives assessment decision-making process and provides an opportunity to understand how different options compare against a set of standard and grouped criteria. The MCA framework developed and adopted by the Project Team involved the following:

- Assessment criteria: Transport outcomes and the four well-beings: Cultural, Social, Environmental and Economic. Several sub-criteria were developed under each wellbeing grouping which were assessed by technical specialists.
- Opportunities: identifying opportunities that can be taken forward in developing the options. These were identified by the relevant technical specialist.
- Additional inputs: Partners, stakeholders, the community and landowner feedback, policy analysis, value for money and resilience.

Options were assessed, and where appropriate, scored at each stage by a multi-disciplinary team, using the MCA framework set out in Table 2-1. Constraints mapping and existing evidence from desktop research were the main sources of information to assist with assessment. In assessing the criteria, guidance was provided by the policy direction of the AUP:OP (e.g., overlays), which could place constraints on the various options identified.

Assessment of the options against the criteria was not the sole means of assessing options but was a tool that informed and was complementary to the decision-making process for the preferred option. The process incorporated Manawhenua input, feedback from the consultation and engagement process and technical experts (engagement discussed in Section 4.5.3). Manawhenua representatives have expressed views, provided specialist advice and raised key issues though workshops and hui held throughout the process.

Table 2-1: Programme MCA Framework

#	Transport Outcomes			Measure
	Transport Outcomes vary for each Project as identified in the sections below			**Options assessed against the transport outcomes. For example, key themes include:** • **Access** • **Reliability** • **Mode choice** • **Integration.**
Well-being	**MCA topic**	**#**	**Criteria**	**Measure**
Cultural	**1. Heritage**	**1a**	Heritage	Extent of effects on: • Sites and places of valued heritage buildings, scheduled trees (with heritage value) and places • Sites and places of archaeological value • Sites and places of European cultural heritage value
		1b	Manawhenua	Feedback on cultural values was sought from Manawhenua at the constraint mapping stage, the options considered in the MCA and on the preferred option.
Social	**2. Socio– economic impacts**	**2a**	Land use futures / integration with planned landuse	To what extent will the option impact on the future development of land (within the corridor, adjacent to it and impacted by it – i.e. consider all 3 scales), in relation to: • Integration with the future land use scenario (including any Structure Plans or Plan Changes) • Size and shape of potential development parcels to enable appropriate building typologies • Ability to consolidate residual land • Access that does not prevent neighbouring development
		2b	Urban design	To what extent does the option support a quality urban environment (both current and future planned state)? particularly relating to: • Context and planned place making considerations • An inviting, pleasant and high amenity public realm • Open space integration • Active interface between public and private realm • Scale of long-term impact on the amenity and character of the surrounding environment.
		2c	Land requirement	Scale of public / private land (m^2 / number of properties / special status of impacted property) required to deliver the option.
		2d	Social cohesion	Impact on, use, connectivity / accessibility for and to the existing urban areas including use and access to: • Employment • Other communities or within the same community • Shops / services / other community and cultural facilities / 'attractors' • Severance of the existing community (including consented)

				• Scale of effect on existing community facilities community and open space • Public access to the coast, rivers and lakes.
		2e	Human Health and Wellbeing	Will the option potentially affect any sensitive land uses nearby or consented (adjacent residential, childcare centres, hospitals, rest homes, marae and schools)? particularly relating to: • Air Quality • Contaminated land • Noise and vibration.
Environment	3. Natural Environment	3a	Landscape / visual	The extent of effects on: • The natural landscape and features such as streams, coastal edges, natural vegetation and underlying topography – acknowledging planned changes to area in light of urban land use / zoning • Natural character and outstanding natural features / landscapes including geological features (mapped and protected features).
		3b	Stormwater	Impact of operational stormwater (both quantity and quality) on the receiving environment, including: • Potential flooding effects of the option within the catchment • Extent and consequences of likely mitigation measures.
		3c	Ecology	Extent of effects on: • Significant indigenous flora • Significant habitats of indigenous fauna • Indigenous biodiversity • Stream / waterway ecology • Marine ecology.
		3d	Natural Hazards	Extent of effect on adverse geology; steep slopes; seismic impacts; other resilience risks (low level infrastructure near coastlines, inundation areas).
Economic	4. Transport	4a	Transport system integration	Extent the option achieves the following: • Connectivity / integration other transport modes (i.e. trains, buses, walking and cycling networks) • Wider transport system effects / benefits • Improve accessibility • Increase mode shift to public transport.
		4b	User safety	Extent of safety effects on all transport users, including: • People in public transport • people walking or cycling • People in private vehicles.
	5. Construction impacts	5a	Construction impacts on utilities / infrastructure	Requirements for relocation / design of existing infrastructure, including: • Consideration of safety impacts • Risk of continuity of service over construction • Opportunities for integration with other bulk infrastructure.
		5b	Construction Disruption	Construction impacts on people and businesses regarding: • Traffic & noise • Earthworks related effects including dust • Quality of life and amenity • Economic impacts on businesses / community / town centres.

	6. Cost & Construction Risk	6a	Construction costs / risk / value capture	Assessed cost for construction of options including: • Complexity and risk in construction (including consideration of constructability) • Complexity in programme • Cost and complexity of safely undertaking works (including works on contaminated land) • Extent to which the option can utilise a value capture mechanism to offset construction costs.

Table 2-2: MCA Scoring Scale

Effects criteria	Scoring
Very high adverse impact	-5
High adverse impact	-4
Moderate adverse impact	-3
Low adverse impact	-2
Very low adverse impact	-1
Neutral impact	0
Very low positive impact	1
Low positive impact	2
Moderate positive impact	3
High positive impact	4
Very high positive impact	5
-	Not scored

Assessment of the options against the criteria was completed by subject matter experts (SME) and discussed at several MCA workshops. In addition to the MCA framework, several additional (and important) inputs were included in the assessment framework (refer Table 2-3).

Table 2-3: Other inputs in MCA framework

Project Partners, including manawhenua, and landowner feedback	Project partner feedback for each option identifying scale / validity of objections; identified preference / proposed changes to options etc. Feedback provided by other key stakeholders, the community and landowners.
Policy Analysis	Options alignment with the strategic policy framework including the AUP:OP, the Auckland Plan, and the North West Spatial Land Use Strategy (NW Spatial Strategy) once it was drafted / adopted and where it assisted in differentiating between options.
Indicative costs	High level indication of costs (including construction and property purchase) where it assisted in differentiating between options.

3 Corridor Assessment

The options assessment process commenced with an assessment of the various network and corridor options to achieve an ISTN to support Auckland's North West growth area. The outcome of this process was the North West Strategic Transport Network. This section summarises the process relevant to the NW Strategic Package and the outcomes of that assessment, taken forward to the route refinement stage.

The corridor assessment process included both long list and short list assessment phases to identify an ISTN for the North West growth areas.

3.1 Longlist Corridor Assessment

The long list assessment phase included development and assessment of a wide range of options against transport outcomes and the MCA framework, using the Programme-wide MCA framework described in Section 2. Key Project Partners (Auckland Council, Manawhenua and KiwiRail) were involved in the development and evaluation of long list options. Section 3.1 provides further details on the long list development and assessment.

3.1.1 Longlist Option Development

For the North West growth area approximately 140 options were initially identified. These options were filtered down to exclude those that were: outside scope, already part of a designated / consented or funded project, considered business as usual, not feasible or duplicates of other options.

Out of 140 options, 75 were taken forward to the North West area long list MCA. These options were categorised and grouped according to their function. Those options which led to the NW Strategic Package are as follows:

Kumeū-Huapai / Riverhead

- **Rapid Transit (RTR-K / RTL-K / RT-K)** – new or upgraded corridor to enable significant mode shift to public transport in the Kumeū-Huapai and Riverhead area.
- **Strategic Sub-Regional Connections (SR-K)** – new or upgraded corridor providing interregional connections between the Kumeū-Huapai and Riverhead area.
- **Arterial Routes (AR -K)** – new or upgraded arterial roads providing both north-south connections and east-west connections through Kumeū-Huapai.
- **Strategic State Highway Connections (SR-SH-K)** – new ASH connection to enable sub-regional connection and freight access.

For the purposes of this report, only those options that would later form part of the NW Strategic Package are included here.

3.1.2 Longlist Option Assessment

At the commencement of the long list assessment phase, the Programme-wide MCA framework was adapted to the North West context and specific growth area. This involved distilling the Programme MCA framework (see Table 2-1) to relevant criteria to enable distinctions to be made such as the removal of criteria where it would result in double counting due to the criteria repeating themes assessed under the transport outcomes. This applied to criteria for ‘transport system integration’ and ‘user safety’.

Each of the long list options were assessed using the distilled MCA framework. Key steps in the options assessment included:

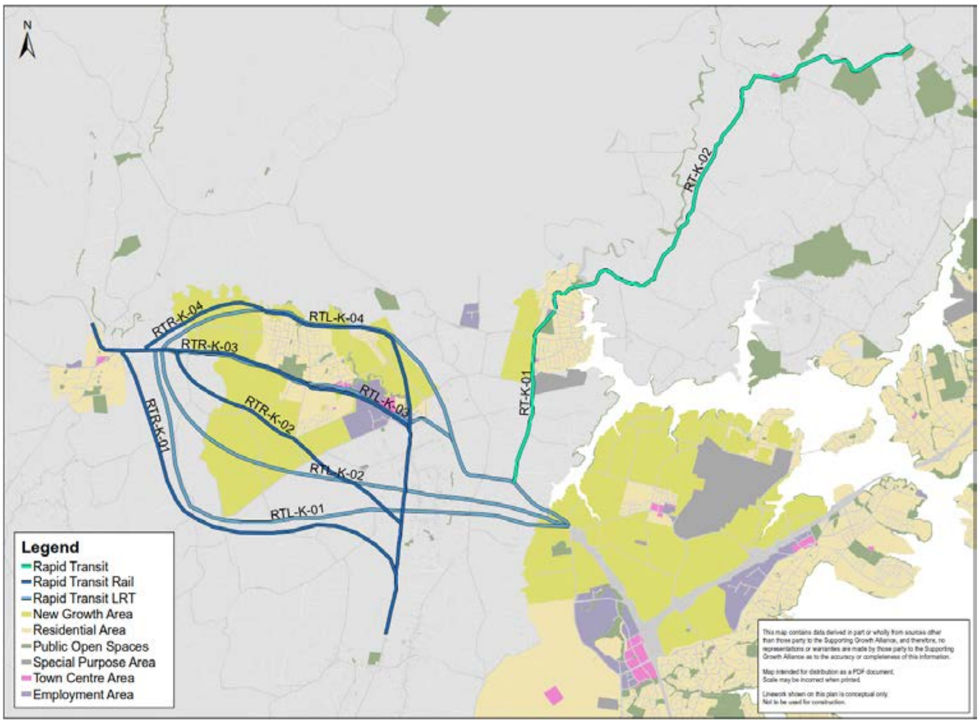
1. Initial long list scoring and assessment of non-scored criteria by subject experts
2. Manawhenua hui and discussion
3. Workshops – collaborative evaluation of options and feedback from Partners
4. Scores refined
5. Long list refinement
6. Identification of the short list.

3.1.3 Recommendations

Table 3-1 provides an overview of the options assessed, recommendations and reasoning for progressing options to the short list.

Table 3-1: Long List Corridor Assessment Recommendations

<table>
<tr><th>Options</th><th>Assessment Recommendation</th></tr>
<tr><td>Rapid Transit

Kumeū-Huapai</td><td>
</td></tr>
<tr><td>10 Options</td><td>Rapid Transit Heavy Rail (RTR)

RTR-K-01: southern bypass
RTR-K-02: through southern FUZ
RTR-K-03: existing rail corridor alignment
RTR-K-04: northern alignment.

Rapid Transit Light Rail (RTL)

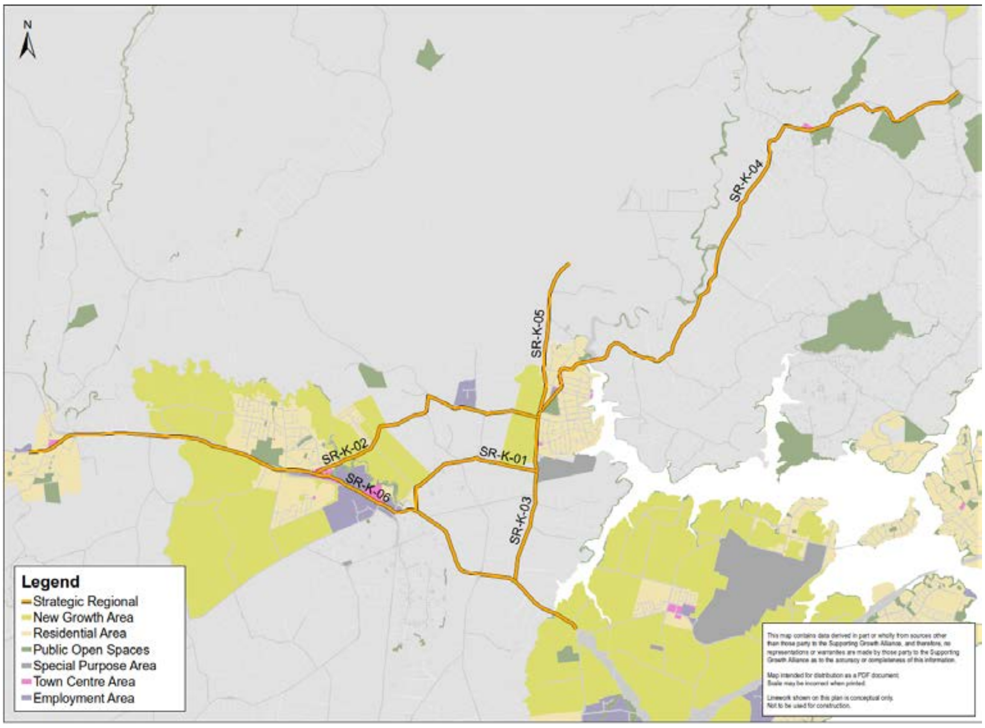
RTL-K-01: southern bypass
RTL-K-02: through southern FUZ
RTL-K-03: existing SH16 alignment
RTL-K-04: northern alignment.

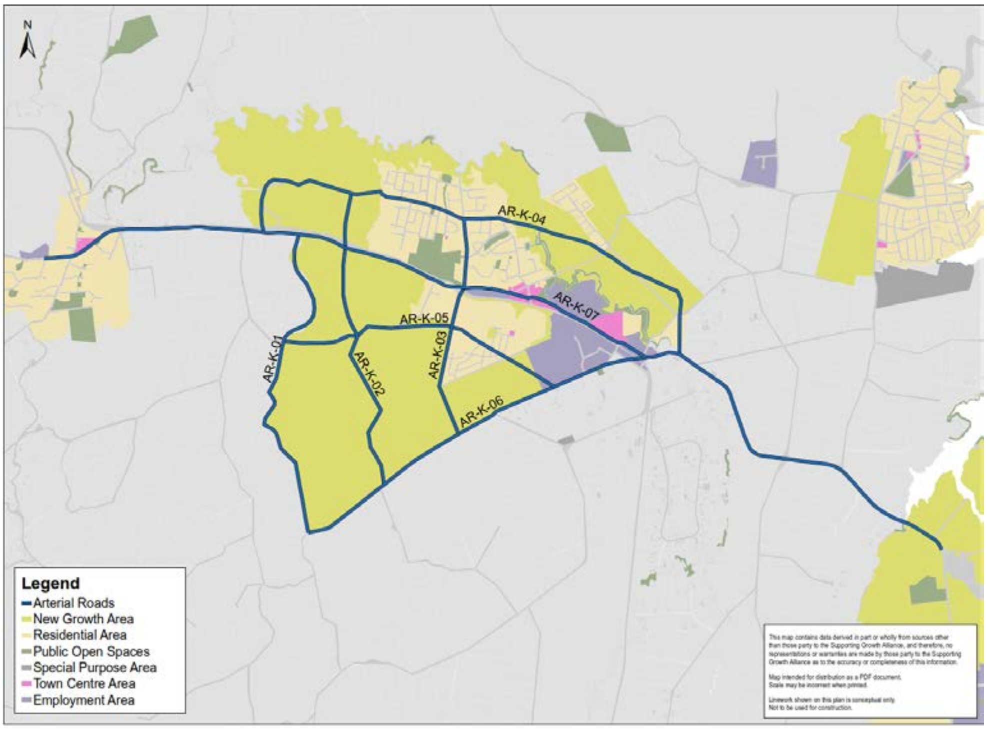
<u>Riverhead Rapid Transit (RT-K)</u>

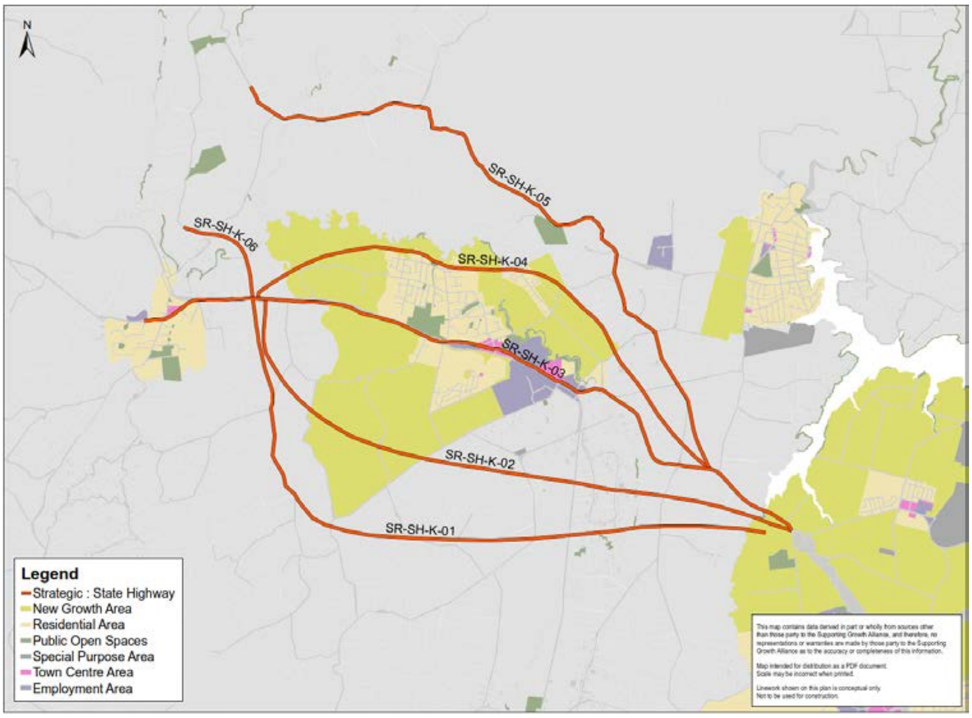
RT-K-01: Riverhead to SH16
RT-K-02: Dairy flats via Coatesville-Riverhead Highway.
</td></tr>
<tr><td>Options progressed</td><td>5 Options: RTR-K-01, RTR-K-02, RTR-K-03, RTL-K-02 and RTL-K-03 were recommended to progress to the short list for further investigation.</td></tr>
<tr><td>Options Discarded</td><td>5 Options: RTR-K-04 and RTL-K-04 were disregarded due to the potential impact on a Significant Ecological Area (SEA) and Outstanding Natural Landscape (ONL) as well as performing lower on ridership.

RTL-K-01 was also disregarded due to its limited integration capabilities with the town centre and other existing transport networks.

RT-K-01 and RT-K-02 were disregarded as they had limited catchments and low strategic significance.</td></tr>
</table>

Options	Assessment Recommendation
Strategic Sub-regional connections **Kumeū-Huapai**	
6 Options	• SR-K-01: southern alignment • SR-K-02: northern alignment • SR-K-03: SH16 to Riverhead • SR-K-04: upgrade of Coatesville-Riverhead Highway to Dairy flats • SR-K-05: Riverhead to Dairy flats new alignment • SR-K-06: existing SH16 alignment.
Options progressed	**4 Options: SR-K-01, SR-K-02, SR-K-03** and **SR-K-04** were recommended to progress to the short list for further investigation.
Options discarded	**2 Options: SR-K-05** was discarded due to its potential impact on sensitive vegetation located within SEA_T_6540. **SR-K-06** scored comparatively poorly against all transport outcomes. The corridor would not cope with the increased demand from growth and was therefore discarded.

Options	Assessment Recommendation
Arterial Routes **Kumeū Huapai / Riverhead**	
7 Options	• AR-K-01: upgrade Puke Road • AR-K-02: upgrade Motu Road to the northern Huapai catchment • AR-K-03: upgrade of Station Road and Tapu Road • AR-K-04: upgrade of Matua Road • AR-K-05: central East-West arterial (south of existing SH16) • AR-K-06: upgrade Tawa / Access Road along FUZ boundary • AR-K-07: existing SH16 alignment.
Options Progressed	**7 Options:** All options were recommended to progress to the short list. The upgrade of arterials is critical in this growth area as they will provide improved traffic safety and transport connectivity to the future rapid transit network, employment zones and social infrastructure.

Options	Assessment Recommendation
Strategic State Highway Connections **Kumeū-Huapai**	
6 Options	• SR-SH-K-01: southern Kumeū bypass • SR-SH-K-02: Kumeū bypass – through southern FUZ • SR-SH-K-03: existing SH16 alignment • SR-SH-K-04: northern fringe bypass • SR-SH-K-05: northern mountain bypass • SR-SH-K-06: Waimauku bypass (extension).
Options Progressed	**2 Options: SR-SH-K-01** and **SR-SH-K-02** were both recommended to progress into the short list.
Options Discarded	**4 Options: SR-SH-K-03** was disregarded as it did not reduce existing severance, stunted long term development and limited effectiveness as a Strategic State Highway due to a number of existing accesses. **SR-SH-K-04** was disregarded as it did not integrate well with future land use and potential impacts on the Kumeū River and cultural values for iwi. **SR-SH-K-05** was disregarded as it performed poorly against outcomes, creating greater social severance on existing connections in the area. It was equal worst for effects on landscape and environment due to potential effects on large stands of native vegetation and being elevated near an ONL. **SR-SH-K-06** was disregarded due to potential environmental impacts, limited demand and complex topography resulting in greater earthworks and construction complexity.

3.2 Shortlist Corridor Assessment

At the short list stage, options underwent a refinement and grouping process. Public consultation was undertaken, and feedback was considered in the evaluation. Key Project Partners were involved in a short list evaluation to recommend the ISTN for the North West growth areas. Section 3.2 provides further details on the short list development and assessment.

3.2.1 Shortlist Option Development

Of the options, 21 were recommended for the initial short list. The Project Team further developed the options to enable testing and evaluation. Based on workshop feedback and a gap analysis, additional refinement occurred, including:

- Addition of variations to some options
- Amalgamating some options to rationalise the assessment
- Removal of some options due to new information.

The process is shown in Figure 3-1 and was documented in the North West IBC Options Assessment in 2018. The results of the short list refinement are summarised in Table 3-2.

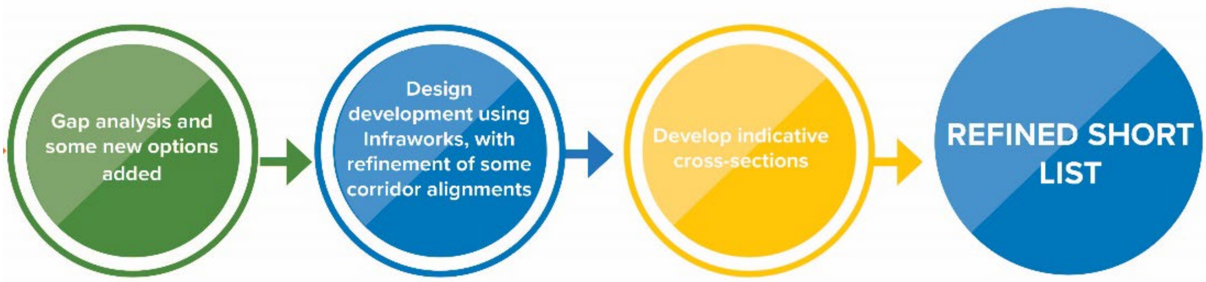


Figure 3-1: Short list development process

Table 3-2: Initial short list refinement outcomes

Option reference & Description	Initial refinement outcome
SR-SH-K-01 Alternative Kumeū corridor – southern	Engineering input provided new variations from SH16 – Brigham Creek roundabout and SH16 – Taupaki Road roundabout. **New / variations:** **SR-SH-K-01a** – Corridor south of Kumeū-Huapai from SH16 – Brigham Creek roundabout to east of Waimauku. **SR-SH-K-01b** – Corridor south of Kumeū-Huapai from SH16 – Taupaki Road roundabout to east of Waimauku.
SR-SH-K-02 Alternative Kumeū corridor – through southern FUZ	Engineering design provided new variations from off SH16 from Brigham Creek roundabout and Taupaki Road roundabout. **New / variations:** **SR-SH-K-02a** – Corridor through Kumeū-Huapai FUZ from SH16 – Brigham Creek roundabout to east of Waimauku.

Option reference & Description	Initial refinement outcome
	SR-SH-K-02b – Corridor through Kumeū-Huapai FUZ from SH16 – Taupaki Road roundabout to east of Waimauku.
SR-K-06 Existing SH16–Brigham Creek to Kumeū	Long List option included the full length of SH16 from Brigham Creek Road to Waimauku and was discarded. However, a shorter version between Brigham Creek Road and Access Road was progressed to Short List. **New / variation** **SR-K-06a:** SH16 between Brigham Creek Road and Access Road, not in Kumeū-Huapai.

3.2.2 Shortlist Option Assessment

The same assessment approach was used at the long list and short list corridor assessment stage. However, a greater level of design detail, technical assessment and specialist input was applied at the short list phase (relative to the long list) and additional consideration of stakeholder and public feedback was made. The short list process included:

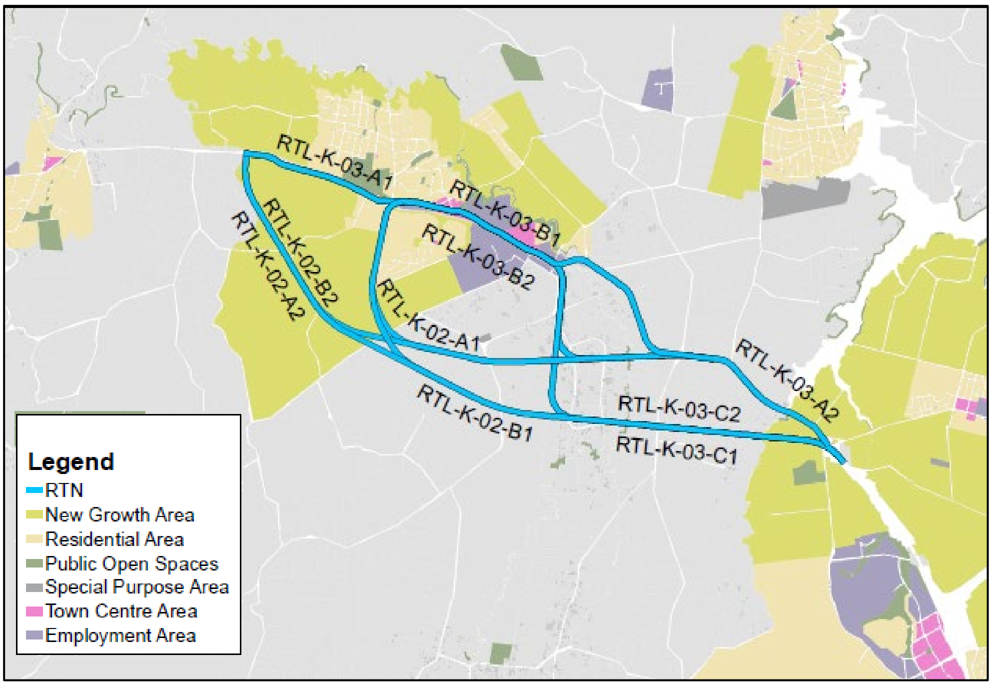
- Initial draft assessment of criteria by subject experts
- Pre-scoring workshop (challenge workshop) by subject experts
- Manawhenua hui to discuss experts scores and an opportunity to score Manawhenua criteria
- Project partner input, stakeholders and public feedback
- Recommendation on ISTN.

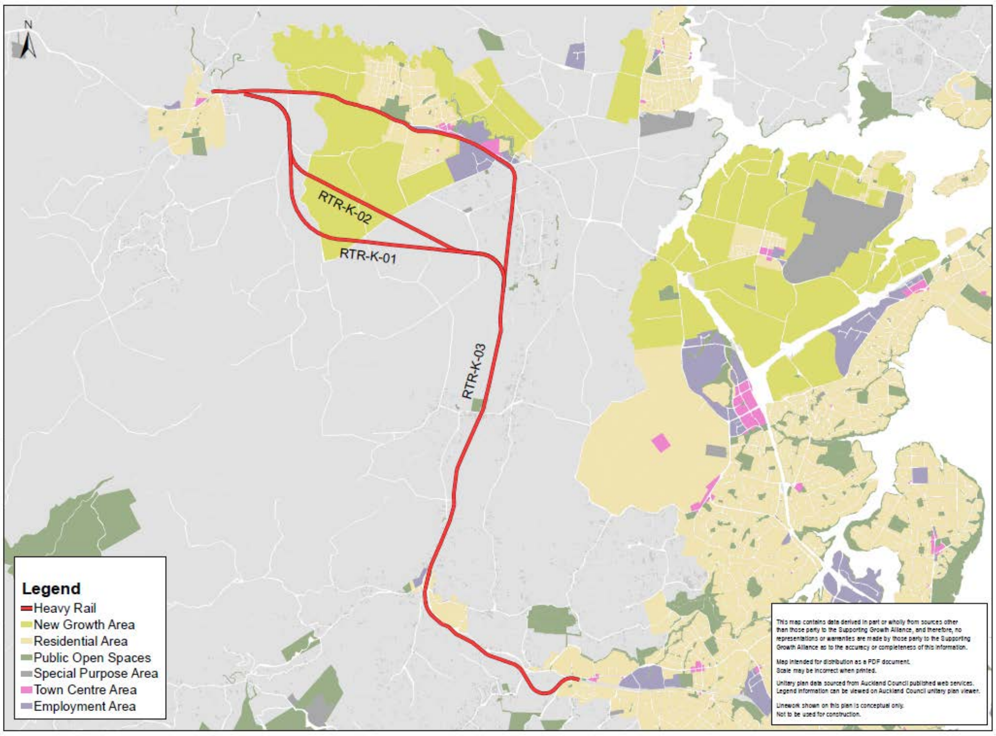
The MCA process was applied at the short list option assessment, however at a more detailed level. Transport outcomes were assessed by the Project Team transport planners using quantitative and qualitative evaluation against key performance indicators and measures. Technical specialists scoring the MCA were fully briefed on the options and MCA process.

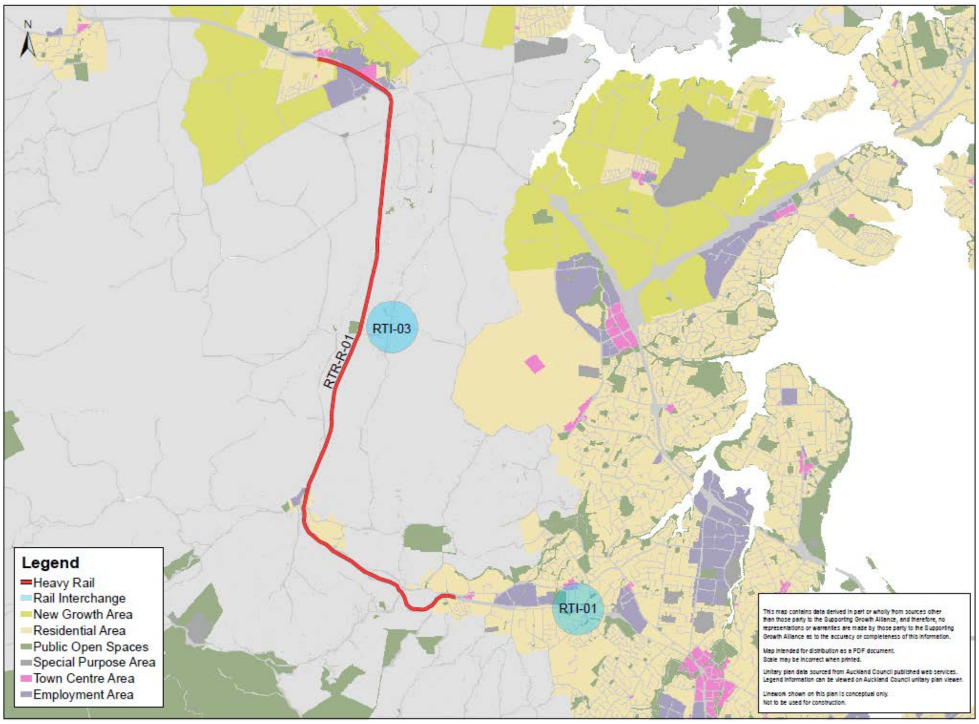
3.2.3 Recommendations

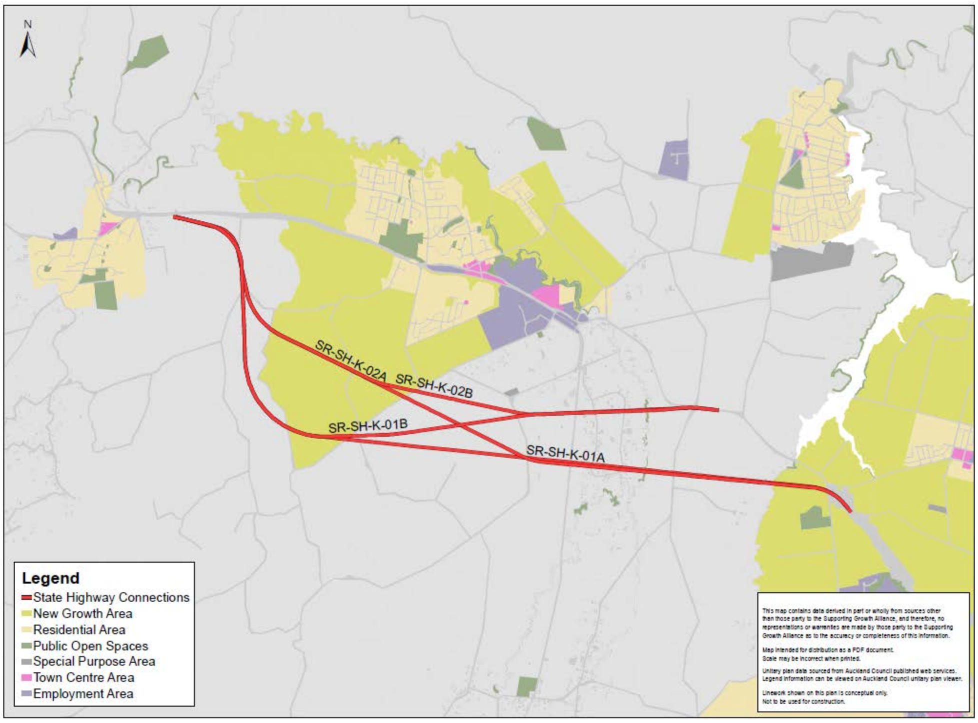
Table 3-3 provides an overview of the options assessed, recommendations and reasoning for identifying the preferred corridors and discarding options. The short list assessment resulted in options being taken forward in the ISTN identified in Section 3.3.

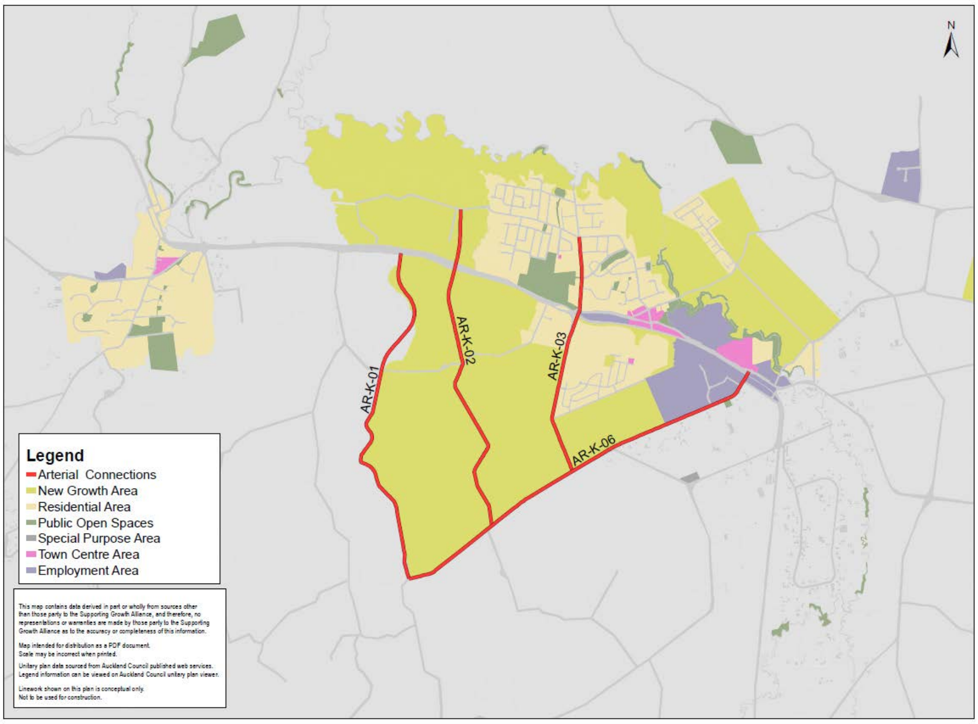
Table 3-3: Short list corridor assessment recommendations

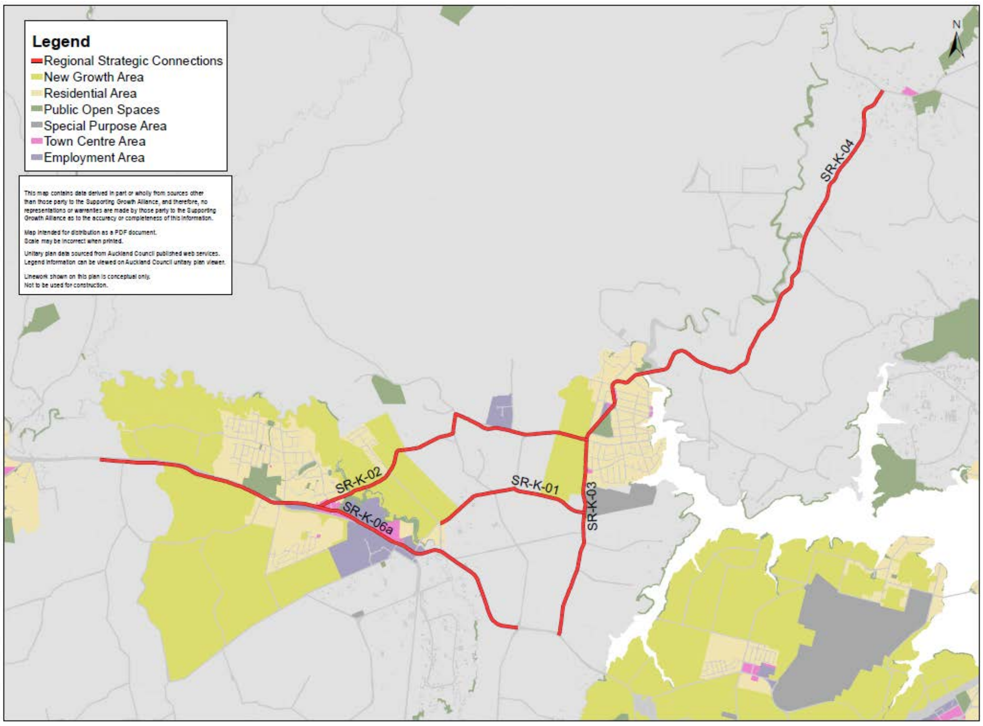
Options	Assessment Recommendation
Rapid Transit **Kumeū-Huapai**	
10 Options	**RTL-K-02: *RT through Kumeū-Huapai FUZ* variants, leave SH16 at** • RTL-K-02-A1: Taupaki Road to end at Kumeū-Huapai centre • RTL-K-02-A2: Taupaki Road to end west of Huapai RUB • RTL-K-02-B1: Brigham Creek to end centre of Kumeū-Huapai • RTL-K-02-B2: Brigham Creek to end west of Huapai. **RTL-K-03: RT through Kumeū-Huapai town variants** • RTL-K-03-A1: follow SH16 end west of Huapai • RTL-K-03-A2: follow SH16 end centre of Kumeū-Huapai • RTL-K-03-B1: leave SH16 at Taupaki Road, follow NAL into Kumeū and end west of Huapai • RTL-K-03-B2: leave SH16 at Taupaki Road, follow NAL to end centre of Kumeū-Huapai • RTL-K-03-C1: leave SH16 at Brigham Creek Road, follow NAL to end west of Huapai • RTL-K-03-C2: leave SH16 at Brigham Creek Road, follow NAL to end at Station Road.
Option Progressed	1 Option: RTL-K-03-C1 was the only Kumeū-Huapai / Riverhead RT option to be recommended as part of the emerging recommended network as it limits additional severance by following the North Auckland Line (NAL), serves Huapai-Kumeū FUZ and urban areas, and increases the network resilience and efficiency with an 'offline' section.
Options Discarded	**9 Options:** • **RTL-K-02**-A1**, RTL-K-02-A2, RTL-K-02-B1, RTL-K-02-B2**: FUZ based options had lower ridership than town-based options and would not serve the existing population as well • **RTL-K-03-A1, RTL-K-03-A2, RTL-K-03-B1, RTL-K-03-B2, RTL-K-03-C2**: Town based options provide access to existing development north of SH16 and existing centres and employment and opportunity for stations to improve built form. SH16 alignments result in greater severance of accesses and properties. RTL-K-03-C2 is similar to the preferred but did not serve the FUZ as well as C1 as it ends at Station Road.

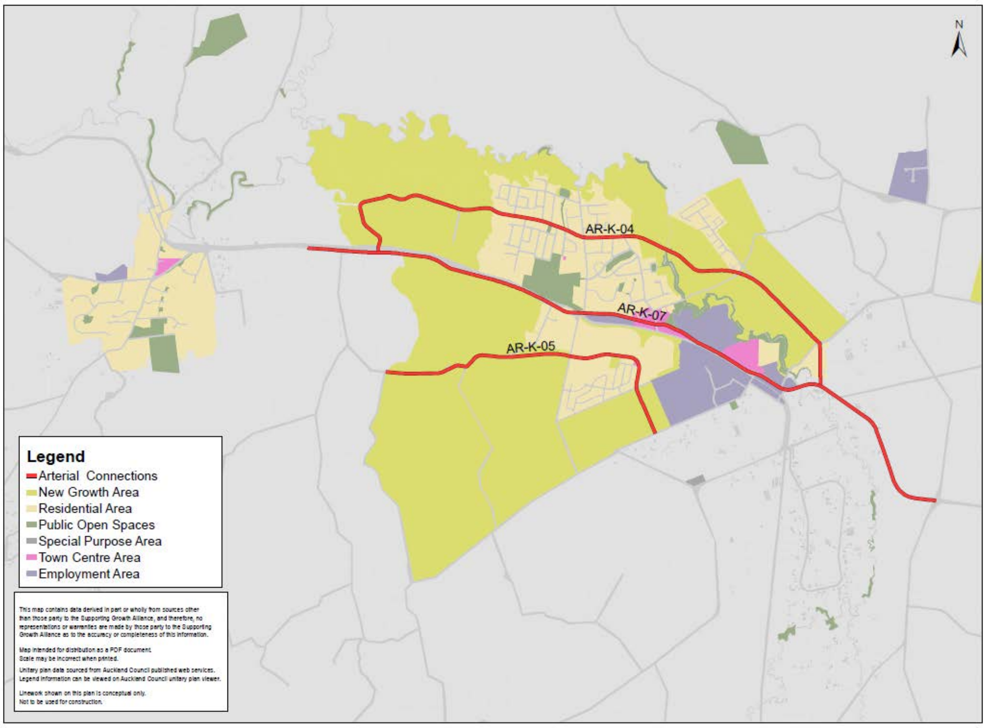
Options	Assessment Recommendation
Heavy Rail **Kumeū-Huapai** **(previously grouped under *Kumeū-Huapai Rapid Transit* split at short list)**	
3 Options	• RTR-K-01: RT heavy rail through southern bypass • RTR-K-02: RT heavy rail through the southern FUZ • RTR-K-03: RT heavy rail on the existing rail corridor alignment.
Options Progressed	None of the options were recommended to be taken forward.
Options Discarded	**3 Options:** Heavy rail options were discarded as a long-term solution as: • The existing NAL alignment does not connect to key North West destinations at Whenuapai and Westgate • Constraints associated with reintroducing passenger rail through Waitakere Tunnel are complex and costly • Existing single track would not meet RT service expectations and has potential conflicts between freight and passenger sharing with different speeds, requiring additional track (with subsequent widening). Reasons for discounting heavy rail are further set out in Section 6.

Options	Assessment Recommendation
Rapid Transit	
3 Options	• RTR-R-01: RT heavy rail, re-open Taupaki Station for passenger service • RTI-01: Rail Interchange at Rānui • RTI-03: Rail Interchange at Taupaki (dependent on train station being activated at Taupaki).
Options Progressed	None of the options were recommended to be taken forward.
Options Discarded	**3 Options:** Due to the current rail alignment not serving the wider catchment area of Whenuapai and the lower predicted patronage demands, reactivation of passenger rail services was discarded as part of the recommended network.

Options	Assessment Recommendation
Strategic state highway connections **Kumeū-Huapai**	
4 Options	**Southern Alternative Corridors** • SR-SH-K-01a: Off existing SH16 at Brigham Creek roundabout, south of Kumeū-Huapai FUZ to SH16 near Waimauku • SR-SH-K-01b: Off existing SH16 at Taupaki Road, south of Kumeū-Huapai FUZ to SH16 near Waimauku. **Mid FUZ Alternative Corridor** • SR-SH-K-02a: Off existing SH16 at Brigham Creek roundabout, through Kumeū-Huapai FUZ to SH16 near Waimauku • SR-SH-K-02b: Off existing SH16 at Taupaki Road, through Kumeū-Huapai FUZ to SH16 near Waimauku.
Option Progressed	**1 Option: SR-SH-K-01a** was recommended to go forward as part of the emerging network as it performs best for strategic movement, supports the implementation of Rapid Transit in Kumeū-Huapai and allows for regeneration of the urban form within Kumeū-Huapai.
Discarded options	**3 Options: SR-SH-K-01b, SR-SH-K-02a and SR-SH-K-02b were discarded.** Of the four options, those with a Brigham Creek Road connection were preferred over the two options with a Taupaki Road connection. Brigham Creek Road was assessed as a better connection point as it provides full integration with SH16 and reduces the need for property requirements to access the State Highway due to utilising the existing interchange footprint and designation. A Brigham Creek connection was also preferred as it will provide more resilience than a Taupaki Road connection, as Brigham Creek Road connects via an interchange rather than a potential five-leg intersection (with Taupaki Road, the existing SH16 and Old North Road). The Mid-FUZ alignments created greater severance through planned urban areas and were less desirable. The southern alignments limited FUZ severance whilst balancing southern topographical constraints.

Options	Assessment Recommendation
North South Arterial Routes **Kumeū-Huapai**	
4 Options	• AR-K-01: Upgrade Puke Road • AR-K-02: Upgrade Motu Road to the northern Huapai catchment • AR-K-03: Upgrade of Station Road and Tapu Road • AR-K-06: Upgrade of Access Road.
Options Progressed	**2 Options: AR-K-03** and **AR-K-06** are both recommended to be part of the emerging network as they provide this growth area with multi-modal access to both the RTC and ASH options.
Options Discarded	**2 Options: AR-K-01** and **AR-K-02** were discarded as they are located west of the existing growth area and due to lack of structure planning, there is high uncertainty of land use and centre location for these corridors. As there is no clear justification for a third spine road at this point, they were discounted.

Options	Assessment Recommendation
Strategic Sub-regional connections **Kumeū-Huapai / Riverhead**	
6 Options	• SR-K-01: Kumeū-Riverhead Southern Option • SR-K-01A: *New variation* Kumeū to Riverhead connection on Riverhead Road • SR-K-02: Kumeū-Riverhead Northern Option • SR-K-03: SH16 to Riverhead • SR-K-04: Upgrade of Coatesville Riverhead Highway to Dairy Flat • SR-K-06A: Existing SH16 alignment – Brigham Creek to Kumeū Only.
Options Progressed	**2 Options: SR-K-01A** was recommended for the growth area to gain access to a potential future City Centre to Westgate RTC Station at Westgate. **SR-K-03** was also recommended to provide a critical social and economic connection between Riverhead and Kumeū.
Options Discarded	**4 Options: SR-K-01**: Provided potential benefits in terms of direct PT routes, but this was offset by potential increase in private vehicles using the route. **SR-K-02:** Scored similarly and received high community support as a direct route. **SR-K-04**: Option disregarded as it had high impacts on threatened habitats and SEAs (SEA_T_6303 and SEA-M2-57b). **SR-K-06A**: Had potentially high impacts on established residential property through construction and required grade separation at some intersections, substantially increasing construction costs.

Options	Assessment Recommendation
East-West Arterial Routes **Kumeū-Huapai**	
3 Options	• AR-K-04: Upgrade of Matua Road and Connection to Oraha Road • AR-K-05: Central East-West arterial (south of existing SH16) • AR-K-07: Existing SH16 alignment.
Option Progressed	**1 Option: AR-K-07** was recommended as it plays an integral role in supporting the development of the RTC through a reduced road hierarchy, potential for enhanced walking, cycling and crossing facilities and maintaining the dual function of moving people and providing property access. It would enable better integration with the Town Centre reducing severance.
Options Discarded	**2 Options: AR-K-04** and **AR-K-05** were discarded as they did not have a direct function to connect to the RTN or ASH corridor. Instead, they both performed a collector function to distribute local trips within Kumeū.

3.3 Indicative Strategic Transport Network

Following the short list assessment, the North West IBC recommended the ISTN (including corridors that form part of the NW Local Arterials Package and those which did not progress to route protection). The indicative network was endorsed by the AT and Waka Kotahi boards in December 2018 to progress to route refinement (DBC), see Figure 3-2 below.

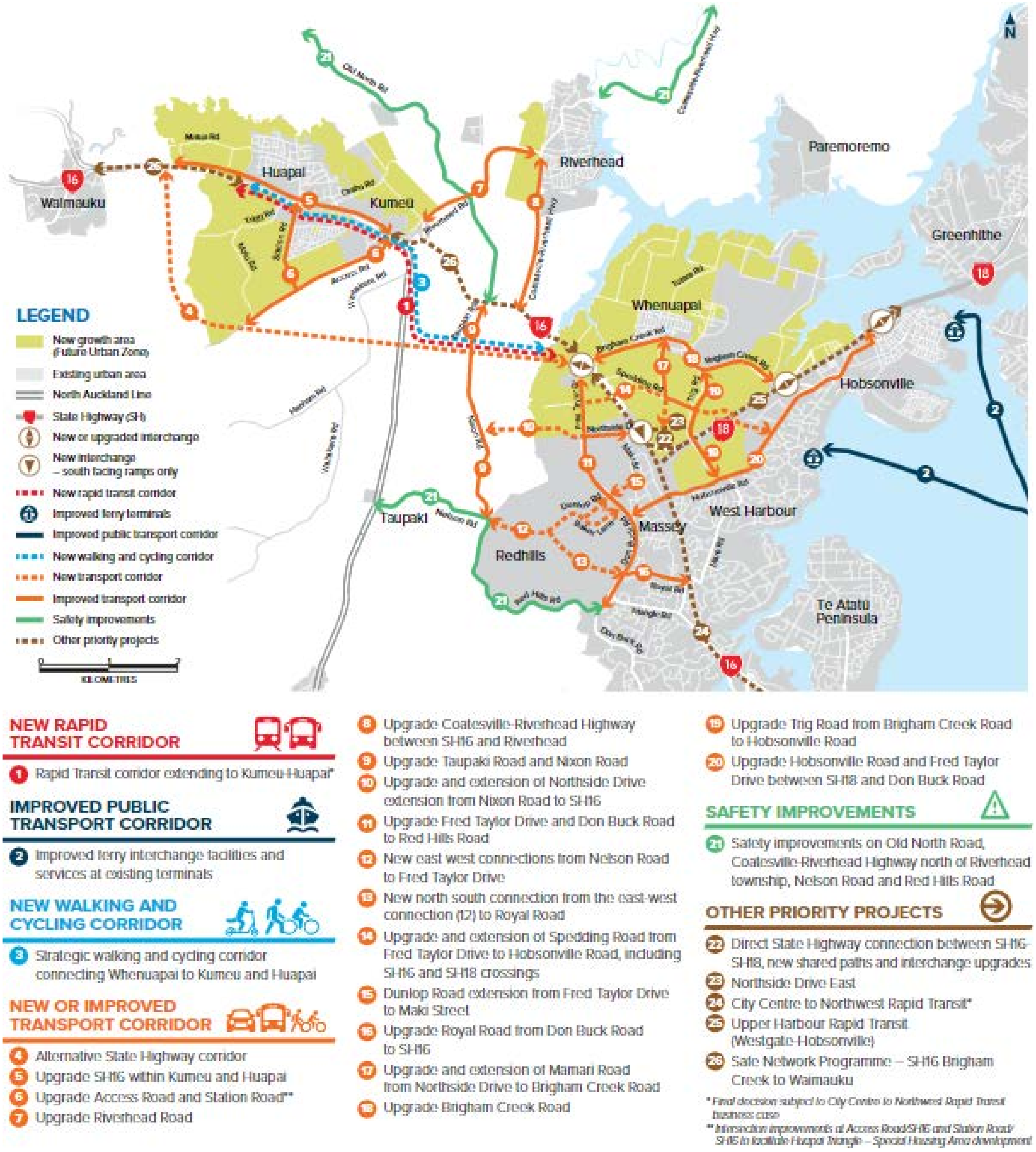


Figure 3-2: Indicative Strategic Transport Network

The corridors identified in the ISTN were assessed and grouped into two packages for the DBC. These were the NW Strategic Package (subject of this report) and the NW Local Arterials Package (a separate package).

The IBC NW Strategic Package identifies the key infrastructure upgrades required to connect the sub regions into existing and proposed transport systems and achieve the land use envisaged in the FUZ. The network will enable greater travel choice, enhanced access to the wider Auckland network, and support travel behaviour change for existing and new communities.

The ISTN corridors which progressed to route refinement and which form part of the proposed NW Strategic Package are outlined in Table 3-4. For the sake of brevity and relevance, ISTN corridors which went to route refinement but did not progress to route protection are not further discussed.

Table 3-4: Corridor Assessment Outcomes- North West Strategic

Shortlist reference and name	Description
RTL-K-03-C1 Rapid Transit Corridor	Rapid Transit option through Kumeū-Huapai town centres leaving SH16 at Brigham Creek Road roundabout before following the NAL corridor into Kumeū and terminating at western edge of Huapai.
AR-K-07 SH16 Main Road	This east-west option proposes to upgrade the existing SH16 from Taupaki Road on eastern side to the west side of Foster Road.
SR-SH-K-01a Alternative State Highway	This strategic state highway alternative corridor deviates from the existing SH16 from Brigham Creek Road roundabout through the Kumeū-Huapai FUZ connecting to SH16 near Waimauku.
AR-K-06 Access Road	Upgrade of Access Road from Puke Road on the south to the SH16.

4 Route refinement development and assessment methodology

4.1 Overview

The corridors identified in the ISTN were assessed and grouped into two packages for the DBC. These were the NW Strategic Package (subject of this report) and the NW Local Arterials Package (a separate package). The progression from corridor assessment to route refinement saw the identification of the preferred network at a 'macro' level during corridor assessment to 'micro' detail at the route refinement phase.

Refinement involved a gap analysis being undertaken to confirm the recommendations, this included a review of the IBC assessment, policy updates, developer aspirations and project interdependencies. Following gap analysis, a land use and constraints mapping exercise and corridor form and function assessment were undertaken to develop refined routes. Assessment of refined routes used the MCA framework (see Table 2-1), with adaptions to suit the option context. Key stages are explained in Sections 4.2 to Section 4.6 below and refinement process shown in Figure 4-1.

The outcome of the refined options assessment was recommended alignments. These were then confirmed by Waka Kotahi and AT to establish the preferred projects for route protection.

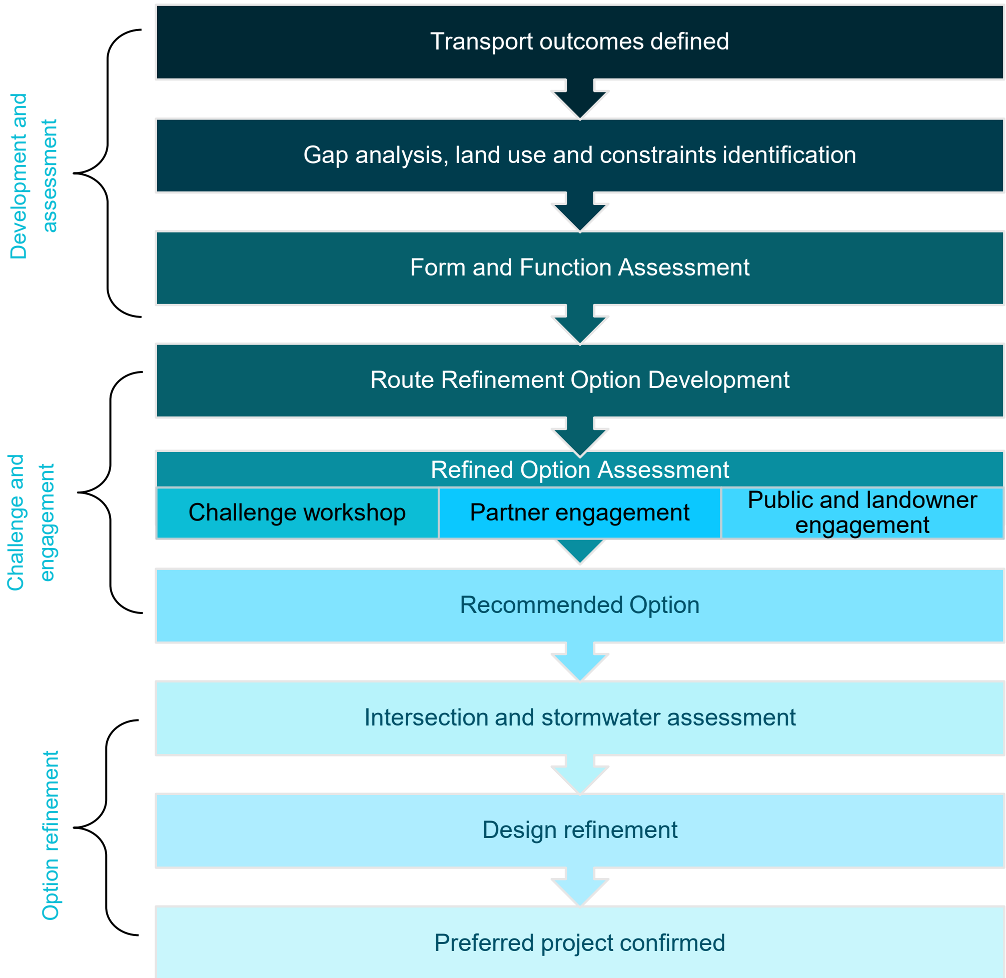


Figure 4-1: Route refinement process following corridor identification

4.2 Gap Analysis, land use and constraint mapping

4.2.1 Gap analysis

A background review was undertaken at route refinement of how the ISTN was identified, to check if any information or assumptions had changed since the corridor assessment. This included policy direction and statutory documents (for example, plan changes), and any issues that required further consideration. The gap analysis included the following:

- Review of Te Tupu Ngātahi Programme Business Case (formerly Transport for Future Urban Growth (TFUG)) recommendations
- Review of the corridor assessment undertaken and the North West IBC (main document and Options Assessment Report), including the long list and the short list options, and the reasons why options were recommended or discounted
- Consideration of the alignment of the recommended options with relevant policy documents (for example, Government Policy Statement on Transport, AUP:OP), in particular, to see if anything had changed since the North West IBC and corridor assessment recommendations
- Consideration of the alignment with strategic plans, other statutory documents and developer aspirations that may have progressed from the IBC. For example, structure plans, plan changes (or appeals), recent NORs and developer plans
- Consideration of other projects planned in the area.

A summary of the analysis undertaken for each Project is summarised in each of the Project specific sections.

4.2.2 Land Use Review and Constraint Mapping

Following gap analysis, a review of the AUP:OP maps and constraints was undertaken. The purpose of the review was to identify potential constraints, inform design refinement and identify whether additional corridor options should be developed. A study area was identified for each local arterial project. This study area was informed by the gap analysis and an initial review of key constraints, including:

- Geological conditions
- Natural hazards such as flooding
- Cultural values – as identified by Manawhenua.
- Contours and likely project earthworks requirements
- Strategic land use plans including live zoning, future urban areas and structure plans
- Identified sensitive areas through the AUP:OP overlays, conflicts with critical services and special purpose zones
- Environmental constraints.

Study areas were 100m wide either side of the corridor, with extensions as prudent or identified by specialists. Constraints were mapped on Te Tupu Ngātahi GIS and discussed at a workshop with the Project Team and specialists.

4.3 Form and Function Assessment

To determine the desired function, and therefore the future form of alternative options, a form and function assessment process was undertaken in early 2020.

4.3.1 Corridor Assessment Principles

A Corridor Form and Function (CFAF) assessment tool was developed to support consistent decision making. The intent of the tool was to encourage well-rounded thinking about both the place and movement function of corridors and ensure all modes are considered, see Figure 4-2.

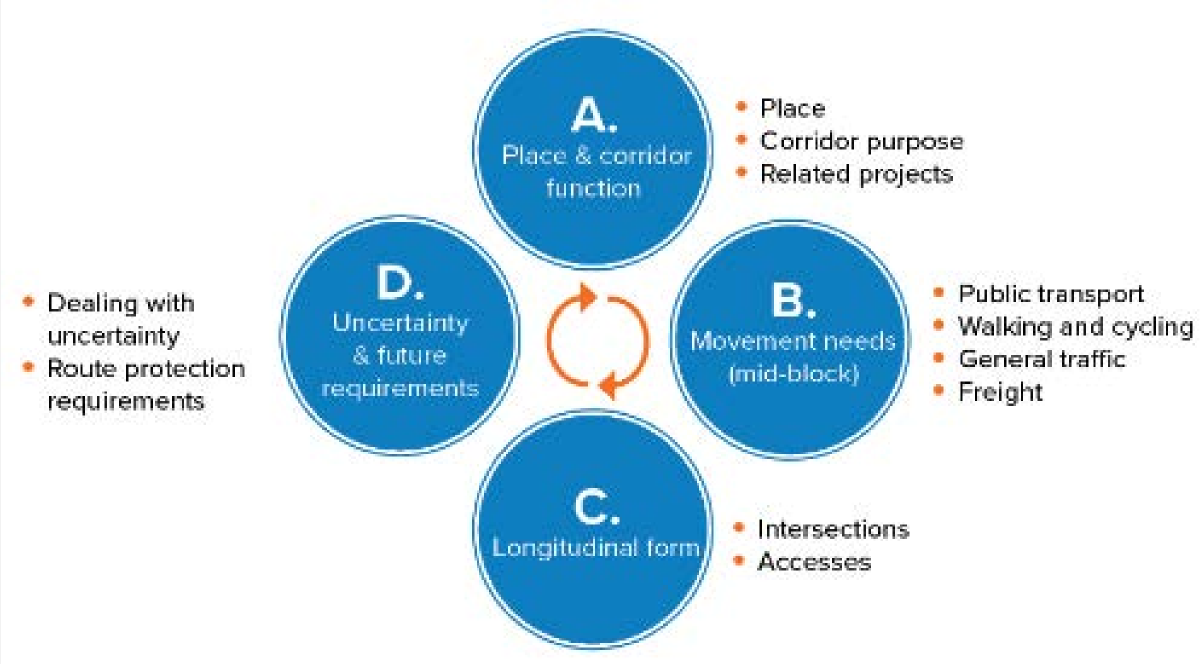


Figure 4-2: Corridor Assessment Principles, from A to D.

Both active and vehicular transport modes were considered in cross section development, however the form and function outcome may not necessarily provide facilities for all modes considered. The resulting cross section forms the basis for route protection of the corridor.

Key principles of the assessment include:

- **Place and corridor**: Surrounding existing and future land use and expected future land use density, including proximity of key trip generators and attractors such as rapid transit stations and schools
- **Movement needs**: Considering the hierarchy of the corridor in the regional network, the corridor modal priorities for the existing and future traffic volumes. Movement is considered at both local and network levels to ensure duplication of route functions is avoided and corridors have targeted modal functions
- **Mode priority**: Under CFAF, general traffic should only be provided with two lanes up to an approximate daily flow of 15,000 vehicles per day, or less than 1,500 vehicles per hour each lane in the peak periods. Four general traffic lanes should only be considered when:
  - daily flow exceeds 15,000 vehicles per day; *and*
  - where the Level of Service (LOS) for two general traffic lanes is less than LOS C in the interpeak; *and*
  - where it can be demonstrated that bus / HOV lanes have been considered first; *and*

  - where it can be demonstrated that two general traffic lanes will not be appropriate
- The 'target' level of service for general traffic is LOS C in the interpeak. LOS D or E in the peak is considered acceptable and can encourage a shift to active modes or public transport for journeys at these times.

The CFAF assessment output informed the footprint of each corridor.

Options disregarded

For existing corridors, an assessment of their current function was used to compare the available facilities with the assessment recommendation. This considered whether re-allocation of existing corridor space would achieve the outcomes sought by Te Tupu Ngātahi.

The assessment considered:

- Land use adjacent to the corridor and certainty of that land use being realised
- Current facilities versus those proposed by any non-Te Tupu Ngātahi project, compared to those recommended by Te Tupu Ngātahi
- Whether sufficient width already existed in the corridor to reallocate space to achieve outcomes sought by Te Tupu Ngātahi.

For each of the NW Strategic Package projects utilising the existing corridor was discounted. This is because there was not sufficient width in the existing corridor to enable re-allocation of space or adequate provision for all modes to achieve the desired outcomes.

Figure 4-3 provides an overview of the form and function for the North West Strategic Network.

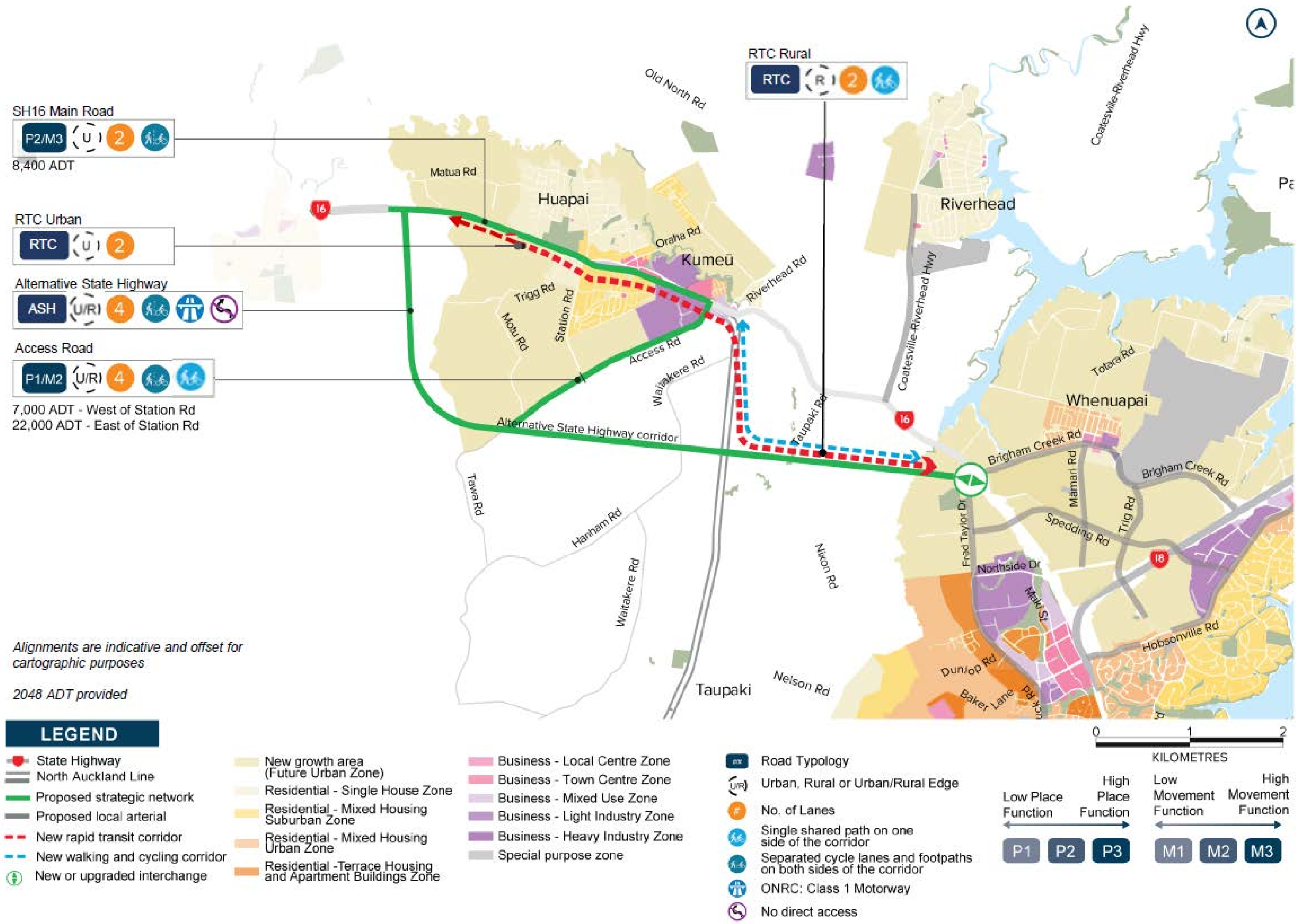


Figure 4-3: NW Strategic Package projects – Form and Function

4.4 Route Refinement Options Development

The gap analysis (Section 4.2) identified whether the recommended option for each Project required reconsideration due to relevant new information e.g., land use assumption changes, new growth projections (population, housing etc.) new constraints raised in engagement. The gap analysis also identified whether the corridor assessment (see Section 3.2) had considered alternatives proportional to the scale of potential effects of each Project. Where new information was identified, or the corridor assessment did not consider alternatives proportional to potential effects sufficiently, additional assessment was undertaken. To achieve the level of assessment required to progress to route protection, three approaches to developing options were used:

- **Corridor Assessment** – options occupying different locations within a defined study area and potentially connecting to the network at different points
- **Route Refinement** – options based on an IBC recommended option but with refinement based on the effects, constraints and opportunities from widening the corridor on either side, both sides, or a combination
- **No Further Options Developed** – project corridor is fit for purpose, or has existing potential to meet needs (e.g., existing designation in place, mode space can be reallocated), therefore the project was not recommended for route protection, or constraints limited the potential to develop feasible alternative options.

Some project corridors were split into sections to allow specific consideration, this resulted in three approaches being used along an alignment. Where specialist input was required SME were used in assessment, however where the project team had the required skills, the project team undertook the assessment. This is indicated as SME input or Project Team input. Table 4-1 states the recommended alternatives assessment approach for each project. The assessment for each Project (or element) is further discussed in the Project specific section.

Table 4-1: Overview of approach to refined option development and assessment

Project assessed	Development of Refined Alternatives – Approach
Rapid Transit Corridor (RTC)	Corridor Assessment Option Assessment with SMEs
Regional Active Mode Corridor (RAMC)	Corridor Assessment Option Assessment with SMEs
State Highway 16 (SH16)	Route Refinement Options Assessment
Alternative State Highway (ASH)	Corridor Assessment Option Assessment with SMEs
Brigham Creek Interchange (BCI)	Corridor Assessment Option Assessment with SMEs
Access Road	Route Refinement Project Team Option Assessment

4.5 Refined Option Assessment

4.5.1 Expert Briefing and Technical Input

SMEs from the following disciplines were involved in the options assessment for the NW Strategic Network:

- Planning and Social Impact
- Archaeology and Built Heritage
- Ecology
- Landscape and Visual
- Urban Design
- Transport
- Stormwater / Flooding
- Construction / Engineering
- Geotechnical / Natural Hazards.
- Property (RTC, ASH and SH16).

Site visits to North West Auckland were undertaken by the Project Team on 11 February 2020 and SMEs on 21 July 2020 to understand the subject environment. Experts were then provided with a briefing pack, containing the MCA framework and assessment guidelines, an overview of the project and options and a template for a summary report to record their approach, assumptions, findings and recommendations. A specialist briefing with the Project Team was also held on the options and assessment process. The refined options for each Project were loaded into the Te Tupu Ngātahi GIS constraints viewer for experts' assessment.

SMEs were given access to the GIS viewer which showed the options against environmental, heritage, and social layers. The viewer mapped constraints and local site information to assist assessment. GIS information was sourced from the Auckland Council GIS datasets and those identified during the constraints mapping exercise in Section 4.2. The GIS viewer was also an interactive tool where information could be displayed in different combinations by the user alongside the options. Specialists were asked to add comments, identify features or areas of concern, so they could be shared with other SMEs and the Project Team. Where appropriate, scoring, and qualitative analysis was completed by the SMEs and discussed at MCA workshops.

Potential property impacts were identified as a consideration for all projects and assessed in the MCA Land Requirement criteria assessed by the project team planning and engineering disciplines. Due to the number of properties affected, difference in land use and potential scale of impact for the ASH, RTC and SH16 Main Road, a Property SME was also engaged.

4.5.2 MCA Framework in the Route Refinement Assessment

There were two approaches to using the MCA framework in the option assessment process: scoring the options or identifying a preference for one of the options. Both approaches used the same programme-wide MCA framework but tailored to suit the North West projects.

Tailoring involved the removal of criteria where it would result in double counting due to the criteria repeating themes assessed under the transport outcomes. This applied to criteria for '*transport* *system integration'* and '*user safety'*[1]. Manawhenua provided qualitative feedback as part of the Project Partner workshops. Options scoring was undertaken when it assisted in differentiating between the options. Scoring was not undertaken for the *Route Refinement* options (see Figure 4-1) due to the options being generally a shift in the alignment, e.g., left side, right side or both sides instead, preferences were stated. The exception for *Route Refinement* options was where constraints were identified, and scores assisted with differentiation.

Experts qualitatively assessed the options against the relevant MCA framework criteria and where relevant scored options on their potential effects and identified or suggested design amendments to reduce adverse effects.

4.5.3 Option Challenge Workshops

Following assessments, scoring and / or preferences were discussed at multi-disciplinary options challenge workshops with the Project Team and other SMEs. Throughout the options assessment process, workshops were held to discuss findings and undertake decision making. Two types of workshops were held: Options Assessment Workshops and Project Team Workshops. The process and purpose are detailed below.

Options Assessment Findings Workshops, with SMEs – The purpose of these workshops was to discuss and challenge initial options assessment findings with specialists and the Project Team. During these workshops the scores (where applicable) and / or findings of each specialist was shared with the Project Team, discussed and challenged. Based on discussions in the workshop, changes to scores or assessments were made where appropriate prior to assessments being confirmed.

Options Assessments Workshops, with Project Team – The purpose of these workshops was to discuss and assess each option on a qualitative basis and challenge Project Team commentary. Assessments were confirmed at the workshop unless additional information or input was required. Workshop outcomes are detailed in the project specific sections.

Following option workshops, the Project Team identified the preferred option.

4.5.4 Project Partner and Landowner Engagement

Throughout optioneering, a range of engagement was undertaken with Project Partners (Auckland Council and Manawhenua). This included evaluation of the options and feedback at workshops and hui. The workshops are identified in this section and the outcomes for each Project described in their respective chapters. Engagement with the public and landowners was undertaken in 2020, 2021 and landowners again in 2022.

Ngā Manawhenua

The Project Team provided regular updates on the option assessment and sought input from manawhenua. North West Strategic engagement included:

- **March 2020** – Introduction to the North West projects located in Kumeū-Huapai and Whenuapai, Riverhead, Redhills (NW Local Arterials Package) and overview of the assessment process
- **May 2020** – Update and outcomes from the constraint mapping process
- **August 2020** – Presentation of the options for the ASH and the rural section of the RTC

[1] Exception was '*user safety'* for Hobsonville Road which was retained as criteria.

- **June 2021** – A North West site visit with manawhenua and the Project Team.

Manawhenua were also invited to a constraints mapping exercise for the corridors and attended post option assessment Project Partner workshops in 2020 and 2021 to seek feedback and option support.

Auckland Council

The Project Team has met with Council on an ongoing basis to discuss land use integration opportunities along each project corridor and to seek views on the proposed transport network.

Council's view has also been sought on the future use of FUZ land which has not been Structure Planned, in Kumeū-Huapai, Riverhead and Redhills North (a structure plan is in place for Whenuapai). Council has prepared the NW Spatial Strategy in response, which was adopted in May 2021. The NW Spatial Strategy identified potential future centres and business land that the Te Tupu Ngātahi transport network will support. Council and the Project Team also discussed the ASH and rural section of the RTC potential impacts on the FUZ at Kumeū-Huapai, the BCI integration to the FUZ and impacts on Fred Taylor Park.

Council also attends Project Partner workshops and the monthly Te Tupu Ngātahi and Council Integration meetings.

AT and Waka Kotahi

Five workshops specific to the North West options assessment were held between September 2020 and May 2021 with AT and Waka Kotahi to discuss options and identify issues to be addressed. Manawhenua and Council also attended these workshops.

- **September 2020** – The following projects were presented at two consecutive workshops: The ASH, the Rapid Transit Network and the SH16 / Main Road upgrade
- **September 2020** – The RAMC was presented at two consecutive workshops
- **February 2021** – Workshop to discuss urban RTC / SH16 Main Road upgrade via Kumeū-Huapai and BCI
- **May 2021** – The projects were presented and discussed with sustainability specialists from Waka Kotahi, outlining agreement to approach adopted in optioneering the project corridors.

Community and Landowners

Community engagement on the proposed North West Transport Network (including NW Local Arterials Package) took place between 30 November 2020 and 1 February 2021. Approximately 650 pieces of feedback were received across all channels between 30 November 2020 and 1 February 2021. Feedback items included comments on Social Pinpoint, online surveys, mailed feedback, landowner meetings, emails and phone calls, official information requests and subscriptions to the North West newsletter.

Following the engagement period, feedback was collated and reviewed by the Project Team and informed the assessment of the options.

4.6 Intersection and stormwater approach

4.6.1 Intersection Form Assessment Methodology

For Access Road and SH16, once the preferred route refinement option was identified, an assessment of the alignment intersections form and function was undertaken to determine the route protection footprint. Intersection design adopts a Safe System approach in line with AT's Vision Zero Policy. Intersection treatments were undertaken for SH16 Main Road and Access Road for the North West Transport Network and included:

- Maintaining existing vehicle access to private property where practicable, but not in a way that precluded efficient movement along the corridor, particularly for public transport and active modes
- Adequate consideration of modal needs at intersections, for example priority intersection requirements for Frequent Transit Network (FTN) and safe and efficient crossing opportunities for active modes
- Intersection size (determined by SiDRA modelling), particularly in more constrained existing urban areas
- Ensuring each intersection has sufficient space for queuing and level of service is acceptable.

The assessment of intersection form adopts a Safe System approach by recommending well-designed roundabouts as the first choice for intersections due to the safety benefits for road users resulting from slowing down through traffic and reducing the number of conflict points. Site Specific constraints are also considered which may prompt design change to meet the needs of different users. In some cases, roundabouts are not preferred, and signalised intersection forms are proposed. Both typologies are designed to meet users' safety needs and respond to site factors, see Figure 4-4.

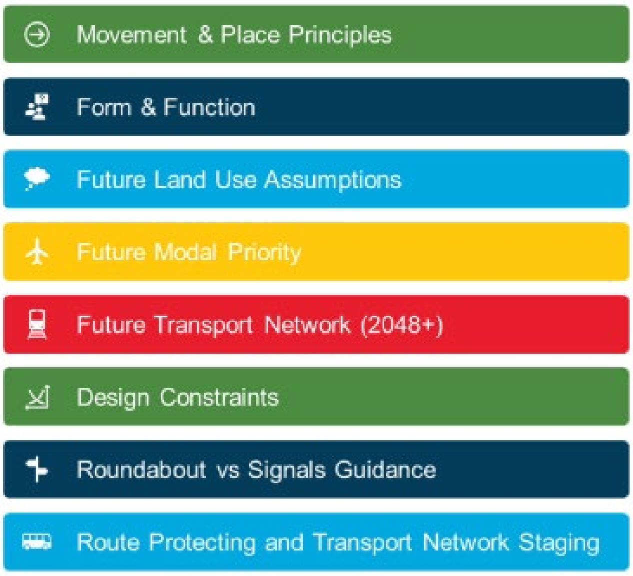


Figure 4-4: Intersection design considerations

Where roads overlap, and to allow delivery staging flexibility, routes are designed to enable them to progress independently of intersecting routes. The area identified for each corridor is sufficient to enable that route to be tied into the existing network. The route protection design allows sufficient flexibility to implement safety measures consistent with Vision Zero principles in the future.

4.6.2 Limited access routes and grade separations

Both the ASH and the RTC have restricted access to enable efficiency and safety and are generally fully separated from local networks. Connections into the existing (or proposed) network for both alignments have been determined on a strategic network requirements basis.

Local roads that cross the alignments have been retained, with no permanent road closures proposed. The decision whether to retain an existing alignment or realign was made based on construction feasibility and design requirements (such as gradients).

4.6.3 Stormwater Infrastructure Design

As part of route protection, the projects are required to identify and appropriately protect the land necessary to enable the future construction, operation and maintenance of required transport corridors / infrastructure. The design has therefore considered the appropriate stormwater management methods to meet likely catchment needs and achieve the future regulatory requirements, the process for identifying stormwater treatment form and location is summarised in Figure 4-5.

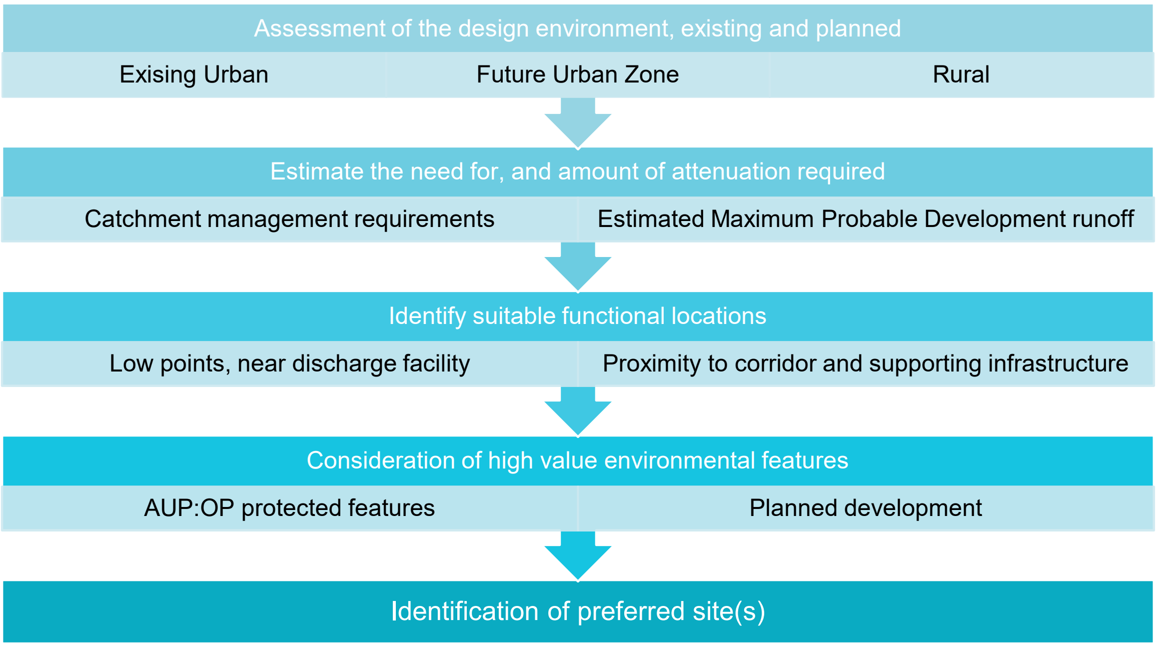


Figure 4-5: Stormwater infrastructure design and location approach

Alternative stormwater solutions were considered for the North West Transport Network to inform the boundaries for each Project.

Design Environment Assessment

The type of stormwater management device was identified based on the Te Tupu Ngātahi design framework which considered:

- The surrounding existing and planned land-use
- Form of the transport route
- Road hierarchy
- How connectivity to adjacent properties would be provided.

This approach is summarised in Table 4-2.

Table 4-2: Stormwater System Design Approach

Design Environment	Conveyance	Treatment	Retention/n	Detention (Attenuation)	Diversion
Existing Urban – footpath and cycleway within existing road reserve	Pits and pipes	Discharge across berm	Raingarden	Wetland / pond	N/A
Existing Urban – increased road reserve and road upgrade	Pits and pipes	Raingardens or treatment wetland / pond, or as a lesser preference, proprietary treatment devices	Raingarden	Wetland / pond	N/A
Future Urban Zone	Pits and pipes preferred	Raingardens or treatment wetland / pond	Raingardens	Wetland / pond	Diversion drain or cut-off channels as required
Rural	Conveyance channels	Treatment swales or treatment wetland / pond	Retention swales	Attenuation swale or wetland / pond	Diversion drain or cut-off channels as required

Need and scale of attenuation required

Design of attenuation devices was undertaken at a high level to determine the need for, and amount of attenuation required, the design approach considered the following:

- Evaluate the overall catchment management plan requirements as approved by Council to determine if attenuation or a “pass it forward” approach was proposed for the catchment
- Determine the road runoff discharge conditions for any tie ins to existing systems or discharge to overland flow paths
- Estimate runoff from maximum probable development in the catchment (i.e., maximum expected impervious areas).

This information was used in the:

- Design of a primary (10-year) network to cater for the estimated runoff
    - Location and sizing of primary (10-year) attenuation devices (if required) to address any capacity constraints in the downstream network, or to reduce the size of stormwater infrastructure (e.g., pipes) required
- Identification of secondary (100-year) flow paths and floodplains
    - Location and sizing of secondary (100-year) attenuation devices to reduce floodplain and overland flow path extents.

Suitable Functional Location

If a pond was required, the location of the pond was selected by identifying a suitable functional location. The functional location considered the off-line low point along the alignment, which was in sufficient proximity to the corridor for ongoing maintenance access, and suitably located for supporting infrastructure such as pipes and discharge outlets to nearby natural streams.

Where there were opportunities to upgrade or share existing public stormwater assets these were preferred and have been selected in various places along the corridors. Co-locating or upgrading existing assets has the benefit of reducing project land requirements, more effectively managing ongoing maintenance requirements through larger and fewer stormwater facilities, rather than multiple smaller devices. If practicable, across the Strategic network, new wetlands were also designed to service multiple routes, to achieve co-location efficiencies.

Consideration of high value environmental features

Once functional locations were considered the design then sought to avoid high value environmental features and where practicable minimise impacts on existing residential or business development.

Where new information or opportunities became available, the Project Team refined the stormwater solutions design and location. For example, where consents were granted for new development, the team made efforts to reconfigure ponds or discharge outlets to reduce impacts on developer aspirations and private property. However, this was not always practicable in constrained corridors.

Summary

The stormwater solution preferred is generally use of centralised wetlands. Wetlands have the benefit of being more effective to operate and maintain, they serve as both attenuation and treatment, and they reduce the overall corridor cross section width. Swales and raingardens for example would impact many owners along the corridor, and in existing urban areas where development is built up this would be particularly undesirable. Additionally, the NW Strategic Package is seeking to support growth and developable land adjacent to the corridors should therefore be maximised. Wider corridors for open channel systems and swales would not be as supportive of this objective as wetlands. The exception to this approach is where the road will remain in greenfield area (Rural zoning), and swales may be used. The approach to considering pond size and location is summarised below.

5 Explanation of the Project Specific Sections

The routes in the refined North West Transport Network went to the AT and Waka Kotahi Boards in December 2021. Refined routes considered to be highest strategic priority were endorsed for route protection (see Table 5-1). The following sections provide a summary of the route refinement assessment for each endorsed Project being route protected in the NW Strategic Package, including:

- Corridor assessment outcomes
- Gap analysis undertaken
- Land use review and constraints mapping
- Form and function assessment
- Route refinement options developed
- Assessment summary including engagement outcomes
- Preferred and discounted options rationale.

Table 5-1: NW Strategic Package projects for route protection

Reference	Project	Delivery Authority
Rapid Transit		
S3	Rapid Transit Corridor[2]	Waka Kotahi
KS	Kumeū Rapid Transit Station	Waka Kotahi
HS	Huapau Rapid Transit Station	Waka Kotahi
Highway Connections		
S2	SH16 Main Road	Waka Kotahi
S1	Alternative State Highway	Waka Kotahi
Roading upgrades		
S4	Access Road	Auckland Transport

Due to either new information or complexity, the following network elements were considered in individual detail:

- The ASH southern link into the existing state highway network (at SH16). Due to the number of corridors affected and associated complexities. This element is assessed under 'Brigham Creek Interchange'
- RTC Stations were identified following the preferred alignment being determined
- Strategic active modes, an opportunity to enhance the strategic walking and cycling network was identified and a series of options were considered. This project is referenced as the 'Regional Active Mode Corridor' (RAMC).

The NW Strategic Package corridors progressing to route protection are illustrated in Figure 5-1.

[2] Stations proposed for the RTC are a subset of the main project, the process of determining station locations is discussed under RTC specific section. RTC Stations are listed and shown here for context.

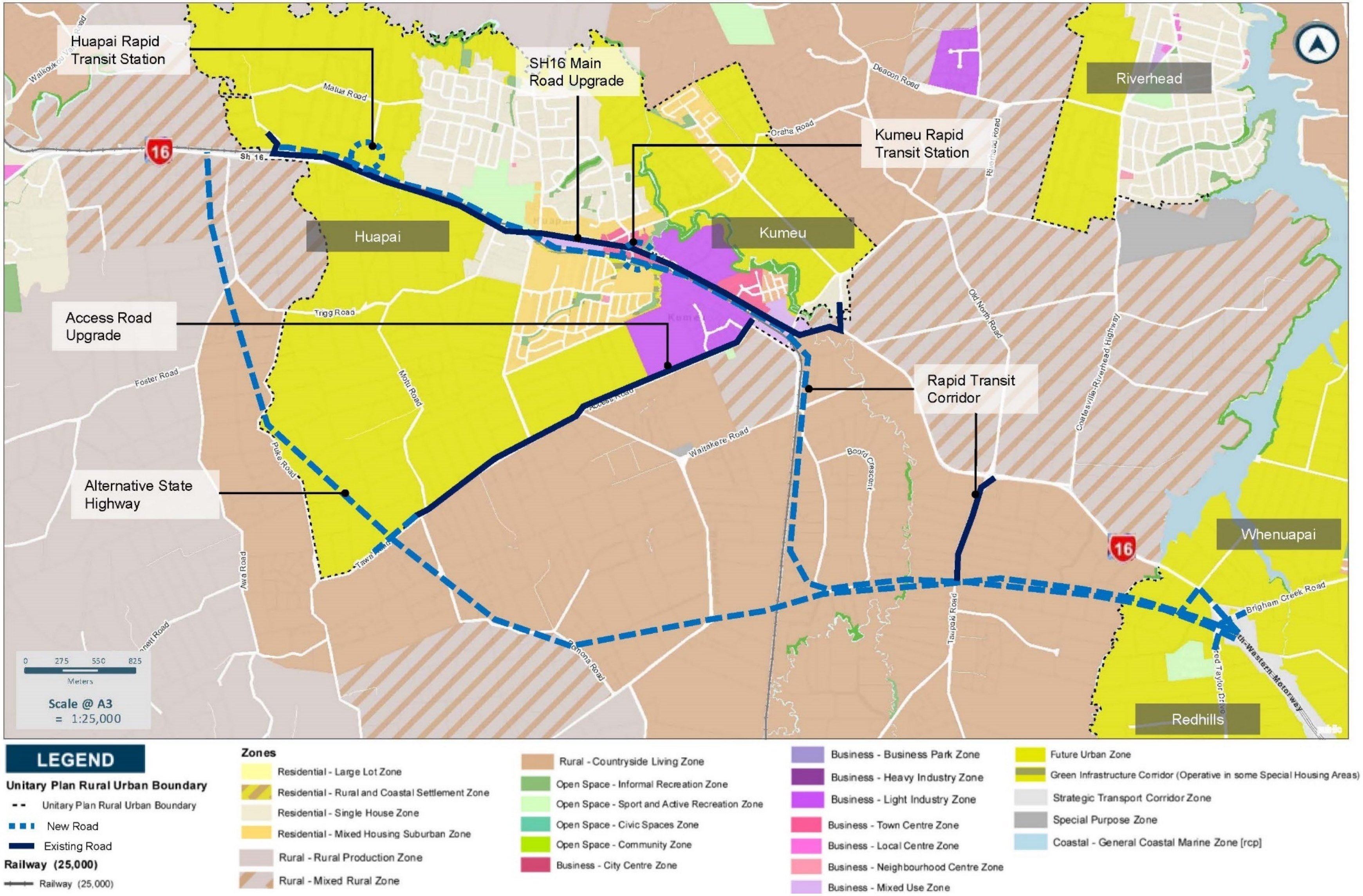


Figure 5-1: Indicative Transport Network – North West Strategic

6 S3: Rapid Transit Corridor

6.1 Overview

The RTC was identified in the TFUG Programme Business Case preferred transport network plan prepared in 2016. The TFUG option was taken forward at IBC stage for development and extended from Westgate in the east terminating at the entrance of Waimauku west of Huapai. The RTC project was integral to the development of the preferred IBC network.

Long list stage considered ten RTC alignments, six of these crossed the Kumeū-Huapai FUZ and four utilised the existing heavy rail alignment (NAL) in some form. The use of the existing rail line was determined to have limited benefits due to it not connecting at key growth areas and the route and mode failing to provide the RTC frequency or reliability needed. See Section 3 for corridor assessment summary). The short list recommended RTC alignment *RTL-K-03-C1,* which connects at Brigham Creek Road in the south at the future interchange (refer to Section 11), running alongside the NAL and SH16 Main Road through Kumeū-Huapai town centre, see Figure 6-1.

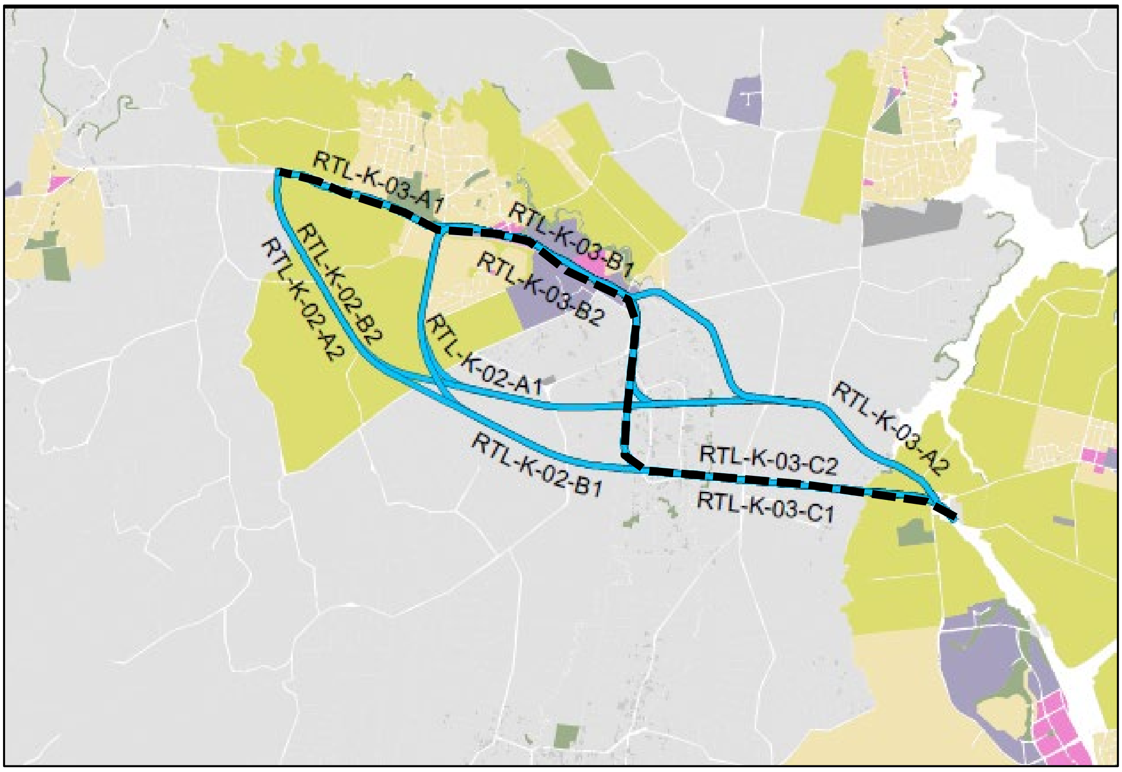


Figure 6-1: Rapid Transit Corridor IBC Option RTL-K-03-C1

The RTC project provides significant opportunity to influence mode shift and for place shaping within the existing township along SH16 Main Road. In particular, the rapid transit can efficiently move large numbers of people to intensely developed centres like Westgate and the CBD. Rapid transit dramatically increases people’s ability to travel between major parts of Auckland (north, central, west and south) by providing a fast and reliable travel option that encourages people out of private vehicles for longer-distance journeys. Rapid transit stations are also expected to deliver long-lasting improvements to areas nearby, improving their attractiveness and redevelopment potential.

6.2 Gap analysis

The gap analysis confirmed key considerations as:

- Uncertainty of future use of the heavy rail line (e.g., freight frequency changes, additional tracks or NAL being shifted out of centre)
- Interdependent external projects including a potential City Centre to Westgate RTC Station (a non-Te Tupu Ngātahi project) in Redhills North
- Uncertainty of future land use outcomes due to Redhills North and Kumeū-Huapai FUZ not being structure planned. Ongoing Council engagement was necessary to inform assessment.

These findings resulted in additional alternatives analysis being undertaken before proceeding with the IBC recommended option. Table 6-1 summarises this additional analysis.

Table 6-1: Gap analysis alternatives options further considered

Option	Analysis
A heavy rail alignment making use of the existing NAL *RTR-K-01* *RTR-K-02* *RTR-K-03*	All options relied upon the existing NAL with one option following the NAL corridor entirely and two diverting eastwards in proximity to Boord Crescent. Heavy rail was discounted for the following reasons: • Heavy rail options would not directly serve key destinations of Westgate, Whenuapai and City Centre which make up a large proportion of the trips from Kumeū-Huapai • Destinations of Henderson and New Lynn could be accessed from RTC via the FTN at Westgate and Lincoln Road • A metro rail service does not typically operate through rural land (i.e., between Swanson and Kumeū) due to reduced catchment so this service extension would be considered an inter-regional service with associated reduced frequency expectations.
A RTC making use of the existing NAL alignment	Relocation of the NAL was identified as an opportunity that would create potential for the RTC to use the existing NAL corridor. • Following the gap analysis, the decision was made to discuss the relocation of the NAL with KiwiRail. KiwiRail confirmed that there are no plans to relocate the NAL from its current location. The NAL corridor is therefore not an available or feasible route for the RTC.

The outcome of this analysis was confirmation of both the IBC's reasons to discount the above options, and the recommended IBC option proceeding to corridor assessment.

Gap analysis concluded that:

- Options should be developed and assessed via an MCA with input from SMEs
- Engagement with Council is required on the potential FUZ landuse.

6.3 Corridor form and function assessment

An assessment was undertaken for the RTC that segmented the corridor into distinct segments based on the surrounding rural and urban zoning[3]. This recommendation informed the route refinement options developed and assessed in Section 6.4.

Cross sections allowing for light rail and bus rapid transit were considered, with bus rapid transit requiring a larger cross section, Figure 6-2 shows the cross sections considered.

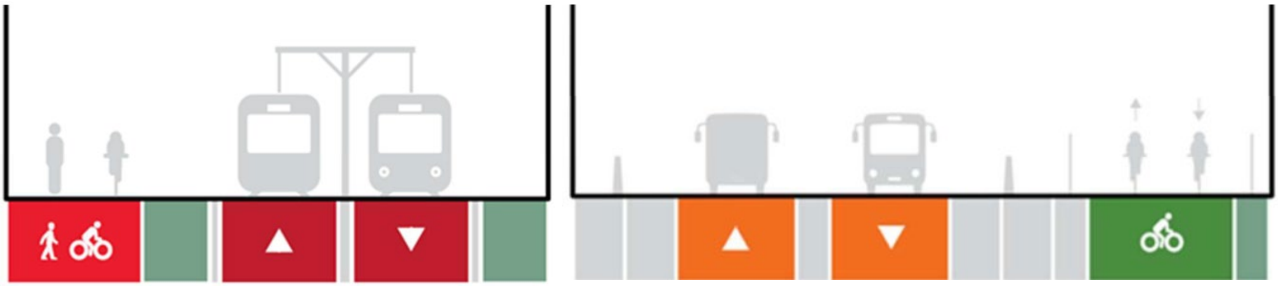


Figure 6-2: RTC light rail and bus rapid transit mode cross section outcomes

<u>RTC and SH16 interface</u>

The RTC Option RTL-K-03-C1 and the SH16 Main Road Option AR-K-07 are adjacent to each other through the urban section of Kumeū-Huapai. Therefore, the two corridors were considered together with their interface being a key consideration. The initial Urban 1A cross section design was a combined SH16 Main Road and RTC cross section, see Figure 9-2.

Figure 6-3: CFAF Outcome RTC (coupled with SH16 Main Road) Indicative cross section

After options development, the S3 RTC and S2 SH16 coupled cross section design was reassessed and further options which decoupled sections of the RTC from SH16 Main Road were developed (see Section 9 for SH16 Main Road assessment and cross section).

6.4 Land use review and constraint mapping

To inform the option development and assessment, a land use review and constraint mapping exercise was carried out to understand the RTC environment. The exercise identified:

- **Extent and zoning:** The RTC study area is split into an urban / future urban and a primarily rural section. The eastern segment is zoned FUZ and Rural-Countryside Living Zone. The western end where it enters Kumeū-Huapai township at Main Road is urban and goes through a variety of zones including Business – Light Industry, Town Centre, Mixed Use, Open Space – Sport and

[3] this did not follow the CFAF methodology in Section 4.4, which addresses road corridors only

Active Recreation, Residential – Single House Zone, Strategic Transport Corridor Zone and Green Infrastructure Corridor

- **Future Land use:** Within the eastern segment, the northern extent of Redhills near the BCI is not structure planned yet. The Councils NW Spatial Strategy identifies the area as 'Future Residential and Other Uses'. Outside the RUB, within the existing rural zoned area, it is anticipated to remain in rural land use and not undergo significant land use change. Within the urban segment those existing business zoned areas are anticipated to continue undergoing development and change, albeit at a slower rate of growth and change than the FUZ in the westernmost end. At the western end the NW Spatial Strategy has identified a new town centre location on the south of SH16 Main Road. The remainder is identified as 'Future Residential and Other Uses'
- **Special uses and constraints:** The study area is crossed by two National Grid Overlays which are generally parallel to the NAL bisecting Boord Crescent continuing through the entrance of Kumeū-Huapai town at SH16 Main Road. The NAL also forms a constraint for the RTC corridor, moving north adjacent to Boord Crescent to the entrance of Kumeū-Huapai town. The NAL is a single-track line designated (#6300) by KiwiRail. Within the urban section the existing land use has several constraints, including the SH16 Main Road and the NAL which are both designated and travel parallel to each other through Kumeū Huapai urban area, and in parts are immediately adjacent to each other. At Station Road, the NAL switches under SH16 Main Road to continue on the northern side of SH16 Main Road
- **Environmental Constraints**: There are a number of environmental constraints along the corridor, including historic heritage structures associated with the railway and the Huapai Tavern (CHI 13234), and parks and public services such as Fred Taylor Park, Kumeū Showgrounds, Huapai Recreation Reserve, Kumeū Fire Station, supermarkets and public library. The area is also bisected by the Kumeū River and tributaries at several locations, in addition to natural flooding hazards
- **Interface with SH16 Main Road:** The SH16 Main Road upgrade and RTC interface through the centre of Kumeū and Huapai. The two projects should not be considered in isolation through this section.

Key outcomes of the review were the decision to:

- Divide the route into rural and urban segments. This responds to the surrounding environments and allows consideration of constraints within each segment. Rural and urban segments were divided into sub-segments to allow focus on key constraints
- Assess the urban section of the RTC with SH16, to better consider impacts on the existing Kumeū-Huapai centre in the context of the two projects
- Undertake an MCA with SMEs due to the mixture of land use, varied landownership and utilities and public services constraints.

6.5 Route refinement option development

As discussed at Section 6.4, the RTC route was split into segments to allow consideration of each area, shown in Figure 6-4. These options were then workshopped based on the indicative cross sections in Figure 6-2 and considering interfaces with SH16 Main Road.

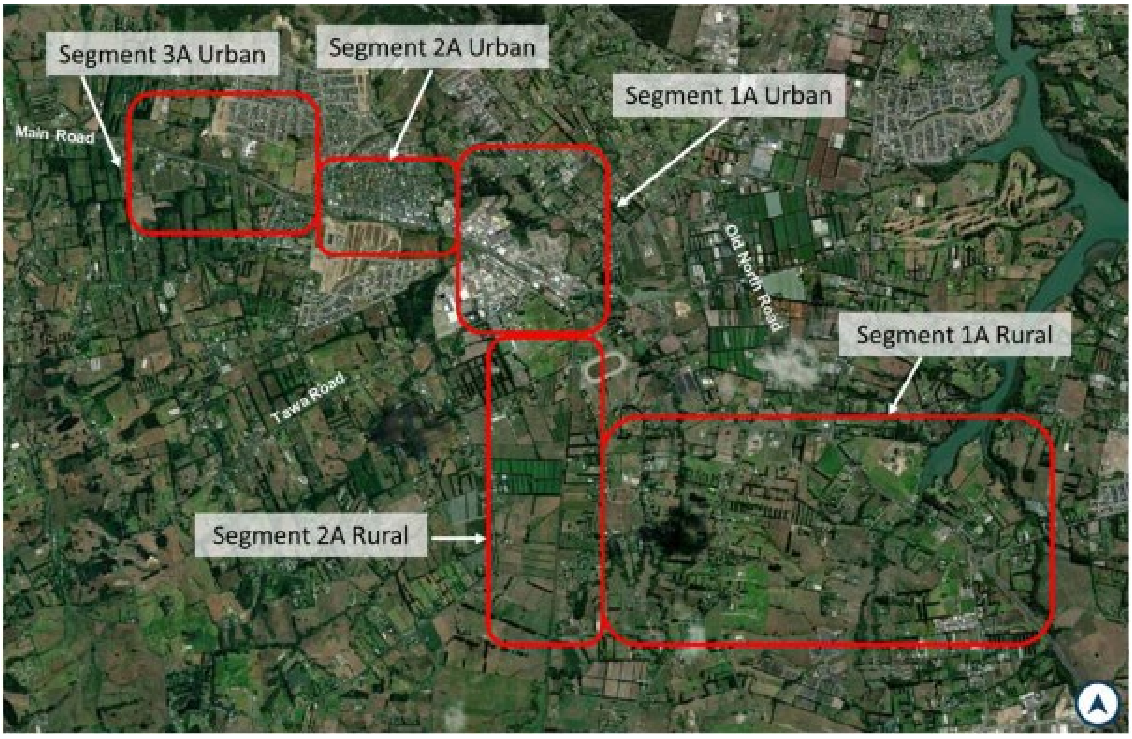


Figure 6-4: Rapid Transit Corridor segments for route refinement

1A Rural: Brigham Creek Interchange to Boord Crescent

Option 1:	Northern alignment option following westerly alignment towards Taupaki Road and south of Boord Crescent
Option 3	Northern alignment option following south-westerly alignment towards Taupaki Road, immediately north of Nixon Road
Option 4:	Southern alignment option following westerly alignment towards Taupaki Road, immediately north of Nixon Road
Option 6:	Southern alignment option following north-westerly alignment towards Taupaki Road and south of Boord Crescent

1A Urban: Kumeū RUB to Huapai town at Kumeū River bridge

Option 1:	30m wide cross section (RTC and SH16 Upgrades) running centrally along the existing Main Road SH16
Option 2:	30m wide cross section (RTC and SH16 Upgrades) to the south of Main Road SH16
Option 3:	30m wide cross section (RTC and SH16 Upgrades) running to the north of Main Road SH16

Option 5: 38m wide decoupled cross section (RTC and SH16 Upgrades) with the RTC running adjacent to the NAL, and the SH16 Main Road Upgrade running centrally along the existing Main Road, SH16

2A Urban: Kumeū River bridge to Station Road

Option 1: Running centrally along the existing SH16 Main Road (30m cross section (RTC and SH16 upgrades together)

Option 2 Running adjacent to the NAL, south of SH16 Main Road (30m cross section (RTC and SH16 upgrades together)

Option 3 Running to the north of SH16 Main Road (30m cross section (RTC and SH16 upgrades together)

Option 5 Running adjacent to the NAL with the SH16 Main Road Upgrade running centrally along the existing Main Road (38m wide cross section (RTC and SH16 Upgrades))

Segments not further assessed

Exceptions to the SME MCA approach were Segment 2A Rural and 1A Urban where hard constraints were identified which discounted further optioneering. Segment 3A Urban was initially also discounted but was later assessed following feedback from Waka Kotahi, see Refinement following Engagement, Section 6.5.2. The following Segment constraints were identified:

- **Segment Rural 2A:** Significant constraint of needing to cross the NAL twice and impacts on the Kumeū Showgrounds sufficient to discount alternatives on the west of the NAL. This resulted in the east side of the NAL being the only feasible option
- **The western end of Segment Urban 1A (to the west of Access Road):** The NAL is a hard constraint and alternative options to the north would not be centred on the existing road corridor and reserve area. This would increase property impacts and the extent of transport infrastructure within the corridor, i.e. it would be less compact.

6.5.1 Assessment

A corridor assessment was undertaken for the RTC alignment, the assessment follows the process outlined in Section 4. The options were assessed against the MCA framework including the ability to achieve the Transport Outcomes.

- **Access:** Provide effective and attractive public transport access to economic and social opportunities for Kumeū-Huapai
- **Mode Choice:** Enable a transformational public transport mode share for trips between Kumeū-Huapai and key centres
- **Reliability:** Enable reliable and resilient public transport trips between Kumeū-Huapai and the strategic network
- **Integration:** Provide a RTC which supports high quality integrated communities.

Segment Rural 1A

Table 6-2 shows scoring of options for Segment Rural 1A using the MCA framework, considerations and constraints identified are shown in Figure 6-5. Table 6-3 provides a summary of the assessment undertaken by SMEs.

Table 6-2: RTC MCA Assessment – Segment Rural 1A

Options	Option 1	Option 3	Option 4	Option 6
IO1. Access	4	4	4	4
IO2. Mode Choice	4	4	4	4
IO3. Reliability	4	4	4	4
IO4. Integration	4	4	4	4
Criteria				
Heritage	-2	-2	-1	-1
Land use futures	-2	-2	-2	-2
Urban Design	-2	-2	-2	-2
Land Requirement	-2	-2	-2	-2
Social Cohesion	-2	-2	-2	-2
Human Health and Wellbeing	-3	-3	-3	-3
Landscape / Visual	-3	-4	-4	-3
Stormwater	-2	-3	-3	-3
Ecology	-4	-4	-4	-4
Natural Hazard	-1	-1	-1	-2
User Safety	2	2	2	2
Construction impacts on utilities / infrastructure	-2	-2	-2	-2
Construction Disruption	-3	-3	-3	-3
Construction costs / risk / value capture	-3	-3	-3	-3

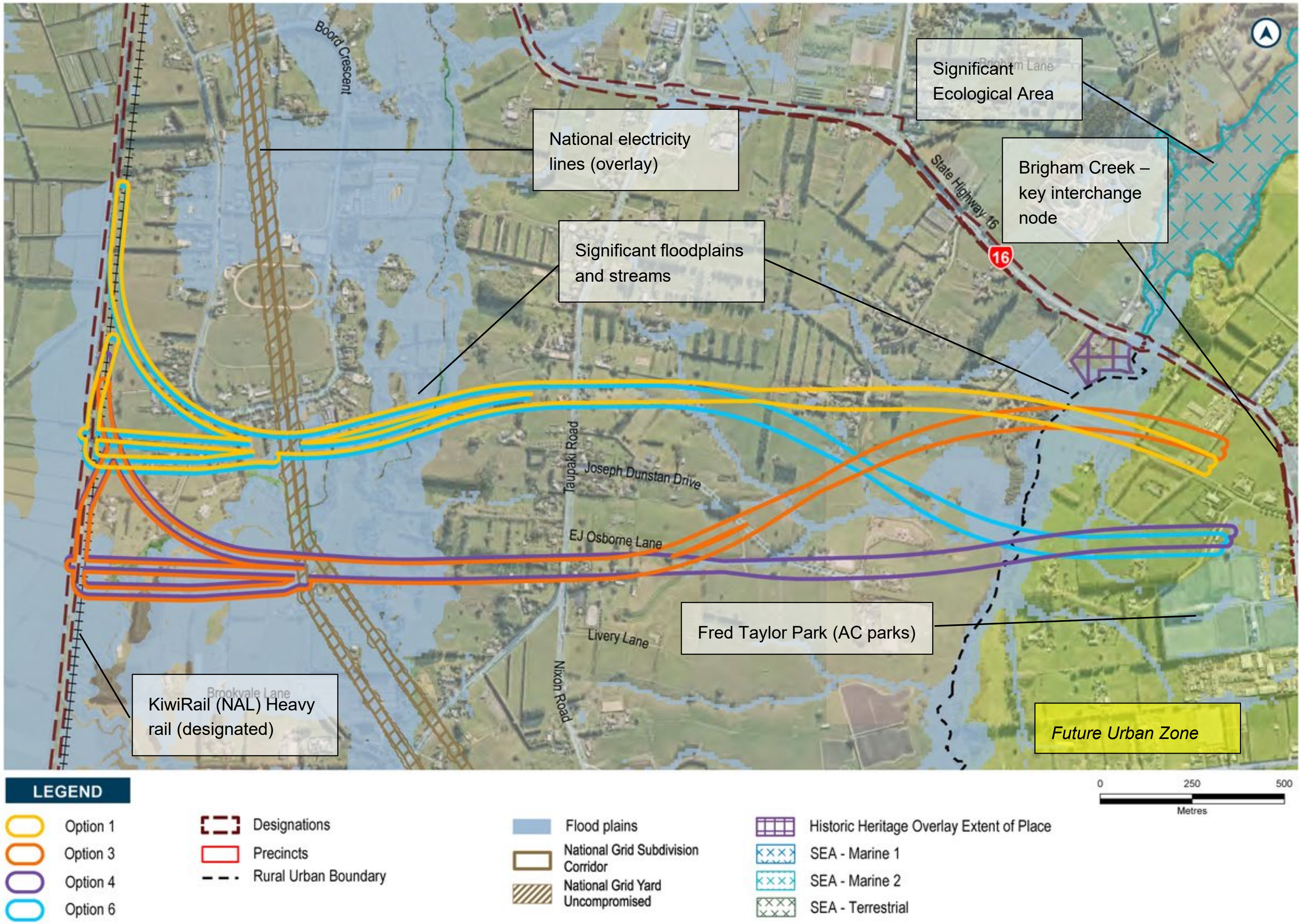


Figure 6-5: RTC Rural 1A Options and identified constraints

Table 6-3: RTC Segment Rural 1A Options Assessment Findings Summary

Wellbeing Assessment	
Transport Outcomes	This RTC segment will not contain a station as the segment maximises movement function of the RTC with no stops and high performance. The segment does not conflict with wider transport networks (grade separated) and will move people quickly and efficiently. All Rural 1A options achieved the transport outcomes sought performing highly positive with no differentiation.
Cultural	Heritage: Options 1 and 3 performed adversely due to the increased number and size of the stream crossings and the proximity to Brigham Creek which has a cluster of archaeological and heritage sites including a possible early church, historic building and historic house which increases the risk of archaeological findings. Options 4 and 6 performed slightly better than Options 1 and 3. Both options are not adjacent to any known archaeological sites, however both cross streams which have a higher likelihood of findings. There is a slight preference for Option 4 as this crosses the least number of streams (3 streams) compared to Option 6 (4 streams).
Social	Future land use integration: All options will impact upon the FUZ and the Rural – Countryside Living Zone. Within the FUZ the options can be integrated into the future development scenarios within Redhills North. Within the Rural Countryside Living all options will reduce the size of lots and will create local access issues and sever sites which may impact on future development. All options perform slightly adversely and there is no significant differentiation between the options.
	Social: All options will create severance issues which will impact upon the existing community located either side of the RTC. All options therefore perform slightly adverse and there is no significant differentiation between the options.
	Urban Design: Option 6 is preferred as it is more distant from the Ngongetepara Stream, mirrors the alignment of John Dunstan Drive and has a curvilinear route around Boord Crescent responding to the existing rural character. The route responds to features which contribute to the rural character.
	Land Requirement: All options will impact on properties within FUZ and Rural – Countryside Living Zone to a relatively similar extent. There is no significant differentiation between the options.
	Human Health and wellbeing: All options will introduce an RTC into a rural environment with residential properties. The adverse effects associated with the RTC, such as noise and disturbance, are considered to be similar for all options. All options perform similarly and there is no significant differentiation between the options
Environment	Landscape and Visual: All options will have landscape and visual effects. Options 1 and 6 are preferred as these will have a relatively more limited effect on the landscape and natural features compared to Options 3 and 4, which both have greater adverse impacts. Option 1 is preferred over Option 6 due to the additional landscape and visual effects arising in Option 6 from the extensive fill earthworks located to the east of Joseph Dunstan Drive. However, the differentiation between Options 1 and 6 is not substantial enough to warrant a difference in performance.

Wellbeing Assessment	
	Stormwater: All options will impact upon overland flow paths, streams, and rivers. Option 1 is the preferred option due to crossing over the Kumeū River floodplain at the shortest point and therefore reducing the flood risk and volume of flood plain displaced by the corridor. Options 3, 4 and 6 all perform worse and there is no significant differentiation between these options to warrant a preference.
	Ecology: Option 1 is the preferred option as it will result in an overall lower ecological impact on floodplains, dams, rivers, streams and their associated habitat availability than the alternatives. Option 6 is second in preference due to a greater effect than Option 1 on potential floodplain extent and intercepting several surface waterbodies (some of which are associated with streams) that could serve as potential habitat for birds. Comparatively, Options 3 and 4 are least preferred and will have the greatest impact on ecology due to additional effects on rivers, streams and floodplains. In regard to the National Policy Statement on Freshwater Management 2020 Options 1 and 6 will impact a greater extent of natural wetlands; however, they also avoid those wetland features with higher ecological value that are crossed by Options 3 and 4. Option 1 and then Option 6 therefore remain preferred.
	Natural Hazards: Options 1, 3 and 4 have similar profiles in terms of geo-technical risks, i.e., ground conditions. Option 6 is least preferred due to the route requiring a greater volume of earthworks in the Waitematā Group ridge gully.
Transport	Safety: There will be no boarding or alighting on this segment and the RTC is considered a "safe" public transport mode (by design). All options therefore have similar safety performance.
Economics	Utilities: All options pass-through green fields and so the impact on existing infrastructure for all options will be low and limited to localised impacts on local roading infrastructure, including Transpower's National Grid Yard overlay and Watercare's gravity sewer. There is no differentiation between the options. Construction: All options will give rise to a similar level of construction disruption. All options will pass through challenging terrain with moderate to severe undulating topography and elevation changes. This will result in significant earthworks volume (cut and fill) to construct. Option 3 is preferred as it will have a better balance of cut and fill compared to the other options where they are predominantly in fill deficit. Option 6 is the second preferred option as this option will require fewer bridges, reducing construction costs.

Segment Urban 1A

Table 6-4 shows scoring of options for Segment Urban 1A using the MCA framework, considerations and constraints identified are shown in Figure 6-6. Table 6-5 provides a summary of the assessment undertaken by SMEs.

Table 6-4: RTC MCA Assessment – Segment Urban 1A

Options	Option 1	Option 2	Option 3	Option 5
IO1. Access	4	4	4	4
IO2. Mode Choice	4	4	4	4
IO3. Reliability	3	3	3	4
IO4. Integration	3	2	3	3
Criteria				
Heritage	-1	-2	-1	-2
Land use futures	-1	3	-1	3
Urban Design	-3	3	-3	3
Land Requirement	-2	-3	-2	-3
Social Cohesion	1	-2	1	-2
Human Health and Wellbeing	2	2	2	2
Landscape / Visual	-2	-2	-2	-2
Stormwater	-1	-3	-2	-3
Ecology	-2	-1	-2	-1
Natural Hazard	-1	-1	-1	-1
User Safety	1	1	1	2
Construction impacts on utilities / infrastructure	-2	-1	-2	-1
Construction Disruption	-2	-1	-2	-1
Construction costs / risk / value capture	-3	-2	-2	-2

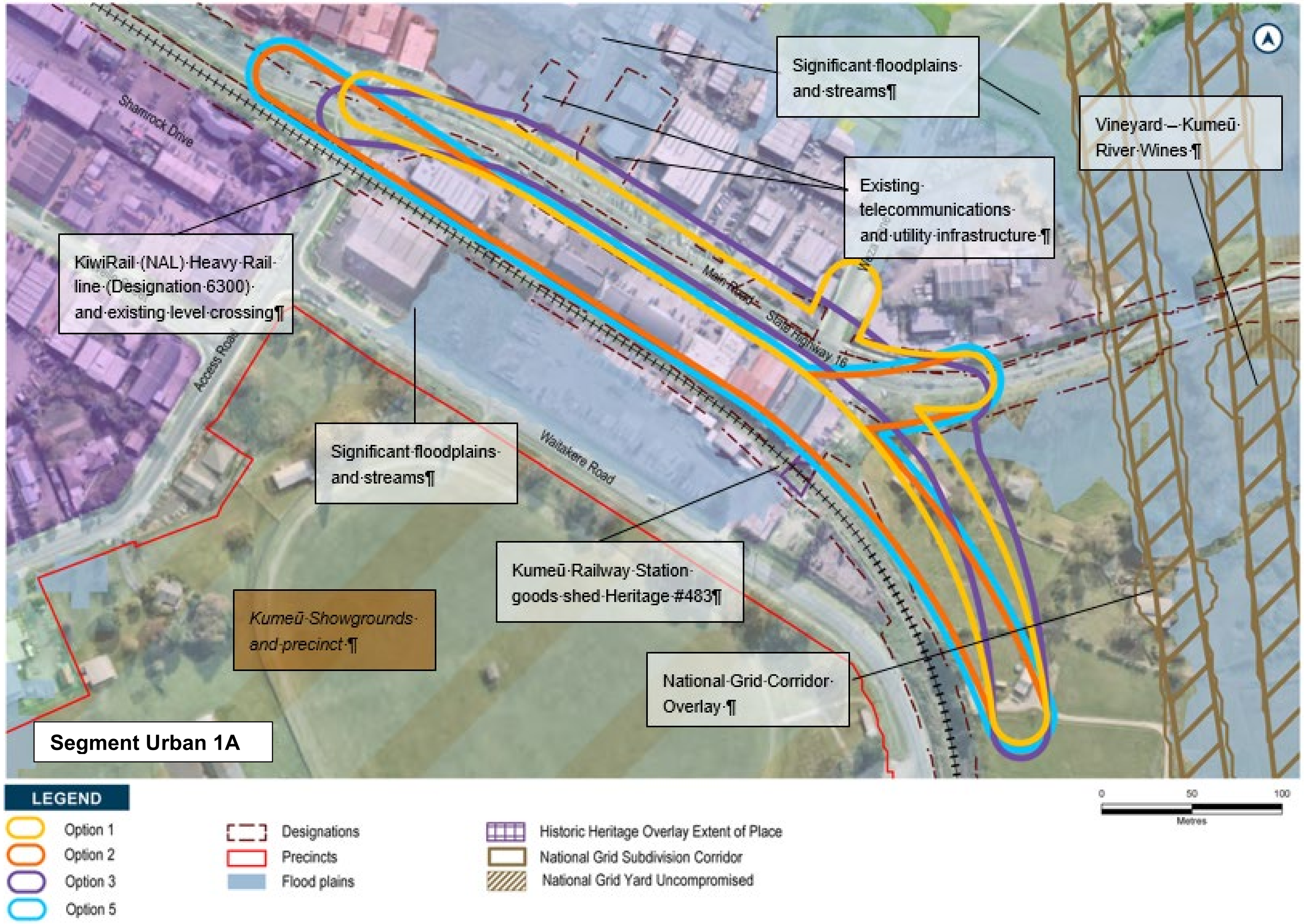


Figure 6-6: RTC Segment Urban 1A Options and identified constraints

Table 6-5: RTC Segment 1A Urban – Options Assessment Findings Summary

Wellbeing Assessment	
Transport Outcomes	All 1A Urban options achieved the transport outcomes sought with no differentiation for Access and Mode Choice performing highly positive. The options differentiated in performance for Reliability and Integration, with Options 1, 2 and 3 having greater intersections interaction with subsequent reduced reliability, Option 5 was the best performing option. For Integration, Options 1, 3 and 5 performed moderately positive. Options 1 and 3 support integration of land on the north and south of the corridor but will reduce direct access on SH16 to left in / left out traffic. Option 5 impacts land on the south but does not restrict access to land on the north. There is no preferred option against this outcome. Option 2 performs somewhat less well as it does not decouple the RTC and SH16 Main Road Upgrade resulting in a less optimal interface with the existing rail level crossings at Access Road.
Cultural	Heritage: Options 1 and 3 will have a limited impact on heritage features located in the Segment. Option 1 has the potential for a minor impact on Kumeū Railway Station goods shed (a heritage overlay in the AUP:OP) and Option 3 on the Masonic Lodge (CHI 16388). Options 2 and 5 will have a greater impact on the goods shed requiring it to be relocated. Option 1 and 3 are slightly preferred.
Social	Future land use integration: Options 1 and 3 both results in relatively minor infringements into adjoining zones and do not undermine their continued use or purpose. Options 2 and 5 both result in the loss of land currently zoned Business – Mixed Use Zone and will impact on land designated by KiwiRail performing more adversely. The KiwiRail land is not currently used for tracks line operation. Option 1 and 3 are preferred.
	Social: Options 1 and 3 largely avoid the shops and employment land use located within the Segment. These options will maintain existing severance issues however as the RTC will hinder crossing the road (subject to the identification of specified crossing points). However, as the severance issues are existing and as shops and employment opportunities can be retained Options 1 and 3 perform positively. Options 2 and 5 will result in the loss of shops and employment opportunities located within the Business – Mixed Use Zone. In addition, these options will impact on the Kumeū Railway Station goods shed which contributes to the character and overall identity of the town (although it is noted that there is the potential to relocate the Shed). Option 1 and 3 are preferred.
	Urban Design: Options 1 and 3 introduce infrastructure of a scale and height (particularly if light metro was the chosen mode as this would likely entail elevated structures), which would have the potential to impact upon the amenity and character of development located on either side of the corridor. Options 2 and 5 are considered better able to support a new quality entrance gateway to Kumeū-Huapai and the options locate RTC infrastructure adjacent to the NAL keeping the area to the north free for redevelopment and reducing severance issues on the existing SH16 corridor. The scale and height impact from the Options would be less significant as the corridor is located away from development on the north. Option 5 is slightly preferred to Option 2 as there is potential to screen the RTC on the south due to the RTC being decoupled from SH16. Option 5 is preferred.

Wellbeing Assessment	
	Land Requirement: Options 1 and 3 make use of the existing road corridor resulting in reduced property impacts and less land needing to be acquired. Options 2 and 5 will have a greater impact on the properties on the south side of the corridor requiring full acquisition.
	Human Health and wellbeing: All options will provide active mode facilities benefiting health and wellbeing. There is a preference for Options 2 and 5 as these have greater potential to mitigate adverse effects due to being less constrained by the existing road corridor.
Environment	Landscape and Visual: The landscape effects will be limited to impacts on a small number of trees along the southern boundary of SH16. Visual effects will be limited to a small number of residential audiences in proximity to the east of the Segment. All perform minor adverse, however there is a preference for Options 2 and 5 due to the alignment being close to the NAL with reduced effects on residential audiences and landscape features compared to Options 1 and 3. If the RTC were elevated through this section it would have a height and form that is out of place at the transition from rural to urban land. This would increase the extent of landscape and visual effects however not to an extent to differentiate between the options.
	Stormwater: Option 1 is the preferred option as it has a moderate flood risk from the Kumeū River. Option 3 has the greatest flood risk from the Kumeū River; however, it has the least flood risk in relation to the NAL and is the least constrained option for providing stormwater infrastructure between the proposed alignment and the NAL. Options 2 and 5 perform slightly worse, due to the proximity of the options to the NAL resulting in greater risk of flooding as they are constrained in providing stormwater infrastructure.
	Ecology: Options 2 and 5 are preferred due to both options being situated further from the Kumeū floodplain, resulting in less ecological impacts on this feature and marginally less fragmentation of ecological features adjacent to the options. Options 1 and 3 are situated closer to the floodplain and both would cross a patch of potential native vegetation south of Main Road.
	Natural Hazards: The geology is the same across all options and the geo-technical risk is low. There is no differentiation.
Transport	Safety: All options will support the shift of people from cars to the RTC which is a safer mode. Options 1, 2 and 3 being coupled with SH16 will result in conflicts between the RTC and other modes at intersections with just minor positive impacts. Option 5 will have reduced interactions with other modes as the RTC will be separate from SH16 for most of the Segment. This results in Option 5 having increased safety and being preferred.
Economics	Utilities: Options 1 and 3 will impact upon utilities and infrastructure located within and adjacent to the existing SH16 corridor. There are risks of interruptions to the continuity of service to properties on both sides of the corridor. The focus of the impacts from Options 2 and 5 will be on the south side of the corridor (noting that some of these properties will be acquired to facilitate construction). Options 2 and 5 extents of impacts will be less and are preferred. Construction: Options 1 and 3 require construction works along both sides of the existing SH16 corridor. Whilst work can be staged to occur on one side at a time it will require active management of pedestrians, cyclists and vehicles to minimise traffic impacts. Construction works will also be disruptive for businesses adjacent to the corridor.

Wellbeing Assessment	
	Options 2 and 5 will largely be constructed offline resulting in less disruption for traffic using SH16. The land requirement will generate the need to acquire or relocate businesses located on the south side of the corridor however impacts on remaining businesses will be limited, Option 2 and 5 perform better for disruption. In terms of risk, Options 2 and 5 have a slightly higher risk profile due to proximity to the NAL, which would require additional controls to be put in place. Option 1 has additional costs associated with maintaining construction areas on both sides of the existing SH16 corridor and as the option will likely require multiple stages to maintain existing traffic flows.

Segment 2A Urban

Table 6-6 sets out the MCA scoring for the segment, considerations and constraints identified are shown in Figure 6-7. Table 6-3 provides a summary of the assessment undertaken by SMEs using the MCA framework.

Table 6-6: RTC MCA scoring Segment 2A Urban

Options	Option 1	Option 2	Option 3	Option 5
IO1. Access	4	4	4	4
IO2. Mode Choice	4	4	4	4
IO3. Reliability	3	3	3	4
IO4. Integration	3	3	3	3
Criteria				
Heritage	-1	-2	0	-3
Land use futures	-2	-2	-2	-3
Urban Design	-3	-3	-3	5
Land Requirement	-2	-3	-2	-4
Social Cohesion	-3	-3	-3	-3
Human Health and Wellbeing	2	2	2	2
Landscape / Visual	-2	-2	-3	-2
Stormwater	-2	-2	-1	-2
Ecology	-2	-2	-2	-2
Natural Hazard	-1	-1	-1	-2
User Safety	1	1	1	2
Construction impacts on utilities / infrastructure	-2	-2	-2	-1
Construction Disruption	-2	-2	-2	-1
Construction costs / risk / value capture	-3	-2	-2	-2

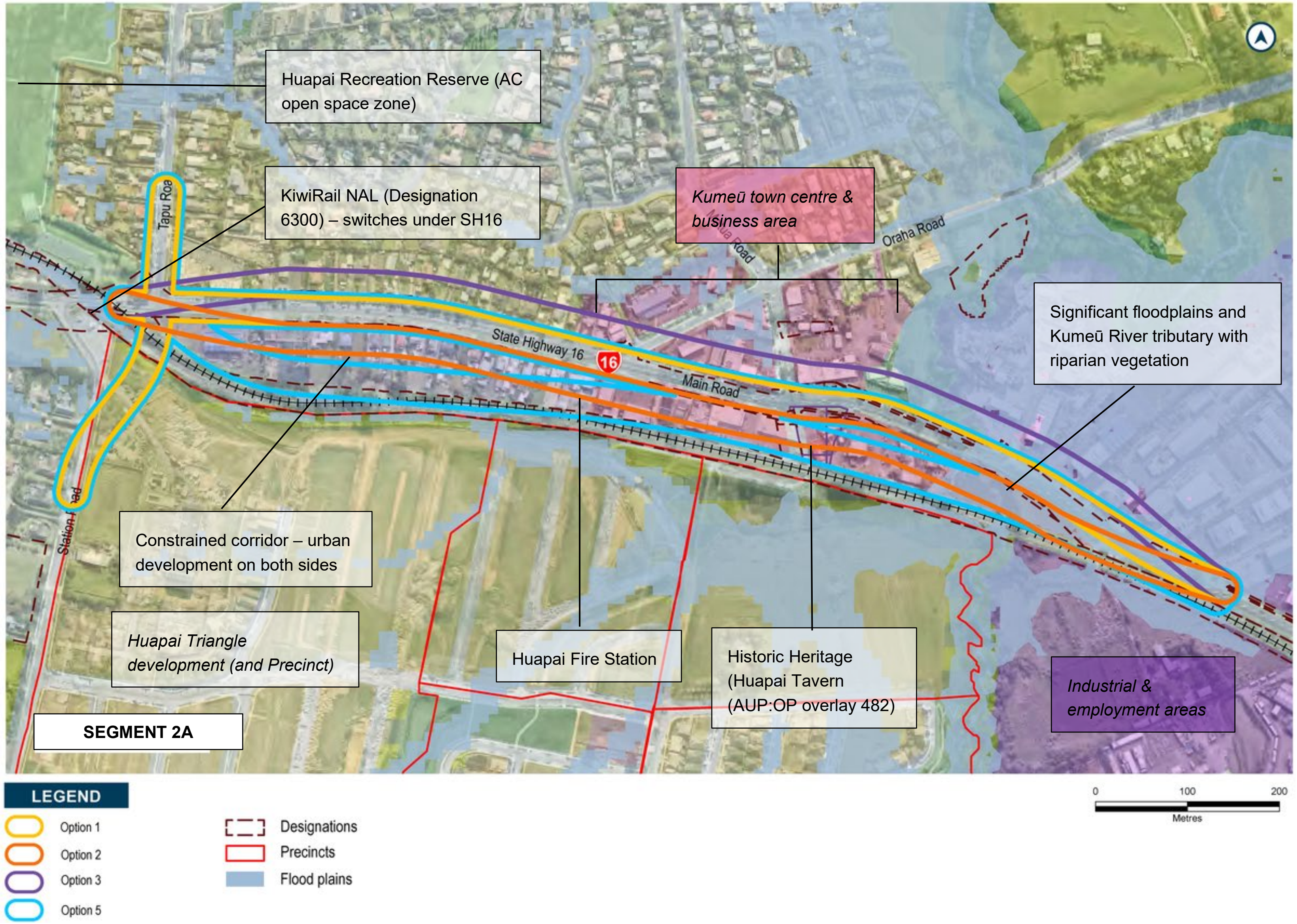


Figure 6-7: RTC Urban 2A Options and identified constraints

Table 6-7: RTC Segment 2A Urban – Option Assessment Findings Summary

Wellbeing Assessment	
Transport Outcomes	All Urban 2A options performed highly positive against Access and Mode Choice. Options 1, 2 and 3 performed positively for 'Reliability' however had greater interaction with intersections reducing reliability, Option 5 performed best. Options 1, 2 and 3 performed well on 'Integration' however reduced access for properties north which access SH16 via an existing service lane. Option 5 did not impact this lane and therefore performed better. Option 5 was preferred.
Cultural	Heritage: Option 3 widens to the north and avoids the heritage features located within the Segment and is the preferred option. Options 1 and 2 impact upon the setting of the heritage features, which are the Railway Carriages (CHI18493) and Huapai Tavern (scheduled AUP:OP 482). Option 2 has greater potential for direct impact on the features. Option 5 will directly impact these features, however there is opportunity to relocate and / or adapt the features to fit within the existing site. Option 3 is preferred option.
Social	Future land use integration: Option 5 will result in the loss of land to the south of the existing SH16 corridor for the de-coupled RTC. This will reduce the development potential of the land along the NAL which is zoned for Business – Mixed Use Zone and Business – Town Centre Zone. The remaining land within the Town Centre Zone will be relatively shallow; however, remains developable and will have better access to the north side of Kumeū-Huapai and a future RTC Station (compared to Options 1, 2 and 3) which will enhance its developability. Options 1, 2 and 3 will infringe upon land which is zoned for Residential – Mixed Housing Suburban Zone, Business – Town Centre Zone and Open Space – Informal Recreation Zone along the length of the segment. Vehicular access to these sites may be constrained at points to 'Left in / Left out' manoeuvring due to locating the RTC within the road corridor. Despite the options impacting the business and residential land and access constraints, the land along the corridor will remain developable. Options 1 and 3 are preferred.
	Social: Options 1, 2 and 3 will introduce an RTC into the existing SH16 corridor which would exacerbate existing severance issues created by SH16. These options also constrain connectivity between the north and south of Kumeū-Huapai to fixed crossing points. These options will have a similar impact on shops and employment opportunities with some properties requiring redevelopment. Open space around the Kumeū River will be impacted but not to a significant extent and the Kumeū Fire station will be avoided but Options 1 and 2 will impact upon the frontage. Option 5 will address the severance issues by decoupling the RTC and upgrading the existing SH16 corridor and will support improved connectivity between north and south Kumeū-Huapai. This option will however result in loss of shops and employment opportunities, the fire station and the Huapai Tavern. Considered in the context of Kumeū-Huapai being likely to redevelop following the introduction of the RTC and the development of the FUZ (which will facilitate provision of shops, employment opportunities and community facilities), Option 5 is preferred.

Wellbeing Assessment	
	Urban Design: Options 1, 2 and 3 introduce the RTC into the existing SH16 corridor adjacent to existing residential, business and town centre areas, where the RTC has the potential to introduce infrastructure of a scale and height that would impact upon the amenity and character of development. Option 5 decouples the RTC from the existing SH16 allowing for a better interface between an upgraded SH16 and surrounding urban area. RTC infrastructure would be positioned away from publicly visible areas reducing its impact on amenity and supporting the enhancement of Kumeū-Huapai. Option 5 is therefore preferred.
	Land Requirement: Options 1, 2 and 3 result in full and / or partial acquisitions. Option 5 de-coupling the RTC results in property impacts on all properties along the NAL. Given the depth of some plots not all may require full property acquisition. Option 5 has potential to minimise impact along the front of the existing SH16 corridor if works can be contained within the alignment. Option 1 and 3 are preferred.
	Human Health and Wellbeing: All options will introduce an RTC into an urban environment in proximity to a mix of residential and commercial uses. The adverse effects associated with the RTC, e.g., noise and disturbance, are considered to be similar for all options. All options will provide active mode facilities benefiting health and wellbeing. Option 5 is preferred as the RTC being de-coupled from SH16 results in greater potential to address operational effects on surrounding land.
Environment	Landscape and Visual: Options 1, 2 and 3 will result in a loss of vegetation to the Open Space around the Kumeū River and will also create adverse visual effects for residential properties along the corridor. The extent of visual effects for Options 1 and 2 are lower. Option 3 due to its proximity to residential properties on the north side of the corridor has less opportunity to mitigate effects through landscaping. Option 5 will result in adverse landscape effects on the Kumeū River and pond area (noting the pond is an artificial feature) and on the mature trees along the NAL. Option 5 will minimise the viewing audience as the land to the north of the RTC is zoned for Business and properties to the south will be afforded visual protection by the Green Infrastructure Corridor zone.
	Stormwater: Option 3 will have the least impact on the flood attenuation pond adjacent to the Kumeū River and has the least risk for the NAL. Options 1 and 2 have greater impacts on the pond and raise the risk of flooding. Option 5 will require alternative methods of attenuation or for the artificial pond to be bridged. The effects of Option 5 have the potential to decrease or increase depending on how the land between the RTC and SH16 is developed. If the land is developed increased drainage will be required.
	Ecology: Options 1, 2 and 3 will impact on the riparian features at the Kumeū River and Main Road crossing and result in a similar level of instream and riparian fragmentation. Option 5 will have a lower impact on mature vegetation within the riparian zone of the Kumeū River; however, the option will fragment features to the south of SH16. Overall level of effect is similar for all options, however there is a slight preference for Option 2 as this will have the least impact on mature vegetation.
	Natural Hazards: The geology is much the same across all options. The slopes are gentle for Options 1, 2 and 3. Option 5 crosses the Kumeū River and pond and is adjacent to the railway embankment where slopes are less gentle. Option 5 has an increased risk of instability and requirement for retaining walls.

Wellbeing Assessment	
Transport	Safety: All options will support the shift of people from cars to the RTC which is a safer mode. Options 1, 2 and 3 will result in conflicts between the RTC and other modes at intersections. Option 5 will have reduced interactions as the RTC will be decoupled from SH16 for most of the Segment, resulting in Option 5 having increased safety benefits.
Economic	Utilities: Options 1, 2 and 3 will impact upon utilities and infrastructure located within and adjacent to the existing SH16 corridor. The risks of interruptions to the continuity of service will be to properties on both sides of the corridor. Impacts from Option 5 will be focussed on the land along the north side of the NAL (noting that some of these properties will need to be acquired to facilitate construction). The extent of impacts will be lessened as some works can be undertaken offline. Construction: Options 1, 2 and 3 require construction works along the existing SH16 corridor which will require active management of pedestrians, cyclists and vehicles to minimise traffic impacts. Construction works will also be disruptive for the Kumeū Fire station, businesses and residential properties adjacent to the corridor. Option 5 will largely be constructed offline resulting in less disruption for traffic using SH16. Options 1, 2 and 3 will require temporary pavements, staged work areas and tie ins with adjacent roads. Options 2 and 3 will result in widening largely on one side of the road, which is efficient for construction, whereas Option 1 will widen on both sides of the road which is less efficient. Option 5 is largely offline which is preferred, however will require bridging over the Kumeū River.

6.5.2 Refinement through engagement

The RTC alignment was consulted on at a high level at IBC, key feedback received was:

- Public feedback indicated a strong desire for immediate improvement to the North West public transport services, particularly for Kumeū-Huapai and Riverhead. Concerns were raised whether the RTC would meet community efficiency and frequency needs, as well as time and cost of implementation
- Overall, public and stakeholders supported an RTC with integration of walking and cycling. The Kumeū-Huapai Residents and Ratepayers Association also supported a ‘Park and Ride’ facility along the corridor
- Both Local Boards emphasised the need to prioritise public transport in the North West. Rodney Local Board remained neutral to mode with slight preference for a ‘mass transit system’; the Henderson Massey Local Board preferred light rail.

Post MCA and Constraint Mapping

Following the constraint mapping exercise (see Section 6.4), the initial decision in Segment Urban 3A was to locate the RTC south of the NAL and co-locate it with SH16 Main Road upgrades (see Section 9). Feedback was received from Waka Kotahi that this alignment would not enable RTC grade separation from other corridors (both the NAL and Station Road). Whilst a bus based rapid transit corridor does not have a functional need for grade separation from other corridors, and could have priority at an at-grade intersection with Station Road, this would result in additional delay and safety conflicts with the local road network. Grade separating the RTC at this location therefore benefits both the RTC (enables it to continue uninterrupted), as well as local transport movements for both active modes and local bus services.

As Option 1 was determined to not achieve the transport outcomes the decision was made to discount Option 1 and consider alternatives. This assessment was undertaken by the Project Team and supported by SMEs.

3A Urban: Station Road to Matua Road options

Option 2	A refined version of the Option 1, Option 2 incorporates a 3-tiered grade separation of Station Road, the NAL and the RTC
Option 3	Crosses north of SH16 and extends across Huapai Recreation Reserve before crossing to south of the NAL and SH16
Option 4	Crosses north of SH16 and extends across Huapai Recreation Reserve before returning south of the NAL. (The return south is further west than Option 3)
Option 5:	RTC running north adjacent to the NAL (SH16 Main Road upgrade along existing SH16) (38m wide cross section))

Figure 6-8 shows the options against identified constraints. The options were assessed against their ability to achieve the transport outcomes identified and key MCA criteria. Options were not scored, but preferences are noted as applicable.

Table 6-8 provides a summary of the assessment findings against the Transport Outcomes and key differentiating criteria.

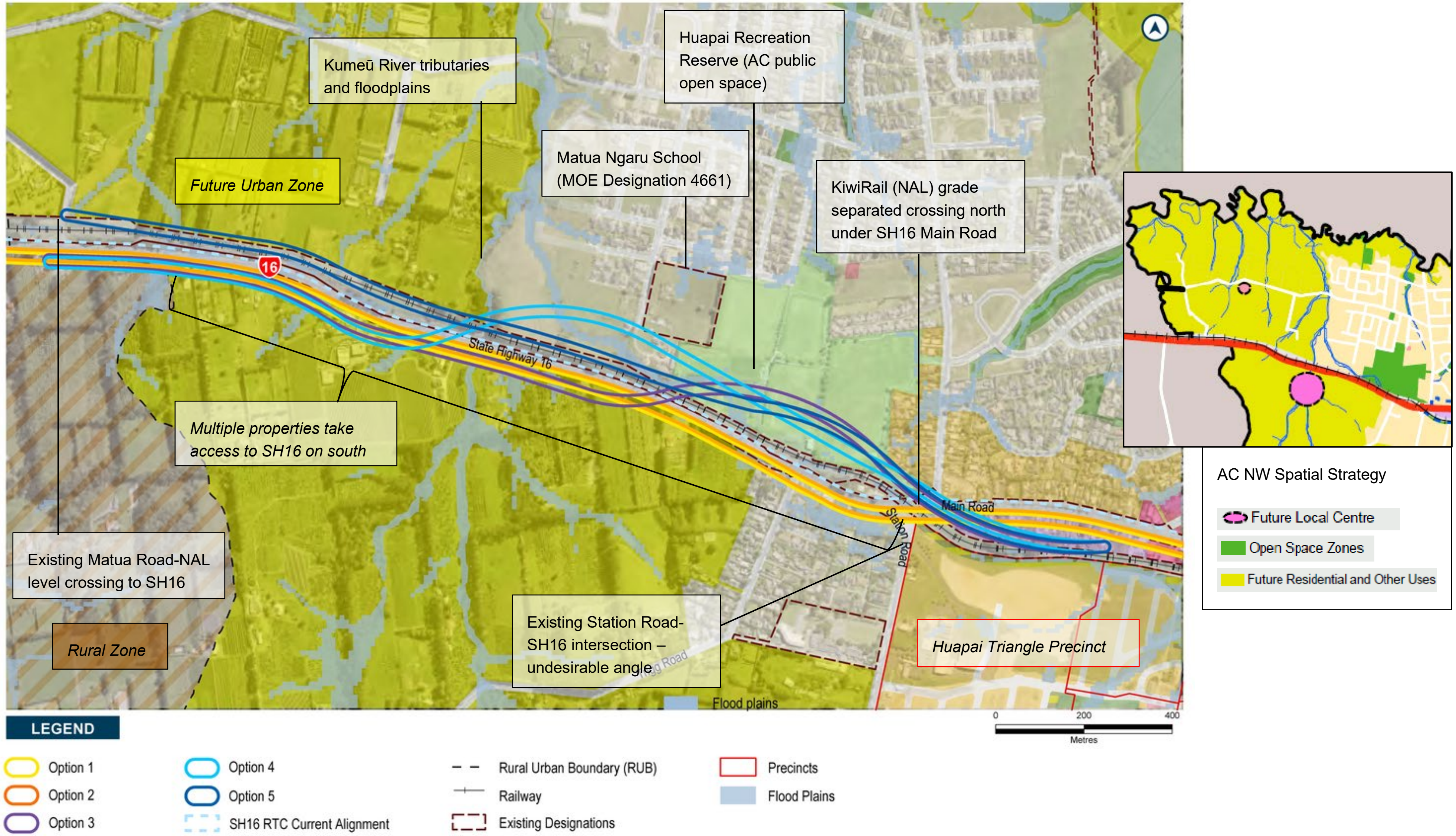


Figure 6-8: Segment 3A Urban Options and identified constraints

The options were assessed against their ability to achieve the transport outcomes identified and key MCA criteria. Options were not scored, but preferences are noted as applicable.

Table 6-8: RTC Segment 3A Assessment

Transport Outcomes	*Access*: All options will support provision of effective and attractive public transport *Mode choice*: All options enable a transformational mode shift through provision of public transport infrastructure and will connect to eastern options in Urban 2A. *Reliability*: Grade separated options 2, 3 4 and 5 perform higher on this criterion than Option 1 (discounted) which interacts with traffic on Station Road, SH16 and the heavy rail line. *Integration*: Options 2, 3 and 4 which run south along SH16 performed poorly for integration, as these options would require either the RTC running along the front of properties restricting access or a shift in SH16 alignment south to accommodate the RTC between SH16 and the NAL, impacting the properties frontage and introducing additional severance. Option 5 performs better as properties on north do not rely on access to SH16.
Cultural	Heritage: There are no recorded heritage items along this section of the corridor, there are a few streams with potential for accidental discoveries for all options. No differentiation between options.
Social	Future Land use Integration: Option 2 crossings scale and alignment south of SH16 would not support land use integration with the surrounding zones. Option 2 geometry also requires the RTC to be positioned to the south of SH16, this would result in a loss of highway frontage for future development within the FUZ and require alternative local access. Options 3 and 4 would require either the RTC running along the front of properties restricting access or a shift in SH16 alignment south to accommodate the RTC between SH16 and the NAL, impacting the frontage of the properties and introducing further severance. Option 5 impacted properties do not rely on access south and had more capacity to integrate. The FUZ means greater potential for future development to take account of the RTC. Social: Option 3 has largest extent of footprint on Huapai Recreation Reserve with associated high adverse social impacts. Option 4 also had extensive footprint in the reserve in addition to impacts on the Matua Ngaru local school under MOE designation 4661. Options 2 did not impact the reserve or school and performed better. Option 5 intrudes further into the reserve than Option 2, but also avoids impacts at the school and is less intrusive than Option 3 and 4. Urban Design: Options 2 resulted in a loss of highway frontage for future development within the FUZ (a poor urban design outcome) and infrastructure out of scale with residential land use at Station Road. Option 3 and 4 also introduce grade separated crossings over the NAL and SH16 which impact viewers at Huapai Recreation Reserve, and residential areas. Option 3 second crossing to return to the south of the NAL is a poor urban design outcome, as it results in a 'barrier' on the SH16. Option 5 performed higher on urban design as its alignment alongside the NAL reduces viewing impact and it avoids grade separated bridges by passing under Station Road alongside the NAL. Option 5 is preferred. Land Requirement: Option 2 would require the acquisition of frontages along the front of SH16 and potentially several full acquisitions in order to provide road access to sites that had relied on SH16.There is no alternative to Sh16 for these sites. Option 3 and 4 have less private land requirements but intrude further into Huapai recreation Reserve and Matua Ngaru school.

	Greater sections of Option 5 hug the NAL designation and has less full property requirements. Impacts are generally partials impacts on property. Human Health and Safety: All options can be designed to be safe. All options will introduce additional noise closer to residential areas. Options 3, 4 and 5 impact on the Huapai Recreation reserve and therefore potential adverse impacts on community health and wellbeing. Options which intrude less into the park and school have reduced impact (such as Option 2 and 5).
Environment	Landscape and visual: Option 2 grade separation over NAL and Station Road would result in scale of infrastructure out of keeping with the existing environment and the urban design outcomes anticipated in the future environment. Stormwater: Option 3, 4 and 5 impact a park pond which would need to be potentially relocated or treatment replaced. Ecology: All options will impact upon streams and mature trees, Options 2 along the SH16 Main Road and Option 3, 4 and 5 at the entrance to Huapai Recreation reserve will impact mature trees along the park entrance road. Option 5 and 4 also cross a tributary of the Kumeū River at the FUZ and associated riparian vegetation, however, the level of effects are considered to be able to be mitigated. Natural Hazards: All options have similar geo-technical risks
Economics	Utilities: Options that affect SH16 will have greater potential for service disruptions to utilities (Options 2, 3 and 4). Construction: All options would have impacts at the Station Road, Tapu Road and SH16 intersection, with associated traffic management and construction disruption. Options with second bridges and grade separation would involve greater costs. Option 5 is the only option without bridging structures as it goes under SH16 adjacent the NAL, the works could largely be undertaken offline from SH16 with reduced disruption and traffic management.

Following the assessment, the preferred alignment was identified as Option 5.

6.5.2.1 Engagement outcomes

The Project Team engaged with Partners and the community on the options; the main outcomes were:

- Reaching agreement with the preferred Option 6 in Segment Rural 1A and in Segments Urban 1A and Urban 2A the preferred of Option 5
- Waka Kotahi feedback on the residual land potential between SH16 Main Road and the proposed RTC and whether it was developable. The Project Team had tested the area of land between the two corridors and identified that key lots although shallower, would remain developable. The team confirmed this with Partners.

Auckland Council

Proposed an alternative alignment in Urban 3A that diverted the RTC through an expanded Kumeū-Huapai town centre (as shown in the NW Spatial Strategy). The intent of the alternative alignment was to use a station as a catalyst for the town centre growth. The Project Team considered this alternative however it was discounted as it would:

- Generate severance within the NW Spatial Strategy town centre proposed

- Create a detour off SH16 Main Road reducing catchment to the south
- Increase property requirements, reducing the land available for the proposed town centre.

Urban 3A Option 5 was discussed with Council as the NW Spatial Strategy for the North West identifies a future local centre on the south side of SH16. The centre's southern location was not considered to warrant locating the RTC south of the NAL as the future station on the norths walkable catchment could cover the north and south. This catchment would require a north south connection to the station which would be provided for connectivity purposes, regardless of the side the station located.

KiwiRail

Any relocation of the NAL is outside the NW Strategic Package scope, however, as an opportunity it was discussed with KiwiRail. KiwiRail confirmed there are no plans to relocate the NAL from its existing alignment and it was not a strategic priority. The impacts of preferred Options on the NAL were discussed and KiwiRail confirmed that there was no in principle objection to proposed additional crossings of the NAL at localised points (note: proposed as grade separated crossings).

Public and Landowners

The RTC was consulted on between November and March 2021 and further feedback was received in support of using the existing heavy rail line (NAL) for the RTC. Alignments based on heavy rail and / or using the NAL had been considered thoroughly and previously discounted at both short list (see Section 3.2) and gap analysis (see Section 6.2). The use of heavy rail was therefore not considered further.

6.5.3 Preferred option

Following the MCA assessment and consideration of feedback received from Partners and community, a preferred option for the RTC was identified. The preferred option varied in each Segment, enabling an alignment that reduces impacts on sensitive features along the corridor.

In Segment Rural 1A the preferred is Option 6 because:

- It will have less impacts on potential archaeological sites adjacent to streams and potential heritage and archaeological sites around Brigham Creek than other options
- Although Option 6 crosses a greater extent of natural wetlands (south of Boord Crescent) it avoids the wetlands and ecological features with higher ecological value and will have less ecological impacts than all except Option 1
- Require fewer bridges than Options 1 and 4, resulting in comparatively reduced construction costs
- Has more limited effects on the landscape and natural features
- Responds to the existing character of the area including the curvilinear alignment around Boord Crescent.

In Segment Urban 1A the preferred is Option 5 because:

- While it has a higher land requirement; it facilitates better urban design and land use outcomes, such as the creation of a gateway entrance to Kumeū-Huapai
- It best addresses the severance issues with the existing SH16 and will not restrict access to left in / left out for land development on the northern side of the corridor

- Involves offline construction, which will minimise construction impacts and maintain accessibility for traffic using SH16
- It performs better against ‘Reliability’ Outcome and ‘User Safety’ criterion, due to less interaction with other transport modes at intersections
- Feasible engineering solutions are available to provide appropriate stormwater infrastructure to avoid or mitigate flood risks.

In Segment Urban 2A the preferred is Option 5 because it:

- Best addresses the existing severance issues with the SH16 corridor and avoids exacerbating severance or increasing transport infrastructure dominance by decoupling the RTC from the SH16
- Although it has higher land requirements and results in the loss of some developable land; the residual land remains developable and is accessible to the north side of SH16
- Will facilitate better urban design outcomes, including the interface between SH16 and adjacent urban areas by avoiding infrastructure out of scale and character being positioned on the existing SH16
- Involves offline construction, which will minimise construction impacts and maintain accessibility for SH16 users
- Performs better against ‘Reliability’ Outcome and the ‘User Safety’ criterion due to less interaction with other modes at intersections.

In Segment Urban 3A the preferred is Option 5 because it:

- Provides for grade separation under Station Road, parallel to the NAL
- Has less intrusion into the Huapai Recreation Reserve compared to Options 3 and 4 as the curves north are less. There is also less impact on Matua Ngaru School compared to Option 4
- Does not require large additional infrastructure to re-cross NAL and SH16 Main Road which would be a poor urban design outcome due to the scale of infrastructure required to support crossing
- Retains frontage and access for land within the FUZ south of SH16 and limits access impacts on the north by locating adjacent to the NAL.

There will be further opportunities to minimise impacts during detailed design as a result, no further design refinement is required at this stage.

6.5.4 Discounted options

Table 6-9 summarises reasons for discounting individual options along each segment.

Table 6-9: RTC discounted options

Option	Reason for discounting
Segment Rural 1A	
Option 1	• Increased archaeological and heritage impacts due to proximity to Brigham Creek and the number of stream crossings • Increased construction costs associated with the number of bridges required along the alignment • Does not align with the preferred option for BCI.

Option	Reason for discounting
Option 3	• Increased archaeological and heritage impacts due to proximity to Brigham Creek and the number of stream crossings • Greater ecological effects on wetlands and ecological features with higher ecological value • Increased landscape effects, particularly in western section of the option • Less responsive to the existing rural character.
Option 4	• Greater ecological effects on wetlands and features with high ecological value • Increased construction costs associated with the number of bridges required along the alignment • Less responsive to the existing rural character.
Segment Urban 1A	
Option 1	• Does not perform as positively against the Reliability and Integration Investment Objectives • Would potentially introduce infrastructure of a scale and height that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) • Does not support the creation of a gateway to Kumeū • Ecological impacts due to proximity to Kumeū floodplain.
Option 2	• Does not perform as positively against the Reliability and Integration Investment Objectives • Less opportunities for landscaping as part of a gateway to Kumeū.
Option 3	• Does not perform as positively against the Reliability and Integration Investment Objectives • Would introduce infrastructure that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) • Does not support the creation of a gateway to Kumeū • Ecological impacts due to proximity to Kumeū floodplain.
Segment Urban 2A	
Option 1	• Does not perform as positively against the Reliability and Integration Outcomes • Would potentially introduce infrastructure of a scale and height that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) and would result in visual effects on residents • Would maintain severance issues with the RTC impeding access across the corridor from north to south Kumeū-Huapai • Would involve construction disruption and impacts on utilities as RTC would be constructed within the existing SH16 corridor.
Option 2	• Does not perform as positively against the Reliability and Integration Investment Objectives • Would potentially introduce infrastructure of a scale and height that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) and would result in visual effects on residents • Would maintain severance issues with the RTC impeding access across the corridor from north to south Kumeū Huapai • Would involve construction disruption and impacts on utilities as RTC would be constructed within the existing SH16 corridor.
Option 3	• Does not perform as positively against the Reliability and Integration Investment Objectives • Would potentially introduce infrastructure of a scale and height that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) and would result in visual effects on residents

Option	Reason for discounting
	• Would maintain severance issues with the RTC impeding access across the corridor from north to south Kumeū Huapai • Highest construction disruption as least efficient option and impacts on utilities as RTC constructed within the existing SH16 corridor.
Segment Urban 3A	
Option 1	• Alignment is not grade separated and so does not enable the RTC to satisfy the Transport Outcomes identified • Option results in loss of frontage and access for future development along SH16 (a poor urban design and integration outcome).
Option 2	• Grade separation would require significant infrastructure scale out of character for the area and a poor urban design outcome • Results in loss of frontage and access along SH16 for future development (a poor design and landuse integration outcome).
Option 3	• Second bridge crossing is required to return to the south of the NAL is a poor urban design outcome, i.e., the crossing results in a ‘barrier’ on the SH16.
Option 4	• Has impacts on Matua Ngaru School and extends further into the Huapai Recreation Reserve.

6.6 S3: Rapid Transit Corridor summary

As outlined through the assessment process and feedback from Project Partners and landowners, the preferred option for the RTC in rural areas is:

- Rural 1A preferred is Option 6
- Rural 2A is to align the RTC on the eastern side of the NAL.

In the urban areas is:

- Urban 1A preferred is Option 5 which decouples the RTC from SH16
- Urban 2A preferred is Option 5 which decouples the RTC from SH16
- Urban 3A preferred is Option 5, where the RTC goes under Station Road and follows the NAL.

7 Rapid Transit Corridor Stations

7.1 Overview

Exact station locations were not identified at the IBC stage as they were dependent on the preferred RTC alignment being identified (see Section 6). The rapid transit alignment is recommended to follow SH16 Main Road with catchment analysis showing options through the existing Kumeū-Huapai centre have the highest ridership potential by providing access to existing development north of SH16, the existing centre (and associated employment) and future development south of SH16 in the FUZ.

Station locations outside the urban area were considered but ultimately discounted, as their rural catchment may result in pressuring unplanned urbanisation outside the RUB. This resulted in a station study area along the RTC within the Kumeū-Huapai RUB, see Figure 7-1.

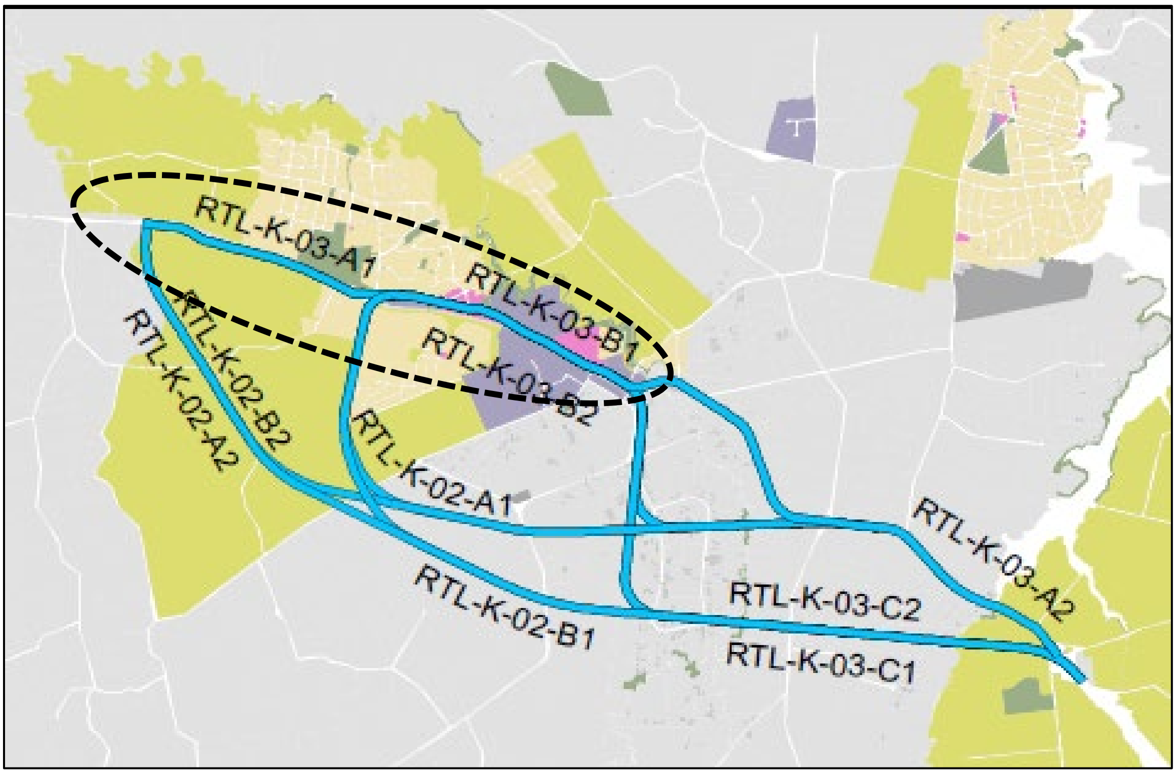


Figure 7-1: Rapid transit stations study area, alongside preferred RTC alignment

Station locations should seek to maximise access to key destinations as well as promote good land use integration and urban development. This may include direct access to a new local centre west of Station Road. Park-and-ride facilities are required to complement the rapid transit network and AT principles identifying those new facilities are at the public transport network periphery, to avoid additional car travel congestion. Park-and-ride is most effective on the urban periphery in areas with few access alternatives.

As Kumeū-Huapai has not been structure planned yet, there is some uncertainty of future land use. To address this AC prepared the NW Spatial Strategy, which sets out indicative commercial and town centre land use locations, which helped inform rapid transit station locations.

7.2 Gap Analysis

Following endorsement of the indicative network by AT and Waka Kotahi, a gap analysis was undertaken to confirm the recommendations. This included a review of the IBC recommendation to locate stations within the Kumeū-Huapai growth area.

Initial locations were developed on future land use and active mode catchments. Catchments were sized at 1km walk and 3km cycle (from the station centre outwards) and located along the recommended RTC alignment. The indicative potential station shown at Brigham Creek is separate (non-Te Tupu Ngātahi) and provides network context only.

This analysis identified two to three stations could suitably service the area, see Figure 7-2 for a two-station scenario and Figure 7-3 for three station scenario.

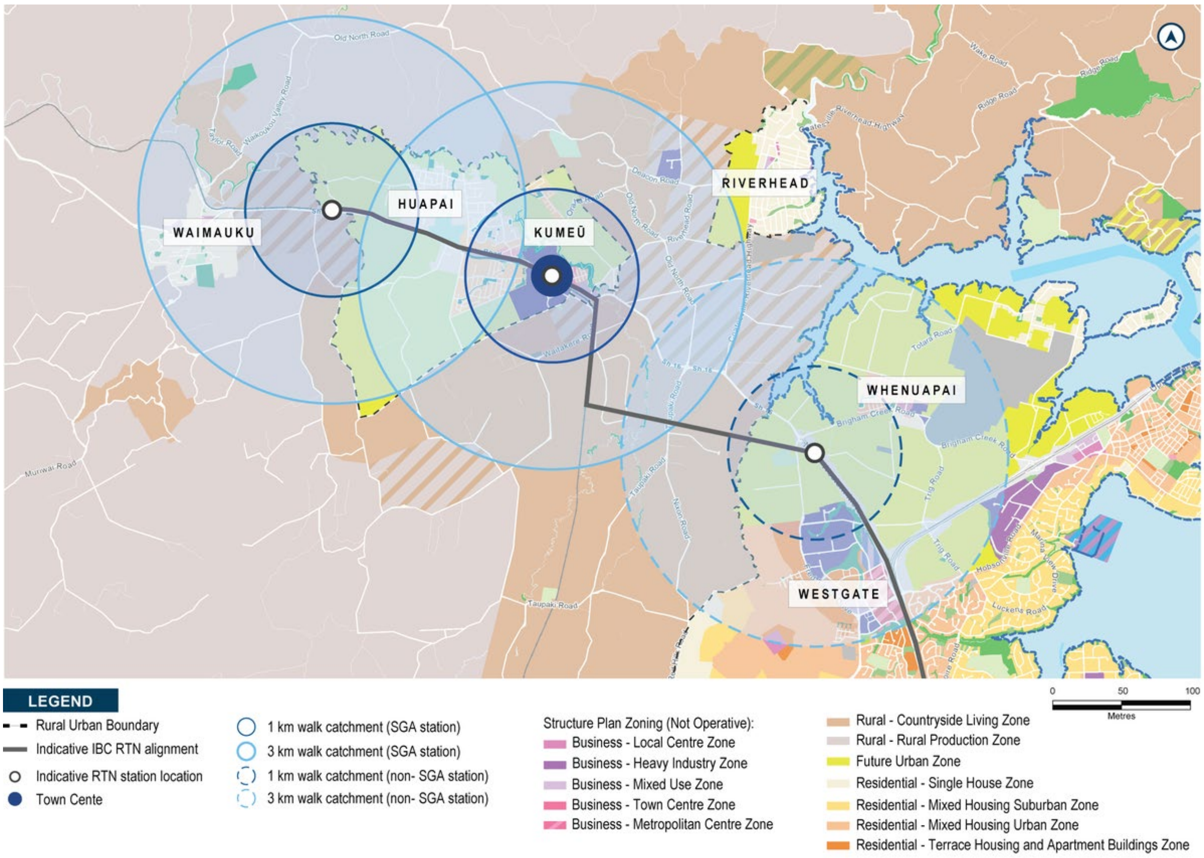


Figure 7-2: Indicative active modes and walk catchment (Two Station Scenario)

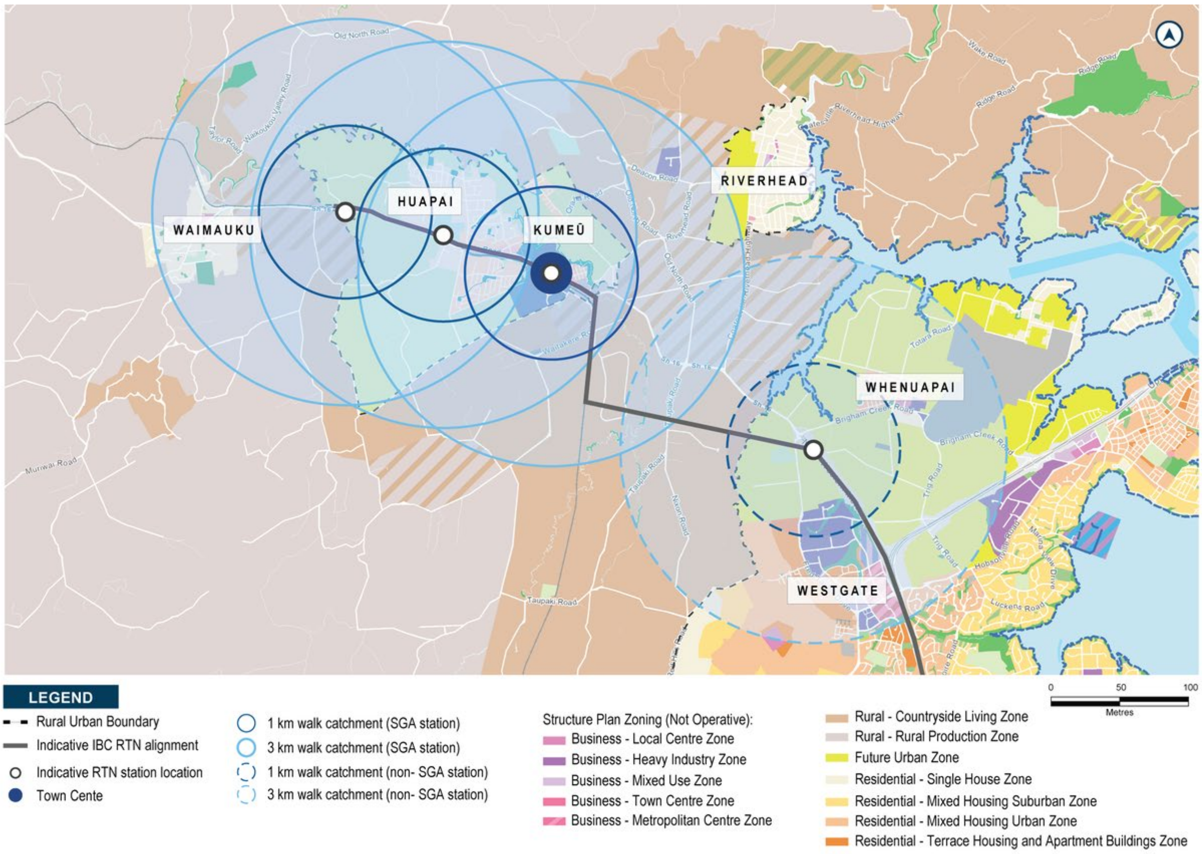


Figure 7-3: Indicative active mode and walk catchment (Three Station Scenario)

Early consideration was given to an intermediate station at Taupaki Road, however, was ultimately discounted because it would service Rural-Countryside Living Zone not planned FUZ and could generate re-zoning pressure. Additional RTC stops would also reduce the network speed and efficiency. The Riverhead FUZ was considered to be adequately serviced by bus to Brigham Creek and Westgate.

The catchment exercise re-confirmed the indicative stations at SH16 Main Road provided a comprehensive opportunity to support the Kumeū-Huapai growth area. The alignment also has opportunity to tie into Kumeū-Huapai town centres identified in the NW Spatial Strategy.

Gap analysis confirmed that:

- Station locations would be located within the Kumeū-Huapai RUB, along the RTC alignment, generating a study area approximately between Access Road and Foster Road. No stations would be provided outside the RUB
- The NW Spatial Strategy provides suitable land use certainty to inform station location options
- Additional assessment to confirm the number of stations (two or three) was required before proceeding to option refinement, see Section 7.2.1.1.

7.2.1.1 Numbers of stations required

Four potential station locations were considered, see Figure 7-4, these were developed using the draft NW Spatial Strategy landuse scenario.

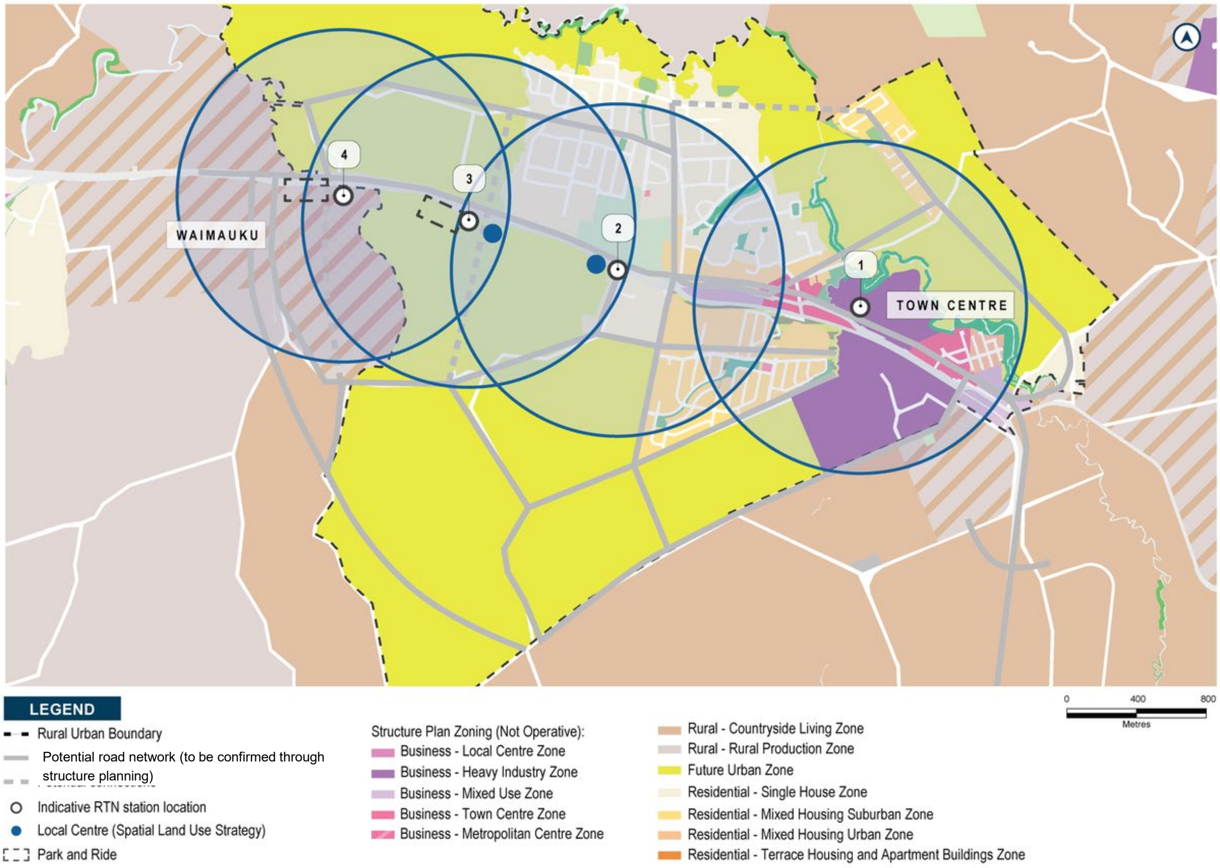


Figure 7-4: Potential station location options

The four initial locations identified were:

Location 1: Aligns with the NW Spatial Strategy future town centre, has opportunity to support north east Kumeū-Huapai, including current and future employment at Access Road

Location 2 A mid-way option within Kumeū-Huapai and an opportunity to support existing residential use and southern FUZ

Location 3 Supports north and south FUZ and opportunity to co-locate with Local Centre identified in the NW Spatial Strategy

Location 4 Supports north and south FUZ at the western edge and opportunity to locate terminating station with park-and-ride at RUB

Location 1 was considered an appropriate station location, as it met the Te Tupu Ngātahi Design Framework station principles and Transport Outcomes. As such, further assessment focused on Locations 2, 3 and 4. The performance of each location was considered individually and as a network (in context of Location 1).

Location 2 was discounted early as a terminating station, as the centre of existing urban area was not considered appropriate and the proximity to Huapai Recreation Reserve reduced the catchment potential. Location 4 was similarly discounted as a station located on the RUB meant a significant portion of catchment was rural with reduced development potential and may pressure urban expansion. Location 4 also provided no ability to integrate with the future local centre.

As a result, Location 3 was progressed as a recommended option, along with Location 1. This provided two station locations for Kumeū-Huapai which had a similar patronage level as three station scenarios (see Figure 7-2).

7.3 Station form and function assessment

An assessment was undertaken for the RTC stations form and function. As they are site specific and not corridors, they did not follow the CFAF methodology in Section 4.3. Stations were based on the AT Transport Design Manual Type 2 station which is a '*staffed rural suburban or urban station*' which includes facilities to connect to local public transport services and active modes. Based on the AT Transport Design Manual Type 2 requirements and assessment of similar new stations (in particular Drury Central and Paerata southern rail stations), the location indicative footprints are:

<u>Town Centre (Kumeū) Station</u>

Approximately 1.5 hectares for station facilities, including:

- Station building and platforms
- Transport access facilities, for active modes, public transport (bus feeder services) and pick-up and drop-off by car
- Active modes bridges crossing over RTC and NAL.

<u>End of line (Huapai) Station</u>

Approximately 1.5 hectares for station facilities, including:

- Station building and platforms
- Transport access facilities for active modes, public transport (bus feeder services) and pick-up and drop-off by car
- Station 'End of line' facilities to provide layover for RTC bus services
- Active modes access crossing bridges over RTC, NAL and SH16 to southern FUZ.

Stations were assessed against the AT park-and-ride principles and it was determined to be suitable at Huapai Station; principles assessment is summarised below:

- **Strategic fit**: Station identified in ATs Park-and-Ride Programme Business Case and has a peripheral public transport network location
- **Land use zoning**: Station is located within FUZ, with potential to integrate with future land use through structure planning
- **Urban realm integration**: No existing parking facilities are provided in the area
- **Walk / cycle catchment**: Walk and cycle is currently limited by the existing road network, however, access can be improved through provision of active mode facilities. Alongside this, however, the station is expected to attract a wider catchment than active modes, including rural users (e.g. Waimauku)
- **Public transport feeder services**: Station expected to attract a wider catchment than local feeder bus network, including further rural populations.

The Park-and-Ride adds approximately 1.5 hectares for up to 500 at grade spaces to Huapai Station footprint. The total facility footprint is therefore approximately 3 hectares, not including supporting features (e.g., stormwater treatment, construction space). These recommendations informed the location options developed and assessed in Section 7.5, further station form and footprint analysis will subject to further design development.

7.4 Land use review and constraints mapping

To inform the option development and assessment, a land use review and constraint mapping exercise was carried out to understand the station environment. The exercise identified that:

- **Existing and Future Land use:** The Council's NW Spatial Strategy identifies expanded town centre between Huapai and Kumeū. Location 4 is located on existing Town Centre zoned land. A mix of business and residential zoning can be found in the surrounding area. The Kumeū Huapai FUZ is not structure planned, and the NW Spatial Strategy identifies the area on both sides of SH16 around the Huapai Station options as 'Future Residential and Other Uses'. Residential Single House Zone is adjacent within the existing urban area
- **Special uses and constraints:** The SH16 Main Road and the NAL travel parallel to each other from the entrance through Kumeū Huapai urban area, in parts immediately adjacent to each other. At Station Road, the NAL switches under SH16 Main Road to continue on the northern side of SH16 Main Road
- **Environmental Constraints**: There are a number of environmental constraints along the corridor, including the Huapai Tavern, which is a historic heritage structure. The area is bisected by the Kumeū River with tributaries in proximity to a number of the station options. In addition, land within Kumeū is subject to natural hazards from flooding
- **Project Interdependencies**: The stations are integrated with the RTC and as such the alignment represents a fixed point for the stations to be located on.

Key outcomes of the review were the decision to:

- Undertake an MCA with specialists due to the variety of land uses, varied land ownership patterns and existing development, heritage and environmental feature constraints.

7.5 Station refinement option development

Eight station options were developed based on Locations 1 and 3, informed by the land use and constraints mapping outcomes (see Section 7.3) and by specialists MCA assessment already undertaken for the RTC corridor (see Section 6).

<u>Kumeū Station Options</u>

Option K1: On land to the east of the Kumeū tributary, including SH16 Main Road is re-aligned north around the station footprint

Option K2: Easternmost option within existing light industry zone, including SH16 Main Road is re-aligned north around the station footprint

Option K3: Located between Option 1 and Option 2 with SH16 Main Road re-aligned north around the station platforms and station building located on the southern side of the NAL

Option K4: Located west of the Kumeū tributary, including SH16 Main Road is re-aligned north around the station footprint

Huapai Station Options

Option H1: Western consolidated option with all facilities north of the NAL within FUZ

Option H2: Eastern consolidated option with all facilities north of the NAL within FUZ

Option H3: Western split option, including station and bus layover facilities in FUZ north of the NAL and park and ride and local bus bays located on south of SH16

Option H4: Eastern split option, including station and bus layover facilities in FUZ north of the NAL, park and ride and local bus bays located on south of SH16

7.6 Location refinement assessment

7.6.1 Assessment

Location refinement assessment was undertaken for station locations. The assessment follows the process outlined in Section 4.4. The eight options were assessed against the MCA framework including the ability to achieve the Transport Outcomes.

- **Access:** Provide effective and attractive public transport access to economic and social opportunities
- **Integration:** Provide a rapid transport corridor station which supports high quality integrated urban communities.

Town Centre (Kumeū) Station

Option MCA performance is set out in Table 7-1, considerations and constraints identified are in Figure 7-5. Table 7-2 provides a summary of the assessment undertaken by SMEs using the MCA framework.

Table 7-1: Town Centre (Kumeū) Station Options Performance

Criteria	OPTION K1 - Kumeū West	OPTION K2 - Kumeū East	OPTION K3 – Kumeū South	OPTION K4 - West of Kumeū Tributary
Option scoring				
RTN Access	4	4	3	4
RTN Integration	3	2	2	3
Culture				
Heritage	-1	0	0	-2
Social				
Land use futures / integration with planned land use	2	2	2	4
Urban Design	4	3	2	4
Land Requirement	-2	-2	-2	-1
Social Cohesion	2	2	2	4
Human Health and Wellbeing (Operational Effect)	3	3	3	3
Environmental				
Landscape / Visual	-3	-2	-2	-2
Stormwater	-4	-4	-3	-1
Ecology	-3	-2	-2	-3
Natural Hazard	-3	-2	-2	-3
Economic				
Construction impacts on utilities / infrastructure	-3	-2	-2	-1
Construction Disruption	-3	-3	-3	-1
Construction costs / risk / value capture	-2	-2	-2	-2

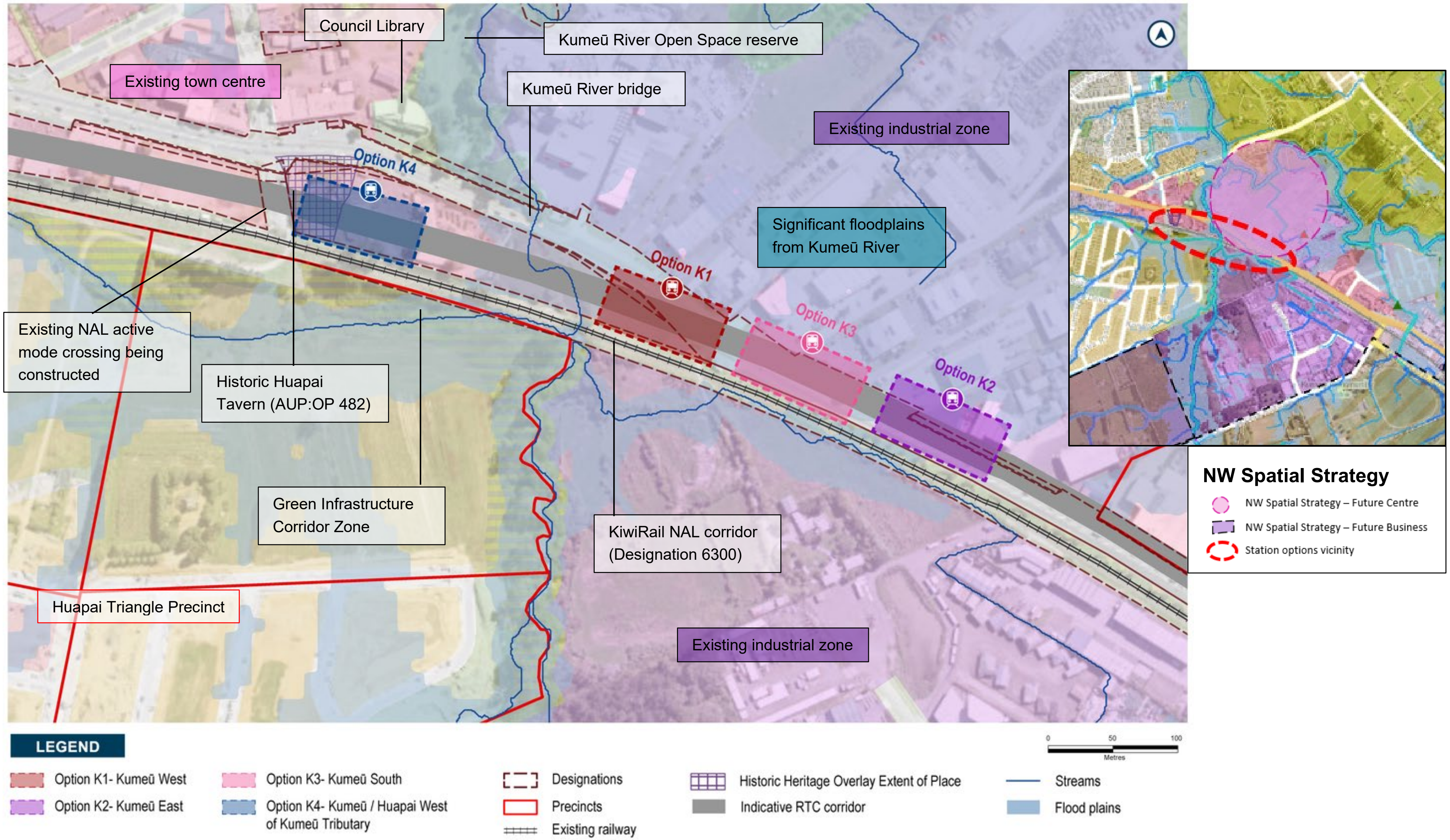


Figure 7-5: Town Centre (Kumeū) Station Location Options against landuse and constraints

Table 7-2: Kumeū (Town Centre) Station options wellbeing assessment

Wellbeing Assessment	
Transport Outcomes	Access: Options 1, 2 and 4 performed highly positive as the station platforms would orientate to SH16 Main Road. This access is more convenient and attractive to users in the existing and proposed town centre and to local bus and active mode facilities on SH16. Option 3 performed moderately positive as it is orientated to the south industrial land with less convenient platform location to the existing and proposed town centre, and less convenient active mode and local bus access. Option 1, 2 and 4 are preferred. Integration: All station options support urban intensification. Options 1, 2 and 3 are more aligned with existing industrial land, including the northern expanded town centre proposed by the NW Spatial Strategy. Option 4 is adjacent to the existing town centre and its walkable catchment extends to the proposed town centre. Option 4 integrates with Huapai Triangle via the overbridge which provides a direct connection. Options 2 and 3 have potential to impact nearby local road intersections. They are also relatively constrained due to the relationship with SH16 and provide less opportunity for 'kiss-and-ride' and taxi to supplement active mode and bus integration. These options perform minor positive. Option 1 and 4 perform moderate positive. Option 1 and 4 are preferred.
Cultural	Heritage: No heritage sites or structures were identified for Options 2 and 3, both are neutral. Option 1 performs minor adverse as it is located adjacent to a stream with low potential for unexpected discoveries. Option 4 impacts the Huapai Tavern (Historic Heritage Overlay 482); however, the building is already compromised by the proposed RTC. Opportunities exist to integrate the tavern building with the RTC station site. Option 4 performs minor adverse. Option 2 and 3 are preferred.
Social	Land Use: Option 4 is located at and integrates with the existing town centre. Option 4 walkable catchment also supports the expanded town centre identified in the NW Spatial Strategy. Given site constraints from the proposed SH16 upgrade and proposed RTC, Option 4 makes good use of land between the projects and is preferred. Options 1, 2 and 3 align with the location of the proposed expanded Town Centre in the NW Spatial Strategy. The Strategy only indicates future land use, and potentially the industrial land use will remain for some time. Under the National Policy Statement on Urban Development the industrial land may also not qualify for intensification (an opportunity presented by RTN stations). In this scenario Options 1, 2 and 3 would not as fully integrate with surrounding land use. Option 1, 2 and 3 also require re-alignment of SH16 which would result in loss of industrial land. Options 1, 2 and 3 perform minor positive.
	Urban Design: Option 1, 2 and 4 are north facing and have a clear interface with SH16 which supports a high-quality public realm. Options 1 and 4 are adjacent to the Kumeū River which as a feature can enhance the future station character and support quality urban realm. This results in Options 1 and 4 being high positive. Option 2 which is positioned away from the river is moderate positive. Between Option 1 and 4, Option 4 is preferred as there is greater connectivity with the path along the Kumeū River tributary to the north. It also noted that there is less certainty in terms of supporting a quality urban environment with Option 1 as the surrounding land may remain industrial in character. Option 3 is less legible from SH16 Main Road and has less potential to support place making along that corridor. Option 3 therefore performs minor positive. Option 1 and 4 are preferred.

Wellbeing Assessment	
	Land Requirement: Option 4 will impact on a limited number of properties from the footprint of the station and perform slightly adverse. Options 1, 2 and 3 will impact land required for the station and also the re-alignment of SH16 Main Road, resulting in minor adverse performance. Option 4 is preferred.
	Social Cohesion: Options 1, 2 and 3 each perform minor positive due to the overall benefits of a new station for the community. Options 1, 2 and 3 performances also recognise that each will result in loss of existing businesses, including a supermarket, located along the SH16 Main Road. This will reduce existing services and employment opportunities for the community. Option 4 will be located in proximity to a number of community facilities / connection, including the Kumeū Library, a walkaway along the Kumeū tributary and proposed bridge across the NAL. The station will support the active use of these features by the community. There are a number of businesses currently located on the site of Option 4; these will also be impacted by the proposed RTC corridor and to an extent SH16 Main Road upgrade. The impacts are therefore not directly associated with Option 4. Option 4 performs highly positive and is preferred.
	Human Health and Wellbeing: All options support a shift to public transport and active modes, which supports health and wellbeing outcomes. There is no differentiation in the scoring, and all perform moderately positive.
Environment	Landscape / Visual: Option 1 performs moderately negative as it has the greatest potential for adverse landscape effects on the Kumeū River and associated riparian vegetation. Whilst mitigation may be feasible, avoiding these features is preferred by moving the option to the west. Options 2, 3 and 4 perform minor adverse. Option 2 is located to the east of the tributary and is preferred as it not close to any sensitive landscape features. Option 3 is located near the tributary and has potential to affect the appreciation of the tributary; however, the effects are not as great as Option 1. Option 4 is close to but not immediately adjacent to a pool of water associated with the Kumeū tributary, there is however a separation between the station and the feature. This also reduces the effects compared to Option 1. Option 2 is preferred.
	Stormwater / Flooding: Options 1, 2 and 3 are located in the flood plain and at major risk of flooding. The options will need to be designed to be above a 1 in a 100-year flood plain level. The provision of stormwater treatment is considered difficult due to the floodplain location. Option 1 and 2 perform highly adverse, and Option 3 performs moderately adverse due to the options position making it less difficult for stormwater provision. Option 4 is out of the floodplain with reduced flood risk and is easier to accommodate stormwater treatment. Option 4 therefore performs slightly adverse. Option 4 is preferred.
	Ecology: Options 1 and 4 will impact on the Kumeū tributary and associated riparian features and stream habitat and effects on potential natural wetlands to the south. Both Options perform moderate adverse with Option 4 being preferred over Option 1 due to the set back from the stream. Options 2 and 3 are positioned away from the Kumeū River tributary, however there are potential impacts on the stream habitat to the south. Option 2 performs slightly adverse as the potential impacts are low. Option 3 also performs slightly adverse due to potential effects on natural wetlands on the south. Option 2 and 3 are preferred.

Wellbeing Assessment	
	Natural Hazards: All options may require ground improvements and / or piling due to soft ground conditions. Options 1 and 3 have potential slope instability issues due to proximity to the Kumeū River to be addressed, this results in slightly adverse performance for Options 2 and 3 and moderate adverse for Options 1 and 4. Options 2 and 3 are preferred.
Economic	Construction impacts on utilities / infrastructure: Options 1, 2 and 3 require a re-alignment of SH16 Main Road (a re-alignment to the north) which will impact on the utilities located within that section of the road corridor. Options 2 and 3 perform minor adverse with Option 1 performing moderate adverse due to more extensive work (the road level may need to be increased) which has the potential for further impacts. Option 4 makes use of land between SH16 Main Road and the NAL and does not require a re-alignment of SH16 Main Road. Option 4 it is not expected to cause significant disruptions to the existing infrastructure and utilities services and therefore Option 4 is slightly adverse.
	Construction Disruption: Options 1, 2 and 3 will require the realignment of SH16 which will result in additional construction works and also the demolition of some buildings within the light industrial zone. This will be disruptive for remaining businesses and for those travelling along this section of SH16 Main Road. These options perform moderate adverse. Option 4 will not require the re-alignment of SH16 and construction will be relative contained. Direct construction disruption effects of the station are more limited, and therefore just slightly adverse.
	Construction costs / risk / value capture: All options perform slightly adverse. Options 1, 2 and 3 will have construction costs and risks associated with being located in the flood plain and the re-alignment of SH16 Main Road. Option 4 also performs slightly adverse due access with constructing the pedestrian and cycle access to the south. Overall Option 3 is preferred due to the larger construction area providing more flexibility for construction.

End of Line (Huapai) Station

Option MCA performance is set out in Table 7-3, considerations and constraints are identified in Figure 7-6. Table 7-4 provides a summary of the assessment undertaken by SMEs using the MCA framework.

Table 7-3: End of line (Huapai) Station Option MCA Performance

Criteria	Option H1 – Consolidated West	Option H2 – Consolidated East	Option H3 – Split West	Option H4 – Split East
Option scoring				
RTN Access	3	3	3	3
RTN Integration	3	3	2	2
Cultural				
Heritage	0	-1	0	-1
Social				
Land use futures / integration with planned landuse	3	4	3	4
Urban Design	2	4	2	3
Land Requirement	-2	-2	-2	-2
Social Cohesion	4	4	4	4
Human Health and Wellbeing (Operational Effect)	3	3	3	3
Environmental				
Landscape / Visual	-2	-3	-2	-3
Stormwater	-1	-1	-1	-1
Ecology	-1	-3	-3	-2
Natural Hazard	-1	-2	-2	-4
Economic				
Construction impacts on utilities / infrastructure	-1	-1	-1	-1
Construction Disruption	-1	-2	-2	-2
Construction costs / risk / value capture	-2	-2	-2	-2

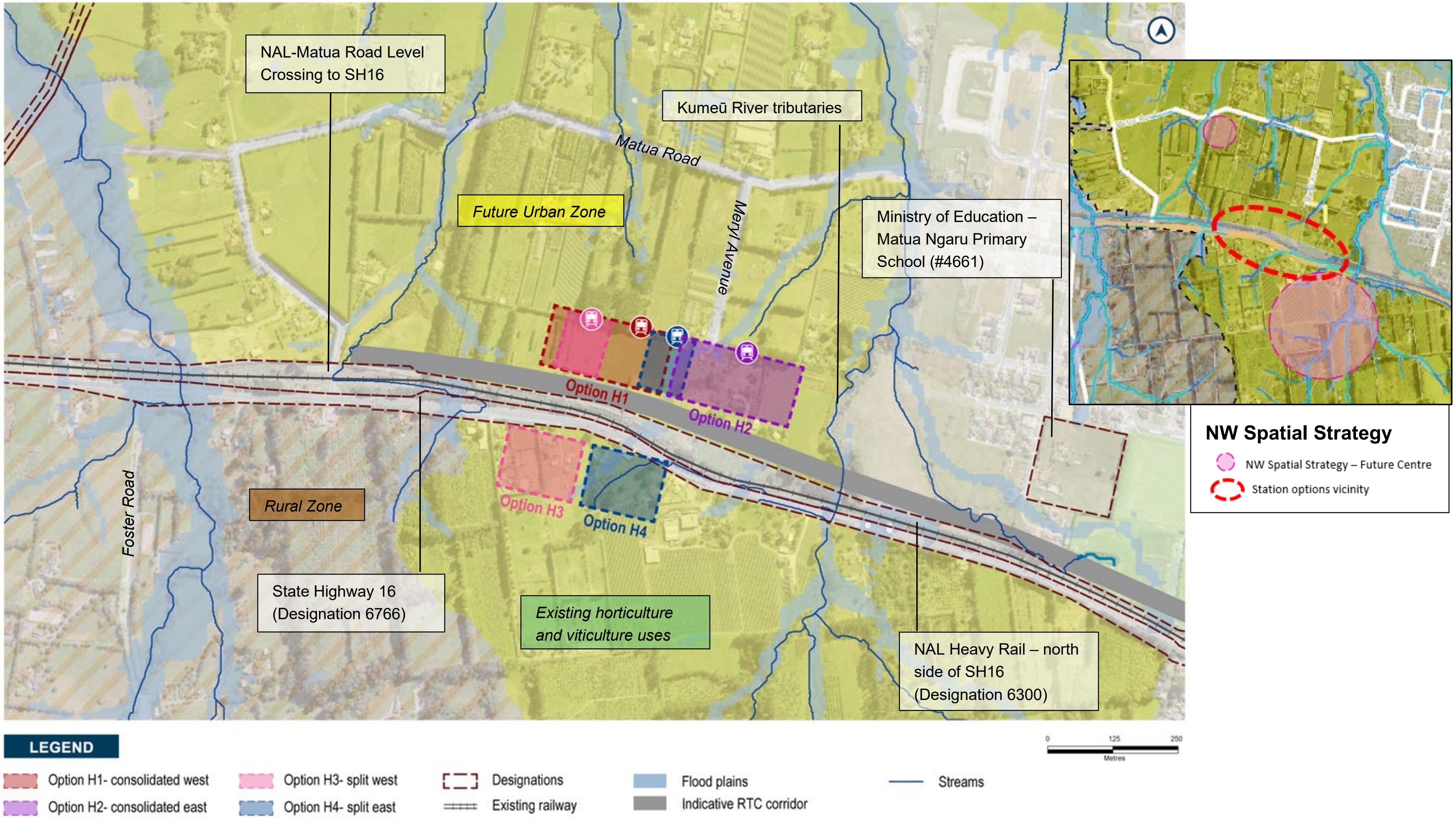


Figure 7-6: Huapai (End of Line) Station options and identified constraints

Table 7-4: End of line (Huapai) Station Options Assessment

Wellbeing Assessment	
Transport Outcomes	Access: The western options (2 and 4) are not as well integrated with the Local Centre location identified in the NW Spatial Strategy, compared to the eastern options (1 and 3). Options 1 and 2 have consolidated the station and park and rides on the north side of SH16. These options are less convenient for the rural catchment due to the need to access the facility via Matua Road. The park-and-ride is however more conveniently located reducing distance to the stations. Options 1 and 2 are less convenient for vehicle access from the southern FUZ area compared to Options 3 and 4. Overall, the options all support RTN access, and all perform moderately positive. Integration: Options 1 and 2 identify a single larger site to the north of SH16 / NAL which provides more flexibility for the co-location of all interchange elements. This improves functionality which will better support a high quality integrated urban community compared to Options 3 and 4 which split the station and park and ride facilities. Options 1 and 2 perform moderately positive, with Options 3 and 4 performing minor positive due to the reduced functionality. Option 1 and 2 are preferred.
Cultural	Heritage: No heritage sites or structures were identified for any of the Options. Options 2 and 4 are located adjacent to a stream and there is a low potential for unexpected archaeological discoveries. This results in a slightly adverse performance. Options 1 and 3 are neutral.
Social	Land Use: Options 1 and 3 will be located closer to the FUZ edge and RUB boundary, which would create a walkable catchment including the rural zoned land. This has the potential to create pressure for development in the rural zoning. Options 2 and 4 are located on the east and will create a walkable catchment focused on future and existing urban areas. Options 2 and 4 are therefore preferred and perform highly positive. Options 1 and 3 perform moderately positive due to the potential for development outside of the RUB boundary.
	Urban Design: Options 2 and 4 are located in a future urban area and away from the RUB optimising placemaking opportunities. Urban design outcomes between the station and existing community facilities (Huapai Recreation Reserve) exist due to the relative proximity and the presence of a stream. Option 2 performs highly positive as the consolidated station will allow a future local centre to develop with the character not impacted by locating the parking adjacent to the centre. Option 4 does not consolidate the parking and performs moderately positive. Options 1 and 3 will be closer to the RUB boundary which may fragment the urban use of the station and do not have the same level of opportunities to support urban design outcomes, i.e., not positioned next to a stream or proximity to community facilities.
	Land Requirement: All 4 options will require a similar area of land and there is no significant differentiation on this criterion.
	Social Cohesion: All four options will support a future local centre and the resultant socio-economic opportunities for the community. All provide access across the NAL and SH16. Options 1 and 3 are located on the western entry to Huapai so more convenient park-and-ride for those travelling from Waimauku and wider North West. However, all options provide park and ride and as such, this does not warrant a change in performance. Options 2 and 4 offer

Wellbeing Assessment	
	greater opportunities to connect with the Huapai Recreation Reserve, which is located east of the stations. All options perform highly positive.
	Human Health and Wellbeing: All options support a shift to public transport and active modes, which will support health and wellbeing outcomes. There is no differentiation in performance.
Environment	Landscape / Visual: Options 2 and 4 are located adjacent to a tributary of the Kumeū River which will be sensitive to the station development. Both options perform moderate adverse due to the potential impacts on the stream. Options 1 and 3 are in proximity to a stream and wetland with potential impacts and perform slightly adverse. The difference in performance is due to respective options landscape value and potential impacts associated.
	Stormwater / Flooding: Options 1 and 3 are preferred as Options 2 and 4 have a comparatively increased flood risk due to proximity of streams. Potential effects are manageable however, as such there is no distinction in performance, and all are slightly adverse.
	Ecology: Options 1 and 3 are in proximity to a valley bottom wetland. Option 1 has the potential for indirect impacts and is slightly adverse, Option 3 has the potential for more significant impacts and performs moderate adverse (the least preferred option). Option 2 directly impacts a valley bottom wetland, the option also affects watercourses, including the Kumeū River east and west of the option. Option 2 is therefore moderate adverse. Option 4 is adjacent to the Kumeū River and there is a high likelihood of wetland habitat which may be directly impacted. The option performs minor adverse.
	Natural Hazards: All options may require ground improvements and / or piling due to soft ground conditions. Option 1 is slightly adverse, Options 2, 3 and 4 are adjacent to streams / wet areas resulting in the potential for more soft / organic ground issues. Options 2 and 3 perform minor adverse, with Option 4 performing highly adverse due to the potential for slope stability at stream banks.
Economic	Construction impacts on utilities / infrastructure: The main construction activities for the future station are in greenfields with all options requiring a bridge across SH16 and the NAL. Disruptions with adverse effects to existing infrastructure and utilities is therefore likely to be minor with impacts on SH16 and NAL likely to be manageable. There is no significant differentiation between the options.
	Construction Disruption: All options are located in greenfields, and the main disruption impacts will be to operators and users of SH16 and the NAL. Management and co-ordination with KiwiRail to minimise disruption will be required. All options have the potential for amenity impacts. For Options 2 and 4 construction will occur in relative proximity to residential zoned land, sensitive to construction disruption. Options 3 and 4 involve park-and-ride construction in proximity to a (future) local centre and have potential to disrupt the local centre. On this basis Option 1 performs slightly adverse and all other options perform minor adverse.
	Construction costs / risk / value capture: All options perform minor adverse. There is a slight preference for Option 1 as it has the shortest SH16 and NAL overbridge.

7.6.2 Refinement through engagement

As the options for stations were developed following the preferred RTC Option being identified, separate partner workshops were held to discuss the options. AT, Waka Kotahi, Auckland Council and Manawhenua were engaged with.

Key partner feedback related to:

- Desire for both stations to enable local bus access from both the north and south sides of the RTC alignment, in particular at Kumeū (town centre) Station enabling a southern bus entrance
- Confirming the preferred Kumeū Station site is suitably sized to accommodate a station and facilities
- Confirming the preferred options maximised the walking and cycling catchment for the area, and whether the Huapai Station southern side was sufficient given the lack of existing road network.

In response the project team undertook further assessment, to determine whether the stations could be serviced by the existing or reasonably feasible future road network and considered how shifting the Kumeū Station further east or west on the parcel impacted station functionality.

The outcome of this assessment was:

- A southern bus access to Kumeū (town centre) Station was investigated, this may extend off Vintry Drive. The existing southern site is undeveloped, however. It was determined that future roading network could be determined separately with the landowner, and that walking and cycling access as part of the town centre station provided suitable southern catchment access
- The preferred Kumeū Station option slots into a curve between Main Road and the NAL, providing approximately 26m wide sufficient for a station. Shifting the station east or west would narrow the site (down to 15m wide) and restrict site flexibility
- A catchment analysis was undertaken for each option with an indicative road network to demonstrate how FUZ and greenfield may integrate with the options. This demonstrated the options had suitable 5, 10, 15 and 20 min walk catchments. A roading network can be delivered separately through structure planning or private development, with access enabled by station overbridges north and south.

<u>Community Feedback</u>

Flooding within Kumeū has been raised as a significant issue. This issue was considered in the assessment and the selected option is located out of the flood prone area.

7.6.3 Preferred option

Following the MCA assessment and consideration of feedback received from Partners and the community, preferred options for Huapai and Kumeū Stations were identified. The preferred option in Kumeū is Option 4 (western town option) and in Huapai Option 2 (eastern consolidated).

Kumeū Station Option K4 was chosen because:

- It integrated best with the existing town centre and supported quality urban design outcomes
- It avoided the risk of locating a station in an industrial area which is exempt from the intensification under the National Policy Statement on Urban Development, as although the NW Spatial Strategy indicates a desire to shift industrial use to Access Road, the timing and form of this is uncertain

- Although impacts on the Historic Huapai Tavern, this is already affected by the RTC, and there are opportunities to relocate and enhance the heritage as part of the project.

Huapai Station Option H2 was chosen because:

- The option supported intensification within the RUB
- A consolidated station with park and ride offers better functionality flexibility and convenience
- The location supports good urban design and placemaking outcomes, with opportunity to connect to the town centre via an overbridge.

There will be further opportunities to minimise any impacts within the Projects during the detailed design of the Projects. As a result, no further design refinement is required at this stage.

7.6.4 Discounted option

Table 7-5 summarises the reasons for discounting the other options.

Table 7-5: Discounted RTN Station Locations

Option	Reasoning
Kumeū Station	
Option K1	• Greatest potential for adverse landscape effects on Kumeū River • If industrial land use does not change to town centre use, the station would not integrate as well with future land and may miss opportunity of density near RTN stations • Is at risk of flooding as located in a flood plain, also making stormwater treatment difficult • Potentially requires road level of SH16 to be lifted, with higher construction disruption.
Option K2	• Site is more constrained and less able to integrate with transport network • Is at risk of flooding due to location in a flood plain, also making stormwater treatment difficult • If industrial land use does not change to town centre use, the station would not integrate as well with future land and may miss opportunity of density near RTN stations.
Option K3	• Orientated to the south industrial land making it less convenient and legible from SH16 Main Road, less potential to support place making • Is at risk of flooding due to location in a flood plain, making stormwater treatment difficult • If industrial land use does not change to town centre use, the station would not integrate as well with future land and may miss opportunity of density near RTN stations.
Huapai Station	
Option K1	• Located closer to the RUB and catchment extent has potential to pressure urban expansion.
Option K3	• Located closer to the RUB and catchment extent has potential to pressure urban expansion • Has moderate adverse impact due to proximity to a natural wetland • Potential construction disruption to future local centre from park and ride proximity.
Option K4	• Higher potential for slope instability near steam banks, increasing hazard risk • Potential construction disruption to future local centre from park and ride proximity.

7.7 Rapid Transit Stations summary

As outlined, through the assessment process and following feedback from Project Partners and the community, the preferred option for the RTC Stations is Option K1 for Kumeū (town centre) station, and Option H2 consolidated facility for Huapai (end of line) station.

8 Regional Active Mode Corridor

8.1 Overview

At IBC stage an opportunity to include a strategic walking and cycling connection alongside the RTC and ASH, between Brigham Creek and Kumeū-Huapai was identified. A regional active mode corridor (RAMC) would help promote a mode shift by enabling greater access to economic and social opportunities between Kumeū-Huapai, Whenuapai and Westgate. The recommended option was co-located alongside the RTC and the ASH in a multi modal corridor and provided the following benefits:

- Connection to key destinations, including Kumeū-Huapai, Whenuapai and Westgate town centres and RTC stations
- Connection to the wider active mode network proposed as part of the NW Local Arterials Package (separate Te Tupu Ngātahi package) and North Western cycleway
- Separation of strategic walking and cycling from traffic
- Connection between the southern and western edges of Kumeū-Huapai FUZ alongside the ASH.

The RAMC was proposed to follow the ASH and RTC alignments therefore an assessment of alternative options was not undertaken at IBC phase.

8.2 Gap Analysis

Following strategic indicative network endorsement by AT and Waka Kotahi (Section 3.3), a gap analysis to confirm North West active modes provision was undertaken. This included review of the IBC options assessment, planning and policy updates, developer aspirations and project interdependencies.

Gap analysis identified:

- The RAMC was an opportunity at IBC, so function, catchment and rationale had not been well documented or defined. Therefore, defining a ‘regional active mode corridor’ form and function was required before being further developed
- The need to consider alternative alignments that were not coupled with the ASH and RTC
- Whilst a shared path was included on the ASH enabling access to the Kumeū-Huapai town via Access Road, the route was less direct. Waka Kotahi’s ‘SH16 Brigham Creek to Waimauku’ proposed a shared path on SH16 between Brigham Creek and Kumeū-Huapai, however, due to higher vehicle conflict this facility would not provide the same service level.

The gap analysis confirmed that the opportunity should be recommended to move forward to the route protection stage (confirmed by the NW DBC), and that the RAMC alternative alignments should be assessed.

8.2.1 Form and Function Analysis

A RAMC was defined as a top tier walking and cycling facility with the following characteristics:

- Movement functions: provides for intra-regional connections including spanning rural land between centres, and provides for a range of trips including long-distance commuter trips

- Spatial connections: provides connections to and between centres, rapid transit services, and other active mode routes
- Facility type: high-quality pedestrian and cyclist facility, generally outside of the road reserve.

These attributes informed the options developed and assessed in Section 8.3.

8.3 Corridor Option Development

Options were developed between Brigham Creek and Kumeū-Huapai township. Alignments were initially identified north of SH16 but later discounted due to significant impacts on the Kumeū River *Open Space -Conservation Zone* and terrestrial SEA (SEA_T_7036). The RAMC options that progressed to long list assessment were:

Option A	A direct route between Brigham Creek Interchange and the eastern entry to Kumeū-Huapai through the rural residential area
Option B	Zigzag route along S1 ASH to Taupaki Road where it proceeds north and joins the existing SH16 to Kumeū-Huapai
Option C	A direct route between Brigham Creek Interchange to the entry of Kumeū-Huapai along the existing SH16.
Option D	Route following the ASH and the rural RTC corridor (original alignment opportunity identified)

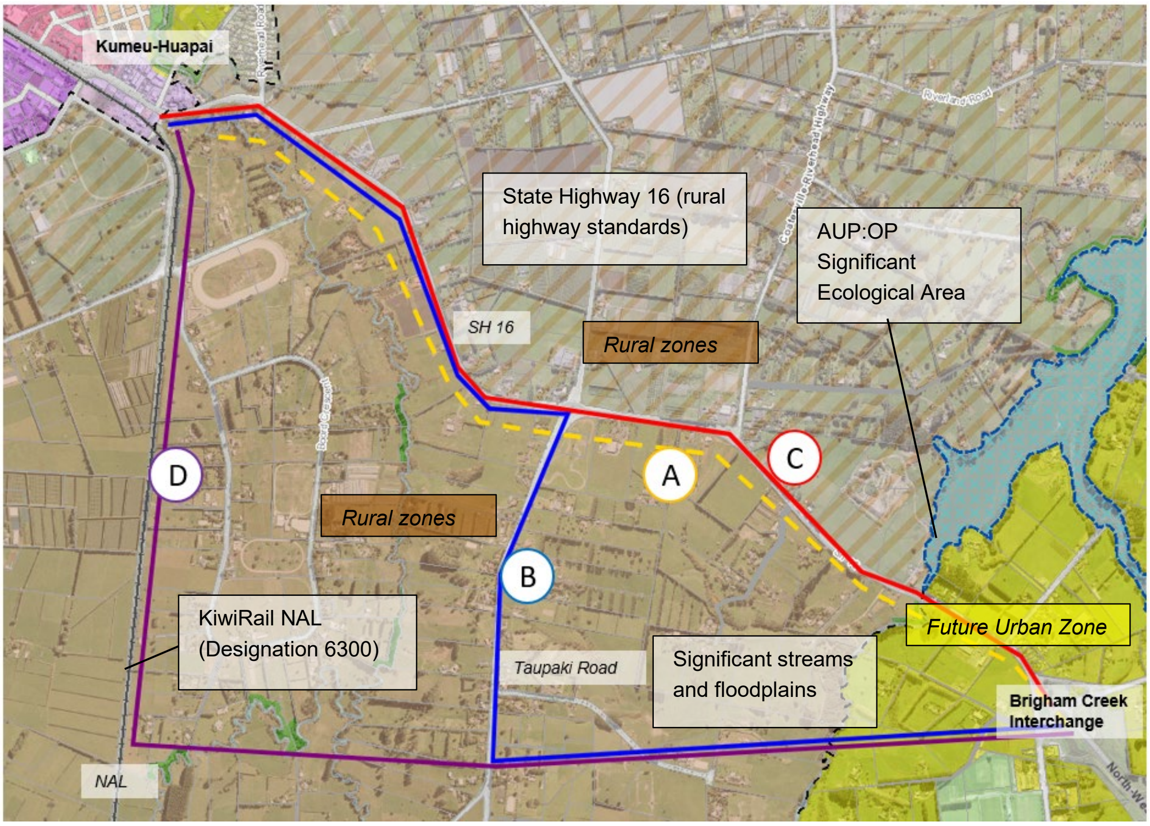


Figure 8-1: RAMC option alignments (indicative only) against constraints and landuse

8.4 Assessment

The RAMC was assessed as a stand-alone project with a specific set of transport outcomes and requirements (and subsequently incorporated into S3).

As the assessment was a corridor level assessment and due to its regional active modes function the assessment did not use the full MCA framework set out in Table 2-1 instead, the following specific assessment criteria were developed and options were considered against these specific assessment criteria by the Project Team to identify a short list:

- Access: An active mode corridor that provides better access to economic and social opportunities within and outside the North West area
- Mode Choice: Support transformational mode share in the North West by providing a high quality, safe and attractive movement of people between Redhills, Whenuapai, Riverhead and Kumeū-Huapai
- Safety and CPTED: Contribute to a transport network within the North West growth area that is free from deaths and serious injuries
- Reliability: Enable reliable and resilient active mode trips between Kumeū-Huapai and the wider strategic network.

Regional active mode facility attributes:

- Performance against RAMC attributes of Movement Function, Spatial Connection and Facility Type.

Quality of Service:

- Short list options were assessed against ATs Quality of Service attributes derived from the *AT Practitioners Guide – Quality of Service for Auckland Cycle Facilities* (2016), to determine the RAMC preferred emerging option (see Section 8.3).

8.4.1.1 Long List Assessment

Table 8-1 summarises the long list options assessment against the Transport Outcomes and key differentiating criteria.

Table 8-1: RAMC Long List Options Assessment against Transport Outcomes

Transport Outcomes	Access: All options have limited local access except for Option C which follows existing SH16 and has access with several routes including Riverhead. Option C is preferred for 'Access'. Mode Choice: All options have the ability to induce mode shift within the community. Option A will likely function as a recreational facility through the countryside, therefore the route will less likely be used by commuters. Option B must integrate with three road types including local, arterial and SH. The route is likely to be less consistent. Option C has topographical challenges through the Ngongetepara Stream section which would adversely affect user experience. Option D follows the NAL, however is the most consistent facility with minimum roadside friction and pedestrians / car conflict points. Option D has a

	gentle slope (average 3% gradient) enabling higher speeds with opportunity to become an express cycleway[4]. Option D is likely to be most attractive to commuters. Option C and Option D are preferred for Mode Choice (overall preference for Option D due to its attractiveness to a wider range of users). Safety and CPTED: All options, except Option A, benefit from passive surveillance from adjacent corridors and existing residential properties. Option A and Option B require the installation of street / corridor lighting within rural sections, increasing cost at implementation stage to meet safety expectations. Option D would benefit from lighting as part of the design for RTC and ASH projects. Options A and D provide a continuous uninterrupted journey for commuters from Brigham Creek to eastern entry of Kumeū-Huapai. Option B is likely to have significant side friction from rural accessways along Taupaki / Nixon Road and SH16. Option C requires cyclists to cross the Taupaki / SH16 intersection and is affected by multiple vehicular intersections. Option D is uninterrupted with limited intersections and no driveways and is preferred for safety. Reliability: All except Option D are likely to be vulnerable to natural hazards such as flooding and intense rainfall. The RTC and ASH alignment has considered hazards in location and design, and a co-located cycleway would have similar hazard resilience and benefit from associated infrastructure (e.g., bridges). Option D is therefore preferred for 'Reliability'.
Differentiating Criteria	
Land Use	Option A is within a rural area not identified for urbanisation. This option will retain a rural character interface. Option B is proposed to interface with three distinct road types (local, arterial, and state highway) within both rural and urban areas. Given the three interface types, delivering a consistent facility along the route would be challenging.
Land requirement	Option A will require more extensive property than Option B, C and D which are either widening other corridors or co-located with other strategic projects. As Option A is standalone it will likely duplicate infrastructure (i.e., bridges).
Ecology	Options B and C will potentially require widening of the existing Kumeū River crossing. Option A is likely to require new stream crossings. Option D will impact environmental features of streams but will reduce impacts extent over the natural feature, by co-locating crossings in one section.
Network relationship	Option D is co-located with the RTC and a section of the ASH. This has the benefit of enabling design, route protection and delivery to be undertaken as one project. Option B is likely to have two asset owners (Waka Kotahi and AT) as it utilises Nixon / Taupaki Road. Shared ownership increases potential complications in terms of design standards, project delivery and ongoing maintenance once operational. The other options are with one asset ownership.

[4] "*Express networks are major cycleways on busy streets or off-road paths. They connect people to major centres and form the base structure of the cycleway network. Express networks should be planned as part of the regional network*".pg 10, AT TDM Cycling Infrastructure

Regional active mode attributes

The options were assessed against the regional active mode facility attributes, to confirm the options serve a strategic network function. Option assessment outcomes are summarised in Table 8-2.

Table 8-2: Long List options assessment – regional active mode definition

Criteria	Assessment
Movement function	All options provide a direct intra-regional connection between the proposed BCI and the eastern entry to Kumeū-Huapai. Each route ranges between 4km and 5.4km and all presents opportunities to connect to primary and secondary active mode connections. No option is preferred and there is no significant differentiation between the options.
Spatial Connection	All options connect the Westgate centre and the Kumeū-Huapai area. All options have the potential to connect to the wider proposed North West cycling network. Only Option C also provides direct connection to the Rodney Greenways network (Rodney Local Board, 2019) and connection to the Coatesville-Riverhead Highway shared path (part of NW Local Arterials Package – separate Te Tupu Ngātahi package). Option C is therefore preferred.
Facility Type	Options A and D are outside the road reserve and entirely separate from vehicle traffic. Option C (as proposed by SH16 Brigham Creek to Waimauku project) does not provide separation from traffic. Without width and gradient modifications Option C does not meet facility attribute requirements. Option D is preferred as it is separated from the road reserve and likely to have a better riding surface than Option A.

8.4.1.2 Long List Discounted Options

Reasons for discounting are summarised in Table 8-3.

Table 8-3: RAMC Long List discounted options

Option	Reasoning
Option A	• Option A will cross several streams and is likely to have a greater ecological impact on these watercourses • The cycleway is likely to provide a lower level of service as it is anticipated to be a gravel route. While this type of facility would provide for a better interface within its rural context, it is also likely that it would be lower speed and less attractive to commuters and would remain a recreational facility type.
Option B	• Option B is a less legible route as the main regional route as it is composed of three different facility types along its length (rural section, Taupaki section and SH16 section) and is not separated from vehicular traffic due to multiple driveways and busy intersections with side roads along the corridor.

8.4.1.3 Short List Assessment

The two options that proceeded to short list were:

- Option C: Shared path alongside SH16
- Option D: Separated cycle path alongside the ASH and / or RTC.

ATs Quality of Service criteria for cycle facilities was used to identify the preferred option. Quality of Service is based on five principles, however only three are relevant for route protection stage, these are:

- Safe: It feels safe for users and helps overcome safety concern associated with cycling
- Direct It follows direct routes with minimal detours and waiting times
- Comfortable: It provides an easy and pleasurable cycling experience.

Coherence and attractiveness are excluded from consideration as they relate to network and detailed design. RAMC option assessment is at corridor level (route protection only) so only mid-block criteria were considered. Table 8-4 provides a summary of the qualitative assessment.

Table 8-4: RAMC Quality of Service Short List Assessment Summary

Principle	Assessment
Safe	<u>Conditions – </u>Option C performed well against infrastructure type, as a 3m wide shared path, it is assumed best case cross section for suitability for side traffic speed and volume. Option D proposed 6m cross section has a 4m wide cycling and walking path, and a 2m buffer zone with physical barriers between the facility and high-speed traffic. <u>Dimensions – </u>Option C proposed a 3m shared path facility. The Te Tupu Ngātahi required cross section for an appropriate facility is 4m in width. Option D is appropriate in dimensions (4m path with 2m buffer). <u>Conflicts – </u>Option C is interrupted along the alignment by multiple private driveways which provide opportunity for cyclist and vehicle conflict and associated safety risks. Option D provides an uninterrupted route from Brigham Creek Road to Kumeū-Huapai whilst providing access at side roads. Option D is preferred against the safety criterion.
Direct	Option C offers the most direct route between BCI and Kumeū-Huapai with a minimum geometric distance between the two destinations. Option D presents a significant deviation from the geometrically direct route, and for this reason Option C is preferred for directness.
Comfortable	Option C has a 7-10% vertical gradient in some sections. This will make it challenging for some users. The route does provide adjacent human activity and buildings for passive surveillance with good lighting. ‘Escape routes’ are also available. Option D has an average of 3% grade along the alignment, which is a gentle slope accessible to most users. Some human activity and building overlook the path, but this is less than Option C. Escape paths are available.

8.4.2 Refinement through engagement

The Project Team engaged with Project Partners to discuss the options and emerging preferred Option D, no feedback was received that changed the option assessment.

8.4.3 Preferred option

Following assessment and Partners' feedback, the preferred was identified as Option D because it:

- Performs highly on the Transport Outcomes sought
- Avoids significant safety issues at key intersections and driveways, resulting in low side friction and higher safety performance
- Is a predominantly flat route (average 3% gradient) attractive to a wide range of users
- Co-location with the ASH and RTC results in a multimodal corridor with delivery and construction efficiencies, including reducing the number of properties impacted
- Has some human activity (passive surveillance) with escape routes available.

8.4.4 Discounted Options

Table 8-5 summarises reasons for discounting Option C.

Table 8-5: RAMC discounted options

Option	Reason for discounting
Option C	• Does not deliver as well on the objectives, notably on safety • Topography is challenging and less attractive for a range of users, particularly the less confident or novice cyclists • Has a lower Quality of Service compared to Option D.

8.5 Amendments to Regional Active Mode Connection

Following the preferred North West Transport Network being endorsed by the AT and Waka Kotahi boards, the Taupaki-Nixon Road upgrade was not progressed as part of the wider NW Local Arterials Package (separate Te Tupu Ngātahi package).

The RAMC had previously connected to the Taupaki-Nixon Road upgrade, the routes removal resulted in a cycle network gap of approximately 600m between the RAMC connection at Taupaki Road and the Waka Kotahi proposed SH16 shared path.

It was therefore determined to include the Taupaki Road shared path between SH16 and the RAMC in the alignment as a connection. This alignment follows the RAMC Long List Option B but stops at SH16. Although Option B was not preferred as the primary strategic alignment, the connection on Taupaki Road serves a beneficial connection between the two cycle routes.

The east side location of the active modes on Taupaki Road ties in to the main RAMC on/off ramps and SH16. This reduces the number of road crossing required for those travelling from the RAMC and then east along SH16, via Taupaki Road. This was the primary reason for selecting the eastern location and no significant constraints were identified to prefer a western location.

8.6 Regional Active Mode Corridor summary

As outlined, through the assessment process and feedback from Partners the preferred RAMC alignment is Option D, following the ASH and RTC corridor from Brigham Creek to Kumeū-Huapai Township.

9 S2: SH16 Main Road

9.1 Overview

SH16 Main Road was included in the TFUG Programme Business Case preferred transport network plan prepared in 2016. The upgrade of SH16 Main Road extending from Taupaki roundabout to west of Foster Road was assessed at IBC short list stage as both a Strategic Sub Regional Connection referenced *SR-K-06A* and an East West Arterial referenced *AR-K-07*, see Figure 9-1. The IBC recommended not to pursue a Strategic Sub Regional Connection (SR-K-06A) as it would hinder property access, and in context of wider projects (NOR S1 ASH and NOR S3 RTC) to instead reduce Main Roads strategic role and enhance its arterial function (AR-K-07).

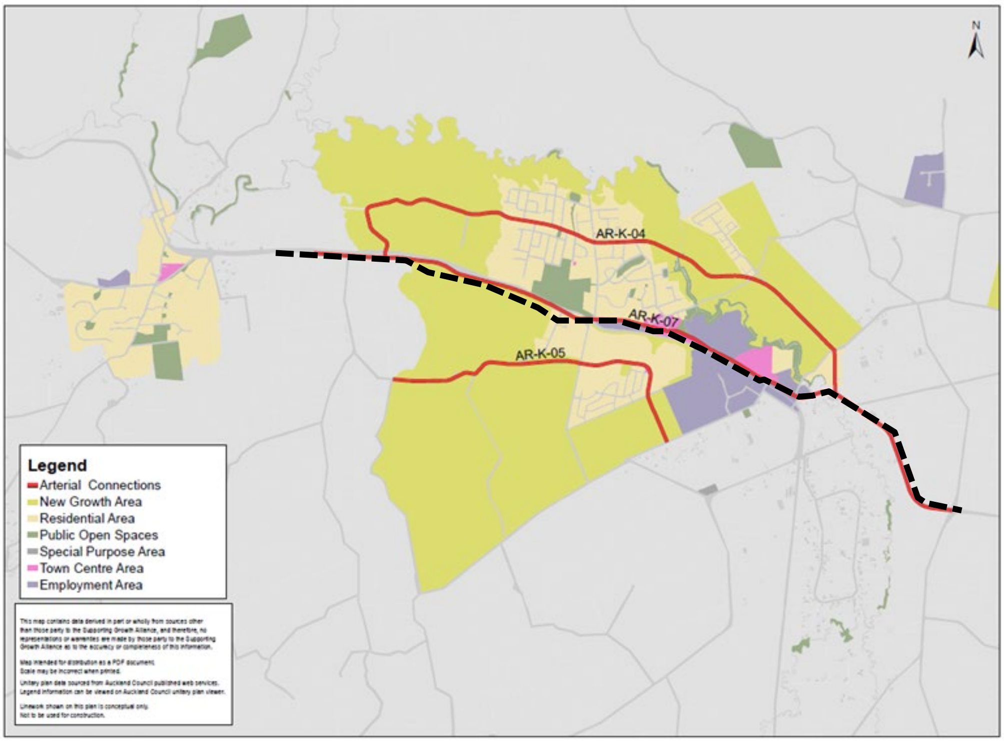


Figure 9-1: SH16 Main Road IBC Option SR-K-06A / AR-K-07

Analysis showed by removing through traffic from SH16 Main Road (via S1 and S3), it created the opportunity to redesign the corridor with upgraded walking, cycling, safety outcomes.

The SH16 Main Road upgrade will reduce existing severance by the NAL, provide more travel choices for walking and cycling, improve local trip connectivity and access to the town centre adjacent to SH16. Engagement with Project Partners and the public showed strong support for active modes and safety improvements. The Main Road upgrade was considered in the context of the wider changes resulting from the network options for the S1 ASH (see Section 6) and RTC (see Section 6).

9.2 Gap analysis

The gap analysis for SH16 Main Road confirmed key considerations as:

- The interface with the wider network such as the Safe Roads Alliance which has recommended a shared path and additional traffic capacity between Brigham Creek Road and Taupaki Road (connecting onto and east of AR-K-07)
- Uncertainty of future land use in FUZ, as although the centre of Kumeū-Huapai is zoned urban, the FUZ is yet to be structure planned. Structure planning by Auckland Council is also not expected imminently and would be closer to land release.

Gap analysis confirmed that:

- Adequate corridor assessment for the existing alignment was undertaken at IBC, however, route refinement assessment was warranted to further assess constraints identified but not closely considered at IBC
- Further engagement with AC on the FUZ and land use aspirations for the area was required.

9.3 Corridor form and function assessment

An assessment was undertaken for the SH16 Main Road upgrade following the CFAF methodology in Section 4.3.1. This recommendation informed the corridor options developed and assessed in Section 0. The assessment identified that SH16 Main Road is a key arterial running through the growth area of Kumeū and Huapai supporting the FUZ. The route also connects people to rapid transit stations, the strategic cycling network and motorway interchanges, the cross section was to provide:

- General vehicle lanes (one either direction) to be retained
- Separated walking and cycling facilities on both sides.

<u>RTC and SH16 interface</u>

The SH16 Main Road Option AR-K-07 and the RTC Option RTL-K-03-C1 are adjacent to each other through the town centre of Kumeū-Huapai. Therefore, the two corridors were considered together with their interface being a key consideration. The initial cross section design was a combined SH16 Main Road and RTC cross section, see Figure 9-2.

Figure 9-2: CFAF Outcome SH16 Main Road (coupled with RTC) Indicative cross section

After options development, the S3 RTC and S2 SH16 coupled cross section design was reassessed and further options which decoupled sections of the RTC from SH16 Main Road were developed. The decision to develop decoupled options also was made because:

- A coupled RTC and SH16 cross section design resulted in delivery dependency between the RTC and SH16. The ability to deliver either project independently of the other was desirable and a coupled cross section reduced this flexibility
- Splitting the cross sections provided greater flexibility to avoid constraints, minimise effects and optimise transport outcomes.

The uncoupled SH16 Main Road cross section was significantly smaller in scale, consisting primarily of active modes to the corridor, see Figure 9-3. See Section 6 for RTC cross section.

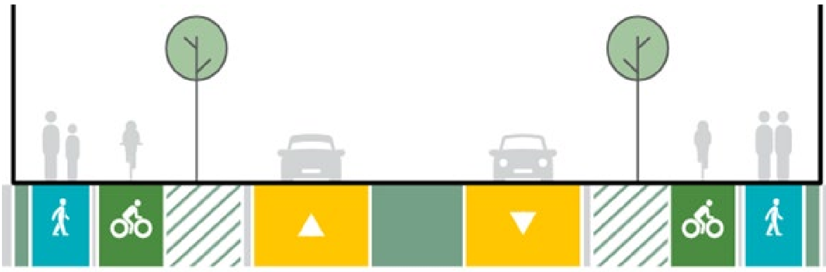


Figure 9-3: CFAF outcome SH16 Main Road only 24m (decoupled from RTC cross section)

However, considered alongside the (also decoupled) RTC cross section, the decoupled options were larger in aggregate. Therefore, the RTC and SH16 options were assessed together through the urban section. Both the coupled and decoupled options are discussed in Section 9.5.

9.4 Land use review and constraints mapping

To inform the option development and assessment, a land use review and constraint mapping exercise was carried out, the exercise identified:

- **Extent and zoning**: The existing SH16 Main Road corridor is an urbanised corridor with a mix of Residential (Single House Zone) and Business zoning (Business – Mixed Use Zone, Business – Town Centre Zone and Business – Light Industry Zone) in the north between the eastern entrance and Station Road. The southern section of the road corridor is zoned light industry and residential within the Huapai Triangle Precinct. West of Station Road is an area of residential (Single House Zone), Open Space (Sport and Active Recreation Zone) and then FUZ on both the north and south side of Main Road to the edge of the RUB
- **Special uses and constraints**: The NAL (under KiwiRail Designation 6300) is an influential feature in the landscape, bisecting Kumeū-Huapai town adjacent to Main Road on the south and the crossing under Main Road at Tapu Road-Station Road to cross to the north of SH16 Main Road alongside the Open Space Zone at Huapai Recreation Reserve (AC park). There is a historic building (Huapai Tavern) located at 319 SH16 Main Road under an AUP:OP extent of place overlay, with supporting heritage features
- **Environmental Constraints**: Natural streams bisect the corridor from the Kumeū River, often with established riparian vegetation. AUP:OP Notable Trees are present at 396 Main Road (#2603). The existing urban area is 'bookended' by open space, at Kumeū Showgrounds (south of Main Road) and Huapai Recreation Reserve (north of Main Road).

Key outcomes of the land use and constraints review was the decision to:

- Split the corridor into three assessment segments: Segment One: Riverhead Road to Kumeū River bridge; Segment Two: Kumeū River bridge to Station Road; and Segment Three: Station Road to Matua Road, see Figure 9-4.

- Develop and assess the options via an MCA with input from SMEs.
- Consider the extent of optioneering in Segment 1 due to the NAL and SH16 constraints.

9.5 Route refinement option development

Options were developed for each segment in Figure 9-4, based on the cross section in Figure 9-2 and workshopped with SMEs.

Figure 9-4: SH16 Main Road Segments for option development

Segment 1 Options: Riverhead Road to Kumeū River bridge

Four options for Segment 1 were developed, three coupled with the RTC using a 30m wide cross section, and the fourth decoupled from the RTC using a 38m wide cross section.

Option 1	30m wide cross section (RTC and SH16 Upgrades) running centrally along the existing Main Road SH16
Option 2	30m wide cross section (RTC and SH16 Upgrades) running adjacent to the NAL, south of Main Road SH16
Option 3	30m wide cross section (RTC and SH16 Upgrades) running to the north of Main Road SH16
Option 5	38m wide decoupled cross section (RTC and SH16 Upgrades) running adjacent to the NAL, south of Main Road SH16

Segment 2 Options: Kumeū River bridge to Station Road

Four options for Segment 2 were developed, with three coupled with the RTC using a 30m cross section, and the fourth decoupled from the RTC using a 38m cross section.

Option 1	30m wide cross section (RTC and SH16 Upgrades) running centrally along the existing Main Rd SH16
Option 2	30m wide cross section (RTC and SH16 Upgrades) to the south of Main Rd SH16

Option 3 30m wide cross section (RTC and SH16 Upgrades) running to the north of Main Rd SH16

Option 5 38m wide decoupled cross section (RTC and SH16 Upgrades) with the RTC running adjacent to the NAL, and the SH16 Main Road Upgrade running centrally along the existing Main Rd, SH16

Segment 3 Options: Station Road to Matua Road

Two options were developed for Segment 3, both addressed alternative layouts for the Tapu Road and Station Road intersection using a 24m cross section.

Option 1A 24m wide cross section on Station Road and Tapu Road

Option 1B 24m wide cross section on Station Road only

The options were assessed against the MCA and ability to meet the Transport Outcomes.

- Access: Improve access to social and economic opportunities for active modes, public transport and local trips within Kumeū-Huapai
- Mode Choice: Support transformational mode share in Kumeū-Huapai by providing a high quality, safe and attractive active mode facility on the existing SH16 corridor between Matua Road and Access Road
- Integration: Provide a transport system that is integrated with land use enabling a more sustainable, high quality, connected urban form, and supports growth in Kumeū-Huapai
- Safety: Provide improvements to the existing SH16 corridor between Matua Road and Access Road that contribute to a transport network that is free from deaths and serious injuries.

Segment 1: Riverhead Road to Huapai bridge

Table 9-1 sets out the MCA scores for the Segment 1 SH16 Main Road options. Considerations and constraints identified are shown in Figure 9-5 below and Table 9-2 provides a summary of the SMEs assessment using the MCA framework.

Note the assessment is focused on the eastern section of Segment 1. This is because the NAL is a hard constraint and alternative options would result in shifting SH16 to the north in the western section. This would increase property impacts and the extent of transport infrastructure within the corridor, i.e. it would be less compact.

Table 9-1: Segment 1 SH16 Main Road – MCA assessment scores

Options		Option 1	Option 2	Option 3	Option 5
Urban RTN - Performance against investment objectives	IO1. Access	4	4	4	4
	IO2. Reliability	3	3	3	4
	IO3. Mode Choice	4	4	4	4
	IO4. Integration	3	2	3	3
SH16 Main Road - Performance against investment objectives	IO1. Access	4	4	4	4
	IO3. Mode Choice	4	4	4	4
	IO4. Integration	3	2	3	3
	IO5. Safety	3	3	3	3
Criteria					
Heritage		-1	-2	-1	-2
Land use futures		-1	-3	-1	-3
Urban Design		-3	3	-3	3
Land Requirement		-2	-3	-2	-3
Social Cohesion		1	-2	1	-2
Human Health and Wellbeing		2	2	2	2
Landscape / Visual		-2	-2	-2	-2
Stormwater		-1	-3	-2	-3
Ecology		-2	-1	-2	-1
Natural Hazard		-1	-1	-1	-1
User Safety (RTN only)		1	1	1	2
Construction impacts on utilities /		-2	-1	-2	-1
Construction Disruption		-2	-1	-2	-1
Construction costs / risk / value capture		-3	-2	-2	-2

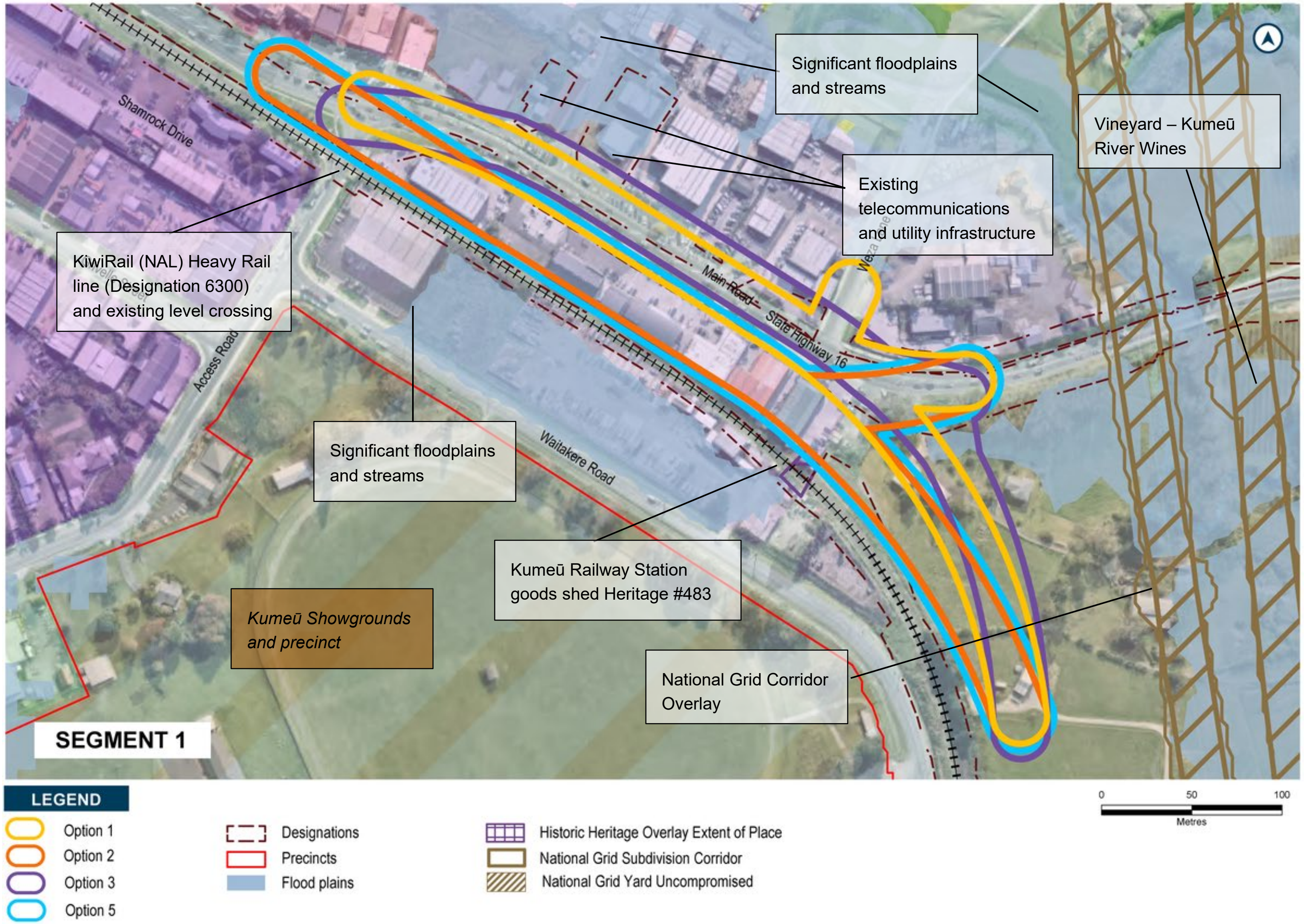


Figure 9-5 : SH16 Main Road Segment 1 Options and identified constraints (note Option 5 -decoupled is 38m vs Option 2 (30m wide)

9.5.1 Assessment

Route refinement assessment was undertaken following the process outlined in Section 4.

Table 9-2: SH16 Main Road Segment 1- MCA Assessment Summary

Wellbeing Assessment	
Transport Outcomes	Access: All options perform equally positive and improve access to social and economic opportunities within Kumeū-Huapai for active mode users, public transport and local trips. No differentiation between options.
	Mode Choice: All options perform highly by providing high-quality facilities for active modes, to support transformational mode shift. No differentiation between options.
	Integration: All options support integration; however, Options 1, 2 and 3 reduce direct access on SH16 to Left In / Left Out, which limits existing and future development access. Option 5 will not restrict development access and is therefore preferred.
	Safety: All options provide the same quality of active mode facilities and support lower speeds along the SH16 corridor. Options 1, 2 and 3 will avoid conflicts between the RTC and vehicles by restricting access to left in / left out. Option 5 will avoid conflicts by decoupling the RTC from SH16. Given that all options will avoid conflicts there is no differentiation on the performance. No differentiation between options.
Cultural	Heritage: The upgrade of SH16 Main Road can be refined for all options to avoid significant impacts on Kumeū Railway Station Goods Shed (AUP:OP Historic Heritage Overlay 483). More significant impacts on the shed have the potential to result from the RTC project and these are considered in Section 6. There is no significant differentiation on this score.
Social	Future land use integration: Options 1 and 3 both have relatively minor infringements into adjoining zones which do not undermine the zones continued use or purpose. Options 2 and 5 perform worse as both result in the loss of Business – Mixed Use Zone land. However, considered alongside the RTC, this land would be utilised by the RTC alignment and therefore already be impacted.
	Social: Options 1 and 3 largely avoid the existing shops and industry located within Segment 1. Options 2 and 5 result in the loss of shops and employment opportunities located within the Business – Mixed Use Zone. In addition, these options will impact on the Kumeū Railway Station Goods Shed (AUP:OP 483) which contributes to the character and overall identity of the town (this may be mitigated by relocation of the Shed). The impacts of these options 2 and 5 are related to the relationship with the RTC. On a standalone basis (considered without the RTC) the SH16 option could be refined to avoid significant impacts and the land would remain developable.
	Urban Design: All options will result in enhancements to SH16. Option 5 has potential for landscaping on the southern side which would screen the RTC and be a feature on arrival to Kumeū. Option 5 is preferred.
	Land Requirement: Options 1 and 3 make more use of the existing road corridor resulting in reduced property impacts. Options 2 and 5 will have a more significant impact on the properties on the southern side of the corridor requiring full acquisition of the land. These impacts would also occur as a result of the RTC as both projects impact on the business on the south of the corridor.

Wellbeing Assessment	
	Human Health and Wellbeing: All options result in an upgrade of the existing road and due to the S1 ASH providing an alternative for through vehicles and freight will see reduced traffic. This will reduce impacts on human health and wellbeing associated with the existing road corridor. All options provide active mode facilities benefiting health and wellbeing, and there is no differentiation.
Environment	Landscape and Visual: On a standalone basis the SH16 options have no differentiation as all will enhance the SH16 corridor. When considered in the RTC context, there is a preference for Options 2 and 5. This is due to the option alignments being closer to the NAL which will reduce effects for viewers. Options 1 and 3 have the potential to be more infrastructure dominated due to the NAL corridor and RTC being separate, which would increase the impact on the landscape for viewers. Options 2 and 5 are preferred.
	Stormwater: On a standalone basis, the upgrade of SH16 has no significant differentiation between the options. When considered in the RTC context there is greater differentiation: Option 1 has a moderate flood risk from the Kumeū River and is the preferred option. Option 3 has the greatest flood risk from the Kumeū River; however, has the least flood risk in relation to the NAL and the least constraints for stormwater infrastructure between the option and NAL. Options 2 and 5 perform worse due to proximity to the NAL resulting in greater flooding risk on the NAL and have constrained space for stormwater infrastructure.
	Ecology: On a standalone basis the upgrade of SH16 has no significant differentiation between the options. When considered in the RTC context however there is greater differentiation: Options 2 and 5 are preferred due to both options being situated further from the Kumeū floodplain resulting in less ecological impacts on this feature and marginally less ecological fragmentation adjacent to the options. Options 1 and 3 are situated closer to the Kumeū floodplain and both cross native vegetation south of Main Road.
	Natural Hazards: Geology is the same across all options and geo-technical risk is low.
Economic	Utilities: The SH16 upgrade has no significant differentiation between options. When considered in the RTC context there is greater differentiation: Options 1 and 3 will impact upon utilities and infrastructure located within and adjacent to existing SH16 (AC utility reserve and Spark and Chorus telecommunications) with risk to the continuity of service for properties on both sides of the corridor. Options 2 and 5 impacts extent will be lower, and the impact focus will be on the southern side of the corridor. Option 2 and 5 are preferred. Construction: All options will result in construction impacts within the road corridor. Options 2 and 5 require demolition of buildings within the business zones south of SH16. These works would however be offline and due to the NAL away from receivers, so are not a significant differentiator. When considered in the RTC context however there is greater differentiation: Options 1 and 3 require construction works along both sides of SH16. Whilst work can be staged to alternate sides, it will require active traffic management of pedestrians, cyclists and vehicles to minimise impacts. Construction works will also be disruptive for businesses adjacent to the corridor, therefore Options 1 and 3 perform slightly negative. Options 2 and 5 will be partly constructed offline with less disruption for SH16 users. The need to acquire those businesses located on the south side of the corridor means reduced

Wellbeing Assessment	
	operational impacts on businesses during construction. Options 2 and 5 have a slightly higher risk profile compared to Option 3 due to their proximity to the NAL, this would require additional construction controls. Option 1 performs worst due to additional costs associated with operating construction sites on both sides of SH16 and likely staging to maintain traffic flows.

Segment 2: Huapai bridge to Station Road

Table 9-3 sets out the MCA scores for the Segment 2 SH16 Main Road options. Considerations and constraints identified are shown in Figure 9-6 below and Table 9-4 provides a summary of the SMEs assessment using the MCA framework.

Table 9-3: Segment 2 SH16 Main Road – MCA assessment scores

Options		Option 1	Option 2	Option 3	Option 5
Urban RTN – Performance against investment objectives	IO1. Access	4	4	4	4
	IO2. Reliability	3	3	3	4
	IO3. Mode Choice	4	4	4	4
	IO4. Integration	3	3	3	4
SH16 Main Road – Performance against investment objectives	IO1. Access	4	4	4	4
	IO3. Mode Choice	4	4	4	4
	IO4. Integration	3	3	3	4
	IO5. Safety	3	3	3	3
Criteria					
Heritage		-1	-2	0	-4
Land use futures		-2	-2	-2	-4
Urban Design		-3	-3	-3	-2
Land Requirement		-2	-3	-2	-4
Social Cohesion		-2	-2	-2	-3
Human Health and Wellbeing		1	1	1	0
Landscape / Visual		-2	-2	-3	-2
Stormwater		-1	-1	-1	-2
Ecology		-3	-3	-3	-3
Natural Hazard		-2	-2	-1	0
User Safety (RTN only)		1	1	1	2
Construction impacts on utilities /		-2	-2	-2	-2
Construction Disruption		-2	-2	-2	-2
Construction costs / risk / value capture		-3	-2	-2	-2

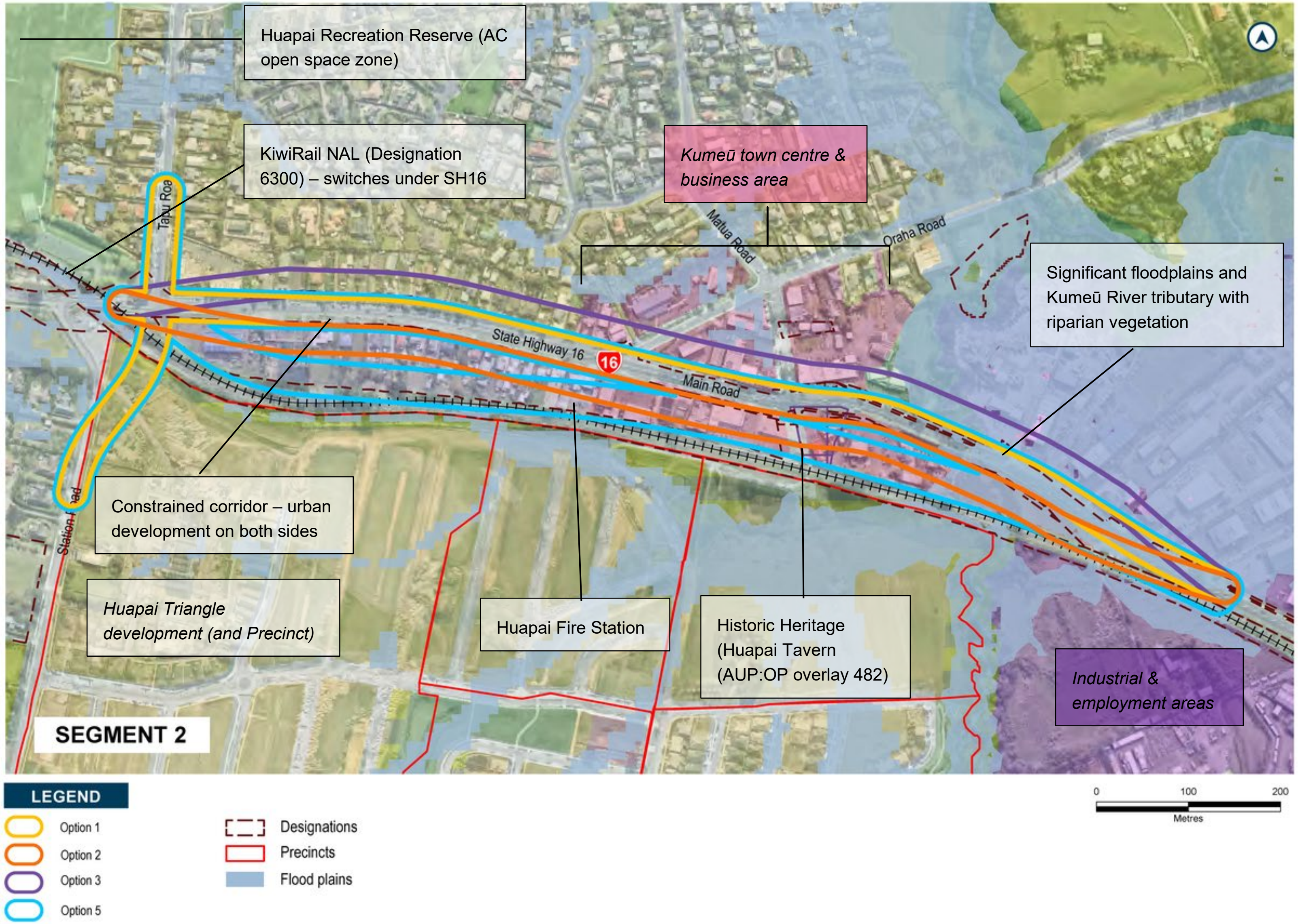


Figure 9-6 Segment 2 SH16 Main Road Options and constraints

Table 9-4: SH16 Main Road Segment 2 MCA Assessment Summary

Wellbeing Assessment	
Transport Outcomes	Access: All options improve access to social and economic opportunities within Kumeū-Huapai for active mode users, public transport and local trips. No differentiation in option performance.
	Mode Choice: All options provide high-quality facilities for active modes users, which will support transformational mode shift in Kumeū-Huapai. No differentiation in option performance
	Integration: On a SH16 standalone basis all options support integration. However, when considered in the RTC context, the option impacts result in differentiation. Options 1, 2 and 3 will reduce direct property access on SH16 to Left In / Left Out only, which reduces access for both existing and future development along the corridor. Option 5 (decoupled) will not restrict adjacent development access to SH16 and is therefore better able to support integration. Option 5 is preferred.
	Safety: All options provide quality active mode facilities and support lower speeds along SH16. There is no differentiation.
Cultural	Heritage: On a SH16 standalone basis all options can avoid the Historic Huapai Tavern building (AUP:OP 482) with no significant differentiation between the options. When considered in the RTC context however there is greater differentiation: Options 1 and 2 will impact the setting of the Huapai Tavern. Option 3 widens to the north away from the Tavern and avoids heritage features in the Segment and is preferred. Option 5 will directly impact the heritage features and require relocation or adaption of the Huapai Tavern within the existing site and therefore performs moderately negative. Option 5 has the greatest impact on the heritage features but also the greatest potential for mitigation opportunities through relocation, and in the case of the Huapai Tavern by opportunity to remove the unsympathetic (non-heritage) additions, whilst retaining the building on the original site. These mitigation opportunities have been considered but are not accounted for in option performance or scores.
Social	Future land use integration: On a SH16 standalone basis Option 5 is preferred as the upgrades are undertaken within the existing corridor (and the RTC is de-coupled (separate)). This reduces the impacts on land when compared to Options 1, 2 and 3. When considering options in the RTC context there is greater differentiation: Options 1, 2 and 3 impact land along the Segment length and due to locating the RTC within the road corridor, access to some properties may be constrained to Left in / Left out only. Despite the options intrusion into the sites and access constraints, land along the corridor will remain developable. Option 5 decoupled RTC will reduce land development potential alongside the NAL with the loss of land south of existing SH16. The remaining Town Centre Zone lots will be relatively shallow; however, they remains developable and will have better access to the northern side of Kumeū-Huapai and future RTC Stations (compared to Options 1, 2 and 3) which will enhance its developability. Due to loss of developable business land resulting from the RTC route, Option 5 performs moderately adverse.
	Social: On a SH16 standalone basis all options enhance the SH16 Main Road corridor and will provide active mode facilities for the community. When considered in the RTC context there is greater differentiation:

Wellbeing Assessment	
	Options 1, 2 and 3 introduce active modes to SH16 alongside the RTC which would exacerbate existing corridor severance created by SH16. The options would also constrain connectivity between the north and south sides of Kumeū-Huapai to specific crossing points (due to constraints of crossing RTC). Options 1, 2 and 3 have similar impacts on shops and employment opportunities with some sites requiring redevelopment. The Kumeū River open space area would be impacted but not significantly. The Kumeū Fire station will be avoided but Options 1 and 2 will affect its access. Option 5 decoupling the RTC and placing it behind lots, separate from main property access along SH16 combined with upgrading the existing SH16 corridor will address the severance issues and support improved connectivity north and south in Kumeū-Huapai centre. Option 5 will however result in loss of several shops with associated employment opportunities, impact the existing Huapai Fire Station site and the Historic Huapai Tavern building. Social impacts of Option 5 are considered in planning context that the Kumeū-Huapai town is likely to redevelop following the introduction of the S3 RTC and development of the FUZ. This will facilitate provision of new businesses, employment opportunities and community facilities. On this basis, Option 5 is preferred.
	<u>Urban Design:</u> Options 1, 2 and 3 introduce the RTC into existing SH16 adjacent to existing residential, business and town centre areas. This has potential to introduce significant infrastructure that would impact amenity and character of development. The SH16 active mode facilities would be experienced within this infrastructure context. Option 5 decouples the RTC from existing SH16 allowing for a more pleasant interface between upgraded SH16 and surrounding urban area. RTC infrastructure would be located away from publicly visible areas reducing its impact on amenity and supporting enhancement of Kumeū Huapai town. Option 5 therefore performs highly positive and is preferred.
	<u>Land Requirement:</u> Options 1 and 3 perform slightly adverse and Option 2 moderately adverse due to the level of property impacts and degree of full and partial properties required. In terms of upgrading SH16 alone, Option 5 is preferred as it has potential to minimise impacts from the SH16 Main Road upgrade along the existing corridor, with works contained within the corridor. However, the impact and preference changes when including the RTC. In context of the RTC, Option 5 performs mid-high adverse as de-coupling the RTC impacts all properties alongside the NAL alignment, although some deeper sites may not require full property acquisition.
	<u>Human Health and Wellbeing:</u> All options upgrade the existing corridor and will also see traffic reduced due to the ASH providing an alternative route for vehicles, including freight. This will reduce impacts on human health and wellbeing associated with the existing road corridor. All options provide active mode facilities benefiting health and wellbeing. When also considering the RTC, Option 5 is preferred as the RTC will be de-coupled from SH16 resulting in greater potential to mitigate operational effects on surrounding land.
Environment	<u>Landscape and Visual:</u> Options 1, 2 and 3 result in loss of vegetation at the Kumeū River Open Space and create adverse visual effects for residential properties along the corridor. Options 1 and 2 adverse effects are lower than Option 3 which scores moderately adverse due to its proximity to residential properties on the northern side of the corridor and reduced opportunity to mitigate effects through landscaping. In context of the RTC, Option 5 will result in adverse landscape effects on the Kumeū River, artificial pond and mature trees along the NAL. On the other hand, Option 5 will have fewer

Wellbeing Assessment	
	visual audiences experiencing adverse visual effects (compared to coupled options) as land north of the RTC is business zone and properties to the south will be afforded visual protection by the Green Infrastructure Corridor Zone. When considered on a SH16 standalone basis, Option 5 SH16 works will largely fit within the existing corridor and can avoid impacting landscape features. On a SH16 basis alone, Option 5 is preferred.
	Stormwater: Option 3 will have the least impact on the artificial pond adjacent to the Kumeū River and has the least risk for the NAL. Options 1 and 2 have greater impacts on the pond and increased risk of flooding. Option 5 performs minor adverse due to the RTC extending into the pond and reducing its capacity. This will require alternative attenuation methods or the pond to be bridged. On a SH16 standalone basis Option 5 will have a similar impacts to Options 1 and 2.
	Ecology: Options 1, 2 and 3 impact riparian features at the Kumeū River SH16 bridge crossing with a similar level of instream and riparian vegetation fragmentation. Option 5 has a lower impact on mature vegetation in the Kumeū River riparian zone when SH16 is considered without the de-coupled RTC, Option 5 is preferred. This is because it is largely based within the existing corridor, reducing ecological impacts.
	Natural Hazards: Option 5 crosses the Kumeū River and artificial pond and is adjacent to the railway embankment where slopes are steeper compared to Options 1, 2 and 3. Option 5 has increased risk of embankment instability and requirement for retaining walls performing slightly adverse. When considering SH16 Main Road works on a standalone basis however there is no differentiation between the options.
Transport	User Safety: All options will provide dedicated and upgraded facilities for active modes. No differentiation.
Economic	Utilities: Options 1, 2 and 3 will impact utilities and infrastructure within and adjacent to existing SH16 with risk of service continuity interruptions affecting properties either side of the corridor. Option 5 impacts will focus on the southern side of the corridor with reduced impact extent. When considered without the RTC Option 5s impacts are further reduced. Construction: Options 1, 2 and 3 works along existing SH16 require traffic management to minimise impacts. Construction works will be disruptive for the Huapai Fire station, businesses and residential properties along the corridor. Options 1, 2 and 3 therefore perform slightly negative. Option 5 will be less disruptive as the RTC will be constructed offline from SH16 Main Road and works in the SH16 corridor are limited to active modes only.

Segment 3: Station Road to Matua Road

Table 9-5 sets out the MCA scores for Segment 3 SH16 Main Road options. Considerations and constraints identified are shown in Figure 9-7 below and Table 9-6 provides a summary of the SMEs assessment using the MCA framework.

Table 9-5: Segment 3 SH16 Main Road – MCA assessment scores

Options	Option 1A	Option 1B
IO1. Access	4	4
IO3. Mode Choice	4	4
IO4. Integration	2	2
IO5. Safety	3	3
Criteria		
Heritage	0	0
Land use futures	2	-1
Urban Design	2	-2
Land Requirement	-2	-2
Social Cohesion	-2	1
Human Health and	1	1
Landscape / Visual	-3	-2
Stormwater	-1	-2
Ecology	-2	-1
Natural Hazard	-2	-1
User Safety (RTN only)	1	1
Construction impacts on	-1	-2
Construction Disruption	-2	-1
Construction costs / risk /	-3	-2

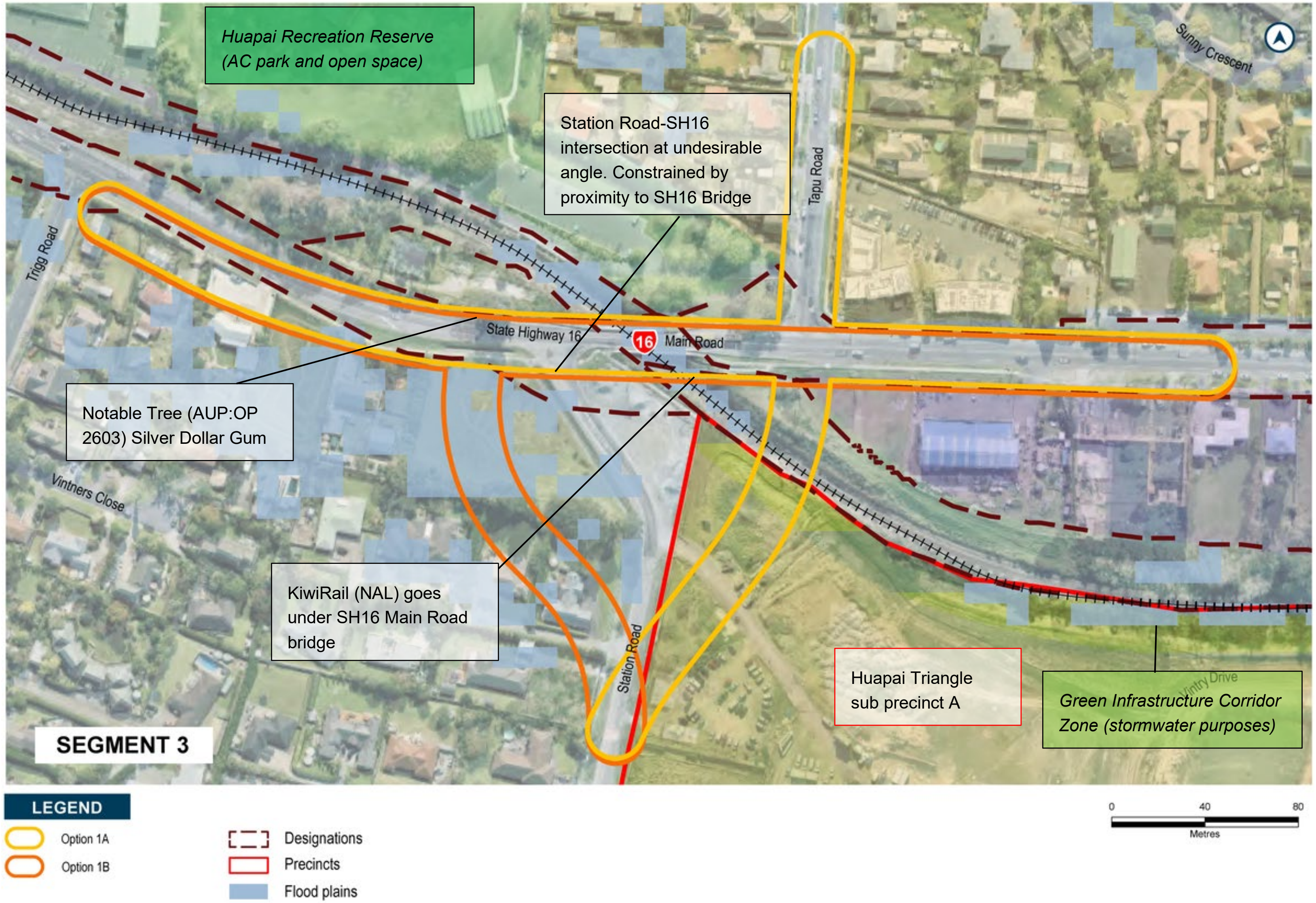


Figure 9-7: Segment 3 SH16 Main Road Options and constraints

Table 9-6: Segment 3 SH16 Main Road MCA Assessment Summary

Wellbeing Assessment	
Transport Outcomes	Access: Both options improve access to social and economic opportunities within Kumeū Huapai for public transport, local trips and active mode users. No preference.
	Mode Choice: Both options provide the high-quality facilities for active modes users, which will support transformational mode shift in Kumeū-Huapai. No differentiation.
	Integration: Both options support integration of the transport system with growth in Kumeū-Huapai. Option 1A is preferred as it results in only one intersection onto SH16 and will directly connect Tapu Road and Station Road. Option 1A preferred.
	Safety: Both options provide quality active mode facilities and support road speed reductions. No preference.
Cultural	Heritage: No heritage features or constraints were identified in this segment.
Social	Future land use integration: Option 1A aligns with the Huapai Triangle Precinct '*Road Hierarchy / Movement Plan'* which identifies a similar alignment. Option 1A has impacts on land at Tapu Road within the Residential – Mixed Housing Suburban Zone; however, the land would remain developable. Option 1A performs minor positive. Option 1B crosses Residential – Single House Zone land with existing development however the land affected by the Option is relatively small (approximately 5 properties), Option 1B therefore performs slightly adverse. Option 1A is preferred.
	Social: Option 1A provides greater connectivity between the communities on Tapu Road and Station Road than Option 1B does due to the direct connection. Both Options will impact on the businesses and associated employment opportunities located on Tupu Road. Option 1A performs slightly positive and Option 1B slightly negative. Option 1A is preferred.
	Urban Design: Option 1A provides a clear entry to the western end of Huapai commercial area, legibility between the two residential areas north and south and supports a connected street urban structure, i.e., there will be a direct connection between Station Road and Tapu Road. Option 1B removes the existing single zone buildings which provide a coherent frontage to the road and will therefore not enhance legibility on Tapu Road. Option 1A is preferred.
	Land Requirement: Both options impact a similar number of properties however there is a preference for Option 1A as the extent of impact on a number of properties is reduced, resulting in less full acquisitions, compared to Option 1B. Option 1A is preferred.
	Human Health and Wellbeing: Option 1A positions Station Road alignment east away from existing residential properties on Station Road, as anticipated in the Huapai Triangle Precinct plan. Option 1B shifts the alignment closer to residential properties on Tapu Road. Option 1B will bring associated road impacts such as noise, closer to existing residential properties which has a higher adverse effect. The number of residential properties impacted is limited for both, therefore both options perform minor adverse.
Environment	Landscape and Visual: Option 1A will have low visual effects, due to the new section of road being located further away from residential properties.

Wellbeing Assessment	
	Option 1B will have adverse visual effects on properties but on a small number. Option 1B also has some limited landscape effects, due to removal of mature vegetation along residential property boundaries.
	Stormwater: Option 1B performs minor adverse as it is located within a floodplain introducing a flooding risk, compared to Option 1A. Although Option 1A out of the floodplain it is located within the Green Infrastructure Corridor Zone which is intended to support drainage. Option 1A is preferred to Option 1B.
	Ecology: Option 1A extends into and fragments a small section of the Green Infrastructure Corridor Zone, which is a potential lizard habitat. Option 1B extends across a floodplain, which may increase hydrological stress on the downslope environment's ecology. Both Options perform minor adverse however Option 1A is preferred as it avoids floodplains and there are opportunities to mitigate fragmentation of the Green Infrastructure Corridor Zone.
	Natural Hazards: Geology is the same for both options, however Option 1A has an increased risk of instability due to steep railway cuttings.
Economic	Utilities: The Option 1B extent impacts on utilities infrastructure and areas likely to be affected by interruption are slightly greater than for Option 1A. Option 1A is therefore preferred. Construction: Option 1A performs moderate adverse as it requires the upgrade of the existing SH16 bridge and construction of an additional bridge crossing over the NAL specifically for the realignment of Station Road. Bridging increases the construction cost, programme, risk and has increased potential for disruption. Option 1B construction is close to existing residential properties on Station Road, with resulting impacts on residential amenity, however the works can be constructed offline and will not require traffic management. Option 1B will require the upgrade of only the existing SH16 bridge crossing the NAL.

9.5.2 Refinement through engagement

The emerging preferred from the assessment was Option 5 (decoupled RTC and SH16) in Segment 1 and 2 and Option 1A in Segment 3.

Throughout the option assessment workshops, the Project Team engaged with Partners to discuss the options. Feedback was received regarding the impact of Option 5 on residual land between SH16 Main Road and the proposed RTC. The project team considered the residual land between the two corridors during the assessment and confirmed that key sections of the corridor would remain developable.

9.5.3 Preferred option

Following the MCA assessment and consideration of feedback the preferred option for SH16 Main Road was identified.

In Segment 1 the preferred is Option 5, because it:

- Reduces the scale of construction for the SH16 Main Road upgrades, as the RTC will be offline. This will reduce construction disruption and maintain accessibility for traffic using SH16

- Was the most effective at addressing severance along existing the SH16 and ensures development the northern side retains access and is not restricted to Left In / Left Out movements which may inhibit future development
- The active modes facilitates better urban design and land use outcomes, such as opportunity to create a 'gateway' entrance to Kumeū-Huapai in east
- Although Option 5 has potential stormwater and flooding effects, there are feasible engineering solutions to ensure stormwater can be managed, these effects also largely result from the RTC component.

In Segment 2 the preferred is Option 5 preferred because:

- Despite having a higher land requirement resulting in loss of developable land, the created residual land remains developable and can be accessed from SH16. This land requirement effect results from the RTC, and the SH16 works enable refinements to minimise the land requirement from the upgrade of SH16
- The option will best address severance along the existing SH16 and reduces new severance by decoupling the RTC from SH16
- The option facilitates better urban design outcomes between SH16 and adjacent land use and it avoids introducing additional transport infrastructure along SH16
- It can be constructed while maintaining accessibility for traffic using SH16, resulting in less disruption impacts.

In Segment 3 the preferred is Option 1A, because it:

- Follows the road corridor identified within the Huapai Triangle Precinct Plan and only has minor impacts on residential zoned land
- Supports place making outcomes by providing a clear entry to the western end of Huapai commercial area
- Enhances connectivity north and south of SH16 by connecting Tapu Road and Station Road
- Has reduced adverse visual effects due to position of road further from residential properties.
- Avoids the floodplain west of Station Road and opportunity for drainage into Green Infrastructure Corridor Zone.

There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects. As a result, no further design refinement is required at this stage.

9.5.4 Discounted option

Table 9-7 summarises the reasons for discounting the options in each segment.

Table 9-7: SH16 Main Road Discounted Options

Option	Reasoning for discounting
Segment 1	
Option 1	• Does not support the creation of a gateway to Kumeū • Ecological impacts due to proximity to Kumeū floodplain.
Option 2	• Does not perform as positively against the Integration Investment Objectives • Less opportunities for landscaping as part of a gateway to Kumeū.

Option	Reasoning for discounting
Option 3	• Does not support the creation of a gateway to Kumeū • Ecological impacts due to proximity to Kumeū floodplain.
Segment 2	
Option 1	• Does not perform as positively against the Integration Investment Objective • Would potentially introduce infrastructure of a scale and height that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) and result in visual effects on residents • Would maintain severance issues with the RTC impeding access across the corridor from north to south Kumeū Huapai • Construction disruption and impacts on utilities as RTC constructed within the existing SH16 corridor.
Option 2	• Does not perform as positively against the Integration Investment Objective • Would potentially introduce infrastructure of a scale and height that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) and result in visual effects on residents • Would maintain severance issues with the RTC impeding access across the corridor from north to south Kumeū Huapai • Construction disruption and impacts on utilities as RTC constructed within the SH16 corridor.
Option 3	• Does not perform as positively against the Reliability and Integration Investment Objectives or the User Safety criteria • Would potentially introduce infrastructure of a scale and height that would not be keeping with the surrounding area (particularly if light metro was the chosen mode) and result in visual effects on residents • Would maintain severance issues with the RTC impeding access across the corridor from north to south Kumeū Huapai • Highest construction disruption as least efficient option and impacts on utilities as RTC constructed within the existing SH16 corridor.
Segment 3	
Option 1B	• Would impact on and result in the loss of Residential – Single House Zone land (although it is noted that this zone will likely be upzoned following Plan Change 78) • Does not as effectively support connectivity between communities located on Tapu Road and Station Road • Would result in adverse visual effects on properties adjacent to Station Road • Construction disruption and impacts on utilities as RTC constructed within the SH16 corridor • Has increased flooding risk.

9.6 SH16 Main Road Summary

As outlined, through the assessment process and feedback from Project Partners and landowners, the preferred option for SH16 Main Road is Option 5 in Segments 1 and 2, and Option 1A in Segment 3. The corridor was developed alongside the options for the RTC (discussed in Section 6) and provides for SH16 and RTC to run alongside each other (but not combined) at the eastern end, fully separating at the Kumeū River Bridge at the entry to Huapai. SH16 is then fully separated from the RTC by the NAL at the western end.

10 S1: Alternative State Highway

10.1 Overview

The ASH corridor formed part of the TFUG in the Programme Business Case preferred transport network plan prepared in 2016. The ASH (and RTC) would connect the north west communities of Waimauku, Helensville and Kumeū-Huapai with an efficient connection to the strategic highway network and directly onto a BCI providing strategic network resilience. By removing through traffic from the Kumeū-Huapai town centre the project would allow SH16 Main Road (NOR S2) to return to an arterial road function and consequently enhance the economic and social functions within the Kumeū-Huapai town.

The proposed corridor extends from Brigham Creek to connect onto SH16 west of Foster Road outside the Kumeū-Huapai FUZ. The option (SR-SH-K-01a) was assessed as one of the Strategic State Highway connections at IBC stage, see Figure 10-1 and considered against several alternatives. The option was recommended as it performed best for strategic travel and has co-implementation benefits for the RTC (NOR S3) and enables regeneration in Kumeū-Huapai town.

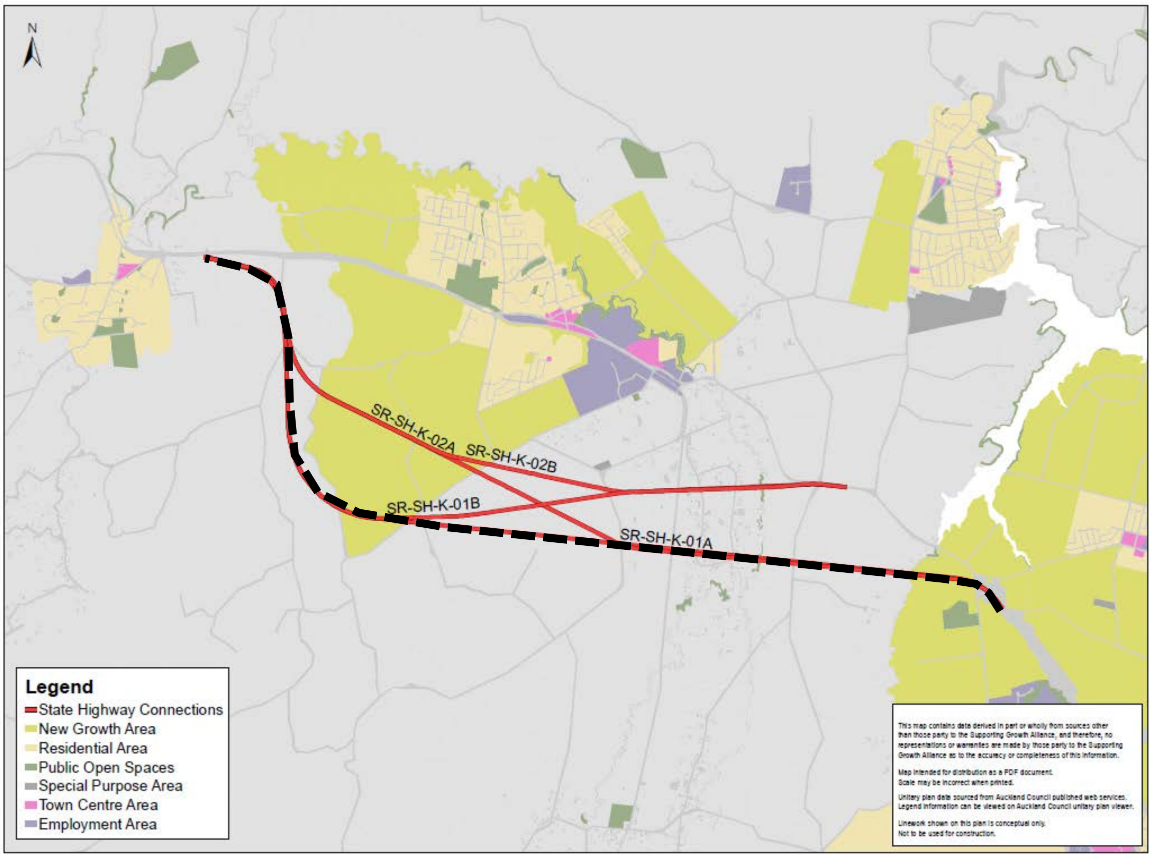


Figure 10-1: Alternative State Highway IBC Option SR-SH-K-01A

Of the options assessed, southern connections were preferred with northern options near Helensville and Waimauku being discounted due to significant adverse environmental impacts and complex topography. Of the southern options, a connection at Brigham Creek was identified as providing advantages as it enables full integration with the interchange which would reduce private property impacts and the connection was considered to have higher resilience than a connection at Taupaki Road.

10.2 Gap analysis

The gap analysis identified key issues as uncertainty of future land use due to the Kumeū-Huapai FUZ not being structure planned in the short term. The potential relocation or expansion of the NAL by KiwiRail was also identified as an area of uncertainty and also a potential opportunity.

Key gap analysis decisions were to:

- Undertake additional corridor assessment within a study area based on the IBC recommendation, prior to proceeding with the recommended option, due to the corridor's length and range of potential effects
- Undertake further analysis and engagement with KiwiRail regarding plans for the NAL and consideration on whether options for the ASH would preclude re-location of the NAL out of Kumeū-Huapai
- Undertake option assessment via an MCA with input from SMEs.

10.3 Corridor form and function assessment

A corridor extent and form assessment was undertaken for the ASH. This recommendation informed the options developed and assessed in Section 10.4, Figure 10-2 shows the form outcome.

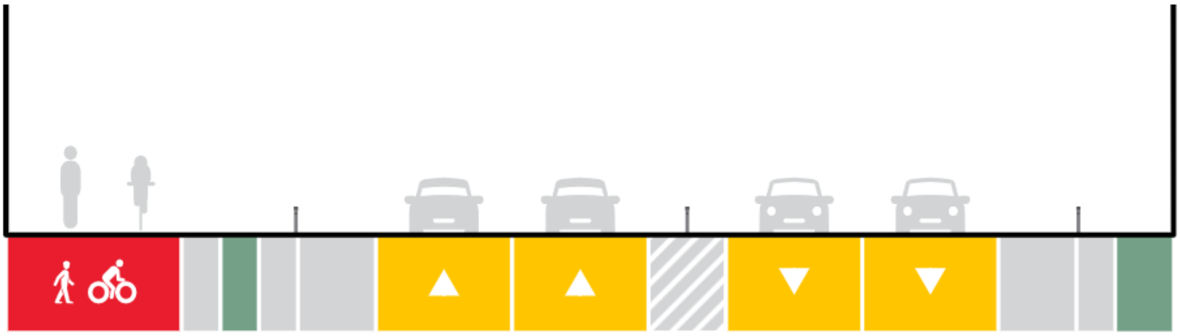


Figure 10-2: ASH CFAF Outcome – 50m cross section

10.4 Land Use Review and Constraint Mapping

To inform the option development and assessment, a land use review and constraint mapping exercise was carried out, this divided the corridor into three segments for analysis. Key matters identified were:

- **Extent and Zoning:** The ASH corridor extends from Brigham Creek Road to SH16 west of Foster Road through primarily rural land use, zoned under the AUP:OP as Rural – Countryside Living with an area of Rural – Mixed Use Zone. The land at Brigham Creek near Redhills North and at the lower edge of the Tawa Road intersection is zoned FUZ
- **Future land use:** The area will not be structure planned in the short term by Council, however the NW Spatial Strategy prepared by Council in 2021 identified key urban land use including industrial and town centre areas. This identified an expansion to the Business- Light Industry Zone at Access Road, away from Main Road which will have an expanded town centre area along SH16. The FUZ was not specified at Tawa Road intersection or BCI and remains as '*future residential and other uses*'. The Whenuapai Structure Plan 2016 north of BCI, identified higher density residential (Terraced Housing and Apartment Building Zone) and an expanded industrial land

- Special uses and constraints:
  - The study area is crossed by two Transpower National Grid Overlays under the AUP:OP
  - The western rural end is bound by the NAL under Designation 6300 for rail purposes, KiwiRail is the requiring authority
  - New Zealand Refining Company Ltd's petroleum pipeline and First Gas Limited gas pipeline are both designated and run west of Kumeū-Huapai FUZ in a north-south alignment. They form a construction and operational constraint
  - Existing sports and recreational facilities are at Fred Taylor Park, in addition to rural land use such as equestrian and viticulture activities
- Environment / social constraints:
  - Discussion with Council indicates that the southern section of the Kumeū-Huapai FUZ will likely be zoned for low density development, akin to Rural – Countryside Living due to the topography being challenging and less suitable for dense urbanisation
  - Significant flood plains, streams and wetlands are present across the catchment from the Kumeū and Ngongetepara River tributaries
  - Rural area has high value / production soils present
  - Native bats, a critically engendered species were identified as present in the area. The bats fly between the Riverhead Forest (north of Kumeū-Huapai) and the Waitakere Ranges (south of area).

Key project impacts were identified as being on property and the natural environment in particular streams and productive soils.

The outcome of this land use and constraint review was:

- Option assessment should be undertaken in alignment segments (see Figure 10-3) to allow localisation of the assessment and respond to considerations and constraints in each
- Options should be developed and assessed via an MCA with input from SMEs
- Option alignments that connect to SH16 west of Waimauku were discounted due to challenging topography and as they wouldn't as well serve the Kumeū-Huapai FUZ
- Engagement with Council is required on the future of Kumeū-Huapai FUZ
- All of the Long list and Short List options would cross between these habitats (Riverhead Forest and Waitakere Ranges), and therefore did not discount the option. Impacts on bats would need to be carefully considered as part of the option design.

10.5 Corridor Option Development

To assist with the assessment the corridor was divided into three segments, see Figure 10-3.

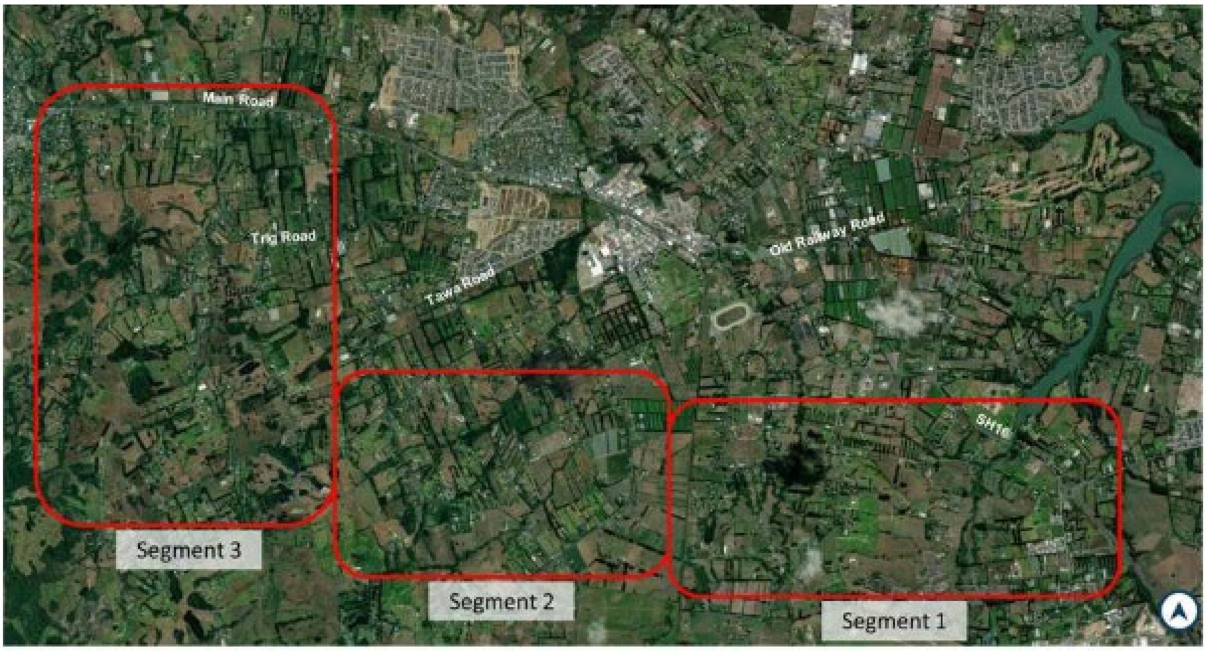


Figure 10-3: Alternative State Highway option development segments

Segments 1 and 3 were considered to be anchor points for the ASH as they form the desired tie ins to the existing strategic transport network. At Segment 1 in particular, the ability to connect to proposed BCI was an assessment criterion (see Section 11 for BCI assessment). The preferred option in Segment 2's ability to tie in to Segments 1 and 3 preferred options would be a consideration.

10.6 Corridor Option Development

10.6.1 Assessment

The assessment undertaken for the ASH corridor follows the process outlined in Section 4.4. All Section options were assessed qualitatively against the MCA framework by SMEs and the Project Team. Options were also assessed against their ability to achieve the Transport Outcomes sought.

Transport Outcomes

- Access: Improve access to economic and social opportunities to, from and within Kumeū-Huapai by removing the strategic function from the existing state highway
- Reliability: Improve reliability of inter-regional movements in the North West growth area
- Integration: Provide a transport system that enables a more sustainable, high quality, connected urban form and supports growth in Kumeū-Huapai
- Safety: Contribute to a transport network between Brigham Creek and Waimauku that is free from deaths and serious injuries.

ASH Segment 1 Brigham Creek to NAL

<u>Segment 1 Options</u>

Four options for Segment 1 using the approximate 50m wide cross section from Figure 10-2: ASH CFAF Outcome – 50m cross section were workshopped, these were:

Option 1: Northern alignment option following westerly alignment towards Taupaki Road and south of Boord Crescent

Option 3 Northern alignment option following south-westerly alignment towards Taupaki Road, immediately north of Nixon Road

Option 4: Southern alignment option following westerly alignment towards Taupaki Road, immediately north of Nixon Road

Option 6: Southern alignment option following north-westerly alignment towards Taupaki Road and south of Boord Crescent

See Table 10-1 for MCA performance and Figure 10-4 for these option alignments against the identified corridor constraints.

Table 10-1: ASH MCA Assessment – Segment 1

Options	Option 1	Option 3	Option 4	Option 6
IO1. Access	4	4	4	4
IO2. Reliability	3	3	3	3
IO4. Integration	3	2	3	3
IO5. Safety	3	3	3	3
Criteria				
Heritage	-2	-2	-1	-1
Land use futures	-2	-2	-2	-2
Urban Design	-2	-2	-2	-2
Land Requirement	-2	-2	-2	-2
Social Cohesion	-2	-2	-2	-2
Human Health and Wellbeing	-3	-3	-3	-3
Landscape / Visual	-3	-4	-4	-3
Stormwater	-2	-3	-3	-3
Ecology	-4	-4	-4	-4
Natural Hazard	-1	-1	-1	-2
Construction impacts on utilities / infrastructure	-2	-2	-2	-2
Construction Disruption	-3	-3	-3	-3
Construction costs / risk / value capture	-3	-3	-3	-3

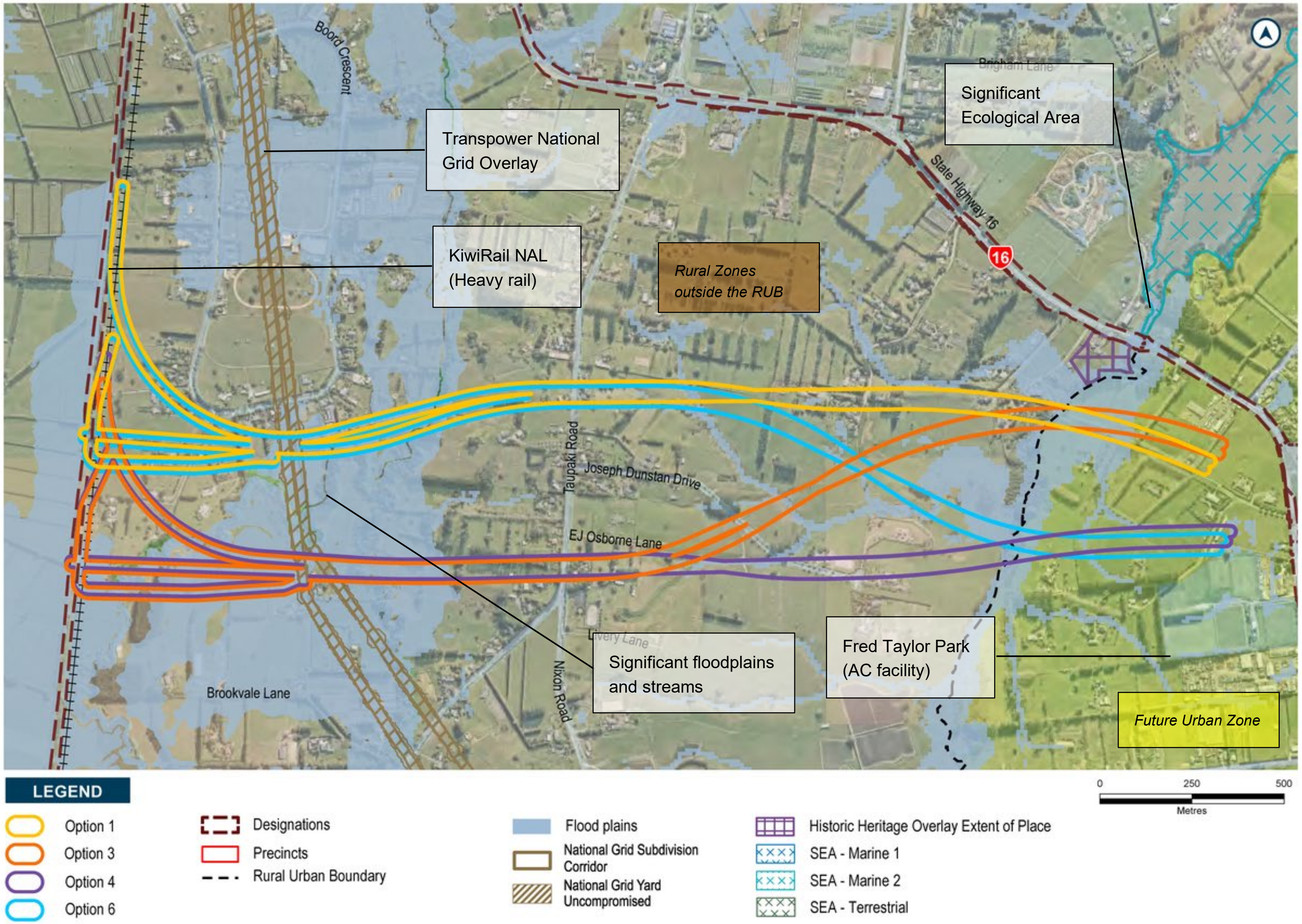


Figure 10-4: ASH Segment 1 Options and identified constraints

Table 10-2: ASH Segment 1 – Option Assessment Summary

Wellbeing Assessment (Brigham Creek to NAL)	
Transport Outcomes	_Access:_ All four options will remove strategic trips from the Kumeū-Huapai section of existing SH16. This will positively contribute to the economic and social opportunities within Kumeū-Huapai. No access from local roads is proposed in this Segment which will support efficiencies and accessibility. There is no differentiation between the options.
	Reliability: All four options will improve freight reliability as the ASH is fully segregated with no access from local roads, resulting in no side friction as currently occurs on SH16. There is no differentiation between the options.
	Integration: All four options provide capacity to move vehicles out of Kumeū-Huapai which will open up space to improve urban outcomes and activate the town centre. Option 3 will result in greater adverse effects on local roads, particularly where it severs the end of Joseph Dunstan Drive and therefore performs less well than Options 1, 4 and 6 which are equally preferred.
	Safety: All four options will have an appropriate risk rating for a state highway function, and all will be safer than the existing SH16 risk rating. The options will provide a suitable facility for through trips which is likely to reduce traffic on local roads which will contribute to improved local safety. There is no differentiation between the options performance.
Cultural	Heritage: Both Option 4 and 6 are not adjacent to any known archaeological sites. There is a slight preference for Option 4 however as this crosses the least number of streams (three streams) compared to Option 6 which crosses four streams. Option 1 and 3 cross more significant streams and are closer to Brigham Creek which has a cluster of archaeological and heritage sites, and therefore have a higher potential for archaeological impact. Option 4 is preferred.
Social	Future land use integration: All four options will impact upon the FUZ and the Rural – Countryside Living Zone. Within the Redhills North FUZ options can be integrated into the future development. All options will impact lots and create local access and severance issues. There is no significant differentiation between the options.
	Social: All four options will create localised severance issues which will impact upon the existing community. There is no significant differentiation between the options.
	Urban Design: All four options performed similarly, however Option 6 is preferred as it is more distant from the Ngongetepara Stream, mirrors the alignment of Joseph Dunstan Drive and curves around Boord Crescent responding to the existing rural character. Option 6 responds to features which contribute to the rural character and requires less bridges and / or culverts. Option 6 is preferred.
	Land Requirement: All four options will impact properties within the FUZ and Rural – Countryside Living Zone to a similar level. There is no significant differentiation between the options.
	Human Health and Wellbeing: All options will introduce a state highway with additional traffic and associated effects into a rural environment with residential use. Effects are similar for all options with no differentiation.

Wellbeing Assessment (Brigham Creek to NAL)	
Environment	Landscape and Visual: All options will have adverse landscape and visual effects. Options 2 and 3, have more significant adverse landscape effects whereas Options 1 and 6 have more limited effects on the landscape and natural features. Of the two, Option 6 requires extensive fill earthworks east of Joseph Dunstan Drive and therefore Option 1 is slightly preferred.
	Stormwater: All options will impact overland flow paths, streams and rivers. Options 3, 4 and 6 have no significant differentiation. Option 1 crosses the Kumeū River floodplain at the narrowest point reducing flood risk and volume of flood plain displaced. Option 1 is therefore preferred.
	Ecology: Options 3 and 4 will have the greatest impact on ecology due to additional effects on rivers, streams and floodplains. Option 6 performs slightly better, but still impacts on potential floodplains and intercepts several surface waterbodies (such as streams) which are potential bird habitat. Option 1 will result in an overall lower ecological impact on floodplains, dams, rivers, streams and associated habitat and is therefore preferred. Assessment was undertaken prior to the National Policy Statement on Freshwater 2020 taking effect, however, options were reviewed after. Options 1 and 6 impact a greater number of natural wetlands; however also avoid wetlands with higher ecological value which Options 2 and 4 do impact. On this basis, Option 1 followed by Option 6 remain preferred.
	Natural Hazards: Options 1, 3 and 4 have similar geo-technical risks. Option 6 requires a greater volume of earthworks in the Waitematā Group ridge gully and is least preferred.
Economics	Utilities: All four options pass-through green fields and so impact on existing infrastructure will be low and limited to impacts on local roads, Transpower's power pylons / overhead lines and Watercare's gravity sewer. There is no differentiation between the options. Construction: All options pass-through challenging terrain with moderate to severe topography and elevation changes resulting in significant earthworks (cut and fill) to construct. Option 3 has a more equal cut to fill ratio, whereas the others are in fill deficit. Option 6 requires the least bridging. All options have a similar level of construction disruption and there is no disruption differentiation between the options.

ASH Segment 2 NAL to Tawa Road

Segment 2 was initially developed with a northern and a southern option, however post public engagement, four additional options were developed and assessed. The pre-engagement options are set out below and then post engagement options discussed under Section 10.6.2 *Refinement through Engagement*. All options are then shown in Figure 10-8 for comparison.

Segment 2 Options (Pre engagement)

Prior to engagement two options were taken forward for development in Segment 2 using the approximate 50m cross section from Figure 10-2.

Northern Option: Northern alignment with cycleway west of the NAL and SH16 Main Road

Southern Option: Southern alignment with cycleway west of the NAL and SH16 Main Road. Follows a westerly alignment towards the southern section of Pomona Road and Tawa Road, north of Awa Road and Tawa Road intersection

Table 10-3 sets out the MCA performance of the options and Figure 10-8 sets out the options against identified constraints alongside the Post Engagement Options.

Table 10-3: ASH MCA Assessment – Segment 2 (pre-engagement options)

Options	Northern Option	Southern Option
IO1. Access	4	4
IO2. Reliability	4	4
IO4. Integration	4	4
IO5. Safety	3	3
Criteria		
Heritage	-2	-2
Land use futures	-2	-3
Urban Design	-2	-2
Land Requirement	-2	-2
Social Cohesion	-3	-3
Human Health and Wellbeing	-3	-3
Landscape / Visual	-4	-4
Stormwater	-3	-4
Ecology	-2	-4
Natural Hazard	-1	-2
Construction impacts on utilities / infrastructure	-2	-2
Construction Disruption	-3	-3
Construction costs / risk / value capture	-3	-3

Table 10-4: ASH Segment 2 – Pre-engagement Option Assessment Summary

Wellbeing Assessment	
Transport Outcomes	Access: *Pre-engagement Options:* Both options remove strategic trips from the Kumeū-Huapai section of SH16, which will positively contribute to Kumeū Huapai economic and social opportunities. No differentiation between the options.
	Reliability: *Pre-engagement Options:* The form and function are consistent across both options and broadly offer the same reliability improvements. The options are of a similar length with no travel time and congestion differentiation. Both options impact the local road network and require solutions to avoid or minimise impacts on local road reliability. There is no differentiation between the options.
	Integration: *Pre-engagement Options:* Both options provide capacity to move vehicles out of Kumeū-Huapai, which will allow improved urban outcomes and activate the town centre. There is no significant differentiation between the options.
	Safety: *Pre-engagement Options:* Both options will have an appropriate risk rating for a state highway and are better than the existing SH16 risk rating. The options will provide a suitable facility for through trips which is likely to reduce traffic on local roads and contribute to improved local safety. There is no differentiation between the options.
Cultural	Heritage: *Pre-engagement Options:* Both options cross the same number of waterways, where there is a similar risk of encountering unknown archaeological sites There is no preference between options.
Social	Future land use integration: *Pre-engagement Options:* The Northern Option extends across the Rural – Countryside Living Zone and will create residual land and require alternative access to some lots. However, the Northern Option will not have a significant impact on the Rural – Mixed Zone. The Southern Option extends across both the Rural – Countryside Living Zone and the Mixed Rural Zone. The Southern Option will create residual land impacts and require alternative access to be provided to some lots in both zones. By impacting the Mixed Rural Zone, the Southern Option also reduces the land available for rural production purposes. Both options affect high quality soils; however, the Southern Option impacts the Rural – Mixed Use Zone which enables productive use of soils as opposed to low-production Countryside Living. On this basis the Northern Option is preferred.
	Social: *Pre-engagement Options:* Both options have localised severance impacts upon the community and affect employment opportunities in the existing rural area. The Southern Option will avoid some impacts on the community; however the difference is not substantial.
	Urban Design: *Pre-engagement Options:* Both options adversely impact the existing rural character, however the Northern Option is more direct for active mode users to Tawa Road and then future development such as the local centre and industrial areas (refer to Councils NW Spatial Strategy).
	Land Requirement: *Pre-engagement Options:* Both options require full and partial property acquisitions. However, the Southern Option is partially within the Rural – Mixed Use Zone which provides for less development and is therefore slightly preferred (reduced impact on developable land).

Wellbeing Assessment	
	Human Health and Wellbeing: *Pre-engagement Options:* Both options introduce a state highway with additional traffic and associated adverse effects into a rural environment with residential uses. Effects are similar for both options.
Environment	Landscape and Visual: *Pre-engagement Options:* The Northern Option has relatively less earthworks and subsequently less significant landscape effects compared to the Southern Option. The Northern Option earthworks also generally work better with the existing landform compared to the Southern Option. The Northern Option is therefore preferred.
	Stormwater: *Pre-engagement Options:* The Southern Option has an increased flood risk due to a larger upstream catchment, larger extent of floodplain and presence of floodplains between the NAL and Tawa Road. Because the Northern Option is further north the upstream catchment area is reduced compared to the Southern Option, this presents the best freeboard flood opportunity and reduced culvert / bridge lengths. The Northern Option alignment also crosses the overland flow path and floodplain near the NAL at its narrowest point. The Northern Option is therefore preferred.
	Ecology: *Pre-engagement Options:* The Southern Option has significantly greater impact on ecological features, although the Southern Option impacts fewer wetland features than the Northern Option, those it affects have higher ecological value. The Northern Option has the least impact on floodplains and less stream crossings and requires less native tree and woody vegetation removal. The Northern Option is therefore preferred.
	Natural Hazards: *Pre-engagement Options:* The Southern Option has additional risks associated with the larger volume of earthworks. The Northern Option passes through flat alluvial ground with a lower natural hazard risk profile and remediation requirements are less complex than the Southern Option. The Northern Option is therefore preferred.
Economics	Utilities: *Pre-engagement Options:* Both options pass through green fields and existing infrastructure impacts will be limited to local roading and associated utility infrastructure. There is no differentiation between the options. Construction: *Pre-engagement Options:* Both options have a similar level of construction disruption. The Northern Option has less earthworks than the Southern Option, with reduced overall project cost.

The outcome of the MCA assessment was that the Northern Option was determined to be preferred. This would later be assessed and refined through engagement.

ASH Segment 3 Tawa Road to SH16

Segment 3 Options

Seven options were developed for Segment 3 and taken forward for assessment based on the approximate 50m cross section from Figure 10-2, these were:

Option 1 Towards Main Road SH16 to an intersection west of Foster Road / SH16 intersection

Option 2: Towards Main Road SH16 to an intersection east of Wintour Road / SH16 intersection

Option 3: Towards Main Road SH16 to an intersection between Foster Road / SH16 and Wintour Rd / SH16 intersections

Option 4: Towards Main Road SH16 to an intersection west of Foster Road / SH16 intersection

Option 5: Towards Main Road SH16 to an intersection east of Wintour Road / SH16 intersection

Option 6: Towards Main Road SH16 to an intersection between Foster Road / SH16 and Wintour Rd / SH16 intersections

Option 7: Towards Main Road SH16 to an intersection west of Foster Road / SH16 intersection

Refer to Table 10-5 for MCA options performance and Figure 10-5 for location of options developed in Segment 3. The assessment is summarised in Table 10-6.

Table 10-5: ASH MCA Assessment – Segment 3

Options	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7
IO1. Access	4	3	3	4	3	3	4
IO2. Reliability	4	4	4	4	4	4	4
IO4. Integration	4	4	4	4	4	4	4
IO5. Safety	3	3	3	3	3	3	3
Criteria							
Heritage	-2	-2	-2	-2	-2	-2	-2
Land use futures	-2	-3	-3	-3	-3	-3	-3
Urban Design	-3	-2	-3	-2	-3	-3	-3
Land Requirement	-2	-2	-2	-2	-2	-2	-2
Social Cohesion	-2	-3	-3	-3	-3	-3	-3
Human Health and Wellbeing	-3	-3	-3	-3	-3	-3	-3
Landscape / Visual	-3	-4	-4	-4	-4	-4	-4
Stormwater	-3	-3	-4	-4	-3	-3	-2
Ecology	-2	-3	-4	-4	-4	-3	-3
Natural Hazard	-2	-4	-3	-1	-4	-3	-2
Construction impacts on utilities / infrastructure	-2	-3	-3	-3	-3	-3	-3
Construction Disruption	-3	-3	-3	-3	-3	-3	-3
Construction costs / risk / value capture	-3	-3	-3	-3	-3	-3	-3

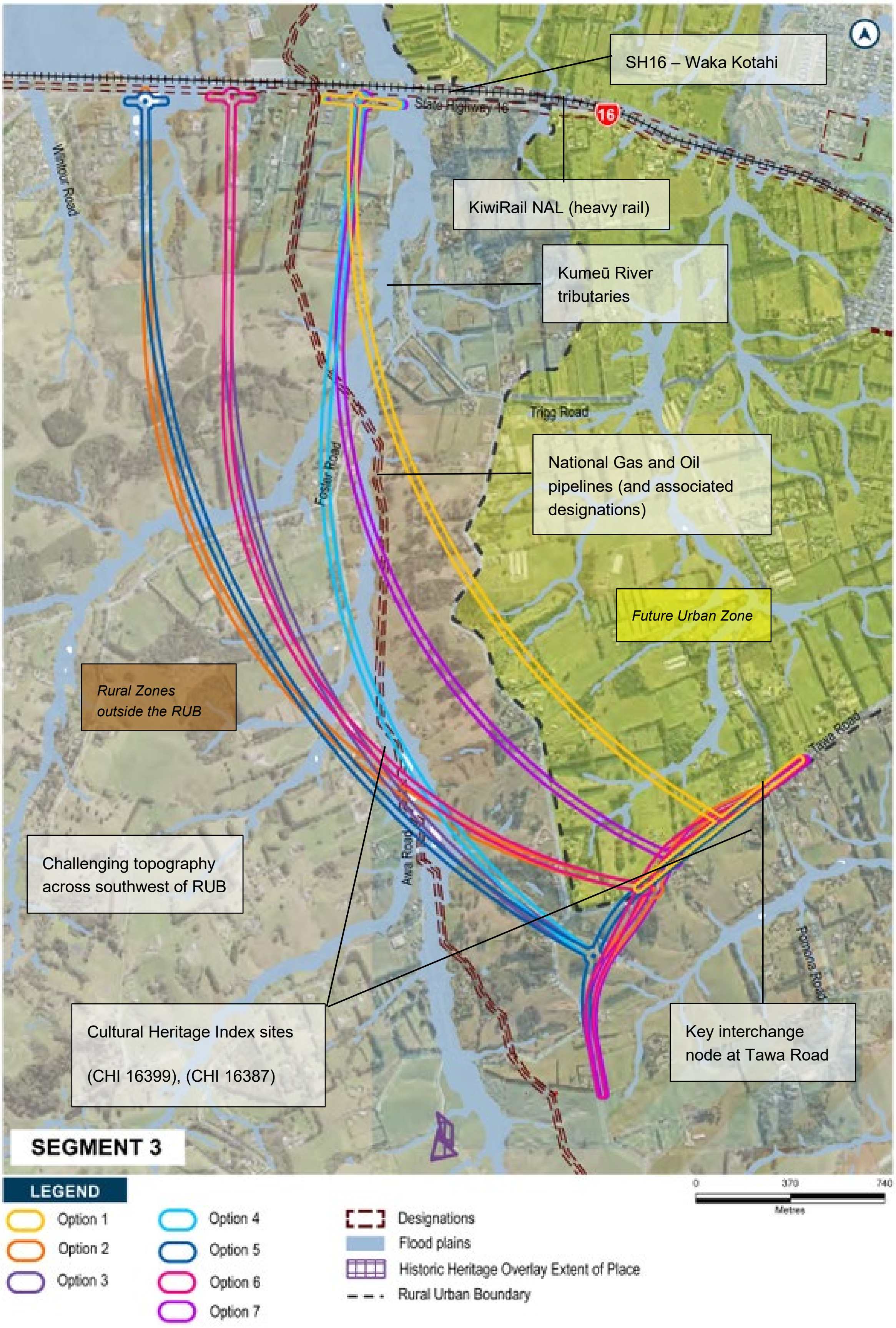


Figure 10-5: ASH Segment 3 Options and identified constraints

Table 10-6: ASH Segment 3 Option Assessment Summary

Wellbeing Assessment	
Transport Outcomes	*Access:* All options will remove strategic trips from the Kumeū-Huapai section of the existing SH16, which will positively contribute to the economic and social opportunities within Kumeū-Huapai. Option 1, 4 and 7 do provide better access to north Huapai and the growth areas and will minimise the need for 'back tracking' to get on or off the ASH. Options 2, 3, 5 and 6's western connection is less well connected to the growth areas in Huapai.
	Reliability: The form and function are consistent across all seven options and will generally offer the same reliability. The options are of a similar length with little differentiation in travel time for vehicles or congestion. All options impact on the local road network to a similar extent and require localised solutions to avoid or minimise impacts on local reliability.
	Integration: All options provide capacity to move vehicles out of Kumeū-Huapai which will release space to improve the urban outcomes and activate the town centre. Option 1 has potential to create severance within the southern FUZ; however, the option traverses the FUZ where the topography means development density and character is likely to be more consistent with the countryside areas. On this basis, there is no differentiation between Option 1 and the other options.
	Safety: All options have an appropriate risk rating for a state highway function and will be better than the existing SH16 risk rating. The options provide a facility suitable for through trip types which is likely to reduce traffic on local roads and will contribute to improved local safety.
Cultural	Heritage: Options 1 and 2 have a reduced number of stream crossings and earthworks will generally occur in hill country. All options impact Cultural Heritage Inventory items (e.g., CHI16387, CHI 16399, and CHI 16400) to a similar degree.
Social	Future land use integration: Option 1 cuts across the Kumeū-Huapai FUZ resulting in a loss of urban land that could otherwise be developed. However, the characteristics, particularly the topography, make the southern section less suitable for dense development. From discussions with AC it is understood, the area is more likely to be developed to a density akin with surrounding Rural – Countryside Living Zone. Option 1 has reduced impacts on the Rural – Countryside Living and Mixed Rural Zone due to the extent of footprint within the FUZ and because the alignment along Foster Road will reduce the potential pressure for 'infill' development on land. Option 1 is preferred. Options 2, 3, 4, 5, 6 and 7 avoid the FUZ resulting in greater adverse impacts on the Rural – Countryside Living and Mixed Rural Zone. Change in the environment from rural to urban is not anticipated in these zones and there will be less ability to integrate the options into a future development scenario. These options go across the rural zone and have potential to generate pressure for infill development outside of the rural – urban boundary. These options therefore perform unfavourably.
	Social: All options create local severance and connectivity constraints which impact the existing rural community. Option 1 within the FUZ performs slightly better as the existing area is anticipated to change and severance issues could be mitigated through structure planning and subsequent plan change processes.

Wellbeing Assessment	
	Urban Design: Options 2, 4 and 7 contribute to the character of Kumeū by providing a gateway opportunity at the western entry to Kumeū. A strategic corridor in this location assists in defining the edge of the Rural – Countryside Living Zone at this western side. Option 2 and 4 have greater character impacts on rural areas and are less preferred than Option 7. Option 7 cuts through a portion of the southern FUZ, however, this is balanced by increased direct access and amenity for cyclists being able to access the FUZ closer to a future local centre and industrial area on the eastern end of Access Road. Options 1, 3, 5 and 6 do not create a gateway opportunity and will result in impacts on rural character. They therefore perform poorly on this criterion.
	Land Requirement: All options impact on properties within FUZ and Rural – Countryside Living Zone to a similar extent. Option 1 has greater impact on the FUZ, which has the greatest development potential. However, as noted the topography constrains realisation of this.
	Human Health and Wellbeing: All options introduce a state highway to a rural environment with subsequent adverse effects. Option 1 will have a greater effect on future residents of the FUZ; however, other options will impact residents within the Rural – Countryside Living Zone. Options 2 and 5 have potential to affect Waimauku due to being closer to the residential area. Options 2 and 5 are the least preferred of the options.
Environment	Landscape and Visual: All options introduce a large change in the landscape character. A section of Option 1 will be within the context of the FUZ environment that is identified for land use change (as opposed to rural areas). Earthworks and vegetation clearance will be viewed within the future urban environment. Option 1 has less crossings of the Ahukaramu Stream which reduces effects on this natural feature. Additionally, Option 1 reduces visual effects on residential audiences in proximity to Awa Road and Foster Road which are relatively well protected from direct views of the option due to existing landform and vegetation. The other options do not have the benefit of landscape change anticipated and will also have greater visual effects on rural residential properties.
	Stormwater: All options impact overland flow paths, and streams including the Ahukuramu Stream. Option 7 tends to 'hug' the valley which facilitates low impact stormwater treatments. It also has reduced stream crossings compared to other options and is the preferred alignment for the stream crossings (including the Ahukuramu Stream). Option 7 also provides the best freeboard flood opportunity. Option 1 is similar to Option 7, however passes through the FUZ which reduces the range of stormwater treatments available for a future urban area. Options 2, 5 and 6 are less preferred than Option 1 as they have skewed stream crossings requiring additional erosion control measures and have increased flood risk where they cross steam beds. Options 3 and 4 both have a higher risk of flooding. Option 7 is preferred.
	Ecology: Option 1 has the least impact on floodplains and less stream crossings. The option also avoids the largest surface waterbodies and will result in the least removal of native trees and woody vegetation. In relation to higher value wetlands the option avoids two systems west of Pomona Road. Options 2, 6 and 7 impact a greater extent of floodplain and native vegetation than Option 1.

Wellbeing Assessment	
	Options 3, 4 and 5 have additional impacts on wetlands and surface waterbodies performing worst of the options. Option 1 therefore is the preferred option.
	Natural Hazards: Option 4 is the preferred option as it follows the valley floor and avoids large earthworks, minimises risks of settlement and liquefaction on Tauranga Group material and stability in the Waitematā Group material. Options 1 and 7 make less use of the valley floor compared to Option 4 increasing the risk profile (although Option 1 is preferred over Option 7). Options 3 and 6 have greater geo-technical risks compared to Options 1, 4 and 7, but make better use of the flat alluvial ground found in the segment, involve less earthworks and have less associated stability risks from large cuts / fills than Options 2 and 5. Option 4 is preferred.
Economics	Utilities: Option 1 has the least impact on local road infrastructure, the Southern Cross international fibre Cable Network, National Oil (New Zealand Refining Company Ltd, Designations 6500), Gas Pipeline (First Gas Limited, Designations 9100 and 9101) and Vector gas and power network. Options 2, 3, 4, 5, 6, and 7 have a greater impact on the existing utilities and infrastructure compared to Option 1. The options also require engineering solutions to protect the Oil and Gas Pipeline during construction and operational phases. These options are therefore least preferred.
	Construction: All options will result in construction disruption, including local access constraints and all options pass-through challenging terrain with moderate to severe topography and elevation changes. This will result in significant earthworks volume to construct the proposed ASH. Options 2 and 5 are closest to the residential land use in Waimauku and are least preferred. Option 3 is preferred as it will have a better cut and fill balance compared to other options which are predominantly cut. There is no significant differentiation between the remaining options.

10.6.2 Refinement through Engagement

Public and Landowner Engagement

The ASH was consulted on between November 2020 and February 2021 via public engagement and landowner meetings. Feedback was received on the following alternative alignments for the ASH (some had been discounted prior at gap analysis, see Section 10.2).

- North of SH16 and reuse of Old North Road
- West of Waimauku
- South of Brigham Creek
- Between the NAL and Brigham Creek to avoid flood plains.

Design changes requested

- A direct access to the ASH at Taupaki Road.

The reasons for discounting these alternatives are set out in Table 10-7.

Table 10-7: Alignments reconsidered at Gap Analysis and through engagement

Further assessment summary
North of SH16 and reuse of Old North Road
Further assessment confirmed discounting the options for the following reasons: SR-SH-K-05: • Has significant impacts on native vegetation in the Riverhead Hills north of the Kumeū River as this is a prominent elevated area within an ONL • Would not efficiently serve growth areas in Kumeū-Huapai and would not support land use integration due to traffic continuing to access SH16 / Main Road. SR-SH-K-04: • Impact on riparian vegetation and the Kumeū River. The area is an ONL and SEA and would likely result in significant adverse effects to the ecology of the area • Both options performed less well on Access, Strategic Connections and Safety Transport Outcomes compared to the southern options.
West of Waimauku
The alignment was discounted for the following reasons. • The topography is challenging for an ASH alignment to the west of Waimauku. This would require increased earthworks with the potential for increased environmental and landscape effects. The topography would result in increased construction costs as hills / steeper terrain requires wider cuts and embankment compared to options crossing flatter / more gentle terrain • The alignment would cross the petroleum and gas pipeline (Designations 6500 and 9100), requiring engineering solutions to be put in place to protect the pipeline during construction and subsequent operation phase • Daily traffic demand on SH16 between the western termination of the ASH (emerging preferred location) near Foster Road, and Waimauku is predicted to increase by around 8,000-9,000 vehicles to around 23,500 daily vehicles. This increase in traffic can be adequately accommodated in the existing road network as Waimauku has less direct frontage, property access and intersections, which generally contribute to the ‘bottlenecks’ and breakdown in traffic flows; and there is not sufficient demand to support the ASH alignment being extended by a further 4 to 5km away from growth areas in Kumeū-Huapai. There is no FUZ in Waimauku.
South of Brigham Creek
The alignment was discounted for the following regions. • Brigham Creek Road roundabout is the current termination of the North Western motorway. An ASH connection at this location integrates with existing SH16 and makes best use of existing motorway • The NW Local Arterials Package includes a new local road corridor (Spedding Road) connecting to Hailes Road and crossing SH16. The proposed alternative south of Brigham Creek Road would impact on the feasibility and benefits of the proposed Spedding Road corridor • The alignment would result in less facilitation of strategic connection between Westgate and Whenuapai as the BCI location would move south. This would also offer less resilience benefits for the transport network.
Between the NAL and Brigham Creek (new option)
The alignment was discounted for further option assessment for the following reasons: • Watercourses and flood plains are found to the north and south of the consulted upon alignment. There are feasible engineering solutions to crossing the watercourses and flood plains and the options can be

Further assessment summary
mitigated to minimise or avoid associated environmental effects. On this basis it was not considered warranted to consider new alternative options or reconsider previously discounted options.
Direct access at Taupaki Road (change to option)
The intersection was discounted for further option assessment for the following reasons: • The land on Taupaki Road is zoned Rural – Countryside Living and not FUZ. The interchange would not directly serve a growth area and would potentially create pressure to re-zone rural zoned land • Connections to Riverhead will be adequately serviced by the proposed BCI.

10.6.2.1 Post engagement refinement

Boord Crescent changes

Further ecological feedback was received for Segment 1, a change to the alignment was recommended to avoid the meandering of the Kumeū River beneath Boord Crescent. The revised alignment minimised effects on ecology, streams and landscape effects on the Kumeū River; whilst maintaining road access on Boord Crescent north properties and avoiding more significant land requirements on the horse track site. See Figure 10-6 and Figure 10-7 for Boord Crescent changes.

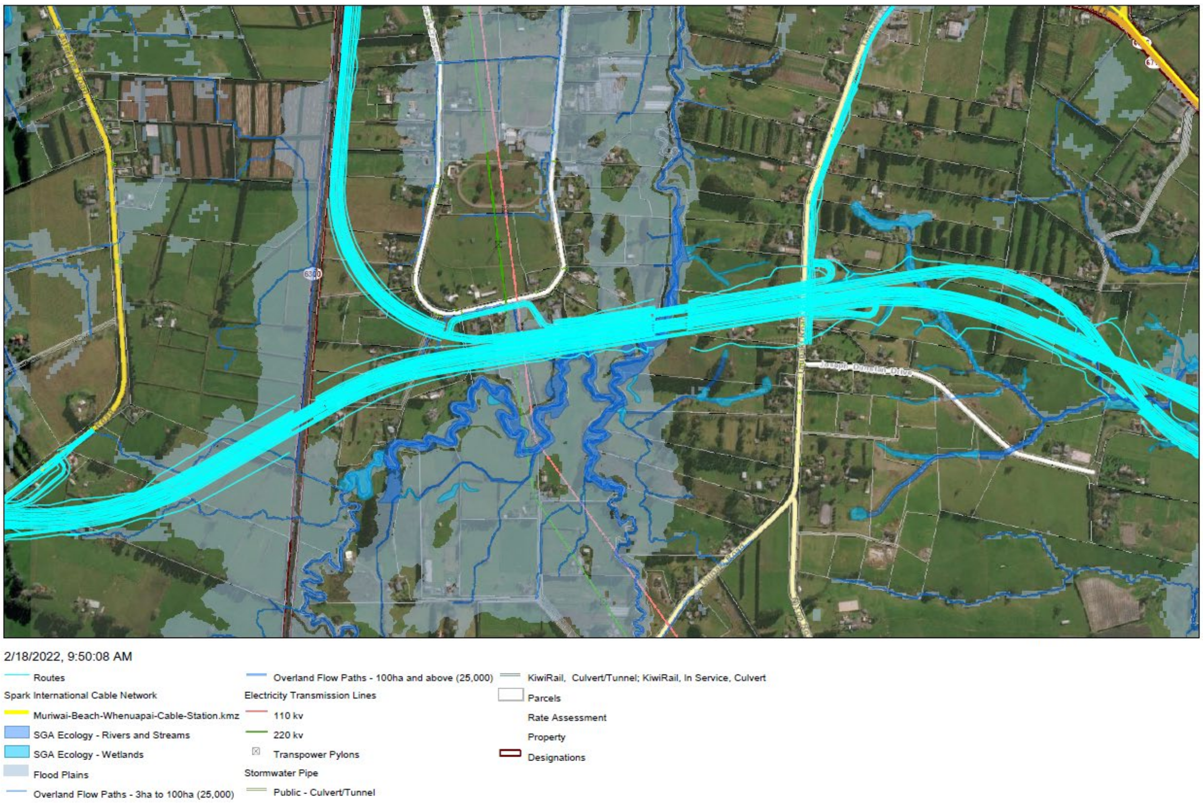


Figure 10-6: Alternative State Highway Kumeū River and Boord Crescent Alignment – pre refinement

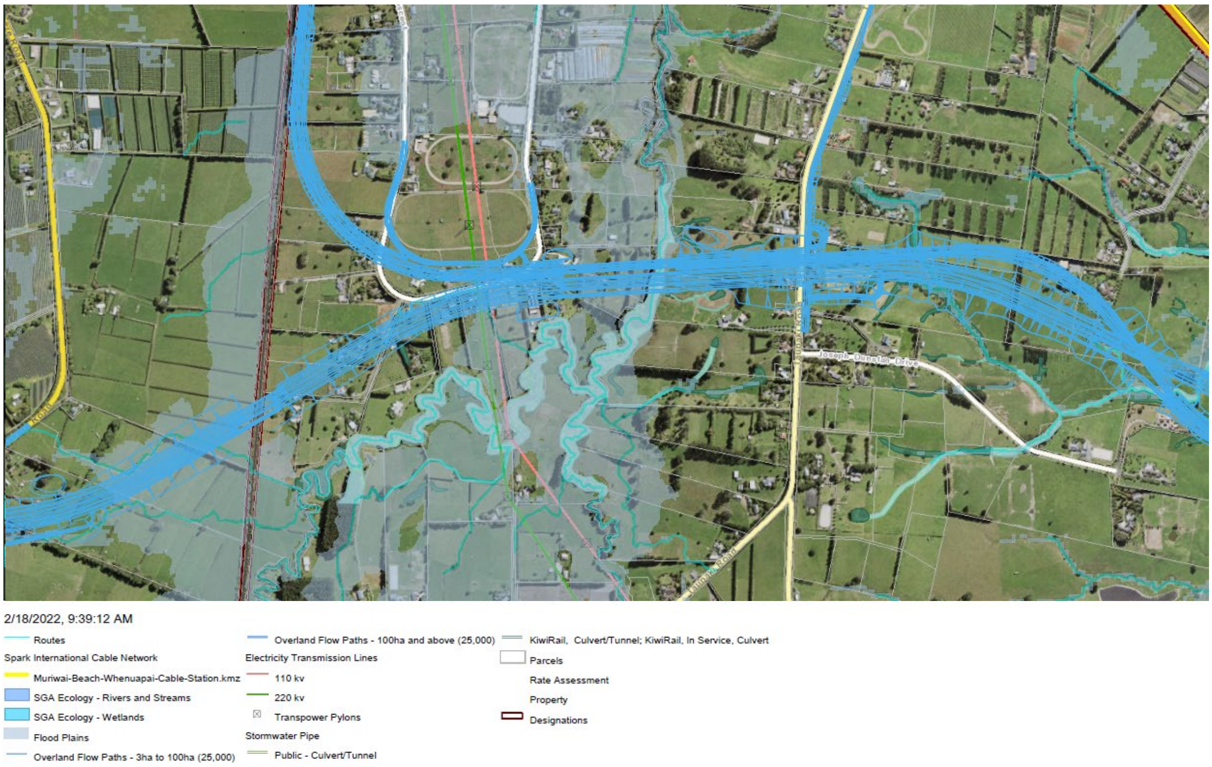


Figure 10-7: Alternative State Highway Kumeū River and Boord Crescent Alignment – post refinement

Engagement (Segment 2 Options)

The key outcome of engagement was new information affecting Segment 2, relating to Gracehill Vineyard Estate and Kumeū River Wines and impacts on Dysart Lane property access (a no exit road). In particular feedback highlighted the importance of vineyards as local businesses. Following feedback, additional consideration was confirmed for Segment 2 and the decision was made to develop four new options and consider the previous preferred, the Northern Option.

<u>Segment 2 Options (Post engagement)</u>

Four post engagement options that utilised the 50m cross section from Figure 10-2.

Option 1:	A northern alignment north of Pomona Road from immediately south of Boord Crescent towards Tawa Road, south-west of Pomona Road. (Similar to the Northern Option above, but with a Tawa Road intersection location)
Option 2:	A southern alignment immediately north of Pomona Road from south of Boord Crescent towards Tawa Road, south-west of Pomona Road
Option 3:	A southern alignment south of Pomona Road from south of Boord Crescent towards Tawa Road, south-west of Pomona Road
Option 4:	A southern alignment along Pomona Road from south of Boord Crescent towards Tawa Road, south-west of Pomona Road

MCA scores are in Table 10-8, options (including northern and southern) are shown in Figure 10-8 and summarised assessment in Table 10-8.

Table 10-8: ASH Segment 2 Post Engagement Options MCA scoring

Options	Option 1	Option 2	Option 3	Option 4
IO1. Access	4	4	4	4
IO2. Reliability	4	4	4	4
IO4. Integration	2	2	3	3
IO5. Safety	4	4	4	4
Criteria				
Heritage	-2	-2	-2	-2
Land use futures	-3	-3	-3	-3
Urban Design	-2	-2	-3	-2
Land Requirement	-4	-2	-3	-2
Social Cohesion	-3	-3	-3	-3
Human Health and Wellbeing	-3	-3	-3	-3
Landscape / Visual	-4	-4	-4	-3
Stormwater	-3	-3	-3	-3
Ecology	-3	-4	-4	-3
Natural Hazard	-1	-1	-4	-1
Construction impacts on utilities / infrastructure	-2	-2	-2	-2
Construction Disruption	-3	-3	-3	-3
Construction costs / risk / value capture	-3	-3	-4	-3

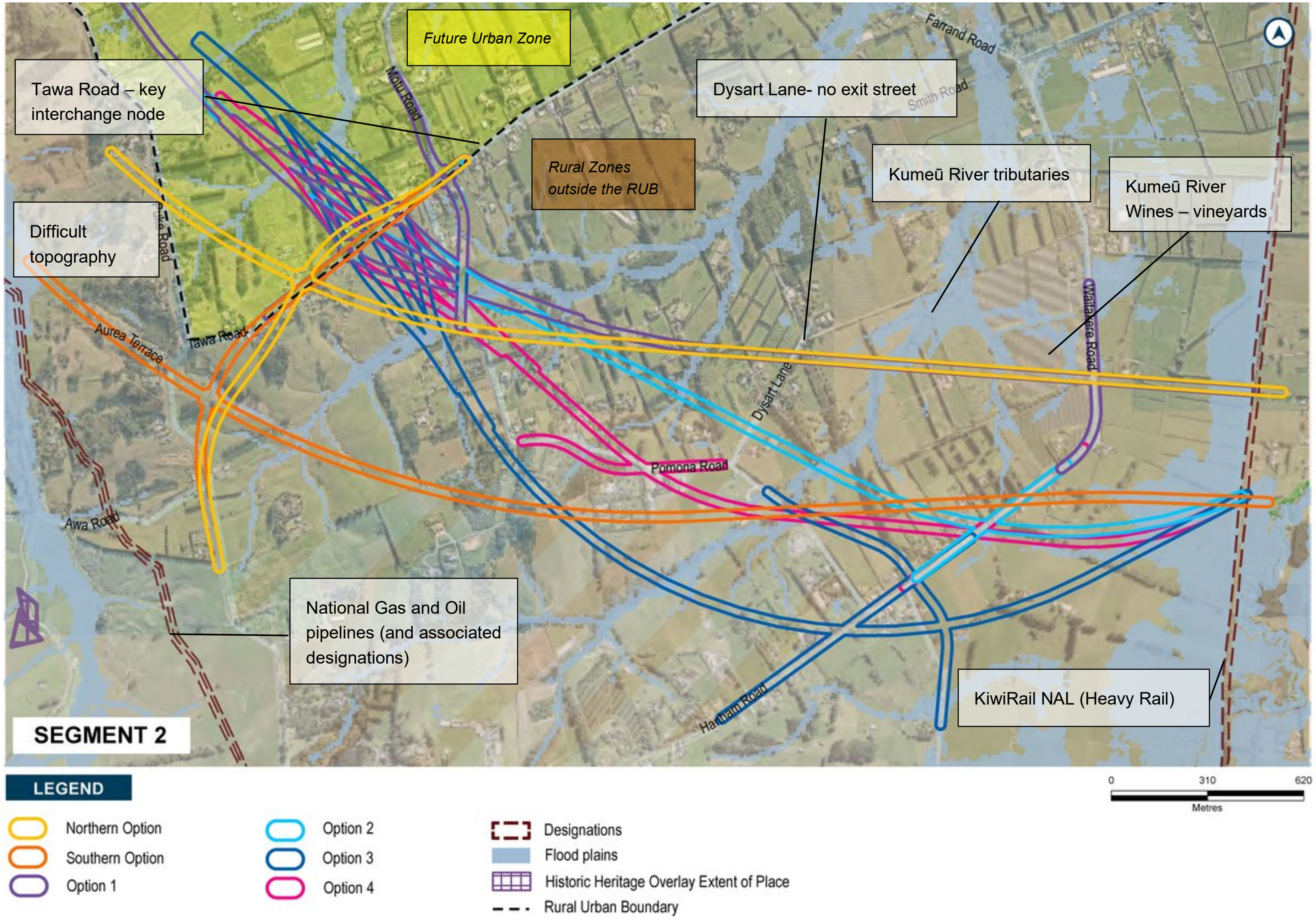


Figure 10-8: ASH Segment 2 Options and identified constraints

Table 10-9: ASH Segment 2 Post Engagement Options MCA

Wellbeing Assessment	
Transport Outcomes	<u>Access:</u> *Post engagement Options:* All four options remove strategic trips from Kumeū-Huapai section of SH16 which will positively contribute to Kumeū Huapai economic and social opportunities. No differentiation between the options.
	<u>Reliability:</u> *Post engagement Options:* The four options have consistent form and function and all broadly offer the same reliability improvements, as 'motorway' standard with no direct access except at the Tawa Road interchange. Overall, options are similar in length within 0.5km or approx. 30 seconds vehicle travel time, with no differentiation on travel times. No differentiation between options all perform well.
	<u>Integration:</u> *Post engagement Options:* All options support urban form in the existing and future town centre of SH16 by removing traffic. All options have similar impacts on property accesses at Boord Crescent (long driveways), however Option 1 and 2 also sever Dysart Lane (a no exit road) and as such do not integrate with the local transport network at this point. Therefore, Options 3 and 4 are preferred to Option 1 and 2.
	<u>Safety:</u> *Post engagement Options:* All options have an appropriate risk rating for a state highway and are better than the existing SH16 risk rating. All options provide a suitable facility for medium to long distance trips and are likely to reduce local road traffic, contributing to improved local safety outcomes. No preference between options.
Cultural	<u>Heritage:</u> *Post engagement Options:* As per Northern and Southern Options, all four option's cross waterways, where there is a similar risk of encountering unknown archaeological sites. There is no preference between options.
Social	<u>Future land use integration:</u> *Post engagement Options:* Options 1 and 2 extend across the Rural – Countryside Living Zone creating residual land and will require alternative access to ensure land remains developable. However, neither Option 1 nor 2 have a significant impact on land supply in the Rural – Countryside Living Zone. Option 3 extends across Rural – Countryside Living Zone, Mixed Rural Zone and a small area of Production Zone. The Mixed Rural Zone and Production Zone enable use and protection of high-quality soils, Option 3 therefore will reduce land supply for productive uses by fragmenting these zones. Option 3 does however avoid access constraints at Dysart Lane (a one-way road). Option 4 impacts a small area of Rural – Mixed Rural Zone resulting in severance at the Zone fringe however retains the majority of the zone southern section. Option 4 also creates a pocket of Countryside Living zone south of Pomona Road. Option 4 avoids access constraints (which would limit development) at Dysart Lane. Options 2, 3 and 4 all impact access to properties south of Boord Crescent, resulting in a land locked area that may be difficult to develop. All options have impacts on land use and there is no significant differentiation.
	<u>Social:</u> *Post engagement Options:* All options create severance which will impact the existing community's cohesion. For Options 1 and 2 these effects are highest at Dysart Lane and for Options 2, 3 and 4 at Boord Crescent. Option 1 results in the loss of Kumeū-River Wines, which (unlike other businesses) is not able to be readily re-located to another location. This has potential to result in wider socio-economic effects on employment and local community values. Option 1 has the greatest extent of adverse socio-economic impacts and is least preferred.

Wellbeing Assessment	
	Options 2, 3 and 4 also impact local businesses, but these have less specific location requirements. All options have adverse social effects with Option 1 least preferred.
	Urban Design: *Post engagement Options:* All four options impact the existing rural character, Options 2, 3 and 4 will result in land to the south of Boord Crescent being land locked and encircled by infrastructure, with reduced potential for good placemaking outcomes. Options 2 and 4 result in a moderately longer route for active mode users and Option 3 results in a circuitous and longer deviation for active mode users. Option 1 has greater effects on rural character due to impact on existing viticulture fields. However, Option 1 is also more direct for active mode users to Tawa Road and better supports future development of the proposed centre and industrial zone (Councils NW Spatial Strategy). On this basis Option 1 is preferred.
	Land Requirement: *Post engagement Options:* Option 1 will impact on land parcels at Kumeū River Wines operating as vineyard, resulting in likely loss of some 20-year-old vines. The vines cannot be readily relocated and therefore the business will either close or have long term losses. Option 3 is the longest route and requires the largest extent of land, severance of parcels and reconnecting property access will increase extent of land required. Options 2 and 4 have less severance and property access constraints and perform better. Option 4 has the least land area required compared to the other options. Option 4 is preferred.
	Human Health and Wellbeing: *Post engagement Options:* All options introduce a state highway into a rural environment near residential properties. Option 3 is primarily within the Rural – Mixed Zone and therefore has lower direct amenity type impacts on health and wellbeing. Option 4 minimises amenity impacts on Rural – Countryside Living Zone north of Pomona Road and is the second preference. Options 1 and 2 are located entirely within Rural – Countryside Living Zone which has higher amenity values (compared to productive zones) and are therefore least preferred. Option 3 is preferred.
Environment	Landscape and Visual: *Post engagement Options:* Options 1, 2 and 3 require a large volume of earthworks that will change the landform. Option 4 has more limited earthworks, avoids the majority of rivers and wetlands and has the least number of river crossings reducing cumulative effects on these natural features. Option 4 is also separated from sensitive residential receivers, compared to alternatives. Option 4 is preferred.
	Stormwater: *Post engagement Options:* Option 1's northern position means it has a reduced upstream catchment area and presents the best freeboard flood opportunity and reduced culvert / bridge lengths. Options 4, 2 and 3 impact on several watercourses, overland flow paths and floodplains. Option 1 is preferred, then Option 4 second preferred.
	Ecology: *Post engagement Options:* Option 1 results in an overall lower ecological impact on floodplains, streams, wetlands and areas of vegetation. Option 4 generally performs better than Option 2 and 3, particularly at streams and wetlands near Pomona Road and Dysart Lane. Option 4 will however affect a high value natural wetland on a tributary of the Kumeū River (south-west of Pomona Road). However, refinements to Option 4 to avoid or appropriately minimise effects on the higher value wetland are feasible. Option 4 is therefore preferred.

Wellbeing Assessment	
	Natural Hazards: *Post engagement Options:* Options 1, 2 and 4 pass through gentle hills of alluvial soils with a lower natural hazard risk profile and simpler remediation requirements (e.g., undercuts to mitigate settlement or liquefaction) compared to Option 3. Option 3 goes through steeper Waitematā Group hills with increased earthworks and slope instability risk and is least preferred.
Economics	Utilities: *Post engagement Options:* All options pass-through green fields and so impacts on existing infrastructure will be limited to local roading and associated utility infrastructure. No differentiation between options. Construction: *Post engagement Options:* All options have a similar level of construction disruption however 4 has the least volume of earthworks and is preferred. .

Post Engagement Option Assessment – Segment 2

The emerging preferred Option from the further option assessment is *Option 4: A southern alignment along Pomona Road from south of Boord Crescent towards Tawa Road, south-west of Pomona Road*.

The outcome of further options assessment post engagement was:

Gracehill Vineyard Estate

Further options were considered however an alternative alignment which avoided Gracehill Vineyard was discounted as:

- Gracehill Vineyard is impacted by all Segment 2 Options taken forward to assessment due to its proximity to Tawa Road which is the location of the interchange
- Alternative alignment would not connect with the emerging preferred Option in Segment 3 which was a key consideration for Segment 2 Options
- Property and socio-economic impacts on the Gracehill Vineyard were not considered sufficient to warrant investigation of further alternatives.

Dysart Lane and Kumeū River Wines

Alternative options to reduce or avoid effects on Dysart lane and Kumeū River Wines were assessed as part of post engagement MCA as:

- Kumeū River Wines was directly impacted by the Northern and Southern Options
- The property and socio-economic impacts of Kumeū River Wines, alongside local property access on Dysart Lane was determined to warrant further alternatives consideration.

The alternative 'Option 3' was provided by a landowner. Option 3 was considered feasible and therefore developed and assessed through the MCA (see above Table 10-9). Option 3 was not preferred and subsequently discounted. However, the preferred Option 4 in Segment 2 also avoids cutting off access to Dysart Lane properties and subsequent impacts on Kumeū River Wines.

Project Partner Engagement

Throughout the option assessment workshops (outlined in Section 4.5.3), the Project Team engaged with Project Partners including Manawhenua and Auckland Council to discuss the options. The key outcome from engagement was support for the emerging preferred alignments of Option 6 in Segment 1, Option 4 in Segment 2 and Option 1 in Segment 3.

Manawhenua supported Option 1 in Segment 3 which better utilised the natural environment, and Auckland Council (Plans and Places) indicated a preference for Option 1 in Segment 3 also. The rationale for this support was that the topography of the southern FUZ was less suitable for development and alternatives developed resulted in greater fragmentation of the rural land use.

Comments were sought from KiwiRail on the ASH options ability to not preclude future re-alignment of the NAL alongside the ASH (opportunity outside scope of this application). The following feedback was received:

- **Horizontal curvature** – track horizontal curvature is critical to operational performance, impacting vehicle speed, noise, and maintenance through effects on wagon and rail wear over time. Based on the high-level design all options were feasible
- **Vertical geometry** – All options grades are beyond the desirable gradient, however, whilst technically challenging, integration of a future rail line at the same grade as the road corridor was considered feasible
- **Clearance** – All options have suitable horizontal and vertical clearance capacity.

On this basis, none of the options preclude a rail line abutting them and it is not a differentiator.

10.6.3 Preferred Option

Following the MCA assessment and consideration of feedback received from Project Partners and the community, a preferred option for the ASH was identified. The preferred option varied in each Segment.

<u>Segment 1 Preferred</u>

Option 6 was preferred alignment in Segment 1, selected because it:

- Was the first or second preference against the MCA criteria when assessed (performed well across criteria)
- Has less impacts on potential archaeological sites adjacent to streams and around Brigham Creek, compared to other options, with the exception of Option 4
- Will have reduced ecological impacts, compared to other options (except for Option 1). Although Option 6 crosses a greater extent of natural wetlands (south of Boord Crescent), it avoids those wetlands and features with higher ecological value. There are also opportunities for refinement
- Will have lower effects on landscape and natural features, compared to Options 3 and 4
- Responds to the existing character of the area including the curvilinear alignment around Boord Crescent.

Option 6 best integrates with the preferred BCI location (refer to Section 11 for BCI discussion) and the preferred option in Segment 2.

<u>Segment 2 Preferred</u>

Option 4 is the preferred alignment in Segment 2, selected because it:

- Has limited impacts on the Rural – Mixed Use Zone leaving a large extent to the south
- Avoids Kumeū River Wines and with subsequent reduced property and socio-economic impacts

- Avoids property access severance on Dysart Lane.

Segment 3 Preferred

Option 1 is the preferred alignment in Segment 3, selected because it:

- Performs better against the '*Access'* Transport Outcome, compared to Options 2, 3, 5 and 6 as it provides better access to growth areas within Kumeū-Huapai
- Has reduced potential for archaeology discovery adjacent to streams
- Whilst it still creates severance issues for the existing community; within the FUZ this can be mitigated through structure planning and plan changes. The Option also has the least severance on the Rural Zone where land use change isn't planned
- Will be viewed within the context of future development in the FUZ, resulting in less significant landscape effects compared to the other (only rural) options
- Has the least impact on floodplains, waterways and native vegetation
- Has the least impact on existing utilities and infrastructure and avoids the National Oil (Channel Terminal Services Limited) and Gas Pipelines (First Gas Limited) and subsequent need to manage construction impacts and operational risks.

In addition, Option 1 aligns well with the preferred option in Segment 2 which is Option 4.

There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects. As a result, no further design refinement is required at this stage.

10.6.4 Discounted Options

Table 10-10 summarises the reasons for discounting the alternative options within each segment.

Table 10-10: ASH discounted options

Option	Reason for discounting
Segment 1 Brigham Creek to NAL	
Option 1	• Higher archaeological and heritage impacts due to proximity to Brigham Creek sites and high number of stream crossings with potential for archaeological findings • Greater extent of stream crossings and required bridge structures results in increased construction costs • Option 1 does not align well with the preferred BCI location (see Section 11.4.3 Option 2D).
Option 3	• Higher archaeological and heritage impacts due to proximity to Brigham Creek sites and high number of stream crossings with potential for archaeological findings • Greater adverse effects on wetlands and ecological features with higher value • Higher landscape effects, particularly in the western section of the option • Less responsive to the existing rural character.
Option 4	• Greater ecological effects on wetlands and features with higher ecological value • The alignment requires a number of bridge structures with associated increased construction costs • Less responsive to the existing rural character.

Option	Reason for discounting
Segment 2 NAL to Tawa Road	
Southern Option	• Greater fragmentation of, and footprint within, the Rural – Mixed Zone and ability to minimise loss of high-quality soils (LUC 2 and 3) • Less direct connection for active mode users to Kumeū-Huapai FUZ • Increased landscape effects • Increased flood risk • Higher adverse effects on wetlands and ecological features which have higher ecological value • Increased earthwork volumes and footprint resulting in higher construction cost.
Northern Option	• High social cohesion / socio-economic impacts from the loss of Kumeū River Wines • The unique requirements of Kumeū River Wines result in significant complexity to acquire the land • Property and access impacts at Dysart Lane.
Option 1	• High social cohesion / socio-economic impacts from the loss of Kumeū River Wines • The unique requirements of Kumeū River Wines result in significant complexity to acquire the land • Higher landscape effects due to larger volume of earthworks / changes to the landform • Property and access impacts at Dysart Lane.
Option 2	• Landscape effects due to larger volume of earthworks / changes to the landform • Ecological effects on wetlands and ecological features • Property and access impacts at Dysart Lane.
Option 3	• Longest alignment resulting in increased costs of construction • Circuitous and longer deviation for active mode users • Largest extent of property required • Higher landscape effects due to larger volume of earthworks and required changes to the topography • Adverse ecological effects on wetlands and ecological features.
Segment 3 Tawa Road to SH16	
Option 2	• Potential to create pressure for infill development outside the RUB between the ASH and the Kumeū-Huapai FUZ • Local severance issues • Greater landscape effects as the option outside context of a future urban environment • Higher flood risk and a skewed stream crossing with increased need for erosion control measures • Equal highest geo-technical risks.
Option 3	• Potential to create pressure for infill development outside RUB between the ASH and the Kumeū-Huapai FUZ • Local severance issues • Greater landscape effects as the option is outside the context of a future urban environment • Equal highest flood risk • Geo-technical risks.

Option	Reason for discounting
Option 4	• Potential to create pressure for infill development outside RUB between the ASH and the Kumeū-Huapai FUZ • Local severance issues • Greater landscape effects as the option is outside the context of a future urban environment • Equal highest flood risk.
Option 5	• Potential to create pressure for infill development outside RUB between the ASH and Kumeū-Huapai FUZ • Local severance issues • Greater landscape effects as the option is outside the context of a future urban environment • High flood risk and a skewed stream crossing increase need for erosion control measures • Equal highest geo-technical risks.
Option 6	• Potential to create pressure for infill development outside RUB between the ASH and Kumeū-Huapai FUZ • Local severance issues • Greater adverse landscape effects as the option is outside the context of a future urban environment • High flood risk and a skewed stream crossing increase need for erosion control measures • Geo-technical risks.
Option 7	• Potential to create infill development pressure on rural land between the ASH and the Kumeū-Huapai FUZ • Local severance issues • Greater adverse landscape effects as the option is outside the context of a future urban environment • High flood risk and a skewed stream crossing increase need for erosion control measures.

10.7 Alternative State Highway summary

As outlined, through the assessment process and feedback from Project Partners and landowners, the preferred option for the ASH is Option 6 in Segment 1, Option 4 in Segment 2 and Option 1 in Segment 3.

The ASH ends at SH16 west of Foster Road, outside the RUB of Kumeū-Huapai. The alignment has three key intersections. Through the intersection form assessment, it was recommended to have a roundabout at SH16 (western connection), and a diamond interchange at Tawa / Access Road. Due to the complexity and significance of the interchange, the arrangement at BCI was determined through a standalone options assessment process, refer to Section 11 for discussion.

11 Brigham Creek Interchange

11.1 Overview

Through the development of the North West Transport Network, it became evident that several key corridors commenced or met at the existing Brigham Creek Road/ SH16 roundabout, see Table 11-1.

Due to the complexity of the interchange and interface with multiple routes, it was decided to assess the connection individually. The BCI however forms part of NOR S1 ASH with NOR S3 RTC also crossing the interchange.

The BCI incorporates the following corridors with the following form and function requirements; for NW Strategic Package corridors, refer to specific sections for detailed form and function.

Table 11-1: Indicative Brigham Creek Interchange corridors

Corridor	Function
NW Strategic Package	
Alternative State Highway	Four lane motorway standard corridor (two lane each direction).
Rapid Transit Corridor	Fully segregated public transport corridor inc. shared use path.
Existing State Highway 16[5]	Highway connection (Varies 2-4 lanes, will be four lanes at implementation). Shared path in sections.
Local Arterials	
Fred Taylor Drive	Four lane FTN arterial with separated walking and cycling.
Brigham Creek Road	Four lane arterial with separated walking and cycling.

11.2 Gap analysis

A gap analysis was undertaken for the BCI, the analysis key points are:

- The interchange was not considered as a separate project at IBC stage. However, given the intersection scale and connections to different corridors a separate option assessment was proposed
- The interchange will interface with S3 RTC and future North Western Bus Improvements and future RTN. The S1 ASH will interface with existing SH16.

11.3 Land use review and constraint mapping

To inform the option development and assessment for the BCI, a land use and constraint mapping exercise was carried out to understand the environment surrounding the interchange. The key findings are summarised below.

[5] Included in separate Waka Kotahi S16/18 Connections and Brigham Creek to Waimauku project.

- **Land use and zoning:** Is located within Redhills North FUZ on the east side of SH16, the land has not been structure planned. The land to the east of SH16 is within the Whenuapai FUZ
- **Future land use:** Council's NW Spatial Strategy identifies a location to the south of Fred Taylor Park (zoned Open Space) as a potential neighbourhood centre. The Whenuapai Structure Plan shows high density residential as a potential future use on the east of SH16
- **Special uses:** SH16 is designated for 'Transport Purposes' by Waka Kotahi. There is a Transpower 110kv transmission line east of SH16 running across Brigham Creek Road and lower SH16
- **Environmental constraints**: Proximity to the coastal marine area and significant ecological area (SEA-M2-57b), significant floodplains, streams and wetlands are present west of Fred Taylor Drive. Fred Taylor Park, an AC facility is located adjacent to Fred Taylor Drive on the west.

The outcome of this land use and constraint review was:

- Options should be developed and assessed via an MCA with input from SMEs
- Engagement with Council is required on the future zoning of Redhills North FUZ.

See Figure 11-1 for existing land use and environmental constraints.

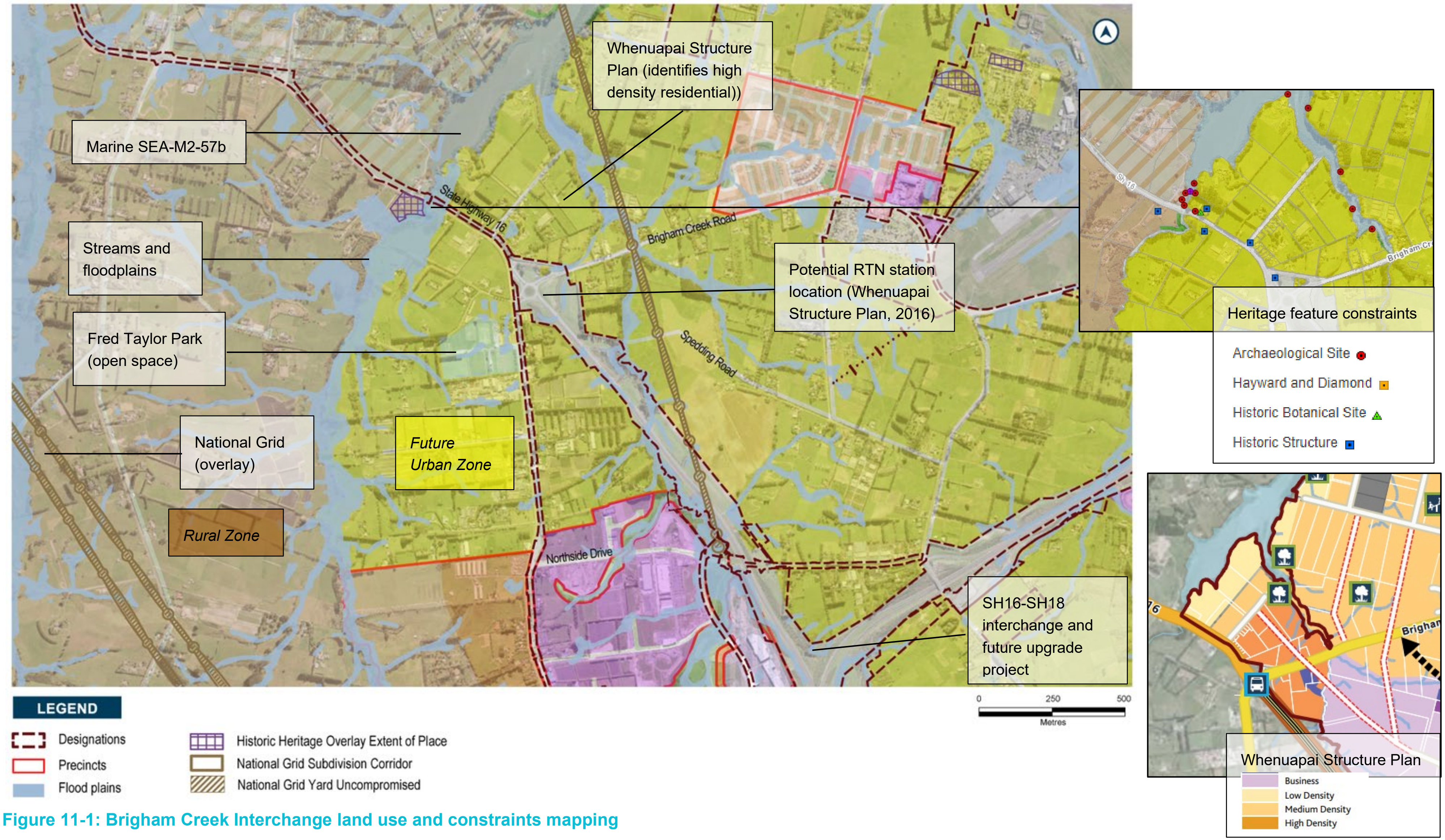


Figure 11-1: Brigham Creek Interchange land use and constraints mapping

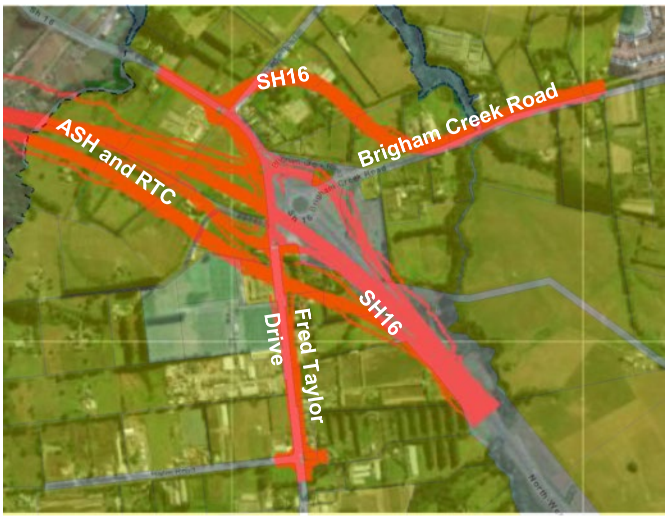
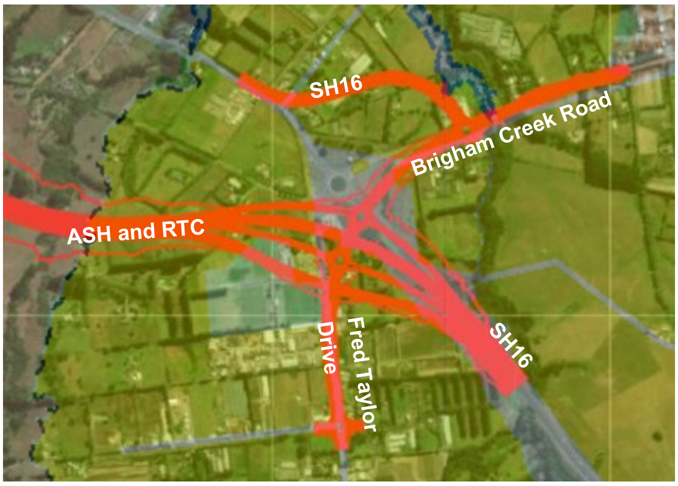
11.4 Corridor Option development

An initial long list of 19 interchange options was developed, of these, ten were discounted because:

- Six options had significant footprints in FUZ which consumed developable land (full trumpet interchange designs)
- Four options (two full diamond and two partial diamond / half clover) had environmental impacts on SEAs and challenging tie-ins to the existing transport network (i.e., interchanged poorly).

Nine options were taken forward to short list options assessment, four were northern options (see Table 11-2) and five southern options (see Table 11-3).

Table 11-2: Northern Brigham Creek Interchange options

Option	Alignment
Option 4A ASH northern alignment with Fred Taylor Drive-SH16 Priority Full diamond interchange.	
Option 5A ASH northern alignment with Fred Taylor Dr-Brigham Creek Rd Priority Full diamond interchange.	

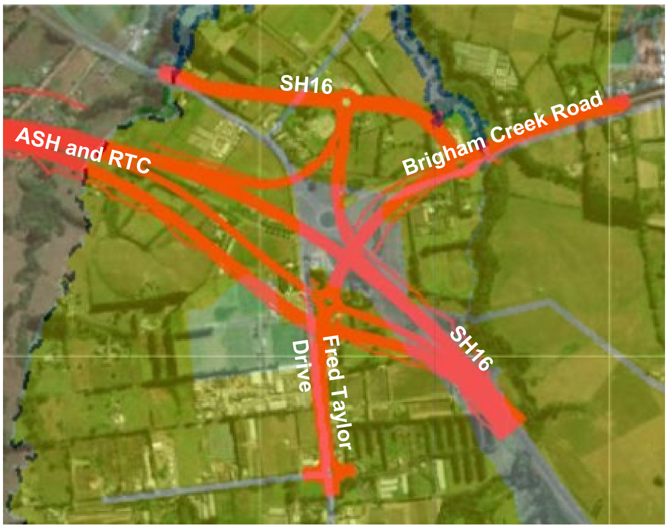
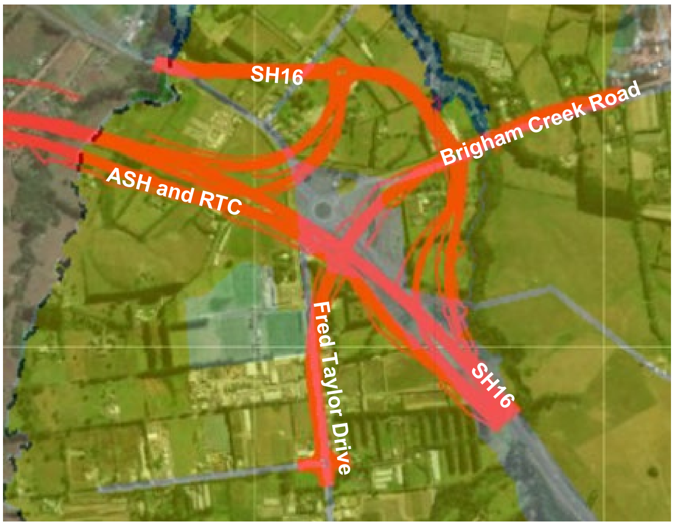
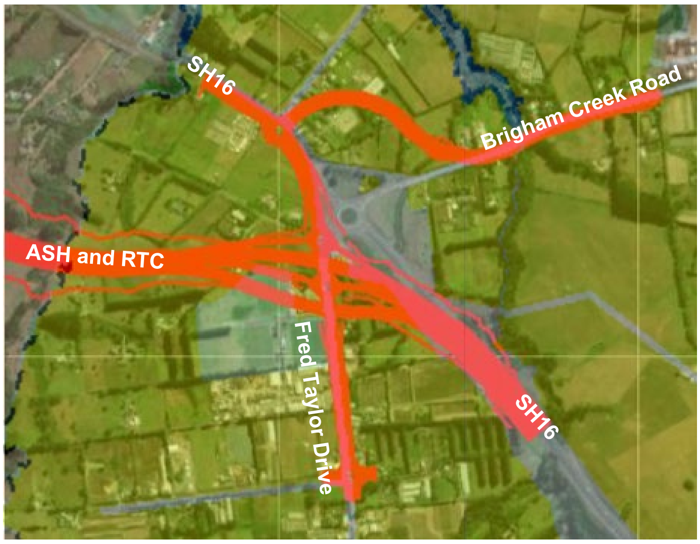
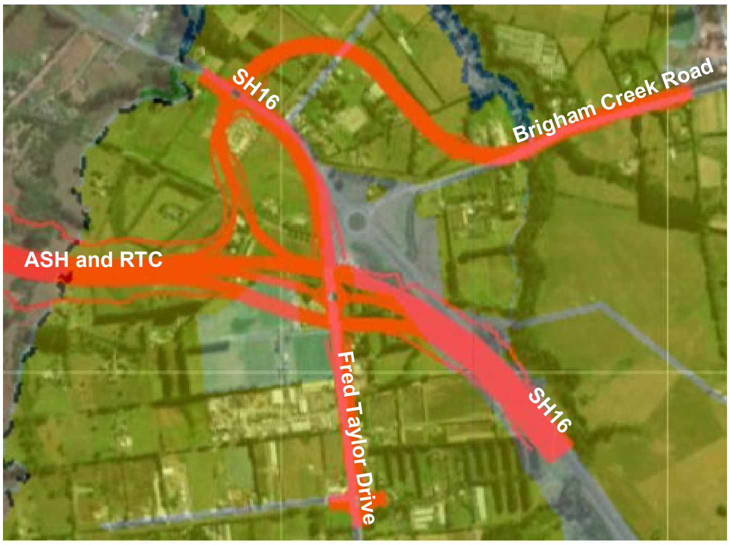
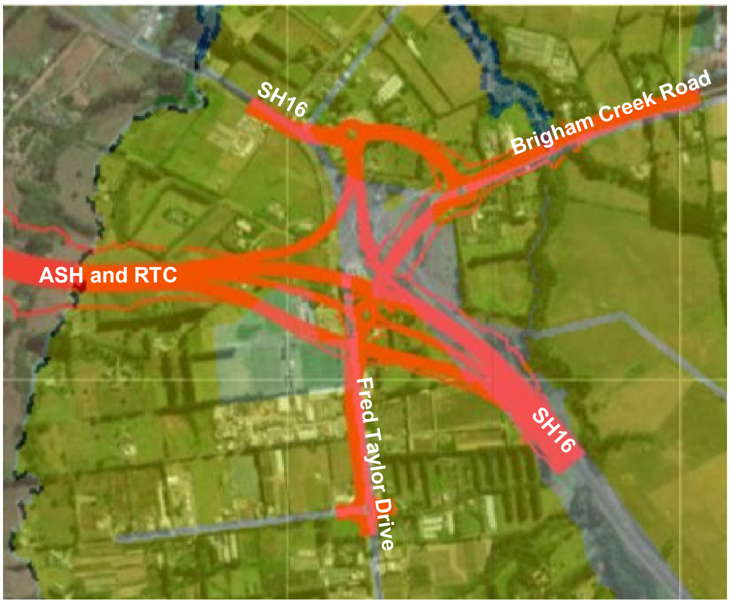
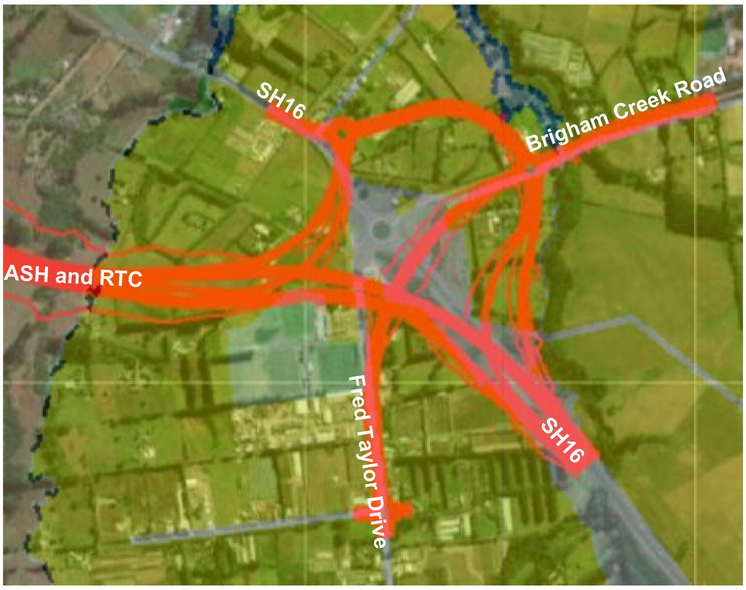
Option	Alignment
Option 5B ASH northern alignment with Fred Taylor Dr-Brigham Creek Rd Priority. Partial clover & diamond interchange.	
Option 5D ASH northern alignment with Fred Taylor Dr-Brigham Creek Rd Priority. Separated eastern and western "fork" ramps interchange.	

Table 11-3: Southern Brigham Creek Interchange Options

Option	Alignment
Option 1A ASH southern alignment with Fred Taylor Dr-SH16 Priority. Full diamond interchange.	

Option	Alignment
Option 2A ASH southern alignment with Fred Taylor Drive-Brigham Creek Road Priority. Full diamond interchange.	
Option 1B ASH southern alignment with Fred Taylor Drive, SH16 Priority. Partial clover and diamond interchange.	
Option 2B ASH southern alignment with Fred Taylor Drive-Brigham Creek Road Priority. Partial clover & diamond interchange.	

Option	Alignment
Option 2D ASH southern alignment with Fred Taylor Dr-Brigham Creek Road Priority. Separated eastern and western "fork" ramps interchange.	

11.4.1 Assessment

The assessment follows a modified version of the process outlined in Section 4.4. The interchange design considered the relationship and function of the various corridors, S1 ASH (see Section 10.3) and S3 RTC (see Section 6.3), as well as the local arterial function of Fred Taylor Drive and Brigham Creek Road (part of the NW Local Arterials Package) . The transport outcomes sought are:

Transport Outcomes

- Access: Improve the access of people to economic and social opportunities for movements through the BCI
- Mode Choice: Support transformational mode share in the area including the provision of a safe and attractive active mode facilities through the Interchange
- Reliability: Improve the reliability of people movement through the BCI
- Safety: Contribute to the operation of an Interchange that is free from deaths and serious injuries

The MCA performance of each option is set out in Table 11-4 below, and assessment of the options against the criteria summarised in Table 11-5.

Table 11-4: Brigham Creek Interchange MCA Assessment

	NORTHERN ALIGNMENTS				SOUTHERN ALIGNMENTS				
Options	Option 04A	Option 05A	Option 05B	Option 05D	Option 01A	Option 02A	Option 01B	Option 02B	Option 02D
IO1. Access	3	3	3	4	3	3	4	3	4
IO2. Mode Choice	2	1	1	1	2	1	2	1	1
IO3. Reliability	3	3	4	4	3	3	4	4	4
IO4. Safety	1	1	1	2	1	1	1	1	1
Criteria									
Heritage	-2	-2	-2	-2	-2	-2	-2	-2	-2
Land use futures	-2	-2	-3	-3	-2	-3	-3	-3	-4
Urban Design	-1	-1	-2	-2	-1	-1	-3	-1	-3
Land Requirement	-2	-2	-3	-2	-2	-2	-2	-3	-3
Social Cohesion	-1	-1	-1	1	-1	-1	-1	-1	-1
Human Health and Wellbeing	-2	-2	-2	-2	-2	-2	-2	-2	-2
Landscape / Visual	-2	-2	-2	-3	-2	-2	-2	-2	-3
Stormwater	-2	-3	-3	-3	-1	-1	-1	-1	-3
Ecology	-4	-4	-4	-4	-4	-4	-4	-4	-4
Natural Hazard	-1	-1	-1	-1	-1	-1	-1	-1	-1
Construction impacts on utilities / infrastructure	-2	-2	-2	-2	-2	-2	-2	-2	-2
Construction Disruption	-3	-3	-3	-3	-3	-2	-3	-3	-3
Construction costs / risk / value capture	-3	-3	-3	-3	-3	-3	-3	-3	-3

Table 11-5: Brigham Creek Options Assessment Findings Summary

Wellbeing Assessment	
Transport Outcomes	Access: All options provide west-facing ramps for the ASH supporting improved strategic access between Kumeū-Huapai and Whenuapai-Westgate and improving access to economic and social opportunities. The differentiator between the options relates to the key strategic people movements between Riverhead / Whenuapai and SH16 to / from the city for vehicle trips. • Options 1B, 2D, 5D vehicles will pass through 1 or 2 intersections in both directions with better directness and efficiency of access to strategic connections for economic and social opportunities.

Wellbeing Assessment	
	• Options 1A, 2A, 2B, 4A, 5A and 5B vehicles will pass through 2 or 3 intersections in both directions with reduced directness and likely reduced efficiency of access to strategic connections for economic and social opportunities. Options 1B, 2D, 5D perform best.
	Mode Choice: All options will support transformational mode share for the Kumeū-Huapai catchment by enabling both the RTC and RAMC to be grade separated from local movements at the BCI. All options will need to provide safe active mode facilities at or through the Interchange. The differentiators for options relate to the attractiveness of the key active modes connection between Riverhead (SH16) and Westgate / Whenuapai / future RTC station, as well as the active modes catchment around the future RTC station: • Options 1A, 1B and 4A each will require a transition through up to 2 intersections between SH16 / Brigham Creek Road and Westgate / future RTC station, which would reduce the attractiveness for active modes in terms of delay and interaction with vehicle movements. • Options 2A, 2B, 2D, 5A, 5B and 5D each will require a transition through 3 intersections between SH16 / Brigham Creek Road and Westgate / future RTC station, as well as a SH16 diversion, which would be least attractive for active modes in terms of delay and interaction with vehicle movements. Options 1A, 1B and 4A perform slightly better.
	Reliability: All options will grade separate local and strategic people movement on separate local and strategic corridors. All options enable the ASH and RTC corridor to be grade separated from local movements, benefiting people travelling on those strategic corridors to / from the Kumeū / Huapai catchments. The differentiators for options relate to the degree of separation between ramp intersections and the number of intersections for key public transport services to traverse through the Interchange: • Options 1B, 2B, 2D, 5B and 5D each provide reasonable separation between ramp intersections and as key public transport services will travel through 2 intersections. This is considered to maintain a good level of efficiency and reliability for people movement through the Interchange, compared with other options. • Options 1A, 2A, 4A and 5A each provide a low to medium degree of separation between ramp intersections and as key public transport services will travel through 3 intersections. This is considered to have a reduced level of efficiency and reliability for people movement through the Interchange, compared with other options. Options 1B, 2B, 2D, 5B and 5D perform best.
	Safety: All options will grade separate local active mode connections from the higher speed state highway movements and reduce interaction between local and strategic vehicle movements. The RAMC will be a high quality and continuous facility in all options. The differentiators for options relate to the level of exposure for local active mode users travelling between the local areas north and south of the Interchange, including to / from the future RTC station: • Options 1A, 1B, 2A, 2B, 2D, 4A, 5A and 5B each will have a higher level of exposure for local active mode users with to more vehicle movements, as they travel through 3 intersections, including the busy east facing ramps.

Wellbeing Assessment	
	• Option 5D will have a lower level of exposure for local active mode users with exposure to fewer vehicle movements, as they travel through 1 or 2 intersections, largely avoiding the busy east facing ramps. Option 5D performs best.
Cultural	Heritage: All options have the potential to disturb known and unknown archaeological sites around Brigham Creek. There is no significant differentiation between the options on this criterion.
Social	Future land use integration: Options 1A, 4A and 5A perform better due to the compact diamond form retain more land for development within the FUZ compared to other options. Option 4A is preferred as it avoids impacting Fred Taylor Park (Open Space Zone) and concentrates the compromised land to along SH16, allowing a more comprehensive approach to structure planning of the remaining land. It is however noted that the land along SH16 with Option 1A remains developable, Option 5A is more compromised. Options 1B, 2A, 2B, 5B and 5D split FUZ land into parcels reducing the ability to comprehensively structure plan and integrate the area. Option 2B will have a greater impact on Whenuapai FUZ including land zoned for higher density housing and is less preferred than the other options. Option 2D impacts developable land within both Whenuapai and Redhills North, creating parcels of residual / land that will be more difficult to develop in a comprehensive way. Option 4A is preferred.
	Social Cohesion: All options will support connectivity for communities located within Redhills North, Whenuapai, Kumeū, Huapai and Riverhead in the long term. All options, except 5D, will impact on Fred Taylor Park on a permanent basis. Option 5D avoids permanent impacts on Fred Taylor Park although it will still likely be impacted at the construction phase. Option 5D is preferred.
	Urban Design: Options 1A, 2A, 2B, 4A and 5A each have compact forms allowing the character of the remaining FUZ land to be less dominated by transport infrastructure. Options 5B and 5D each result in large, isolated pockets and compromised portions of land which impact on the quality of urban design and amenity outcomes. Option 1B has a reduced ability for future built form to define the urban edge north of the Interchange due to the different arms to the local road network. Option 2B has large, isolated pockets similar to Options 5B and 5D, but also has a less defined edge to the north. Options 1A, 2A, 2B, 4A and 5A perform best.
	Land Requirement: Options 1A, 1B, 2A, 4A, 5A, 5D each will impact land within the Redhills North growth area, which is zoned FUZ. Options 1A and 4A are preferred as the area of land likely to be required is less compared to the other options. Options 5B, 2B, 2D will have on / off ramps impacting upon land identified for higher density housing within the Whenuapai Structure Plan in addition to impacting land within Redhills North. Options 1A and 4A are preferred
	Health and wellbeing: All options will introduce an interchange into a future urban environment with additional traffic and associated effects. There is potential for the structure planning and plan change process to guide sensitive receptors away from the interchange, or to require mitigation. There is no differentiation on this criterion.

Wellbeing Assessment	
Environment	Landscape / Visual: Options 5D and 2D impacts on Totara Creek / Inlet and because the increased footprint will result in an increased audience for visual effects. Option 5B also performs poorly as the overall layout covers a large area and therefore a greater impact on the landscape. Options 1A, 1B, 2A, 2B, 4A, 5A, 5B impact on Brigham Creek Road where it crosses Totara Creek and where the ASH route crosses the corner of Fred Taylor Park, but have less cumulative effects compared to both Options 5D and 2D. There is a preference for Option 2B due to the separation from sensitive landscape features along the Totara Creek and Totara Inlet.
	Ecology: All options have potential effects on the three SEA (SEA_T_2034, SEA-M2-57b and SEA-M2-57b), unavoidable stream impacts, change in runoff characteristics and habitat fragmentation. Options 1A and 1B are preferred followed by 2A and 4A due to relatively less interaction with ecological features. The preference is not however sufficient enough to warrant a clear differentiation. Options 1A and 1B are preferred.
	Stormwater: Options 1A and 2A have reduced impervious areas and as they are both centred on a ridge result in limited potential for flooding issues. Options 1B and 2B impact two streams that will require realignment, bridgeworks over Totara Inlet will be required and both options are in proximity to Ngongetepara Stream with associated flood risks. Option 4A will require two bridges over the Ngongetepara Stream creating an issue for stormwater flow to treatment ponds and proximity to an SEA will create greater water quality treatment needs. Options 5A, 5B, 5D and 2D modelling results indicate that the required SH16 culvert over Ngongetepara Stream is close to flooding in a 100yr event and the road may need to be raised. Options 5A, 5B and 5D require more than one bridge over the Ngongetepara Stream creating an issue for stormwater flow to treatment ponds and proximity to an SEA will create greater water quality treatment needs. Option 2D has a very large footprint creating additional stormwater requirements. Options 1A and 2A perform best.
	Natural Hazard: All options have the same geological conditions. Potential risks relate to settlement, liquefaction slope instability. Options 1B, 2B, 2D and 5B involve more earthworks and have a higher risk profile, but not sufficiently high to warrant a difference in scoring.
Economic	Utilities: All options will require local utilities and infrastructure to be relocated. No notable non-transport infrastructure will be impacted. Construction: All options, except Option 2A, will each require moderate to significant works on the existing local road network and will require traffic management during the construction phase. Option 2A will have a larger extent constructed offline, reducing the extent of traffic disruption. Preference for Option 2A

The MCA identified an initial preference for Options 4A (a northern alignment diamond) and Option 1A (a southern alignment diamond) due to the compact form of the diamond better supporting urban design outcomes and retaining more land for future development.

Overall Option 1A was preferred over Option 4A for the following reasons:

- Option 1A has the potential to be refined to reduce permanent impacts on Fred Taylor Park
- Whilst Option 4A was preferred in terms of the Land Use Futures criteria, Option 1A provides the greatest refinement opportunity to amend the Brigham Creek Road Upgrade alignment, reducing the land use impacts on Whenuapai FUZ
- Option 1A is preferred in terms of stormwater due to the reduced impervious area and the least number of culverts required
- Option 1A is preferred in terms of ecology due to less interaction with ecological features.

Although Option 1A and 4A performed well against the Transport Outcomes, the split fork options Option 5D and Option 2D performed better against the operational Transport Outcomes of 'Access' and 'Reliability' due to the split fork interchange design having greater separation between on / off ramps and reduced queuing. Performance on these criterion was a key interchange consideration.

11.4.2 Refinement through engagement

Throughout the option assessment workshops, the Project Team engaged with Project Partners including Manawhenua and Auckland Council to discuss the options. Feedback from Waka Kotahi on the initial preference of a diamond interchange (Option 1A and Option 4A) acknowledged the potential land use impacts of the alternative interchange layouts. However, feedback pointed out that further consideration should be given to the interchanges ongoing operational performance.

The Project Team further assessed the options and split fork interchange layouts, which performed highly. Option 2D was the equal best performing option against the Access, Reliability and Safety Transport Outcomes. Option 2D had potential to also be refined to improve its 'Mode Choice' performance and reduce the impacts on land use and urban design criteria.

Based on the option having scope for refinement, whilst having high operational performance, the decision was made to refine the initial preferred Option 1A and split fork Option 2D, in order to reduce the split fork impacts on FUZ land and improve Transport Outcomes performance.

Following design refinement, the two options were subsequently assessed against the Transport Outcomes and differentiating MCA criteria, see Table 11-6.

Table 11-6: Post engagement refinement – Brigham Creek Interchange assessment

Measure	Assessment Findings
Transport Outcomes	<u>Access</u>: Both options provide grade separated strategic access corridors and high-quality connections. The key differentiator relates to the movements to / from Riverhead. • Option 2D performs highly as it passes through one or two intersections • Option 1A passes through two or three intersections, reducing its directness and efficiency of access to / from Riverhead. <u>Reliability:</u> • Option 2D has higher grade separation between the ramps and public transport movements between Whenuapai and Westgate will pass through one intersection

Measure	Assessment Findings
	• Option 1A has medium ramp separation and public transport between Whenuapai and Westgate will pass through three intersections reducing the reliability of people movement through the interchange. Mode Choice: Both options grade separate strategic public transport and strategic active mode corridors supporting active mode choice. However, Option 2D is preferred as active mode users between Riverhead and Westgate and RTC will only pass through up to two intersections, compared to up to three at Option 1A. Safety: Both options provide high quality and continuous strategic active mode corridors. • Option 1A local active mode users will pass through three intersections, including the busy east facing ramp • Option 2D users will only pass through two intersections and cross the less busy west facing ramps. This results in Option 2D performing better. **Option 2D is preferred against the Transport Outcomes.**
Key differentiating MCA criteria	
Land Use	Both options have been refined to minimise impacts on FUZ land. • Option 2D has larger areas of land within the interchange. The larger areas of land will remain developable. However, as it will be dominated by the interchange and will have reduced accessibility the attractiveness of the land for a wide range of uses (e.g., residential) and activities will be reduced. • Option 1A interchange is compact leaving a larger area of land that is not constrained available for future development. Although, the option does create more residual and undevelopable land within the interchange. Option 1A is slightly preferred.
Urban Design	Option 2D results in more land facing onto embankments, particularly the large piece of land in the centre of the interchange, reducing the amenity value of the land. The number of ramps will also be more dominant in the landscape. Option 1A is considered to have a reduced scale (less elevated ramps) and more active edges allowing integration and interfaces at street level. Option 1A is the preferred option.
Ecology	Neither option is considered to be discountable due to ecological impacts and mitigation is feasible for adverse effects. • Option 2D will have a greater interaction and will also create land locked parcels within the interchange with little ecological benefit. • Option 1A has more limited extent of interaction with ecological features around Totara Creek Terrestrial and Marine SEAs. Option 1A is the preferred option.
Construction, cost and risk	Option 2D provides greater flexibility with more construction occurring off road, resulting in less stages being required to maintain access on the existing road network. Option 1A will require more construction stages and diversions to maintain access and greater traffic management and is less preferred. Option 2D is the preferred option.

Option Refinement Summary

Option 2D performed better against the 'Access', 'Reliability' and 'Safety' Transport Outcomes and was preferred in terms of the 'Mode Choice' Outcome as well as the 'Construction Impacts', 'Costs and Risks' criteria. Option 1A was preferred in terms of the Land Use, Urban Design, and Ecology impacts criteria. The preferred option overall was therefore Option 2D as it best met the Transport Outcomes for the project, and effects were either mitigatable or not significant enough to discount the option.

<u>Auckland Council</u>

Council (Plans and Places Department) questioned whether trenching S1 ASH through Redhills North was feasible. This was suggested in order to optimise the amount of FUZ available for development and reduce effects on the area. The Project Team considered and dismissed trenching for all options because:

- The area is flood prone containing overland flow paths and the Ngongetepara Stream tributary, creating a natural hazard risk and construction complexity
- The southern section of S3 RTC from the city (a non Te Tupu Ngātahi project) is unlikely to be trenched and effectively tying into this section requires the BCI to be at grade
- Trenching has increased construction costs and risk compared to at grade options.

Council also raised the importance of Fred Taylor Park (open space zone) and that a new Aquatic Centre has been considered for the Redhills area.

Only one feasible BCI option, Option 5D, avoided Fred Taylor Park, but construction effects would still likely impact the park (not avoid it). Whilst Option 5D had reduced impacts it performed less well on other key criteria. As Redhills North is not yet urbanised or structure planned, there was greater potential for structure planning to account for open space needs within context of the BCI. Given the Aquatic Centre was raised as an emerging proposal, the proposal was considered not sufficiently advanced to discount the preferred Option 2D.

11.4.3 Preferred Option

Following the MCA and feedback from Project Partners, the BCI preferred option was identified as the refined Option 2D, for the following reasons:

- Increased operational benefits as demonstrated by its performance against the Transport Outcomes due the design being a split fork interchange, compared to a diamond interchange (Option 1A)
- Whilst not the preferred option for Land Use and Urban Design criteria, the land affected by Option 2D remains developable and structure planning undertaken in context of the interchange can identify appropriate landuse to optimise outcomes.

11.4.4 Discounted Options

Table 11-7 summarises the reasons for discounting the seven options individually:

Table 11-7: Brigham Creek Interchange discounted options

Option	Reasoning
Option 4A	• Does not perform as well against Transport Outcomes 'access', 'reliability' and 'safety' • Higher adverse stormwater and flooding impacts • Higher construction disruption, costs and associated risks.
Option 5A	• Does not perform as positively against Transport Outcomes: 'access', 'reliability', 'mode choice' and 'safety' • Higher stormwater and flooding impacts • Higher construction disruption, costs and risks.
Option 5B	• Does not perform as positively against Transport Outcomes: 'access', 'mode choice' and 'safety' • Splits Redhills North FUZ and reduces ability for comprehensive structure planning • Result in large, isolated pockets and compromised portions of land which impact on the quality of urban design and amenity outcomes • Higher stormwater and flooding impacts • Higher construction disruption, costs and risks.
Option 5D	• Does not perform as positively against the Transport Outcome 'mode choice' • Splits Redhills North FUZ land and reduces ability for comprehensive structure planning • Results in large, isolated pockets and compromised portions of land which impact on the quality of urban design and amenity outcomes • Larger footprint results in greater visual and landscape effects • Increased stormwater and flooding impacts • Increased construction disruption, costs and risks.
Option 1B	• Does not perform as positively against the Transport Outcome 'safety' • Splits Redhills North FUZ land and reduces ability for comprehensive structure planning • Increased construction disruption, costs and risks.
Option 2A	• Does not perform as positively against the Transport Outcome: 'access', 'reliability', 'mode choice' and 'safety' • Splits Redhills North FUZ land and reduces ability for comprehensive structure planning.
Option 2B	• Does not perform as positively against Transport Outcome 'access', 'mode choice' and 'safety' • Splits Redhills North and impacts Whenuapai FUZ land, reducing ability for comprehensive structure planning • Increased stormwater and flooding impacts • Increased construction disruption, costs and risks.

11.5 Brigham Creek Interchange summary

As outlined through the assessment process and feedback from Project Partners, the preferred option for the BCI is a refined Option 2D. This preferred layout forms part of the S1 ASH project, and S3 RTC project.

12 S4: Access Road

12.1 Overview

The Access Road / Tawa Road Upgrade (hereafter referred to as Access Road) corridor was included in the TFUG Programme Business Case recommended network plan prepared in 2016. Access Road is a critical connection which supports the Special Housing Area (Huapai Triangle Precinct), comprising 1,200 dwellings and a retirement village. Access Road was assessed as a key north-south arterial and referenced as *AR-K-06* at the IBC stage and extends from SH16 to an intersection with proposed ASH, see Figure 12-1.

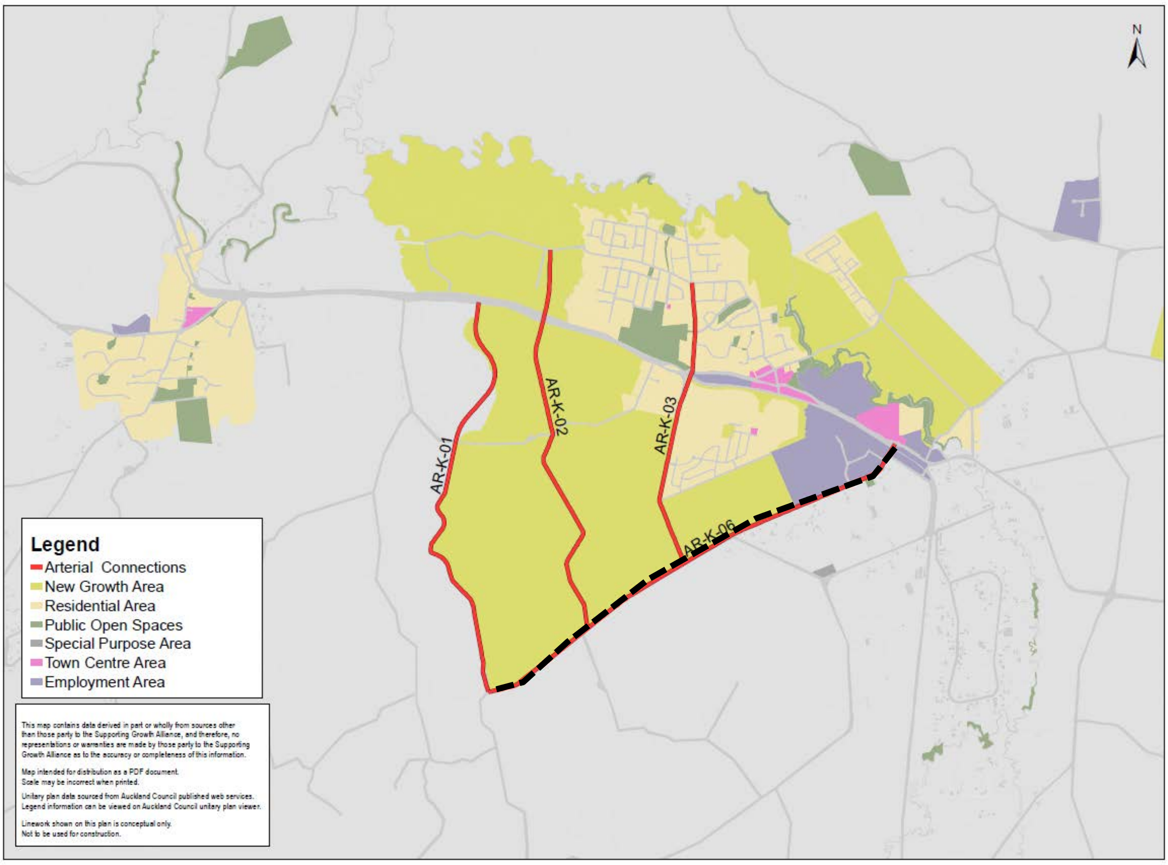


Figure 12-1: Access Road IBC Option AR-K-06 (in black dash)

Access Road is aligned along the south eastern boundary of the Kumeū-Huapai FUZ and will enhance the connection between the network of collector roads in the vicinity, whilst reducing severance effects within the rest of Kumeū-Huapai. The Access Road upgrade was recommended to be a four-lane corridor which will improve local walking and cycling journeys safety and connectivity and contribute to travel choice. In the southern end, it will connect onto the ASH through an interchange, providing a key strategic link to the motorway network, in particular for industrial land use and freight.

Stakeholder and community feedback indicated support for the upgrades proposed for Access Road to reduce congestion pressure and enable a more vibrant town centre.

12.2 Gap Analysis

The gap analysis for Access Road confirmed the key consideration as uncertainty of future land use derived from Council not proposing to structure plan the Kumeū Huapai growth areas in the short term. Gap analysis confirmed that:

- Adequate corridor assessment for the existing alignment was undertaken at IBC, however
- Route refinement was warranted to respond to constraints identified and not considered as part of the IBC.

12.3 Land use review and constraints mapping

To inform the option development and assessment, a land use review and constraint mapping exercise was carried out of the Access Road corridor environment. The exercise identified that:

- **Extent and zoning**: The Access Road corridor extends from SH16 to just east of Pomona Road. The north side of Access Road is zoned in the AUP:OP as FUZ with Business – Light Industry and Mixed-Use Zone on the north-west section of the road. The southern side of Access Road is zoned Rural – Countryside Living up to the Kumeū Showgrounds which are zoned Rural – Mixed Rural Zone and identified as under the Kumeū Showgrounds Precinct
- **Special uses and constraints**: The RUB follows the length of Access Road to Puke Road. Corresponding with the zoning, the northern end is typically urban landuse, and the southern end rural. The Kumeū Showgrounds abuts the corridor at Waitakere Road and the Waka Kotahi SH16 designation (Designation 6766) and KiwiRail NAL (Designation 6300) abut Access Road at the intersection with SH16 Main Road
- **Environmental Constraints:** A permanent stream crosses Access Road at the edge of the existing industrial zone. Three CHI items are along the corridor, CHI 18795 Historic Structure of Pomona Hall near the Kumeū Community Centre; CHI 16377 Shed, gates and railings at 211 Access Road and CHI 16387 Historic House a 2 Pomona Road.

Key outcomes of the review were the decision to:

- Assess route refinement options with the Project Team, see Figure 12-2
- Split the corridor into two Segments (see Figure 12-2 below) to assist with recording feedback on the options. Segment 1 aligned with the FUZ and Segment 2 the Business-Mixed Use Zone.

Figure 12-2: Access Road segments for options assessment

12.3.1 Corridor form and function assessment

An assessment was undertaken for the Access Road upgrade following the CFAF methodology in Section 4.6. This informed the options developed and assessed in Section 12.4 and Section 12.5.

Access Road will be an important connection within the Huapai-Kumeū area, and the corridor will be designed to connect to the ASH. The typical Access Road cross section is shown in Figure 12-3.

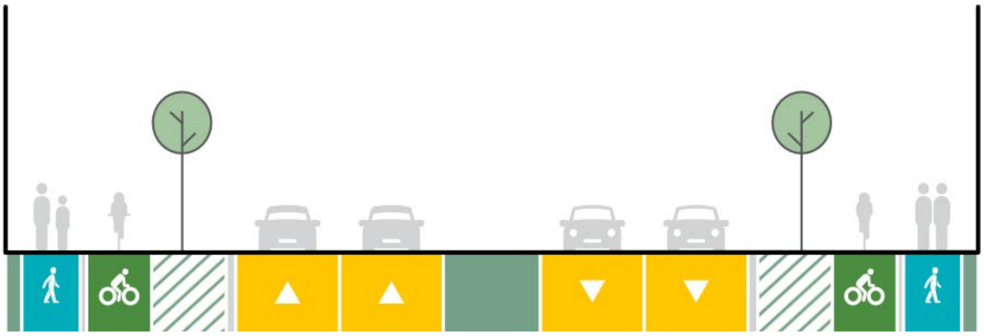


Figure 12-3: CFAF Outcome – Access Road indicative 30m cross section

12.4 Route refinement option development

Three options based on the indicative 30m wide cross section in Figure 12-3 were workshopped initially, with a fourth developed post workshop.

Option 1 / widen both	Holding the existing centreline and widening the road on the northern and southern sides
Option 2 / widen south	Holding the northern boundary and widening to the south
Option 3 / widen north	Holding the southern boundary and widening to the north

12.5 Route refinement assessment

12.5.1 Assessment

Route refinement assessment was undertaken for Access Road. The assessment follows the process outlined in Section 4.4. The options were assessed against the MCA framework including the ability to achieve the Transport Outcomes:

- Access: Improve access to economic and social opportunities by providing an integrated multi-modal corridor in Kumeū-Huapai
- Reliability: Enable reliable people movement to key strategic routes and destinations in Kumeū-Huapai
- Mode Choice: Support transformational mode share in Kumeū-Huapai by providing a high quality, safe and attractive movement of people along Access Road
- Safety: Provide improvements on Access Road that contribute to a transport network that is free from deaths and serious injuries.

All options performed well against the Transport Outcomes without differentiation. Considerations and constraints are identified in Figure 12-4. Table 12-1 provides a summary of the assessment undertaken by SMEs using the MCA framework, options were not scored, instead preferences were noted where applicable.

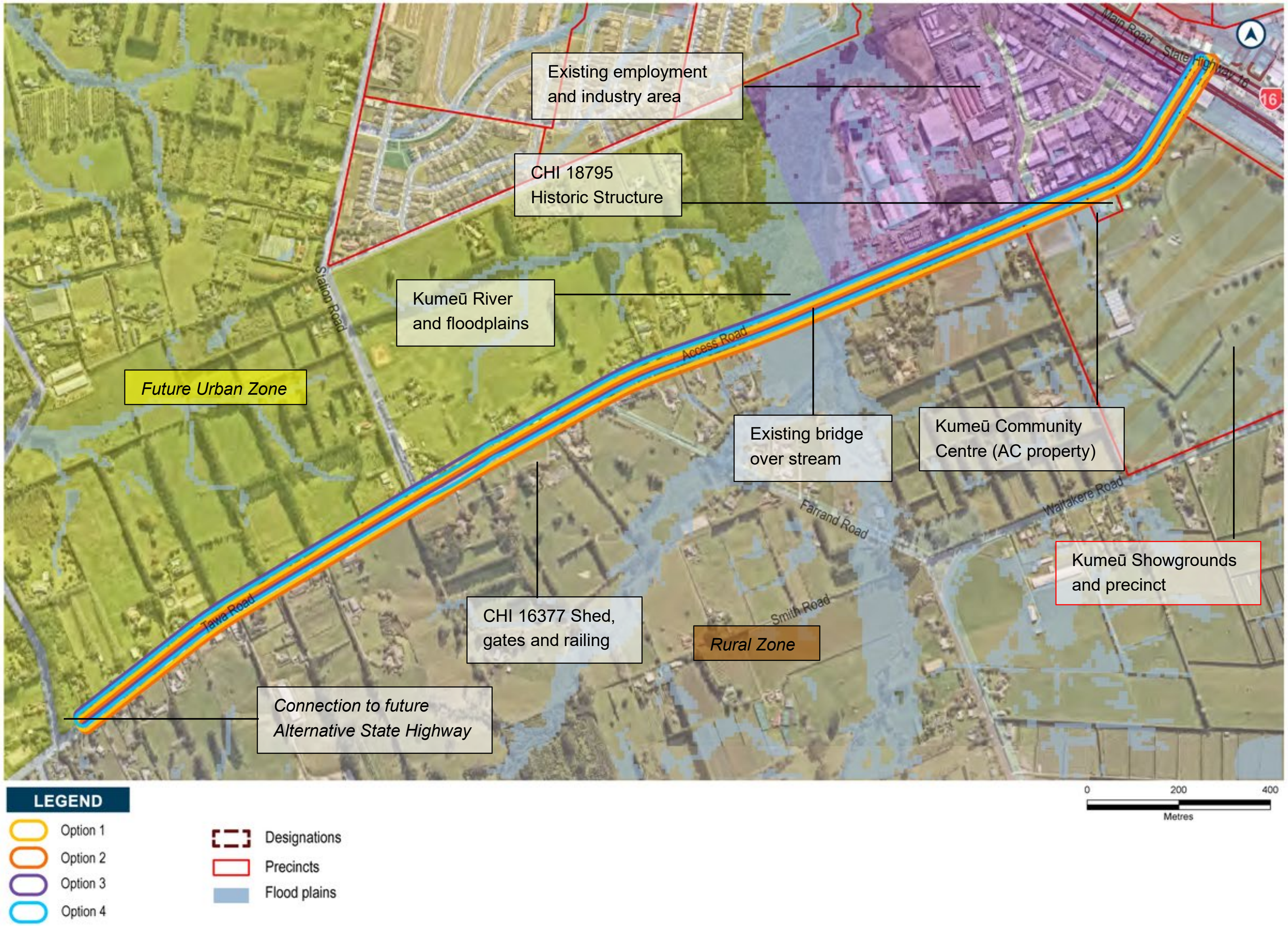


Figure 12-4: Access Road options and identified constraints

Table 12-1: Access Road MCA Assessment Summary – Segment 1

Wellbeing Assessment	
Cultural	Heritage: Option 2 widens the road corridor south and will impact on the existing fence line at 211 Access Road. The CHI item 16377 at No. 211 relates to sheds, railings and gate. Earthwork batters for Options 1 and 3 will also impact the fence line. Option 3 has the greatest potential for refinement to avoid the fence line; however, all options can mitigate impacts by re-positioning the fence.
Social	Future land use integration: Option 3 is preferred as it widens into the FUZ and can be integrated with future development, whilst minimising impacts on the Rural –Countryside Living Zone. Options 1 and 2 are not preferred as they impact on the Rural – Countryside Living Zone with less integration opportunities. Social: No differentiation between the options in Segment 1. Urban Design: Option 3 is preferred as the road corridor will be widened into the FUZ, where character changes are anticipated. Options 1 and 2 are less preferred as they impact the southern side's countryside character. Land Requirement: Option 3 is preferred as it minimises property impacts on the south and overlaps with properties impacted by intersection upgrades at Access Road. Option 1 impacts properties on both sides and is not preferred. Option 2 will increase the extent of properties impacted from the intersection upgrades and widening to the south of the road corridor. Human Health and Wellbeing: All options result in additional traffic with similar level of effects.
Environment	Landscape and Visual: Landscape and visual was not a differentiator with effects generally similar across the options being potential for some adverse visual and landscape effects. Stormwater: All options require stormwater infrastructure either within the road reserve or adjacent property, this was not a differentiator. Ecology: No significant ecological constraints identified along or in close proximity, this was not a differentiator. Natural Hazards: No significant geotechnical constraints or instability issues identified, this was not a differentiator.
Economic	Utilities: No differentiation between the options. Construction: Similar effects and not a differentiator.

Table 12-2: Access Road MCA Assessment Summary – Segment 2

Wellbeing Assessment	
Cultural	Heritage: Pomona Hall is set back from the corridor and will not be affected by any of the options. This was not a differentiator.
Social	Land Use Integration: Option 2 is the preferred option as it avoids impacts on the Business – Light Industry Zone, which contains small lot properties. A reduction in lot size could adversely impact the continued light industrial use. Option 2 will impact the Kumeū Showgrounds Precinct (zoned Rural – Mixed Rural) and the zones on the south side of the corridor; however

Wellbeing Assessment	
	the extent of impacts with the exception of the corner site, will not prevent the continued use of the land or development. Options 1 and 3 impact the Business – Light Industrial land and are therefore not preferred. Social: Options 1 and 2 have minor impact on the Kumeū Showgrounds and the Kumeū Community Centre car park. The community will still be able to make use of both facilities although alternative car parking arrangement may need to be put in place. Options 1 and 3 both impact north Business – Light Industry Zone and associated service and employment opportunities. Option 2 avoids the north side of the corridor and is preferred. Urban Design: Urban design was not a differentiator in Segment 2. Land Requirement: Option 2 is preferred as it avoids business properties. The *Kumeū District Agricultural and Horticultural Society Act 1991* applies to the Kumeū Showground, and this Act does not prevent or add a significant barrier to widening south. Option 1 impacts properties on both sides and is not preferred. Option 3 significantly impacts small business lots and is least preferred. Human Health and Wellbeing: All options will result in additional traffic with a similar level of effects.
Environment	Landscape and Visual: Landscape and visual was not a differentiator with effects generally similar across the options being potential for some adverse visual and landscape effects. Stormwater: All options require stormwater infrastructure either within the road reserve or adjacent property. This was not a differentiator. Ecology: No significant ecological constraints identified along or in close proximity. This was not a differentiator. Natural Hazards: No significant geotechnical constraints or instability issues identified. This was not a differentiator.
Economic	Utilities: Option 2 avoids / minimises impacts on utilities and infrastructure servicing businesses within the Business – Light Industrial Zone and is preferred. Options 1 and 3 have a greater impact on utilities serving the businesses. Construction: Options 1 and 3 will have a greater impact on the business located within the Business – Light Industrial Zone. Option 2 avoids the businesses and is preferred.

12.5.2 Post workshop refinement

Following the option assessment workshop, a further option was developed and considered in order to reduce property impacts along the alignment.

- **Option 4:** 30m cross-section holding the southern boundary and widening to the north.

Option 4 would retain the existing reverse curves (approximately 0.5km north of Station Road intersection). Option 4 was ultimately discounted however for Segment 1 and 2 as it did not significantly reduce land requirements and would retain a non-compliant road design curve.

Flooding requirements

Following option development, additional flooding design requirements were identified which resulted in a change to Segment 1 of Access Road (south of Wookey Lane). The stormwater and drainage requirements resulted in the cross section increasing from 30m to 35m. The 35m cross section was required to:

- Allow space for green infrastructure to convey, treat and attenuate stormwater within swales and reduce hard infrastructure such as pits and pipes
- Allow sufficient capacity to avoid increased flood impact at adjacent properties
- Mitigate safety issues associated with steep swale batters, which would be the outcome of a reduced cross section.

The revised cross section is shown in Figure 12-5 and was applied to Segment 1 (rural) only.

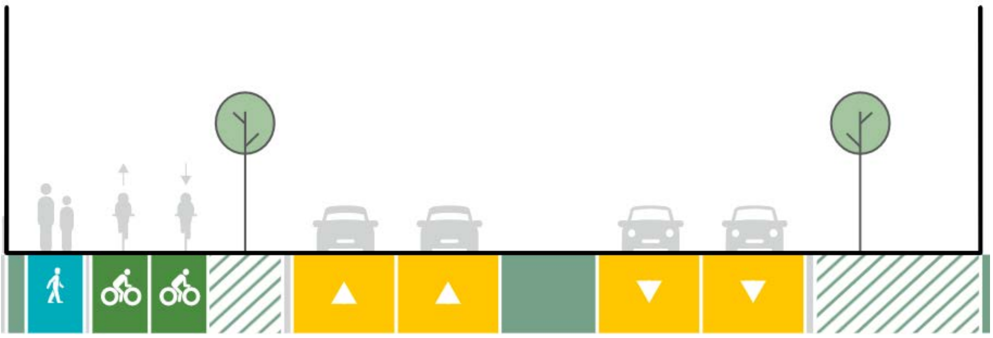


Figure 12-5: Access Road – rural edge cross section (Segment 1)

Options 1, 2 and 3 were reviewed in light of the revised cross section to test whether the increased cross section changed the commentary and preferences identified. The key change related to additional land required in individual properties and landuse integration / property access impacts. However, the number of buildings significantly impacted (and therefore properties likely to be fully required), remained the same. Commentary in Table 12-1 for the 30m cross section therefore remains relevant for a 35m cross section.

12.5.3 Refinement through Engagement

Throughout the option assessment workshops (see Section 4.5.3 and 4.5.3), the Project Team engaged with Partners to discuss the options. The key engagement outcome was Project Partners supported the early emerging preferred being:

- In Segment 1: Option 3 (widen north) using the revised 35m cross section and flooding requirements; and
- In Segment 2: Option 2 (widen south) using the 30m cross section.

Feedback was also received on whether the Access Road upgrade had potential to pressure unplanned urbanisation outside the RUB. Whilst re-zoning matters are outside the scope of the project, the design of Access Road has sought to enforce an urban edge that clearly delineates between the FUZ and Rural Zones through use of swales and placement of active modes paths. Therefore, it was considered that the Access Road upgrade would not pressure additional urbanisation outside the RUB.

12.5.4 Preferred Option

Following the MCA assessment and consideration of feedback received from Partners and the community, a preferred option for Access Road was identified. The preferred option is Option 3 (widen to north) in Segment 1 and Option 2 (widen to south) in Segment 2. This alignment ensured impacts were reduced where possible.

In Segment 1, Option 3 (widen north) was preferred because:

- Widening can be better integrated into the FUZ in Segment 1 and avoid / minimise impacts on the Rural Zone where a lower degree of landuse change is anticipated
- It minimises the extent of property impacts and associated land requirement.

In Segment 2, Option 2 (widen south) was preferred because:

- It avoided the Business-Light Industry Zone and therefore had the least impact on social cohesion.

There will be further opportunities to minimise any impacts within the Project alignment during the detailed design of the Projects. As a result, no further design refinement is required at this stage.

12.5.5 Discounted Options

Table 12-3 summarises the reasons for discounting the options in each segment.

Table 12-3: Access Road Discounted Options

Option	Reasoning
Option 1	Discounted for whole corridor • Increased extent of property impacts by impacting property on both sides of the road • Impacting on the Rural – Countryside Living Zone where development is not anticipated to occur, and so less ability to integrate the road • Adverse impacts on the Business – Light Industry Zone, with the potential to make some lots unusable for light industry • Potential for loss of employment opportunities and services used by the community located within the Business – Light Industry Zone.
Option 2	Discounted in Segment 1 • Increased extent of property impacts by impacting property on south side of the road with intersection upgrades also impacting properties on the north side • Impacting on the Rural – Countryside Living Zone where development is not anticipated to occur, and so less ability to integrate the road.
Option 3	Discounted in Segment 2 • Adverse impacts on the Business – Light Industry Zone, with the potential to make some lots unusable for light industry • Potential for loss of employment opportunities and services used by the community located within the Business – Light Industry Zone.
Option 4	Discounted for whole corridor • Did not significantly reduce property impacts due to the road widening still impacting land • Would maintain existing reverse curves that did not comply with geometric design standards.

12.6 Access Road summary

As outlined, through the assessment process and feedback from Project Partners and landowners, the preferred option for Access Road in Segment 1 is Option 3 using a 35m cross section, and in Segment 2 is Option 2 widening south using a 30m cross section.

13 Alternative Statutory Methods

This section provides an overview of the statutory methods considered to deliver the NW Strategic Package.

13.1 Assessment of route protection methods

The principal objective is to identify, and route protect the strategic transport network for the NW Strategic Package. These projects will support Auckland's projected growth over the next three decades. To achieve this a number of statutory methods have been considered (Figure 13-1). To enable route protection and future implementation, methods were considered in light of each project's strategic importance, delivery urgency / timing, complexity and risk profile.

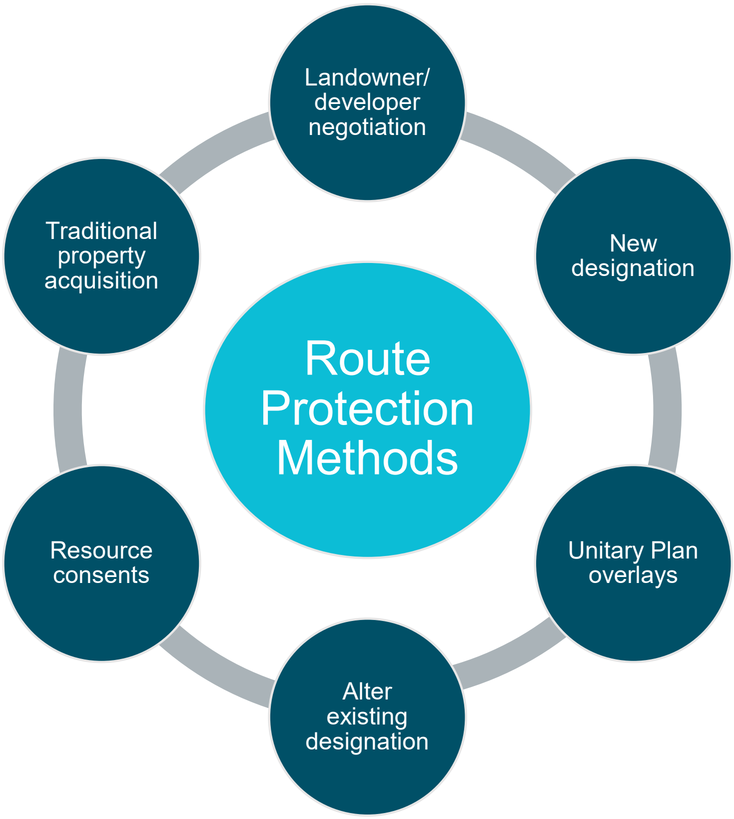


Figure 13-1: Route Protection Methods Considered

Table 13-1 summarises the strengths, weaknesses and suitability of each method for route protecting the NW Strategic Package. The planning context, key risks and considerations which may influence the preferred route protection method were reviewed and evaluated taking into account the planning environment and identified risks and considerations.

A package assessment is provided of the method, and where applicable further commentary is provided on a route's unique characteristics.

Table 13-1: Summary of Route Protection Methods

Methods	Summary of strengths and weaknesses within local context
AUP:OP 'Corridor Overlay'	AUP:OP overlays can provide certainty to the community by publicly identifying the network, however they do not protect the land necessary for the works. Any overlays would require a plan change, this approach may not be accepted by Council as the AUP:OP overlays are generally focussed on RMA Section 6 and 5 matters (e.g., heritage, SEAs) rather than transport. There are existing infrastructure overlays in the AUP:OP for noise (e.g., Airport Noise Overlay, City Centre Port Noise Overlay) as well as the National Grid Corridor Overlay, which is most reflective of how overlay may appear for transport. However, it is noted that the National Grid is also served by the National Policy Statement on Electricity Transmission which sets out key protections from adverse impacts of third-party development. There is currently no National Policy Statement which would provide the required protection for key transport corridors. Progressing a 'Transport Corridor Overlay' within the AUP:OP is not considered a viable route protection method for the NW Strategic Package.
Resource Consents	A resource consent grants approval to use resources such as the land, water, air and coastal environment. A resource consent, if granted, is not shown publicly in a district plan and does not protect land or provide rights of exclusion that would hinder incompatible land use. Therefore, resource consents are not an appropriate route protection method. It can be advantageous to seek resource consents (particularly for construction activities) under the RMA alongside route protection methods in instances where projects will proceed to construction once the route is secured. None of the Projects within the NW Strategic Package have funding for short term construction and delivery, therefore resource consents are not being sought.
Landowner / developer negotiation	Landowner or developer negotiations can include private parties purchasing land and vesting roads that support development, or development agreements whereby a developer agrees to "set aside land for future transport corridor" and / or construction at a future point. Infrastructure Funding Agreements are the preferred form of landowner / developer agreement to enable delivery of transport infrastructure. Infrastructure Funding Agreements provide route protection where a developer agrees to design and implement a project. For landowner agreements to be efficient, the aspirations and timing of each party must be aligned. As the Kumeū-Huapai and Redhills FUZ is not yet structure planned there are few active developers currently. Even if there were, in most cases developers do not own all the required land for a corridor. This then relies on individual property owners, who may not be developers (with sufficient capital or expertise) to enter into agreements. Private property owners with no development aspirations that are not part of a broader scheme may not have capacity or desire to negotiate such agreements. Where several independent properties and developers are involved, the final solution is likely to be delivered piecemeal due to the impracticalities and timeframes required to negotiate complex agreements with numerous landowners for each corridor, noting that there are hundreds of property owners for the Strategic Network. Infrastructure Funding Agreements with a large number of parties are generally impractical to implement and unlikely to protect the corridors within a reasonable time period. Additionally, it is not compulsory for landowners to enter into agreements. For linear corridors requiring a consistent network, agreement must be secured along the length of the route. A piecemeal approach significantly reduces the utility of this method for route protection purposes.

Methods	Summary of strengths and weaknesses within local context
Traditional Property acquisition	Traditional property acquisition to acquire the necessary land for each route was also considered. Land is typically purchased a few years before projects go to construction and delivery, based on detailed design plans. Purchasing property at this stage ahead of detailed design may result in more or less land being acquired than is required to deliver the project. It also may not enable construction areas to be protected which are required temporarily to construct the corridors. Like developer negotiations, traditional property purchase would not provide route protection until acquisition, where multiple owners are present this is unlikely to be achieved in a timely or consistent manner.
Designation	A NOR to designate land for a public work under the RMA provides a strong level of route protection from incompatible development particularly where development pressure is anticipated along the corridor. Once confirmed it also provides authorisation to undertake and maintain the works. A NOR has interim route protection effect as soon as the notice is lodged with Council which ensures the corridors will be protected from incompatible development from that date, enabling a cohesive interim protection for linear networks such as the NW Strategic Package. This effectively manages risk of development within the corridor that may otherwise hinder the proposed work. This is particularly important near BCI at Whenuapai which has been structure planned. The remaining package has not yet been structure planned; however existing urban areas in Kumeū-Huapai may also experience intensification. A designation, if confirmed, is included in the relevant district plan as a publicly visible layer. This provides visibility to the public about the intended land use and project extent, it also provides certainty to other infrastructure providers and developers about the future network location, enabling joined up development planning. A designation enables faster delivery of a corridor following detailed design, by consenting the project requirements under the district plan and allowing regional consents and OPWs to be sought at a later date, faster construction and delivery of the corridor is enabled.
Alteration to existing designations	There are limited opportunities to rely on this method throughout the NW Strategic Package. Lodging a NOR for the alteration of an existing designation has the same strengths and potential risks as identified for a new designation. It also provides for an efficient use of an existing corridor reducing private property impacts. An alteration to an existing designation for the recommended network is feasible for SH16 Main Road under Waka Kotahi Designation 6766.

13.2 Preferred method(s)

Designations (new or alteration to existing) are the preferred method. Designations provide certainty to the public by identifying the long-term transport network, enable it to be implemented in stages as aligned with government funding and pace of growth, enabling effective investment. The method protects the required area by restricting activities or use that may prevent or hinder the project and allows detailed design to be undertaken prior to project delivery. Designations provide an efficient and effective route protection method for projects in a changing environment. Table 13-2 sets out the preferred method for each Project.

Table 13-2: Strategic Network Preferred Method

Ref	Project	Preferred Method
Highway Connections		
S1	Alternative State Highway	Notice of Requirement
S2	SH16 Main Road	Alteration to Waka Kotahi Designation 6766
Rapid Transit		
S3	Rapid Transit Corridor	Notice of Requirement
KS	Kumeū Station	Notice of Requirement
HS	Huapai Station	Notice of Requirement
Roading upgrades		
S4	Access Road	Notice of Requirement

13.3 Summary

The assessment of alternatives undertaken meets the statutory requirements set out in section 171(1)(b) of the RMA.

ATTACHMENT 37

NORTH-WEST STRATEGIC
PROPOSED CONDITIONS
PART 1 OF 3

North West Strategic

Proposed Conditions

Notice of Requirement Key

Reference	Project	Purpose
S1	Alternative State Highway	Construction, operation and maintenance of a transport corridor.
S2	State Highway 16 – Alteration to Designation 6766	State Highway 16.
S3	Rapid Transit Corridor	Construction, operation and maintenance of a public transport corridor.
KS	Kumeū Rapid Transit Station	Construction, operation and maintenance of a public transport station and associated facilities.
HS	Huapai Rapid Transit Station	Construction, operation and maintenance of a public transport station and associated facilities.

Abbreviations and definitions

Acronym / Term	Definition
Activity sensitive to noise	Any dwelling, visitor accommodation, boarding house, marae, papakāinga, integrated residential development, retirement village, supported residential care, care centre, lecture theatre in a tertiary education facility, classroom in an education facility and healthcare facility with an overnight stay facility.
ARI	Annual Recurrence Interval
Average increase in flood hazard	Flow depth times velocity.
AUP	Auckland Unitary Plan
BPO or Best Practicable Option	Has the same meaning as in section 2 of the RMA 1991.
CEMP	Construction Environmental Management Plan
Certification	Confirmation from the Manager that a material change to a plan or CNVMP Schedule has been prepared in accordance with the condition to which it relates. A material change to a management plan or CNVMP Schedule shall be deemed certified: (i) where the Requiring Authority has received written confirmation from Council that the material change to the management plan is certified

Acronym / Term	Definition
	(ii) ten working days from the submission of the material change to the management plan where no written confirmation of certification has been received (iii) five working days from the submission of the material change to a CNVMP Schedule where no written confirmation of certification has been received.
CNVMP	Construction Noise and Vibration Management Plan
CNVMP Schedule or Schedule	A schedule to the CNVMP
Completion of Construction	When construction of the Project (or part of the Project) is complete and it is available for use.
Confirmed Biodiversity Areas	Areas recorded in the Identified Biodiversity Area Schedule where the ecological values and effects have been confirmed through the ecological survey under Condition **Error! Reference source not found.**.
Construction Works	Activities undertaken to construct the Project excluding Enabling Works.
Council	Auckland Council
CTMP	Construction Traffic Management Plan
EMP	Ecological Management Plan
EIANZ Guidelines	Ecological Impact Assessment: EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, second edition, dated May 2018.
Enabling works	Includes, but is not limited to, the following and similar activities: • geotechnical investigations (including trial embankments) • archaeological site investigations • formation of access for geotechnical investigations • establishment of site yards, site entrances and fencing • constructing and sealing site access roads • demolition or removal of buildings and structures • relocation of services • establishment of mitigation measures (such as erosion and sediment control measures, temporary noise walls, earth bunds and planting).
Existing authorised habitable floor	The floor level of any room (floor) in a residential building which is authorised by building consent and exists at the time the outline plan is submitted, excluding a laundry, bathroom, toilet or any room used solely as an entrance hall, passageway or garage.
Flood prone area	A potential ponding area that relies on a single culvert for drainage and does not have an overland flow path.
HHMP	Historic Heritage Management Plan
HNZPT	Heritage New Zealand Pouhere Taonga
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014

Acronym / Term	Definition
Identified Biodiversity Area	Means an area or areas of ecological value where the Project ecologist has identified that the project will potentially have a moderate or greater level of ecological effect, prior to implementation of impact management measures, as determined in accordance with the EIANZ guidelines.
Manager	The Manager – Resource Consents of the Auckland Council, or authorised delegate.
Mana Whenua	Mana Whenua as referred to in the conditions is considered to be (as a minimum but not limited to) the following (in no particular order), who at the time of Notice of Requirement expressed a desire to be involved in the Project: • Te Kawerau a Maki • Ngāti Whātua o Kaipara • Te Ākitai Waiohua • Ngāti Whanaunga
Maximum Probable Development	Design case for consideration of future flows allowing for development within a catchment that takes into account the maximum impervious surface limits of the current zone or, if the land is zoned Future Urban in the Auckland Unitary Plan, the probable level of development arising from zone changes.
Network Utility Operator	Has the same meaning as set out in section 166 of the RMA.
NOR	Notice of Requirement
NZAA	New Zealand Archaeological Association
Outline Plan	An outline plan prepared in accordance with section 176A of the RMA.
Pre-Project development	Existing site condition prior to the Project (including existing buildings and roadways).
Post-Project development	Site condition after the Project has been completed (including existing and new buildings and roadways).
Project Liaison Person	The person or persons appointed for the duration of the Project's Construction Works to be the main point of contact for persons wanting information about the Project or affected by the Construction Works.
Protected Premises and Facilities (PPF)	Protected Premises and Facilities as defined in New Zealand Standard NZS 6806:2010: *Acoustics – Road-traffic noise – New and altered roads*.
Requiring Authority	Has the same meaning as section 166 of the RMA and, for this Designation is Auckland Transport.
RMA	Resource Management Act (1991)
SCEMP	Stakeholder Communication and Engagement Management Plan
Stage of Work	Any physical works that require the development of an Outline Plan.
Start of Construction	The time when Construction Works (excluding Enabling Works) start.

Acronym / Term	Definition
Suitably Qualified Person	A person (or persons) who can provide sufficient evidence to demonstrate their suitability, experience and competence in the relevant field of expertise.
ULDMP	Urban and Landscape Design Management Plan

NoR No.	No.	Condition
General Conditions		
All	**1**	**Activity in General Accordance with Plans and Information** (a) Except as provided for in the conditions below, and subject to final design and Outline Plan(s), works within the designation shall be undertaken in general accordance with the Project description and concept plan in schedule 1: (b) Where there is inconsistency between: (i) the Project description and concept plan in schedule 1 and the requirements of the following conditions, the conditions shall prevail; (ii) the Project description and concept plan in schedule 1, and the management plans under the conditions of the designation, the requirements of the management plans shall prevail.
S2	**2**	Conditions 1 – 40 of this designation shall only apply to the work described in the Project Description and the altered area identified in the Concept Plan in Schedule 1.
All	**3**	**Project Information** (a) A project website, or equivalent virtual information source, shall be established within 12 months of the date on which this designation is included in the AUP. All directly affected owners and occupiers shall be notified in writing once the website or equivalent information source has been established. The project website or virtual information source shall include these conditions and shall provide information on: (i) the status of the Project; (ii) anticipated construction timeframes; (iii) contact details for enquiries; (iv) a subscription service to enable receipt of project updates by email; and (v) how to apply for consent for works in the designation under s176(1)(b) of the RMA. (b) At the start of detailed design for a Stage of Work, the project website or virtual information source shall be updated to provide information on the likely date for Start of Construction, and any staging of works.
All	**4**	**Designation Review** (a) The Requiring Authority shall within 6 months of Completion of Construction or as soon as otherwise practicable: (i) review the extent of the designation to identify any areas of designated land that it no longer requires for the on-going operation, maintenance or mitigation of effects of the Project; and (ii) give notice to Auckland Council in accordance with section 182 of the RMA for the removal of those parts of the designation identified above.
S1 **S3** **S4** **KS** **HS**	**5**	**Lapse** (a) In accordance with section 184(1)(c) of the RMA, this designation shall lapse if not given effect to within [20] years from the date on which it is included in the AUP.
All	**6**	**Network Utility Operators (Section 176 Approval)** (a) Prior to the start of Construction Works, Network Utility Operators with existing infrastructure located within the designation will not require written consent under section 176 of the RMA for the following activities: (i) operation, maintenance and urgent repair works;

<table>
<tr><th>NoR No.</th><th>No.</th><th>Condition</th></tr>
<tr><td></td><td></td><td>(ii) minor renewal works to existing network utilities necessary for the on-going provision or security of supply of network utility operations;
(iii) minor works such as new service connections; and
(iv) the upgrade and replacement of existing network utilities in the same location with the same or similar effects as the existing utility.
(b) To the extent that a record of written approval is required for the activities listed above, this condition shall constitute written approval.</td></tr>
<tr><td colspan="3">Pre-construction Conditions</td></tr>
<tr><td>All</td><td>7</td><td>Outline Plan
(a) An Outline Plan (or Plans) shall be prepared in accordance with section 176A of the RMA.
(b) Outline Plans (or Plan) may be submitted in parts or in stages to address particular activities (e.g. design or construction aspects), or a Stage of Work of the Project.
(c) Outline Plans shall include any management plan or plans that are relevant to the management of effects of those activities or Stage of Work, which may include:
(i) Network Utilities Management Plan;
(ii) Construction Environmental Management Plan;
(iii) Construction Traffic Management Plan;
(iv) Construction Noise and Vibration Management Plan;
(v) Urban and Landscape Design Management Plan;
(vi) Historic Heritage Management Plan;
(vii) Ecological Management Plan; and
(viii) Tree Management Plan.</td></tr>
<tr><td>All</td><td>8</td><td>Management Plans
(a) Any management plan shall:
(i) Be prepared and implemented in accordance with the relevant management plan condition;
(ii) Be prepared by a Suitably Qualified Person(s);
(iii) Include sufficient detail relating to the management of effects associated with the relevant activities and / or Stage of Work to which it relates;
(iv) Summarise comments received from Mana Whenua and other stakeholders as required by the relevant management plan condition, along with a summary of where comments have:
a. Been incorporated; and
b. Where not incorporated, the reasons why.
(v) Be submitted as part of an Outline Plan pursuant to s176A of the RMA, with the exception of SCEMPs and CNVMP Schedules;
(vi) Once finalised, uploaded to the Project website or equivalent virtual information source;
(b) Any management plan developed in accordance with Condition 7 may:
(i) Be submitted in parts or in stages to address particular activities (e.g. design or construction aspects) a Stage of Work of the Project, or to address specific activities authorised by the designation.
(ii) Except for material changes, be amended to reflect any changes in design, construction methods or management of effects without further process;
(iii) If there is a material change required to a management plan which has been submitted with an Outline Plan, the revised part of the plan shall be submitted to the Council as an update to the Outline Plan or for Certification as soon as practicable following identification of the need for a revision.
(c) Any material changes to the SCEMPs, are to be submitted to the Council for information.</td></tr>
</table>

NoR No.	No.	Condition
All	9	**Cultural Advisory Report** (a) At least six (6) months prior to the start of detailed design for a Stage of Work, Mana Whenua shall be invited to prepare a Cultural Advisory Report for the Project. (b) The objective of the Cultural Advisory Report is to assist in understanding and identifying Ngā Taonga Tuku Iho ('treasures handed down by our ancestors') affected by the Project, to inform their management and protection. To achieve the objective, the Requiring Authority shall invite Mana Whenua to prepare a Cultural Advisory Report that: (i) Identifies the cultural sites, landscapes and values that have the potential to be affected by the construction and operation of the Project; (ii) Sets out the desired outcomes for management of potential effects on cultural sites, landscapes and values; (iii) Identifies traditional cultural practices within the area that may be impacted by the Project; (iv) Identifies opportunities for restoration and enhancement of identified cultural sites, landscapes and values within the Project area; (v) Taking into account the outcomes of (i) to (iv) above, identify cultural matters and principles that should be considered in the development of the Urban and Landscape Design Management Plan and Historic Heritage Management Plan, and the Cultural Monitoring Plan referred to in Condition 14; (vi) Identifies and (if possible) nominates traditional names along the Project alignment. Noting there may be formal statutory processes outside the project required in any decision-making. (c) The desired outcomes for management of potential effects on cultural sites, landscapes and values identified in the Cultural Advisory Report shall be discussed with Mana Whenua and those outcomes reflected in the relevant management plans where practicable. (d) Conditions 8(b) and (c) above will cease to apply if: (i) Mana Whenua have been invited to prepare a Cultural Advisory Report by a date at least 6 months prior to start of Construction Works; and (ii) Mana Whenua have not provided a Cultural Advisory Report within six months prior to start of Construction Works.
S1	10	**Urban and Landscape Design Management Plan (ULDMP)** (a) A ULDMP shall be prepared prior to the Start of Construction for a Stage of Work. (b) Mana Whenua shall be invited to participate in the development of the ULDMP(s) to provide input into relevant cultural landscape and design matters including how desired outcomes for management of potential effects on cultural sites, landscapes and values identified and discussed in accordance with Condition 8(c) may be reflected in the ULDMP. The objective of the ULDMP(s) is to: (i) Enable integration of the Project's permanent works into the surrounding landscape and urban context; and (ii) Ensure that the Project manages potential adverse landscape and visual effects as far as practicable and contributes to a quality urban environment. (c) The ULDMP shall be prepared in general accordance with: (i) Waka Kotahi Urban Design Guidelines: Bridging the Gap (2013) or any subsequent updated version; (ii) Waka Kotahi Landscape Guidelines (2013) or any subsequent updated version; (iii) Waka Kotahi P39 Standard Specification for Highway Landscape Treatments (2013) or any subsequent updated version; and (d) To achieve the objective, the ULDMP(s) shall provide details of how the project: (i) Is designed to integrate with the adjacent urban (or proposed urban) and landscape context, including the surrounding existing or proposed topography, urban

NoR No.	No.	Condition
		environment (i.e. centres and density of built form), natural environment, landscape character and open space zones (including Fred Taylor Park); (ii) Provides appropriate walking and cycling connectivity to, and interfaces with, existing or proposed adjacent land uses, public transport infrastructure and walking and cycling connections; (iii) Promotes inclusive access (where appropriate); and (iv) Promotes a sense of personal safety by aligning with best practice guidelines, such as: a. Crime Prevention Through Environmental Design (CPTED) principles; b. Safety in Design (SID) requirements; and c. Maintenance in Design (MID) requirements and anti-vandalism / anti-graffiti measures. (e) The ULDMP(s) shall include: (i) a concept plan – which depicts the overall landscape and urban design concept, and explain the rationale for the landscape and urban design proposals; (ii) developed design concepts, including principles for walking and cycling facilities and public transport; and (iii) landscape and urban design details – that cover the following: a. Road design – elements such as intersection form, carriageway gradient and associated earthworks contouring including cut and fill batters and the interface with adjacent land uses, benching, spoil disposal sites, median width and treatment, roadside width and treatment; b. Roadside elements – such as lighting, fencing, wayfinding and signage; c. architectural and landscape treatment of all major structures, including bridges and retaining walls; d. Architectural and landscape treatment of noise barriers; e. Landscape treatment of permanent stormwater control wetlands and swales; f. Integration of passenger transport; g. Pedestrian and cycle facilities including paths, road crossings and dedicated pedestrian / cycle bridges or underpasses; h. Historic heritage places with reference to the HHMP; i. Reinstatement of construction and site compound areas, driveways, accessways and fences; (f) The ULDMP shall also include the following planting details and maintenance requirements: (i) planting design details including: a. identification of existing trees and vegetation that will be retained with reference to the Tree Management Plan and Ecological Management Plan. Where practicable, mature trees and native vegetation should be retained; b. street trees, shrubs and ground cover suitable for berms; c. treatment of fill slopes to integrate with adjacent land use, streams, riparian margins and open space zones; d. planting of stormwater wetlands; e. identification of vegetation to be retained and any planting requirements under Conditions 23 and 24; f. integration of any planting requirements required by conditions of any resource consents for the project; and g. re-instatement planting of construction and site compound areas as appropriate. (ii) a planting programme including the staging of planting in relation to the construction programme which shall, as far as practicable, include provision for planting within each planting season following completion of works in each Stage of Work; and (iii) detailed specifications relating to the following:

NoR No.	No.	Condition
		a. weed control and clearance; b. pest animal management (to support plant establishment); c. ground preparation (top soiling and decompaction); d. mulching; and e. plant sourcing and planting, including hydroseeding and grassing, and use of eco-sourced species.
S3	11	**Urban and Landscape Design Management Plan (ULDMP)** (a) A ULDMP shall be prepared prior to the Start of Construction for a Stage of Work. (b) Mana Whenua shall be invited to participate in the development of the ULDMP(s) to provide input into relevant cultural landscape and design matters including how desired outcomes for management of potential effects on cultural sites, landscapes and values identified and discussed in accordance with Condition 8(c) may be reflected in the ULDMP. The objective of the ULDMP(s) is to: (i) Enable integration of the Project's permanent works into the surrounding landscape and urban context; and (ii) Ensure that the Project manages potential adverse landscape and visual effects as far as practicable and contributes to a quality urban environment. (c) The ULDMP shall be prepared in general accordance with: (i) Waka Kotahi Urban Design Guidelines: Bridging the Gap (2013) or any subsequent updated version; (ii) Waka Kotahi Landscape Guidelines (2013) or any subsequent updated version; (iii) Waka Kotahi P39 Standard Specification for Highway Landscape Treatments (2013) or any subsequent updated version; and (d) To achieve the objective, the ULDMP(s) shall provide details of how the project: (i) Is designed to integrate with the adjacent urban (or proposed urban) and landscape context, including the surrounding existing or proposed topography, urban environment (i.e. centres and density of built form), natural environment, landscape character and open space zones (including Fred Taylor Park and Huapai Recreation Reserve); (ii) Provides appropriate walking and cycling connectivity to, and interfaces with, existing or proposed adjacent land uses, public transport infrastructure and walking and cycling connections; (iii) Promotes inclusive access (where appropriate); and (iv) Promotes a sense of personal safety by aligning with best practice guidelines, such as: a. Crime Prevention Through Environmental Design (CPTED) principles; b. Safety in Design (SID) requirements; and c. Maintenance in Design (MID) requirements and anti-vandalism / anti-graffiti measures. (e) The ULDMP(s) shall include: (i) a concept plan – which depicts the overall landscape and urban design concept, and explain the rationale for the landscape and urban design proposals; (ii) developed design concepts, including principles for walking and cycling facilities and public transport; and (iii) landscape and urban design details – that cover the following: a. Road design – elements such as intersection form, carriageway gradient and associated earthworks contouring including cut and fill batters and the interface with adjacent land uses, benching, spoil disposal sites, median width and treatment, roadside width and treatment; b. Roadside elements – such as lighting, fencing, wayfinding and signage; c. architectural and landscape treatment of all major structures, including bridges and retaining walls; d. Architectural and landscape treatment of noise barriers;

NoR No.	No.	Condition
		e. Landscape treatment of permanent stormwater control wetlands and swales; f. Integration of passenger transport; g. Pedestrian and cycle facilities including paths, road crossings and dedicated pedestrian / cycle bridges or underpasses; h. Historic heritage places with reference to the HHMP; i. Reinstatement of construction and site compound areas, driveways, accessways and fences; (f) The ULDMP shall also include the following planting details and maintenance requirements: (i) planting design details including: a. identification of existing trees and vegetation that will be retained with reference to the Tree Management Plan and Ecological Management Plan. Where practicable, mature trees and native vegetation should be retained; b. street trees, shrubs and ground cover suitable for berms; c. treatment of fill slopes to integrate with adjacent land use, streams, riparian margins and open space zones; d. planting of stormwater wetlands; e. identification of vegetation to be retained and any planting requirements under Conditions 23 and 24; f. integration of any planting requirements required by conditions of any resource consents for the project; and g. re-instatement planting of construction and site compound areas as appropriate. (ii) a planting programme including the staging of planting in relation to the construction programme which shall, as far as practicable, include provision for planting within each planting season following completion of works in each Stage of Work; and (iii) detailed specifications relating to the following: a. weed control and clearance; b. pest animal management (to support plant establishment); c. ground preparation (top soiling and decompaction); d. mulching; and e. plant sourcing and planting, including hydroseeding and grassing, and use of eco-sourced species.
S2 KS HS	12	**Urban and Landscape Design Management Plan (ULDMP)** (a) A ULDMP shall be prepared prior to the Start of Construction for a Stage of Work. (b) Mana Whenua shall be invited to participate in the development of the ULDMP(s) to provide input into relevant cultural landscape and design matters including how desired outcomes for management of potential effects on cultural sites, landscapes and values identified and discussed in accordance with Condition 8(c) may be reflected in the ULDMP. The objective of the ULDMP(s) is to: (i) Enable integration of the Project's permanent works into the surrounding landscape and urban context; and (ii) Ensure that the Project manages potential adverse landscape and visual effects as far as practicable and contributes to a quality urban environment. (c) The ULDMP shall be prepared in general accordance with: (i) Waka Kotahi Urban Design Guidelines: Bridging the Gap (2013) or any subsequent updated version; (ii) Waka Kotahi Landscape Guidelines (2013) or any subsequent updated version; (iii) Waka Kotahi P39 Standard Specification for Highway Landscape Treatments (2013) or any subsequent updated version; and (d) To achieve the objective, the ULDMP(s) shall provide details of how the project: (i) Is designed to integrate with the adjacent urban (or proposed urban) and landscape context, including the surrounding existing or proposed topography, urban

NoR No.	No.	Condition
		environment (i.e. centres and density of built form), natural environment, landscape character and open space zones (including Fred Taylor Park and Huapai Recreation Reserve); (ii) Provides appropriate walking and cycling connectivity to, and interfaces with, existing or proposed adjacent land uses, public transport infrastructure and walking and cycling connections; (iii) Promotes inclusive access (where appropriate); and (iv) Promotes a sense of personal safety by aligning with best practice guidelines, such as: a. Crime Prevention Through Environmental Design (CPTED) principles; b. Safety in Design (SID) requirements; and c. Maintenance in Design (MID) requirements and anti-vandalism / anti-graffiti measures. (e) The ULDMP(s) shall include: (i) a concept plan – which depicts the overall landscape and urban design concept, and explain the rationale for the landscape and urban design proposals; (ii) developed design concepts, including principles for walking and cycling facilities and public transport; and (iii) landscape and urban design details – that cover the following: a. Road design – elements such as intersection form, carriageway gradient and associated earthworks contouring including cut and fill batters and the interface with adjacent land uses, benching, spoil disposal sites, median width and treatment, roadside width and treatment; b. Roadside elements – such as lighting, fencing, wayfinding and signage; c. architectural and landscape treatment of all major structures, including bridges and retaining walls; d. Architectural and landscape treatment of noise barriers; e. Landscape treatment of permanent stormwater control wetlands and swales; f. Integration of passenger transport; g. Pedestrian and cycle facilities including paths, road crossings and dedicated pedestrian / cycle bridges or underpasses; h. Historic heritage places with reference to the HHMP; i. Reinstatement of construction and site compound areas, driveways, accessways and fences; (f) The ULDMP shall also include the following planting details and maintenance requirements: (i) planting design details including: a. identification of existing trees and vegetation that will be retained with reference to the Tree Management Plan and Ecological Management Plan. Where practicable, mature trees and native vegetation should be retained; b. street trees, shrubs and ground cover suitable for berms; c. treatment of fill slopes to integrate with adjacent land use, streams, riparian margins and open space zones; d. planting of stormwater wetlands; e. identification of vegetation to be retained and any planting requirements under Conditions 23 and 24; f. integration of any planting requirements required by conditions of any resource consents for the project; and g. re-instatement planting of construction and site compound areas as appropriate. (ii) a planting programme including the staging of planting in relation to the construction programme which shall, as far as practicable, include provision for planting within each planting season following completion of works in each Stage of Work; and

NoR No.	No.	Condition
		(iii) detailed specifications relating to the following: a. weed control and clearance; b. pest animal management (to support plant establishment); c. ground preparation (top soiling and decompaction); d. mulching; and e. plant sourcing and planting, including hydroseeding and grassing, and use of eco-sourced species.
All		**Advice Note:** *This designation is not for the specific purpose of "road widening" (see Notice of Requirement Key for Designation Purpose). Therefore, it is not intended that the front yard definition in the Auckland Unitary Plan which applies a set back from a designation for road widening purposes applies to this designation. A set back is not required to manage effects between the designation boundary and any proposed adjacent sites or lots.*
Specific Outline Plan Requirements		
All	13	**Flood Hazard** (a) The Project shall be designed to achieve the following flood risk outcomes: (i) no increase in flood levels for existing authorised habitable floors that are already subject to flooding; (ii) no more than a 10% reduction in freeboard for existing authorised habitable floors; (iii) no increase of more than 50mm in flood level on land zoned for urban or future urban development where there is no existing dwelling; (iv) no new flood prone areas; (v) no more than a 10% average increase of flood hazard (defined as flow depth times velocity) for main access to authorised habitable dwellings existing at time the Outline Plan is submitted. (b) Compliance with this condition shall be demonstrated in the Outline Plan, which shall include flood modelling of the pre-Project and post-Project 100 year ARI flood levels (for Maximum Probable Development land use and including climate change). (c) Where the above outcomes can be achieved through alternative measures outside of the designation such as flood stop banks, flood walls, raising existing authorised habitable floor level and new overland flow paths or varied through agreement with the relevant landowner, the Outline Plan shall include confirmation that any necessary landowner and statutory approvals have been obtained for that work or alternative outcome.
Construction Conditions		
All	14	**Construction Environmental Management Plan (CEMP)** (a) A CEMP shall be prepared prior to the Start of Construction for a Stage of Work. (b) The objective of the CEMP is to set out the management procedures and construction methods to be undertaken to, avoid, remedy or mitigate any adverse effects associated with Construction Works as far as practicable. To achieve the objective, the CEMP shall include: (i) the roles and responsibilities of staff and contractors; (ii) details of the site or project manager and the Project Liaison Person, including their contact details (phone and email address); (iii) the Construction Works programmes and the staging approach, and the proposed hours of work; (iv) details of the proposed construction yards including temporary screening when adjacent to residential areas, locations of refuelling activities and construction lighting; (v) methods for controlling dust and the removal of debris and demolition of construction materials from public roads or places;

NoR No.	No.	Condition
		(vi) methods for providing for the health and safety of the general public; (vii) procedures for incident management; (viii) procedures for the refuelling and maintenance of plant and equipment to avoid discharges of fuels or lubricants to Watercourses; (ix) measures to address the storage of fuels, lubricants, hazardous and / or dangerous materials, along with contingency procedures to address emergency spill response(s) and clean up; (x) procedures for responding to complaints about Construction Works; and (xi) methods for amending and updating the CEMP as required.
All	15	**Stakeholder Communication and Engagement Management Plan (SCEMP)** (a) A SCEMP shall be prepared prior to the Start of Construction for a Stage of Work. The objective of the SCEMP is to identify how the public and stakeholders (including directly affected and adjacent owners and occupiers of land) will be engaged with throughout the Construction Works. To achieve the objective, the SCEMP shall include: (i) the contact details for the Project Liaison Person. These details shall be on the Project website, or equivalent virtual information source, and prominently displayed at the main entrance(s) to the site(s); (ii) the procedures for ensuring that there is a contact person available for the duration of Construction Works, for public enquiries or complaints about the Construction Works; (iii) methods for engaging with Mana Whenua, to be developed in consultation with Mana Whenua; (iv) a list of stakeholders, organisations (such as community facilities), businesses who will be engaged with and the methods for engagement; (v) identification of the properties whose owners will be engaged with; (vi) methods and timing to engage with landowners whose access is directly affected; (vii) methods to communicate key project milestones and the proposed hours of construction activities including outside of normal working hours and on weekends and public holidays, to the parties identified in (iv) and (v) above; and (viii) linkages and cross-references to communication and engagement methods set out in other conditions and management plans where relevant. (b) Any SCEMP prepared for a Stage of Work shall be submitted to Council for information ten working days prior to the Start of Construction for a Stage of Work.
All	16	**Complaints Register** (a) At all times during Construction Works, a record of any complaints received about the Construction Works shall be maintained. The record shall include: (i) The date, time and nature of the complaint; (ii) The name, phone number and address of the complainant (unless the complainant wishes to remain anonymous); (iii) Measures taken to respond to the complaint (including a record of the response provided to the complainant) or confirmation of no action if deemed appropriate; (iv) The outcome of the investigation into the complaint; (v) Any other activities in the area, unrelated to the Project that may have contributed to the complaint, such as non-project construction, fires, traffic accidents or unusually dusty conditions generally. (b) A copy of the Complaints Register required by this condition shall be made available to the Manager upon request as soon as practicable after the request is made.
All	17	**Cultural Monitoring Plan** (a) Prior to the start of Construction Works, a Cultural Monitoring Plan shall be prepared by a Suitably Qualified Person(s) identified in collaboration with Mana Whenua.

NoR No.	No.	Condition
		(b) The objective of the Cultural Monitoring Plan is to identify methods for undertaking cultural monitoring to assist with management of any cultural effects during Construction works; (c) The Cultural Monitoring Plan shall include: (i) Requirements for formal dedication or cultural interpretation to be undertaken prior to start of Construction Works in areas identified as having significance to Mana Whenua; (ii) Requirements and protocols for cultural inductions for contractors and subcontractors; (iii) Identification of activities, sites and areas where cultural monitoring is required during particular Construction Works; (iv) Identification of personnel to undertake cultural monitoring, including any geographic definition of their responsibilities; and (v) Details of personnel to assist with management of any cultural effects identified during cultural monitoring, including implementation of the Accidental Discovery Protocol (d) If Enabling Works involving soil disturbance are undertaken prior to the start of Construction Works, an Enabling Works Cultural Monitoring Plan shall be prepared by a Suitably Qualified Person identified in collaboration with Mana Whenua. This plan may be prepared as a standalone Enabling Works Cultural Monitoring Plan or be included in the main Construction Works Cultural Monitoring Plan. **Advice Note:** *Where appropriate, the Cultural Monitoring Plan shall align with the requirements of other conditions of the designation and resource consents for the Project which require monitoring during Construction Works.*
All	18	**Construction Traffic Management Plan (CTMP)** (a) A CTMP shall be prepared prior to the Start of Construction for a Stage of Work. (b) The objective of the CTMP is to avoid, remedy or mitigate, as far as practicable, adverse construction traffic effects. To achieve this objective, the CTMP shall include: (i) methods to manage the effects of temporary traffic management activities on traffic; (ii) measures to ensure the safety of all transport users; (iii) the estimated numbers, frequencies, routes and timing of traffic movements, including any specific non-working or non-movement hours to manage vehicular and pedestrian traffic near schools or to manage traffic congestion; (iv) site access routes and access points for heavy vehicles, the size and location of parking areas for plant, construction vehicles and the vehicles of workers and visitors; (v) identification of detour routes and other methods to ensure the safe management and maintenance of traffic flows, including pedestrians and cyclists, on existing roads; (vi) methods to maintain vehicle access to property and / or private roads where practicable, or to provide alternative access arrangements when it will not be; (vii) the management approach to loads on heavy vehicles, including covering loads of fine material, the use of wheel-wash facilities at site exit points and the timely removal of any material deposited or spilled on public roads; and (viii) methods that will be undertaken to communicate traffic management measures to affected road users (e.g. residents / public / stakeholders / emergency services). (ix) Auditing, monitoring and reporting requirements relating to traffic management activities shall be undertaken in accordance with the Waka Kotahi Code of Practice for Temporary Traffic Management.
All	19	**Construction Noise Standards**

<table>
<tr><th>NoR No.</th><th>No.</th><th>Condition</th></tr>
<tr><td></td><td></td><td>
(a) Construction noise shall be measured and assessed in accordance with NZS6803:1999 Acoustics – Construction Noise and shall comply with the noise standards set out in the following table as far as practicable:

Table 17.1: Construction noise standards
<table>
<tr><th>Day of week</th><th>Time period</th><th>$L_{Aeq(15min)}$</th><th>L_{AFmax}</th></tr>
<tr><td colspan="4">Occupied activity sensitive to noise</td></tr>
<tr><td>Weekday</td><td>0630h - 0730h
0730h - 1800h
1800h - 2000h
2000h - 0630h</td><td>55 dB
70 dB
65 dB
45 dB</td><td>75 dB
85 dB
80 dB
75 dB</td></tr>
<tr><td>Saturday</td><td>0630h - 0730h
0730h - 1800h
1800h - 2000h
2000h - 0630h</td><td>55 dB
70 dB
45 dB
45 dB</td><td>75 dB
85 dB
75 dB
75 dB</td></tr>
<tr><td>Sunday and Public Holidays</td><td>0630h - 0730h
0730h - 1800h
1800h - 2000h
2000h - 0630h</td><td>45 dB
55 dB
45 dB
45 dB</td><td>75 dB
85 dB
75 dB
75 dB</td></tr>
<tr><td colspan="4">Other occupied buildings</td></tr>
<tr><td>All</td><td>0730h - 1800h
1800h - 0730h</td><td>70 dB
75 dB</td><td></td></tr>
</table>
(b) Where compliance with the noise standards set out in Table [above] is not practicable, and unless otherwise provided for in the CNVMP as required by Condition 18(c)(x), then the methodology in Condition 19 shall apply.
</td></tr>
</table>

<table>
<tr><th>NoR No.</th><th>No.</th><th>Condition</th></tr>
<tr><td>All</td><td>20</td><td>Construction Vibration Standards
(a) Construction vibration shall be measured in accordance with ISO 4866:2010 Mechanical vibration and shock – Vibration of fixed structures – Guidelines for the measurement of vibrations and evaluation of their effects on structures and shall comply with the vibration standards set out in the following table as far as practicable.
Table CNV2 Construction vibration criteria
<table>
<tr><th>Receiver</th><th>Details</th><th>Category A</th><th>Category B</th></tr>
<tr><td rowspan="2">Occupied Activities sensitive to noise</td><td>Night-time 2000h - 0630h</td><td>0.3mm/s ppv</td><td>1mm/s ppv</td></tr>
<tr><td>Daytime 0630h - 2000h</td><td>1mm/s ppv</td><td>5mm/s ppv</td></tr>
<tr><td>Other occupied buildings</td><td>Daytime 0630h - 2000h</td><td>2mm/s ppv</td><td>5mm/s ppv</td></tr>
<tr><td rowspan="2">All other buildings</td><td>At all other times
Vibration transient</td><td>5mm/s ppv</td><td>BS 5228-2*
Table B2</td></tr>
<tr><td>At all other times
Vibration continuous</td><td>5mm/s ppv</td><td>BS 5228-2*
50% of Table B2 values</td></tr>
</table>
<u>* Refer to Waka Kotahi State highway construction and maintenance noise and vibration guide for further explanation regarding Category A and B criteria</u>
**BS 5228-2:2009 ‘Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration’
(b) Where compliance with the vibration standards set out in Table CNV2 above is not practicable, and unless otherwise provided for in the CNVMP, then the methodology in Condition 19 shall apply.
(c) If measured or predicted vibration from construction activities exceeds the Category A criteria, a Suitably Qualified Person shall assess and manage construction vibration during those activities.
(d) If measured or predicted vibration from construction activities exceeds the Category B criteria those activities must only proceed if vibration effects on affected buildings are assessed, monitored and mitigated by a Suitably Qualified Person.</td></tr>
<tr><td>All</td><td>21</td><td>Construction Noise and Vibration Management Plan (CNVMP)
(a) A CNVMP shall be prepared prior to the Start of Construction for a Stage of Work.
(b) A CNVMP shall be implemented during the Stage of Work to which it relates;
(c) The objective of the CNVMP is to provide a framework for the development and implementation of the Best Practicable Option for the management of construction noise and vibration effects to achieve the construction noise and vibration standards set out in Conditions 16 and 17 to the extent practicable. To achieve this objective, the CNVMP shall be prepared in accordance with Annex E2 of the New Zealand Standard NZS6803:1999 ‘Acoustics – Construction Noise’ (NZS6803:1999) and the Waka Kotahi State highway construction and maintenance noise and vibration guide (version 1.1, 2019), and shall as a minimum, address the following:
(i) Description of the works and anticipated equipment / processes;</td></tr>
</table>

NoR No.	No.	Condition
		(ii) Hours of operation, including times and days when construction activities would occur; (iii) The construction noise and vibration standards for the project; (iv) Identification of receivers where noise and vibration standards apply; (v) A hierarchy of management and mitigation options including any requirements to limit night and works during other sensitive times, including Sundays and public holidays as far as practicable; (vi) Methods and frequency for monitoring and reporting on construction noise and vibration; (vii) Procedures for communication and engagement with nearby residents and stakeholders, including notification of proposed construction activities, the period of construction activities, and management of noise and vibration complaints; (viii) Contact details of the Project Liaison Person; (ix) Procedures for the regular training of the operators of construction equipment to minimise noise and vibration as well as expected construction site behaviours for all workers; (x) Identification of areas where compliance with the noise [Condition 16] and / or vibration standards [Condition 17] Category A or Category B will not be practicable and the specific management controls to be implemented and consultation requirements with owners and occupiers of affected sites. (xi) Procedures and requirements for the preparation of a Schedule to the CNVMP (Schedule) for those areas where compliance with the noise [Condition 16] and / or vibration standards [Condition 17] Category A or Category B will not be practicable and where sufficient information is not available at the time of the CNVMP to determine the area specific management controls [Condition 18(c)(x) CNVMP]. (xii) Identification of trigger levels for undertaking building condition surveys, which shall be below Category B day time levels; (xiii) Procedures for undertaking building condition surveys before and after works to determine whether any cosmetic or structural damage has occurred as a result of construction vibration. (xiv) Methodology and programme of desktop and field audits and inspections to be undertaken to ensure that CNVMP, Schedules and the best practicable option for management of effects are being implemented; (xv) Requirements for review and update of the CNVMP.
All	22	**Schedule to a CNVMP** (a) Unless otherwise provided for in a CNVMP, a Schedule to the CNVMP (Schedule) shall be prepared prior to the start of the construction activity to which it relates by a Suitably Qualified Person, in consultation with the owners and occupiers of sites subject to the Schedule to the CNVMP, when: (i) Construction noise is either predicted or measured to exceed the noise standards in Condition 16; (ii) Construction vibration is either predicted or measured to exceed the Category A standard at the receivers in Condition 17; (b) The objective of the Schedule is to set out the Best Practicable Option measures to manage noise and / or vibration effects of the construction activity beyond those measures set out in the CNVMP. The Schedule shall include details such as: (i) Construction activity location, start and finish times; (ii) The nearest neighbours to the construction activity; (iii) The predicted noise and / or vibration level for all receivers where the levels are predicted or measured to exceed the applicable standards in Conditions 16 and 17 and the predicted duration of the exceedance;

NoR No.	No.	Condition
		(iv) The proposed mitigation options that have been selected, and the options that have been discounted as being impracticable and the reasons why; (v) A summary of the consultation undertaken with owners and occupiers of sites subject to the Schedule, and how consultation has and has not been taken into account; and (vi) Location, times and types of monitoring. (c) The Schedule shall be submitted to the Manager for information at least 5 working days (except in unforeseen circumstances) in advance of Construction Works that are covered by the scope of the Schedule and shall form part of the CNVMP. If any comments are received from the Manager, these shall be considered by the Requiring Authority prior to implementation of the Schedule; (d) Where material changes are made to a Schedule required by this condition, the Requiring Authority shall consult the owners and / or occupiers of sites subject to the Schedule prior to submitting the amended Schedule to the Manager for information in accordance with (c) above. The amended Schedule shall document the consultation undertaken with those owners and occupiers, and how consultation outcomes have and have not been taken into account.
S1 **S2** **KS** **HS**	**23**	**Historic Heritage Management Plan (HHAMP)** (a) A HHMP shall be prepared in consultation with Council, HNZPT and Mana Whenua prior to the Start of Construction for a Stage of Work. (b) The objective of the HHMP is to protect historic heritage and to remedy and mitigate any residual effects as far as practicable. To achieve the objective, the HHMP shall identify: (i) Any adverse direct and indirect effects on historic heritage sites and measures to appropriately avoid, remedy or mitigate any such effects, including a tabulated summary of these effects and measures; (ii) Methods for the identification and assessment of potential historic heritage places within the Designation to inform detailed design; (iii) Known historic heritage places and potential archaeological sites within the Designation, including identifying any archaeological sites for which an Archaeological Authority under the HNZPTA will be sought or has been granted; (iv) Any unrecorded archaeological sites or post-1900 heritage sites within the Designation, which shall also be documented and recorded; (v) Roles, responsibilities and contact details of Project personnel, Council and HNZPT representatives, Mana Whenua representatives, and relevant agencies involved with heritage and archaeological matters including surveys, monitoring of Construction Works, compliance with AUP accidental discovery rule, and monitoring of conditions; (vi) Specific areas to be investigated, monitored and recorded to the extent these are directly affected by the Project; (vii) The proposed methodology for investigating and recording post-1900 historic heritage sites (including buildings) that need to be destroyed, demolished or relocated, including details of their condition, measures to mitigate any adverse effects and timeframe for implementing the proposed methodology, in accordance with the HNZPT Archaeological Guidelines Series No.1:_ Investigation and Recording of Buildings and Standing Structures (November 2018), or any subsequent version; (viii) Methods to acknowledge cultural values identified through Condition 9 where archaeological sites also involve ngā taonga tuku iho (treasures handed down by our ancestors) and where feasible and practicable to do so; (ix) Methods for avoiding, remedying or mitigation adverse effects on historic heritage places and sites within the Designation during Construction Works as far as practicable. These methods shall include, but are not limited to: A. security fencing or hoardings around historic heritage places to protect them from damage during construction or unauthorised access

NoR No.	No.	Condition
		B. measures to mitigate adverse effects on historic heritage sites that achieve positive historic heritage outcomes such as increased public awareness and interpretation signage; (x) Training requirements and inductions for contractors and subcontractors on historic heritage places within the Designation, legal obligations relating to accidental discoveries, the AUP Accidental Discovery Rule (E11.6.1). The training shall be undertaken prior to the Start of Construction, under the guidance of a Suitably Qualified Person and Mana Whenua representatives (to the extent the training relates to cultural values identified under Condition 14; and (c) All historic heritage reports relating to historic heritage investigations (evaluation, excavation and monitoring), shall be submitted to the Manager within 12 months of completion.
S3	**24**	**Historic Heritage Management Plan (HHAMP)** (a) A HHMP shall be prepared in consultation with Council, HNZPT and Mana Whenua prior to the Start of Construction for a Stage of Work. (b) The objective of the HHMP is to protect historic heritage and to remedy and mitigate any residual effects as far as practicable. To achieve the objective, the HHMP shall identify: (i) Any adverse direct and indirect effects on historic heritage sites and measures to appropriately avoid, remedy or mitigate any such effects, including a tabulated summary of these effects and measures; (ii) Methods for the identification and assessment of potential historic heritage places within the Designation to inform detailed design; (iii) Known historic heritage places and potential archaeological sites within the Designation, including identifying any archaeological sites for which an Archaeological Authority under the HNZPTA will be sought or has been granted; (iv) Any unrecorded archaeological sites or post-1900 heritage sites within the Designation, which shall also be documented and recorded; (v) Roles, responsibilities and contact details of Project personnel, Council and HNZPT representatives, Mana Whenua representatives, and relevant agencies involved with heritage and archaeological matters including surveys, monitoring of Construction Works, compliance with AUP accidental discovery rule, and monitoring of conditions; (vi) Specific areas to be investigated, monitored and recorded to the extent these are directly affected by the Project; (vii) The proposed methodology for investigating and recording post-1900 historic heritage sites (including buildings) that need to be destroyed, demolished or relocated, including details of their condition, measures to mitigate any adverse effects and timeframe for implementing the proposed methodology, in accordance with the HNZPT Archaeological Guidelines Series No.1:_ Investigation and Recording of Buildings and Standing Structures (November 2018), or any subsequent version; (viii) Methods to acknowledge cultural values identified through Condition 9 where archaeological sites also involve ngā taonga tuku iho (treasures handed down by our ancestors) and where feasible and practicable to do so; (ix) Methods for avoiding, remedying or mitigation adverse effects on historic heritage places and sites within the Designation during Construction Works as far as practicable. These methods shall include, but are not limited to: A. security fencing or hoardings around historic heritage places to protect them from damage during construction or unauthorised access B. measures to mitigate adverse effects on historic heritage sites that achieve positive historic heritage outcomes such as increased public awareness and interpretation signage; (x) Training requirements and inductions for contractors and subcontractors on historic heritage places within the Designation, legal obligations relating to accidental

NoR No.	No.	Condition
		discoveries, the AUP Accidental Discovery Rule (E11.6.1). The training shall be undertaken prior to the Start of Construction, under the guidance of a Suitably Qualified Person and Mana Whenua representatives (to the extent the training relates to cultural values identified under Condition 14; and (xi) For Huapai Tavern (AUP:OP Schedule 14.1 #00482) and Kumeū Railway Goods Shed (AUP:OP Schedule 14.1 #00483) measures and methods shall be identified to: A. appropriately avoid, remedy or mitigate adverse construction effects from the re-location of the buildings; B. appropriately re-locate the buildings within the footprint of designation in a manner that respects the heritage value of the buildings; C. identify non-original additions to the Huapai Tavern which may be removed without compromising the heritage values of the building; and D. identify long term protection management of heritage elements of the buildings; (c) All historic heritage reports relating to historic heritage investigations (evaluation, excavation and monitoring), shall be submitted to the Manager within 12 months of completion.
All	***Accidental Discoveries*** ***Advice Note:*** *The Requiring Authority is advised of the requirements of Rule E11.6.1 of the AUP for "Accidental Discovery" as they relate to both contaminated soils and heritage items.* *The requirements for accidental discoveries of heritage items are set out in Rule E11.6.1 of the AUP [and in the Waka Kotahi Minimum Standard P45 Accidental Archaeological Discovery Specification, or any subsequent version].*	
All	25	**Pre-Construction Ecological Survey** (a) At the start of detailed design for a Stage of Work, an updated ecological survey shall be undertaken by a Suitably Qualified Person. The purpose of the survey is to inform the detailed design of ecological management plan by: (i) Confirming whether the species of value within the Identified Biodiversity Areas recorded in the Identified Biodiversity Area Schedule 2 are still present; (ii) Confirming whether the project will or may have a moderate or greater level of ecological effect on ecological species of value, prior to implementation of impact management measures, as determined in accordance with the EIANZ guidelines. (b) If the ecological survey in (a) above confirms the presence of ecological features of value in accordance with Condition 21(a)(i) or X(a)(ii) and that effects are likely in accordance with Condition 21(a)(ii) then an Ecological Management Plan (or Plans) shall be prepared in accordance with Condition 22 for these areas (Confirmed Biodiversity Areas).
All	26	**Ecological Management Plan (EMP)** (a) An EMP shall be prepared for any Confirmed Biodiversity Areas (undertaken in Condition 22) prior to the Start of Construction for a Stage of Work. The objective of the EMP is to minimise effects of the Project on the ecological features of value of Confirmed Biodiversity Areas as far as practicable. The EMP shall set out the methods that will be used to achieve the objective which may include: (i) If an EMP is required in accordance with Condition 21(b) for the presence of long tail bats, the EMP may include: a. measures to minimise disturbance from construction activities within the vicinity of any active long tail bat roosts (including maternity) that are discovered through survey until such roosts are confirmed to be vacant of bats;

NoR No.	No.	Condition
		b. how the timing of any construction work in the vicinity of any maternity long tail bat roosts will be limited to outside the bat maternity period (between December and March) where reasonably practicable; c. identifying areas where vegetation is to be retained for the purposes of connectivity of long tail bat; d. details of how bat connectivity (including suitable indigenous or exotic trees or artificial alternatives) will be provided and maintained. This could include identification of areas and timeframes for establishment of advance restoration / mitigation planting taking into account land ownership, accessibility and the timing of available funding; e. where mitigation to minimise effects is not practicable, details of any offsetting proposed. (ii) If an EMP is required in accordance with condition 21(b) for the presence of threatened or at risk wetland birds, the EMP may include: a. how the timing of any Construction Works shall be undertaken outside of the bird breeding season (September to February) where practicable. b. where works are required within the Confirmed Biodiversity Area during the bird season, methods to minimise adverse effects on Threatened or At-Risk wetland birds; c. undertaking a nesting bird survey of Threatened or At-Risk wetland birds prior to any Construction Works taking place within a 50m radius of any identified Wetlands (including establishment of construction areas adjacent to Wetlands). Surveys should be repeated at the beginning of each wetland bird breeding season and following periods of construction inactivity; d. what protection and buffer measures will be provided where nesting Threatened or At-Risk wetland birds are identified within 50m of any construction area (including laydown areas). Measures could include: i. a 20 m buffer area around the nest location and retaining vegetation. The buffer areas should be demarcated where necessary to protect birds from encroachment. This might include the use of marker poles, tape and signage; ii. monitoring of the nesting Threatened or At-Risk wetland birds by a Suitably Qualified Person. Construction works within the 20m nesting buffer areas should not occur until the Threatened or At-Risk wetland birds have fledged from the nest location (approximately 30 days from egg laying to fledging) as confirmed by a Suitably Qualified Person; iii. minimising the disturbance from the works if construction works are required within 50 m of a nest, as advised by a Suitably Qualified Person; iv. adopting a 10m setback where practicable, between the edge of Wetlands and construction areas (along the edge of the stockpile / laydown area); and v. minimising light spill from construction areas into Wetlands (b) The EMP shall be consistent with any ecological management measures to be undertaken in compliance with conditions of any regional resource consents granted for the Project. ***Advice Notes:*** *Depending on the potential effects of the Project, the regional consents for the Project may include the following monitoring and management plans:* (a) *Stream and / or wetland restoration plans;* (b) *Vegetation restoration plans; and* (c) *Fauna management plans (e.g. avifauna, herpetofauna, bats).*

NoR No.	No.	Condition
All	27	**Tree Management Plan** (a) Prior to the Start of Construction for a Stage of Work, a Tree Management Plan shall be prepared. (b) The objective of the Tree Management Plan is to avoid, remedy or mitigate effects of construction activities on trees identified as protected or notable in the Auckland Unitary Plan. (c) The Tree Management Plan shall: (i) confirm the trees that will be affected by the project work and are identified as protected or notable in the Auckland Unitary Plan; and (ii) demonstrate how the design and location of project works has avoided, remedied or mitigated any effects on any tree any tree identified in (i) above. This may include: a. planting to replace trees that require removal (with reference to the ULDMP planting design details in Condition 9); b. tree protection zones and tree protection measures such as protective fencing, ground protection and physical protection of roots, trunks and branches; and c. methods for work within the rootzone of trees that are to be retained in line with accepted arboricultural standards. (iii) demonstrate how the tree management measures (outlined in A – C above) are consistent with conditions of any resource consents granted for the project in relation to managing construction effects on trees.
Operational Conditions		
S1	28	**Low Noise Road Surface** (a) Asphaltic mix surface shall be implemented within twelve months of completion of construction of the Project. (b) The asphaltic mix surface shall be maintained to retain the noise reduction performance as far as practicable.
S1	29	**Traffic Noise** For the purposes of Conditions 28 to 40: (a) Building-Modification Mitigation – has the same meaning as in NZS 6806; (b) Design year has the same meaning as in NZS 6806; (c) Detailed Mitigation Options – means the fully detailed design of the Selected Mitigation Options, with all practical issues addressed; (d) Habitable Space – has the same meaning as in NZS 6806; (e) Identified Noise Criteria Category – means the Noise Criteria Category for a PPF identified in *Schedule 3: Identified PPFs Noise Criteria Categories*; (f) Mitigation – has the same meaning as in NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads; (g) Noise Criteria Categories – means the groups of preference for sound levels established in accordance with NZS 6806 when determining the Best Practicable Option for noise mitigation (i.e. Categories A, B and C); (h) NZS 6806 – means New Zealand Standard NZS 6806:2010 Acoustics – Road-traffic noise – New and altered roads; (i) P40 – means Transport Agency NZTA P40:2014 Specification for noise mitigation; (j) Protected Premises and Facilities (PPFs) – means only the premises and facilities identified in green, orange or red in *Schedule 4: PPFs Noise Criteria Categories*; (k) Selected Mitigation Options – means the preferred mitigation option resulting from a Best Practicable Option assessment undertaken in accordance with NZS 6806; and

NoR No.	No.	Condition
		(l) Structural Mitigation – has the same meaning as in NZS 6806.
S1	**30**	The Noise Criteria Categories identified in *Schedule 3: PPFs Noise Criteria Categories* at each of the PPFs shall be achieved where practicable and subject to Conditions 28 to 40 (all traffic noise conditions). Achievement of the Noise Criteria Categories for PPFs shall be by reference to a traffic forecast for a high growth scenario in a design year at least 10 years after the programmed opening of the Project.
S1	**31**	As part of the detailed design of the Project, a Suitably Qualified Person shall determine the Selected Mitigation Options for the PPFs identified on *Schedule* 3 *PPFs Noise Criteria Categories*.
S1	**32**	Prior to construction of the Project, a Suitably Qualified Person shall develop the Detailed Mitigation Options for the PPFs identified in *Schedule 3 PPFs Noise Criteria Categories*, taking into account the Selected Mitigation Options.
S1	**33**	If the Detailed Mitigation Options would result in the Identified Noise Criteria Category changing to a less stringent Category, e.g. from Category A to B or Category B to C, at any relevant PPF, a Suitably Qualified Person shall provide confirmation to the Manager that the Detailed Mitigation Option would be consistent with adopting the Best Practicable Option in accordance with NZS 6806 prior to implementation.
S1	**34**	Prior to the Start of Construction, a Noise Mitigation Plan written in accordance with P40 shall be provided to the Manager for information.
S1	**35**	The Detailed Mitigation Options shall be implemented prior to completion of construction of the Project, with the exception of any low-noise road surfaces, which shall be implemented within twelve months of completion of construction.
S1	**36**	Prior to the Start of Construction, a Suitably Qualified Person shall identify those PPFs which, following implementation of all the Detailed Mitigation Options, will not be Noise Criteria Categories A or B and where Building-Modification Mitigation might be required to achieve 40 dB $L_{Aeq(24h)}$ inside Habitable Spaces ('Category C Buildings').
S1	**37**	Prior to the Start of Construction in the vicinity of each Category C Building, the Requiring Authority shall write to the owner of the Category C Building requesting entry to assess the noise reduction performance of the existing building envelope. If the building owner agrees to entry within three months of the date of the Requiring Authority's letter, the Requiring Authority shall instruct a Suitably Qualified Person to visit the building and assess the noise reduction performance of the existing building envelope.
S1	**38**	For each Category C Building identified, the Requiring Authority is deemed to have complied with Condition 33 above if: (a) The Requiring Authority's Suitably Qualified Person has visited the building and assessed the noise reduction performance of the building envelope; or (b) The building owner agreed to entry, but the Requiring Authority could not gain entry for some reason (such as entry denied by a tenant); or (c) The building owner did not agree to entry within three of the date of the Requiring Authority's letter sent in accordance with Condition 33 above (including where the owner did not respond within that period); or (d) The building owner cannot, after reasonable enquiry, be found prior to completion of construction of the Project.

NoR No.	No.	Condition
		If any of (b) to (d) above apply to a Category C Building, the Requiring Authority is not required to implement Building-Modification Mitigation to that building.
S1	**39**	Subject to Condition 34 above, within six months of the assessment undertaken in accordance with Conditions 33 and 34, the Requiring Authority shall write to the owner of each Category C Building advising: (a) If Building-Modification Mitigation is required to achieve 40 dB $L_{Aeq(24h)}$ inside habitable spaces; (b) The options available for Building-Modification Mitigation to the building, if required; and (c) That the owner has three months to decide whether to accept Building-Modification Mitigation to the building and to advise which option for Building-Modification Mitigation the owner prefers, if the Requiring Authority has advised that more than one option is available.
S1	**40**	Once an agreement on Building-Modification Mitigation is reached between the Requiring Authority and the owner of a Category C Building, the mitigation shall be implemented, including any third party authorisations required, in a reasonable and practical timeframe agreed between the Requiring Authority and the owner.
S1	**41**	Subject to Condition 34, where Building-Modification Mitigation is required, the Requiring Authority is deemed to have complied with Condition 36 if: (a) The Requiring Authority has completed Building Modification Mitigation to the building; or (b) An alternative agreement for mitigation is reached between the Requiring Authority and the building owner; or (c) The building owner did not accept the Requiring Authority's offer to implement Building-Modification Mitigation within three months of the date of the Requiring Authority's letter sent in accordance with Condition 34 (including where the owner did not respond within that period); or (d) The building owner cannot, after reasonable enquiry, be found prior to completion of construction of the Project.
S1	**42**	Within twelve months of completion of construction of the Project, a post-construction review report written in accordance with P40 Specification for Noise Mitigation 2014 shall be provided to the Manager.
S1	**43**	The Detailed Mitigation Options shall be maintained so they retain their noise reduction performance as far as practicable
S1	**44**	The Noise Criteria Categories at the PPFs identified in *Schedule 3* Identified PPFs Noise Criteria Categories do not need to be complied with where: (a) the PPF no longer exists; or (b) agreement of the landowner has been obtained confirming that the Noise Criteria Category level does not need to be met.

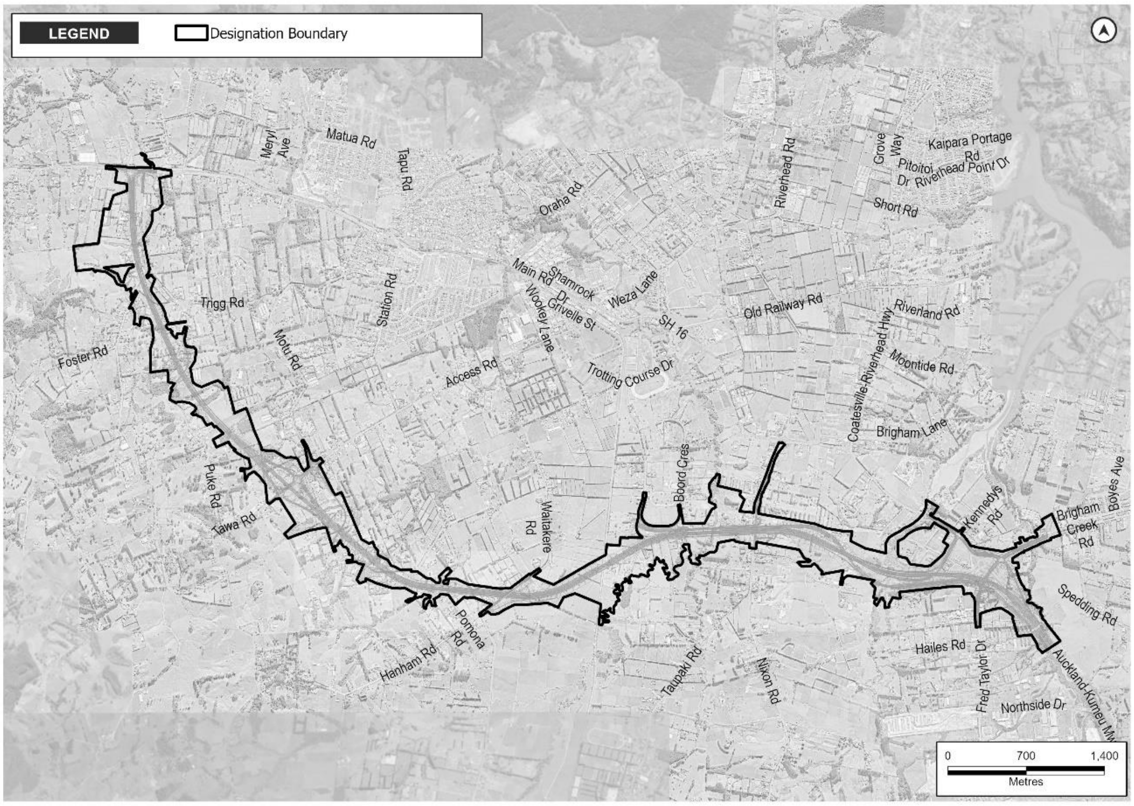
Schedule 1: General Accordance Plans and Information

Project Description

The proposed work is the construction, operation, and maintenance of a state highway in North West Auckland, from State Highway 16 near Foster Road, connecting at Tawa Road, to State Highway 16 at Brigham Creek Interchange, including active transport facilities and associated infrastructure. The proposed work is shown in the following Concept Plan and includes:

(a) A new transport corridor, including public transport and active transport facilities;
(b) Associated works including intersections, interchanges, bridges, embankments, retaining, culverts, stormwater management systems;
(c) Changes to local roads, where the proposed work intersects with local roads; and
(d) Construction activities, including vegetation removal, construction compounds, laydown areas, bridge works area, construction traffic management and the re-grade of driveways.

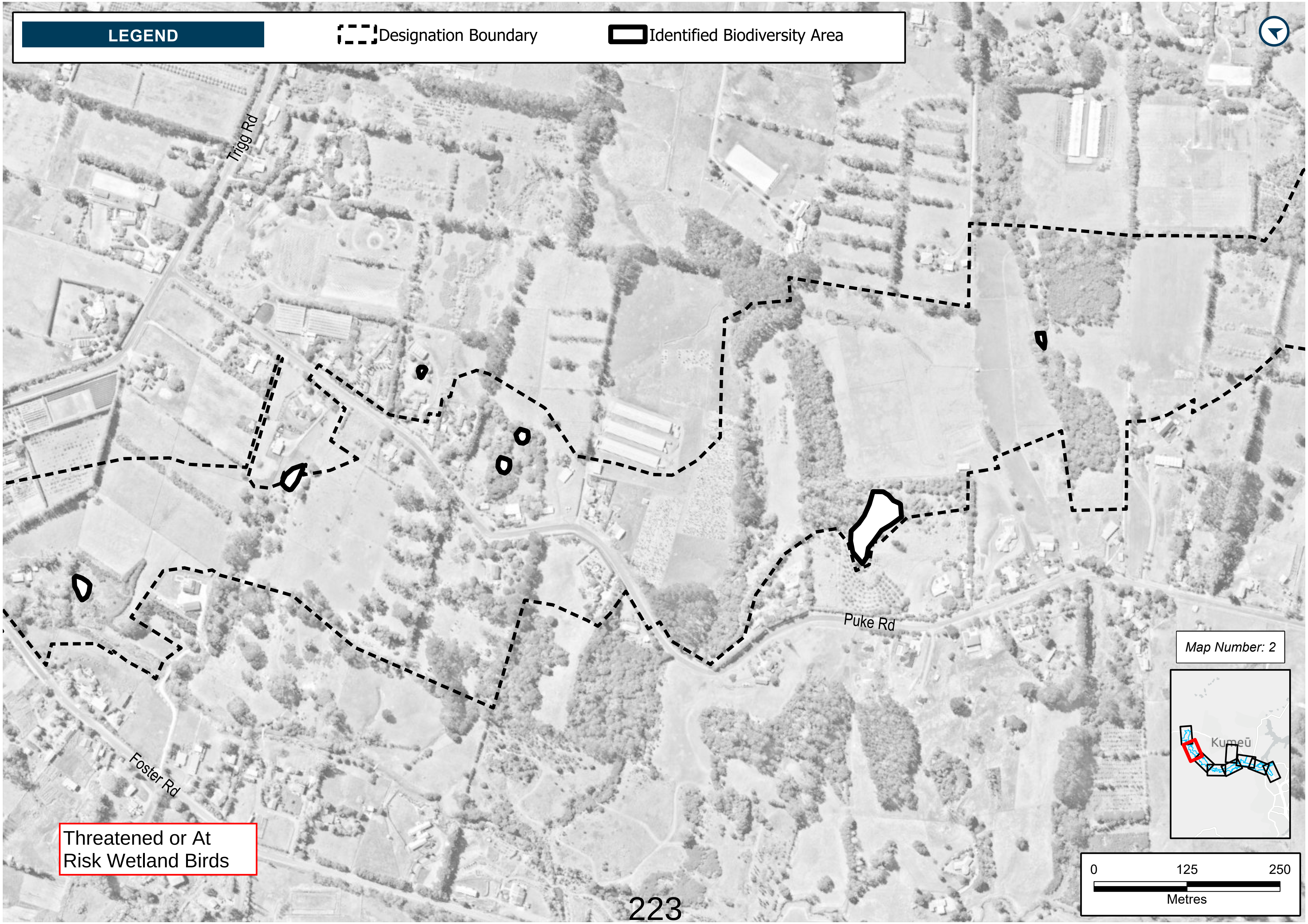
Concept Plan



Schedule 2: Identified Biodiversity Areas

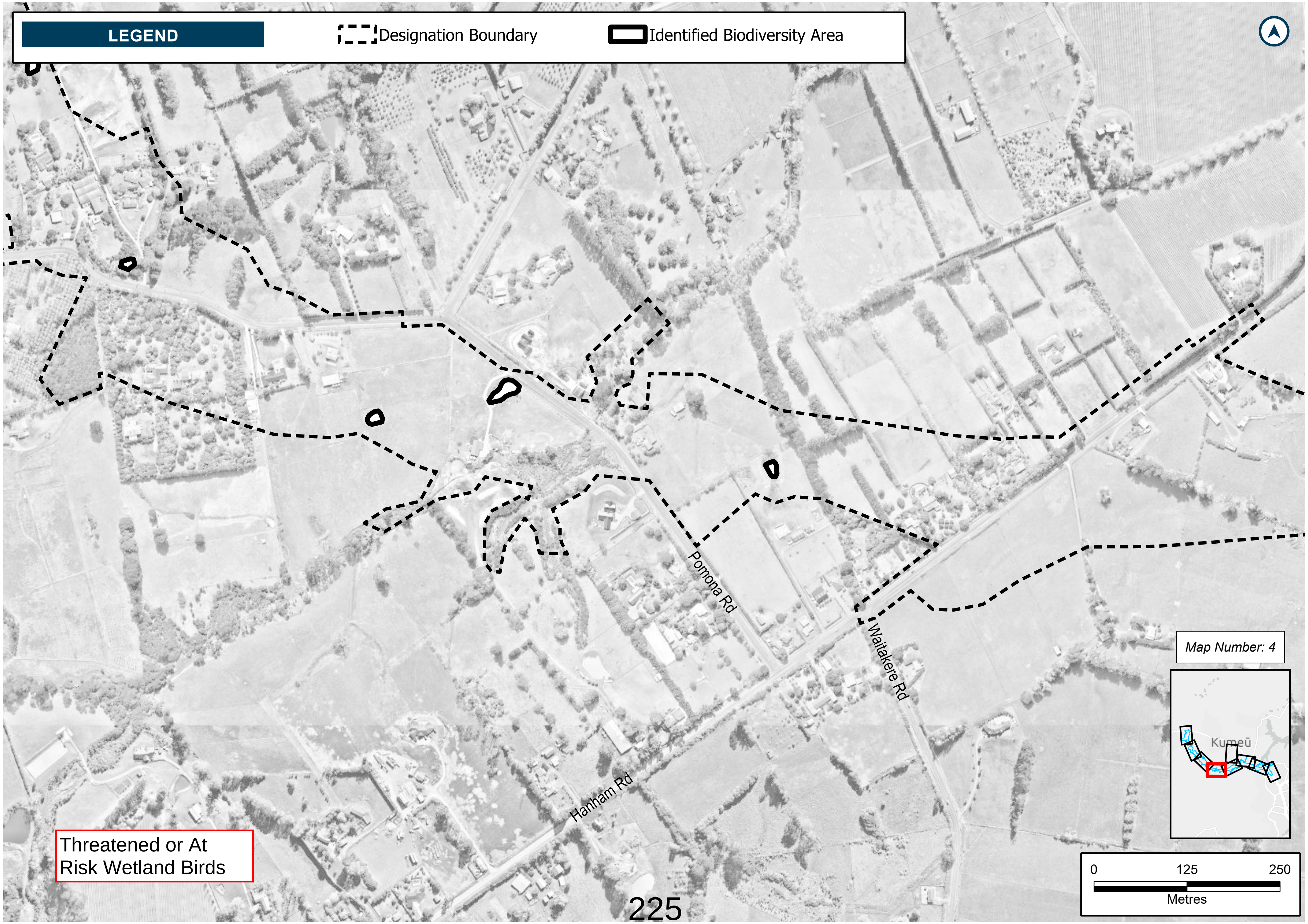

LEGEND
Designation Boundary
Identified Biodiversity Area
Matua Rd
Meryl Ave
Tapu Rd
Oraha Rd
Riverhead Rd
Pitoitoi Way
Grove Dr
Kaipara Portage Rd
Riverhead Point Dr
Short Rd
Trigg Rd
Station Rd
Main Rd
Shamrock Dr
Grivelle St
Wookey Lane
Weza Lane
Old Railway Rd
Riverland Rd
Foster Rd
Motu Rd
Access Rd
Trotting Course Dr
SH 16
Coatesville-Riverhead Hwy
Moontide Rd
Totara Rd
Brigham Lane
Boord Cres
Puke Rd
Tawa Rd
Kennedys Rd
Joseph McDonald Dr
Boyes Ave
Lane
Ripeka
Ngahue Cres
Nils
Andersen Rd
Airport Rd
Brigham Creek Rd
Mamari Rd
Pomona Rd
Waitakere Rd
Hanham Rd
Taupaki Rd
Nixon Rd
Hailes Rd
Taylor Dr
Fred
Spedding Rd
Auckland-Kumeu Mwy
Trig Rd
Northside Dr
Upper Harbour SH 18 Mwy
Ryans Rd
Henwood Rd
Dunlop Rd
Nelson Rd
0
780
1,560
Metres
Long-tailed Bat

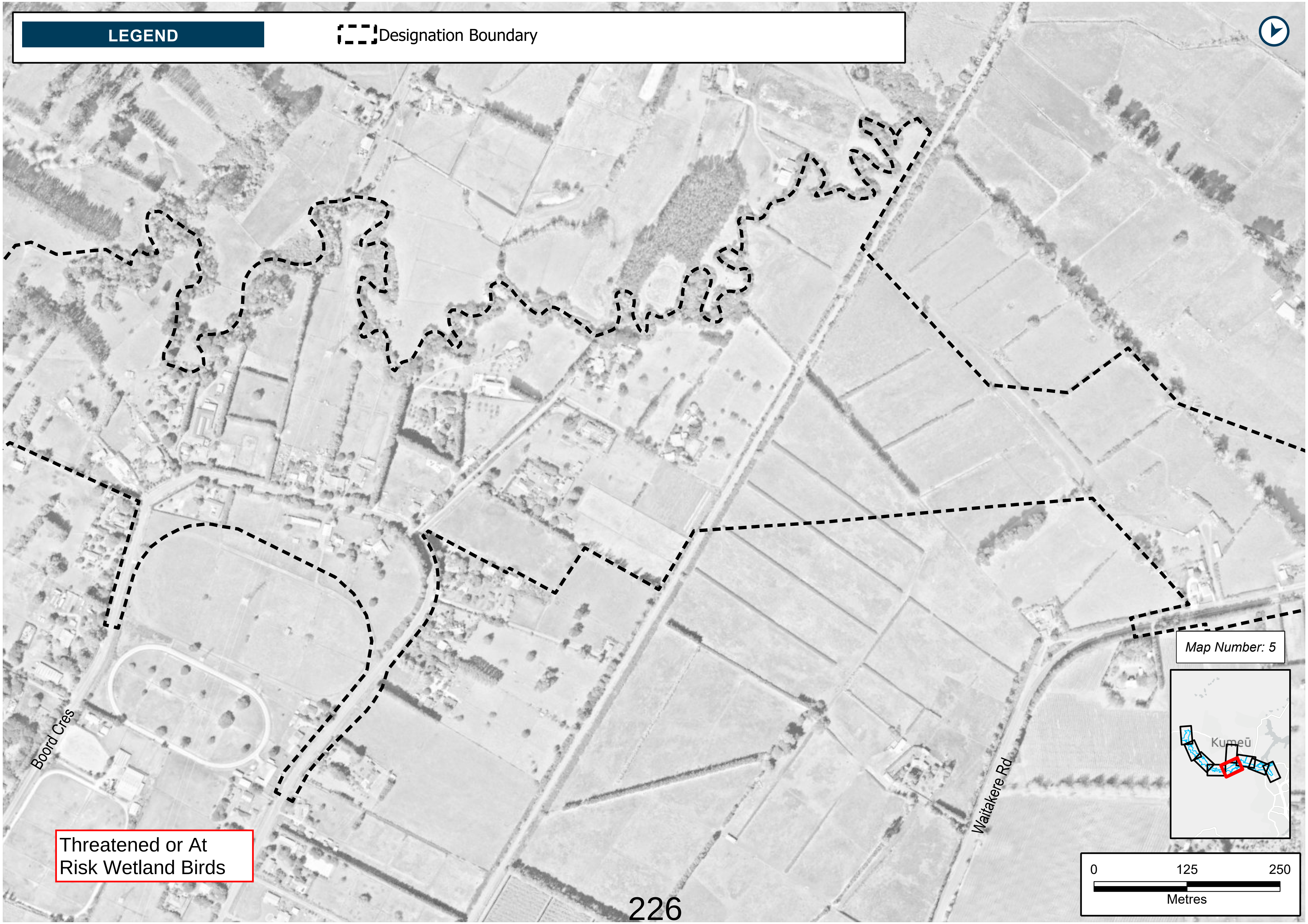

LEGEND
Designation Boundary
Identified Biodiversity Area
Puke Rd
Matua Rd
Trigg Rd
Foster Rd
SH 16
Map Number: 1
Kumeū
0
125
250
Metres
Threatened or At
Risk Wetland Birds
Name of Map: SGA-EC-NW-032-Strategic-ASH-Bird-Mitigation
Path: P:\381\3810934\TGI\02 Data\1 Data Processing 550 Plus\669_NW_Ecology_Mitigation\SGA_NW_Ecology_Mitigation.aprx


LEGEND
Designation Boundary
Identified Biodiversity Area
Trigg Rd
Puke Rd
Foster Rd
Map Number: 2
Kumeū
0
125
250
Metres
Threatened or At
Risk Wetland Birds

Name of Map: SGA-EC-NW-032-Strategic-ASH-Bird-Mitigation

Path: P:\381\3810934\TG\02 Data\1 Data Processing 550 Plus\669_NW_Ecology_Mitigation\SGA_NW_Ecology_Mitigation.aprx


LEGEND
Designation Boundary
Identified Biodiversity Area
Pomona Rd
Waitakere Rd
Hanham Rd
Map Number: 4
Kumeū
0
125
250
Metres
Threatened or At
Risk Wetland Birds
Name of Map: SGA-EC-NW-032-Strategic-ASH-Bird-Mitigation



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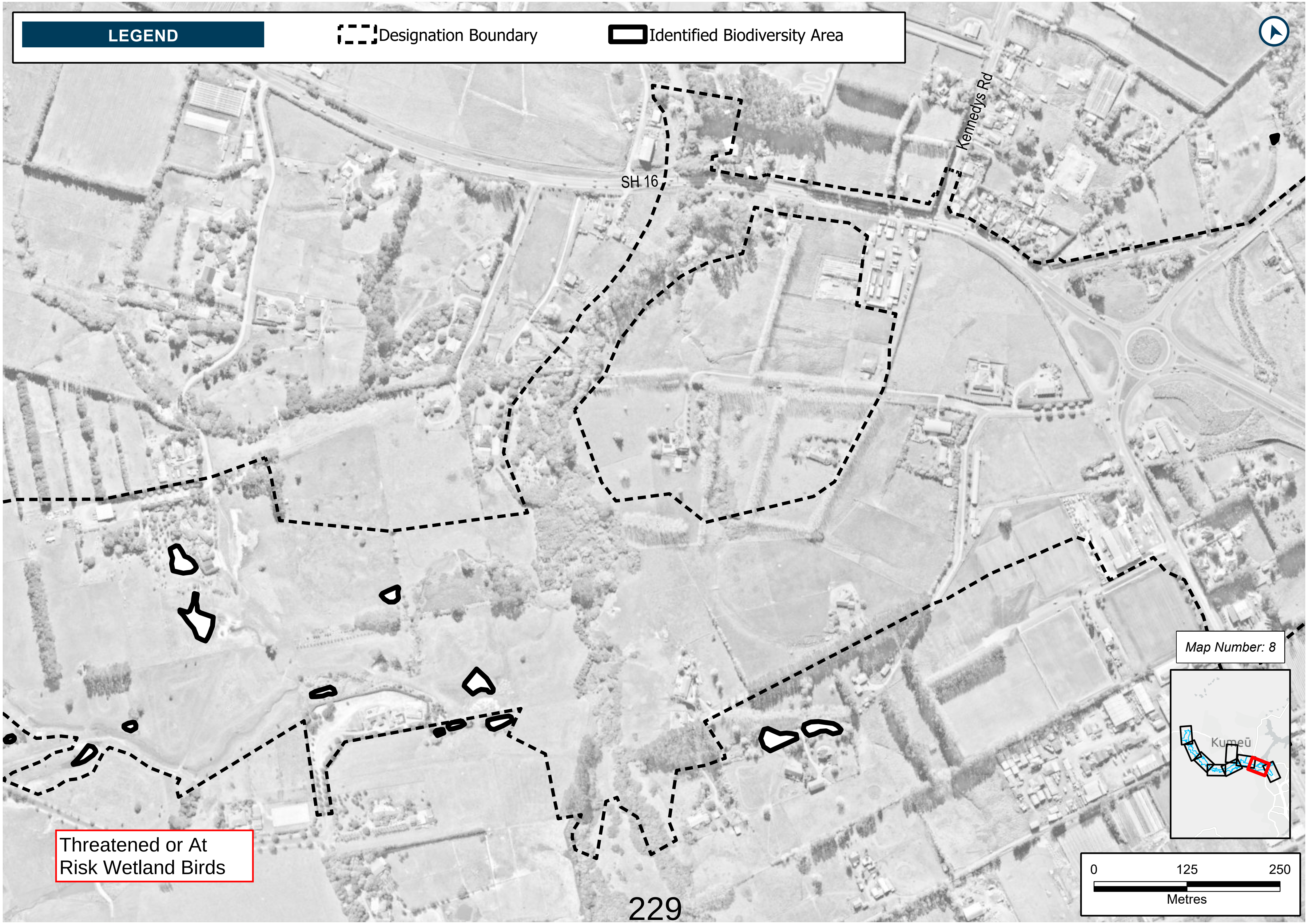
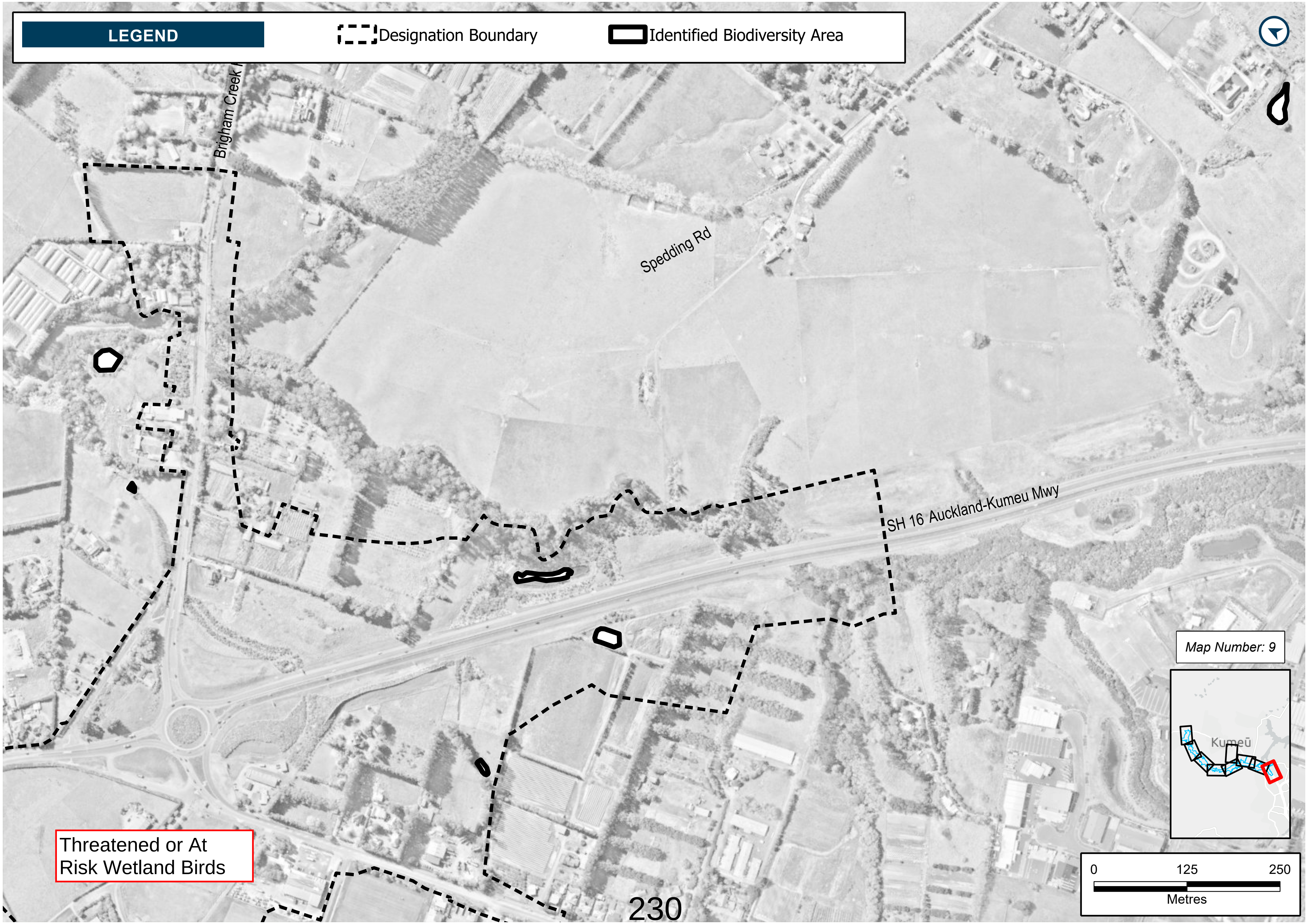
LEGEND
Designation Boundary
SH 16
Trotting Course Dr
Boord Cres
Main Rd
Waitakere Rd
Weza Lane
Grivelle St
Map Number: 6
Kumeū
0
125
250
Metres
Threatened or At Risk Wetland Birds
Name of Map: SGA-EC-NW-032-Strategic-ASH-Bird-Mitigation

Name of Map: SGA-EC-NW-032-Strategic-ASH-Bird-Mitigation

Path: P:\381\3810934\TG\02 Data\1 Data Processing 550 Plus\669_NW_Ecology_Mitigation\SGA_NW_Ecology_Mitigation.aprx


LEGEND
Designation Boundary
Identified Biodiversity Area
SH 16
Kennedys Rd
Map Number: 8
Kumeū
0
125
250
Metres
Threatened or At Risk Wetland Birds


LEGEND
Designation Boundary
Identified Biodiversity Area
Brigham Creek
Spedding Rd
SH 16 Auckland-Kumeu Mwy
Map Number: 9
Kumeū
0
125
250
Metres
Threatened or At
Risk Wetland Birds
Name of Map: SGA-EC-NW-032-Strategic-ASH-Bird-Mitigation

Schedule 3: Identified PPFs Noise Criteria Categories

Address	New or Altered Road	Noise Criteria Category
2 Brigham Creek Road, Whenuapai, Auckland	Altered Road	A
4 Brigham Creek Road, Whenuapai, Auckland	Altered Road	A
6 Brigham Creek Road, Whenuapai, Auckland	Altered Road	A
15 Brigham Creek Road, Whenuapai, Auckland (2)	Altered Road	A
15 Brigham Creek Road, Whenuapai, Auckland (1)	Altered Road	A
23-27 Brigham Creek Road, Whenuapai, Auckland	Altered Road	A
107 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
121 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
125 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
127 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
129 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
131 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
133 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
135 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
137 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
139 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
141 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
143 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A

Address	New or Altered Road	Noise Criteria Category
172 Fred Taylor Drive, Whenuapai, Auckland	Altered Road	A
1 Kennedys Road, Whenuapai, Auckland	Altered Road	A
3 Kennedys Road, Whenuapai, Auckland	Altered Road	A
5 Kennedys Road, Whenuapai, Auckland	Altered Road	A
9 Kennedys Road, Whenuapai, Auckland	Altered Road	A
11 Kennedys Road, Whenuapai, Auckland	Altered Road	A
13 Kennedys Road, Whenuapai, Auckland	Altered Road	A
15 Kennedys Road, Whenuapai, Auckland	Altered Road	A
17 Kennedys Road, Whenuapai, Auckland	Altered Road	A
19 Kennedys Road, Whenuapai, Auckland	Altered Road	A
2-6 Kennedys Road, Whenuapai, Auckland	Altered Road	A
17A Kennedys Road, Whenuapai, Auckland	Altered Road	A
392 Matua Road, Kumeū	Altered Road	A
402 Matua Road, Kumeū	Altered Road	A
392B Matua Road, Kumeū	Altered Road	A
150 Motu Road, Kumeū	Altered Road	A
158 Motu Road, Kumeū	Altered Road	A
164 Motu Road, Kumeū	Altered Road	A
171 State Highway 16, Whenuapai, Auckland	Altered Road	B
173 State Highway 16, Whenuapai, Auckland	Altered Road	B

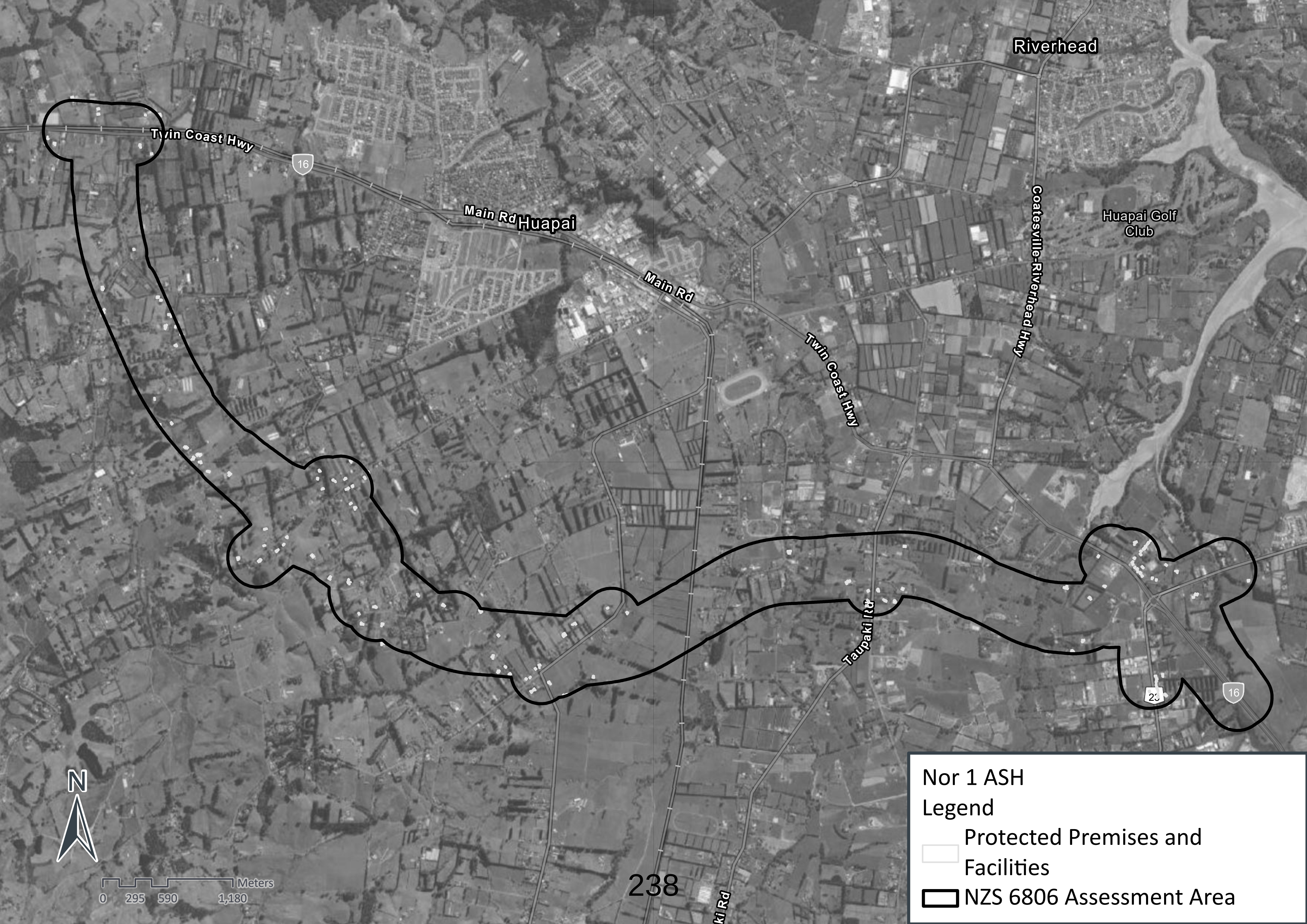
Address	New or Altered Road	Noise Criteria Category
175 State Highway 16, Whenuapai, Auckland	Altered Road	B
177 State Highway 16, Whenuapai, Auckland	Altered Road	B
179 State Highway 16, Whenuapai, Auckland	Altered Road	A
181 State Highway 16, Whenuapai, Auckland	Altered Road	A
218 State Highway 16, Whenuapai, Auckland	Altered Road	A
222 State Highway 16, Whenuapai, Auckland	Altered Road	A
677 State Highway 16, Kumeū	Altered Road	A
693 State Highway 16, Kumeū	Altered Road	A
695 State Highway 16, Kumeū	Altered Road	A
726 State Highway 16, Kumeū (2)	Altered Road	A
726 State Highway 16, Kumeū (1)	Altered Road	A
728 State Highway 16, Kumeū	Altered Road	A
761 State Highway 16, Kumeū (2)	Altered Road	A
761 State Highway 16, Kumeū (1)	Altered Road	A
763 State Highway 16, Kumeū	Altered Road	A
59 Tawa Road, Kumeū	Altered Road	A
63 Tawa Road, Kumeū	Altered Road	A
66 Tawa Road, Kumeū	Altered Road	A
73 Tawa Road, Kumeū	Altered Road	A
76 Tawa Road, Kumeū	Altered Road	A

Address	New or Altered Road	Noise Criteria Category
79 Tawa Road, Kumeū	Altered Road	A
83 Tawa Road, Kumeū (2)	Altered Road	A
83 Tawa Road, Kumeū (1)	Altered Road	A
86 Tawa Road, Kumeū (2)	Altered Road	A
86 Tawa Road, Kumeū (1)	Altered Road	A
186 Boord Crescent, Kumeū	New Road	B
4 Dysart Lane, Kumeū	New Road	B
81 Foster Road, Kumeū	New Road	A
116 Foster Road, Kumeū	New Road	A
131 Foster Road, Kumeū	New Road	A
196 Fred Taylor Drive, Whenuapai, Auckland	New Road	A
198 Fred Taylor Drive, Whenuapai, Auckland	New Road	A
208 Fred Taylor Drive, Whenuapai, Auckland	New Road	B
210 Fred Taylor Drive, Whenuapai, Auckland	New Road	A
2 Hanham Road, Kumeū	New Road	B
6 Hanham Road, Kumeū	New Road	A
8 Hanham Road, Kumeū	New Road	A
9 Hanham Road, Kumeū	New Road	A
14 Joseph Dunstan Drive, Taupaki	New Road	A
28 Pomona Road, Kumeū	New Road	B
48 Pomona Road, Kumeū	New Road	B
66 Pomona Road, Kumeū	New Road	B
90 Pomona Road, Kumeū	New Road	B
94 Pomona Road, Kumeū	New Road	B
95 Pomona Road, Kumeū	New Road	B

Address	New or Altered Road	Noise Criteria Category
96 Pomona Road, Kumeū	New Road	B
114 Pomona Road, Kumeū	New Road	A
123 Pomona Road, Kumeū (2)	New Road	B
123 Pomona Road, Kumeū (1)	New Road	B
151 Pomona Road, Kumeū	New Road	A
191 Pomona Road, Kumeū	New Road	B
194 Pomona Road, Kumeū	New Road	B
212 Pomona Road, Kumeū	New Road	B
214 Pomona Road, Kumeū	New Road	B
218 Pomona Road, Kumeū	New Road	B
18 Puke Road, Kumeū	New Road	A
21 Puke Road, Kumeū	New Road	A
22 Puke Road, Kumeū	New Road	A
27 Puke Road, Kumeū	New Road	A
37 Puke Road, Kumeū	New Road	A
80 Puke Road, Kumeū	New Road	A
104 Puke Road, Kumeū	New Road	A
107 Puke Road, Kumeū	New Road	A
133 Puke Road, Kumeū	New Road	A
139 Puke Road, Kumeū (2)	New Road	B
139 Puke Road, Kumeū (1)	New Road	A
145 Puke Road, Kumeū	New Road	A
151 Puke Road, Kumeū	New Road	A
157 Puke Road, Kumeū	New Road	B
284 State Highway 16, Kumeū	New Road	B
362 Taupaki Road, Taupaki	New Road	A
364 Taupaki Road, Taupaki	New Road	A

Address	New or Altered Road	Noise Criteria Category
367 Taupaki Road, Taupaki	New Road	A
370 Taupaki Road, Taupaki	New Road	A
374 Taupaki Road, Taupaki	New Road	B
375 Taupaki Road, Taupaki	New Road	A
377 Taupaki Road, Taupaki	New Road	B
405 Taupaki Road, Kumeū	New Road	A
137 Tawa Road, Kumeū	New Road	B
141 Tawa Road, Kumeū	New Road	B
145 Tawa Road, Kumeū	New Road	A
148 Tawa Road, Kumeū	New Road	A
154 Tawa Road, Kumeū	New Road	B
155 Tawa Road, Kumeū	New Road	A
176 Tawa Road, Kumeū	New Road	A
227 Trigg Road, Kumeū (2)	New Road	A
227 Trigg Road, Kumeū (1)	New Road	A
609 Waitakere Road, Kumeū	New Road	A
637 Waitakere Road, Kumeū	New Road	B
646 Waitakere Road, Kumeū (2)	New Road	B
646 Waitakere Road, Kumeū (1)	New Road	B
670 Waitakere Road, Kumeū	New Road	B
679 Waitakere Road, Kumeū	New Road	B
682 Waitakere Road, Kumeū	New Road	A
710 Waitakere Road, Kumeū	New Road	A

Address	New or Altered Road	Noise Criteria Category
723 Waitakere Road, Kumeū	New Road	B


Riverhead
Twin Coast Hwy
16
Main Rd
Huapai
Main Rd
Twin Coast Hwy
Coatesville-Riverhead Hwy
Huapai Golf Club
Taupaki Rd
16
N
Meters
0
295
590
1,180
Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area


Matua Rd
Twin Coast Hwy
16
Foster Rd
Trigg Rd
Puke Rd
402
392
392B
677
693
695
726
726
728
761
761
763
81
116
131
18
21
22
27
37
227
227
N
Meters
0 55 110 220
Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area


Trigg Rd
Motu Rd
Motu Rd
Tawa Rd
Tawa Rd
Tawa Rd
Puke Rd
Puke Rd
Puke Rd
66
76
73
79
83
86
86
150
158
164
18
21
27
22
37
137
141
148
145
157
139
145
151
139
133
80
107
104
154
155
176
Meters
0
55
110
220
Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area

ATTACHMENT 38

NORTH-WEST STRATEGIC
PROPOSED CONDITIONS
PART 2 OF 3

Dysart Ln
Pomona Rd
Tawa Rd
Metu Rd
Puke Rd
59
66
63
4
76
73
79
86
86
150
83
83
151
158
164
123
123
66
95
96
28
48
90
94
114
137
141
148
145
154
155
176
N
0
55
110
220
Meters
Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area


Dysart Ln
Pomona Rd
Waitakere Rd
Waitakere Rd
Pomona Rd
Nanham Rd
4
191
194
212
214
218
2 646
646
8
6
9
637
609
679
670
682
710
723
N
0
55
110
220
Meters
Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area

Taupaki Rd
Boord Cres
Boord Cres
186
405
Taupaki Rd
374
370
375
377
364
367
362
14
Joseph Dunstan Dr
Taupaki Rd
Ej Osborne Ln
Livery Ln
N
Meters
0 55 110 220
Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area


Twin Coast Hwy
SH 16
16
Brigham Creek
Twin Coast Hwy
Ngongetepara Stream
Brigham Creek
Brigham Creek Rd
Brigham Creek Rd
Northwestern Mtwy
Fred Taylor Dr
23
17A
17
2-6
15
13
11
9
3
1
181
179
177
175
171
173
5
19
6
2
4
15
15
222
218
284
210
208
196
198
143
N
0
55
110
220
Meters
Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area


Nor 1 ASH
Legend
Protected Premises and Facilities
NZS 6806 Assessment Area
Northwestern Mtwy
Twin Coast Hwy
Brigham Creek Rd
Brigham Creek
Fred Taylor Dr
Hailes Rd
Ngongetepara Stream
23
23-27
15
6
19
17A
17
13
11
9
5
4
2
3
1
181
179
171
175
177
173
2-6
222
218
208
210
107
143
139
141
137
135
125
133
129
131
172
127
196
Meters
0
55
110
220

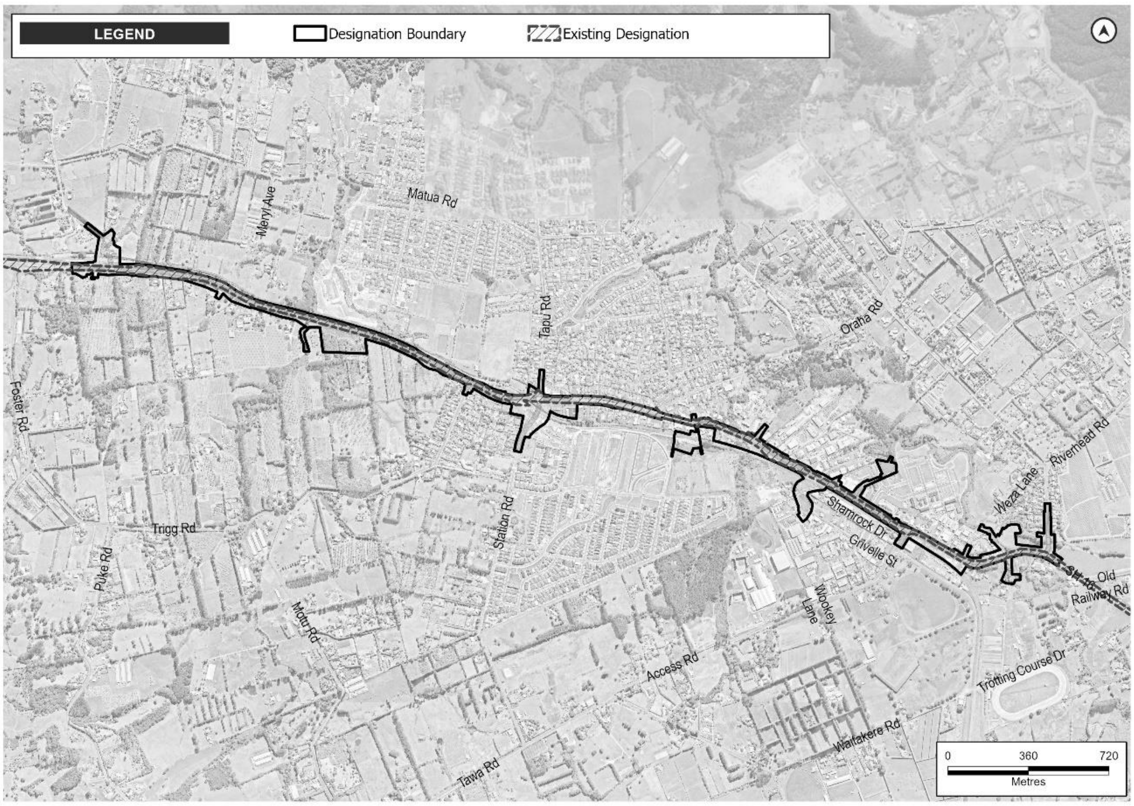
Schedule 1: General Accordance Plans and Information

Project Description

The proposed work is the construction, operation, and maintenance of an upgrade to a state highway in Kumeu-Huapai, from the Matua Road intersection to the intersection with Riverhead Road, including active transport facilities and associated infrastructure. The proposed work is shown in the following Concept Plan and includes:

(a) An upgraded transport corridor and active transport facilities;
(b) Associated works including intersections, bridges, embankments, retaining, culverts, stormwater management systems;
(c) Changes to local roads, where the proposed work intersects with local roads; and
(d) Construction activities, including vegetation removal, construction compounds, laydown areas, bridge works area, construction traffic management and the re-grade of driveways.

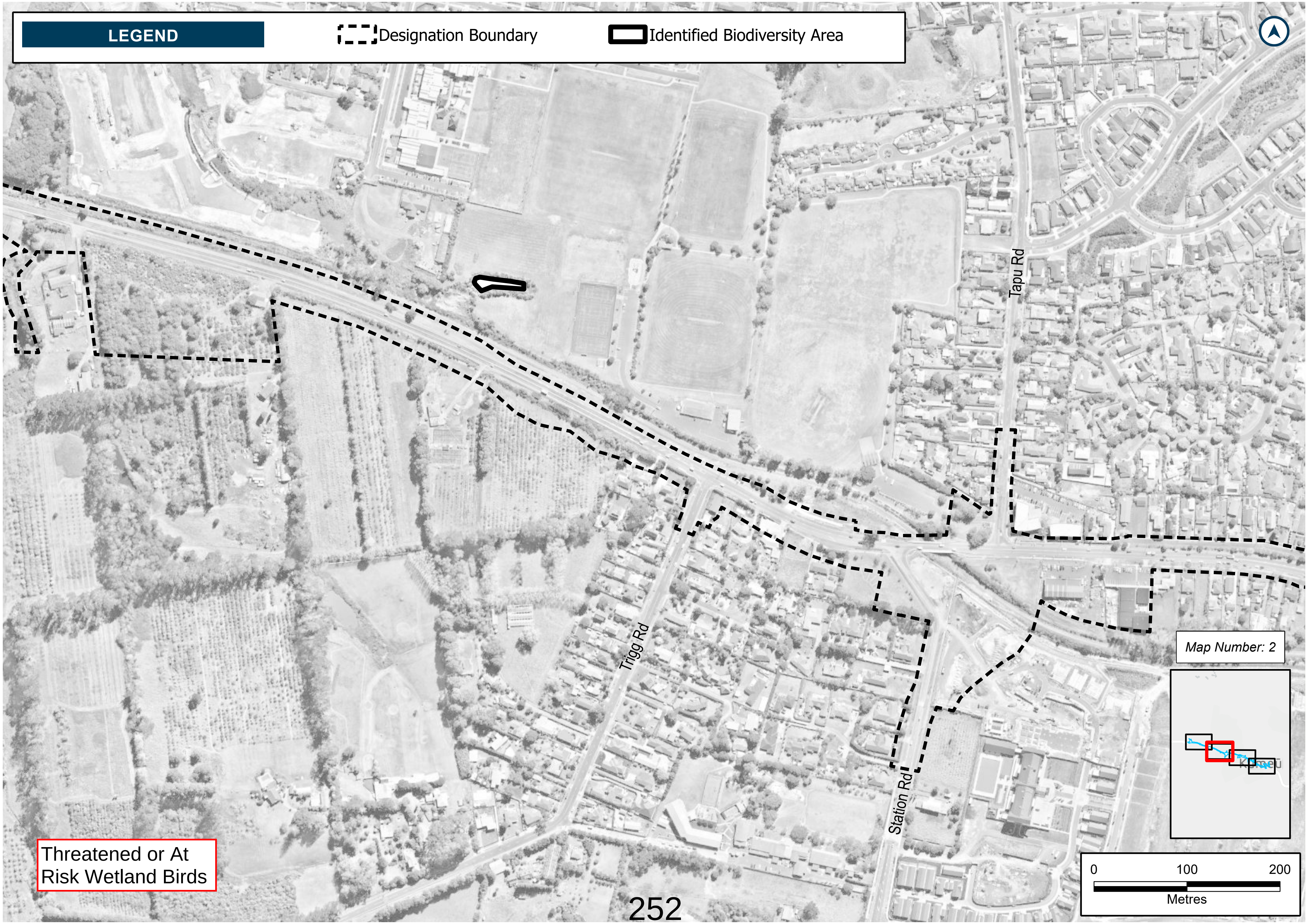
Concept Plan



Schedule 2: Identified Biodiversity Areas


LEGEND
Designation Boundary
Identified Biodiversity Area
Long-tailed Bat
0
780
1,560
Metres
Matua Rd
Meryl Ave
Tapu Rd
Oraha Rd
Trigg Rd
Station Rd
Motu Rd
Foster Rd
Access Rd
Wookey Lane
Weza Lane
Riverhead Rd
Old Railway Rd
SH 16
Trotting Course Dr
Boord Cres
Puke Rd
Tawa Rd
Pomona Rd
Hanham Rd
Waitakere Rd
Taupaki Rd
Nixon Rd
Pitoitoi Way
Grove
Dr
Kaipara Portage Rd
Riverhead Point Dr
Short Rd
Riverland Rd
Coatesville-Riverhead Hwy
Moontide Rd
Brigham Lane
Totara Rd
Kennedys Rd
Brigham Creek Rd
Joseph McDonald Dr
Boyes Ave
Lane
Ripeka
Ngahue Cres
Nils Andersen Rd
Airport Rd
Mamari Rd
Spedding Rd
Hailes Rd
Fred Taylor Dr
Northside Dr
Auckland-Kumeu Mwy
Trig Rd
Upper Harbour SH 18 Mwy
Ryans Rd
Henwood Rd
Dunlop Rd

Name of Map: SGA-EC-NW-033-Strategic-SH16-Bird-Mitigation



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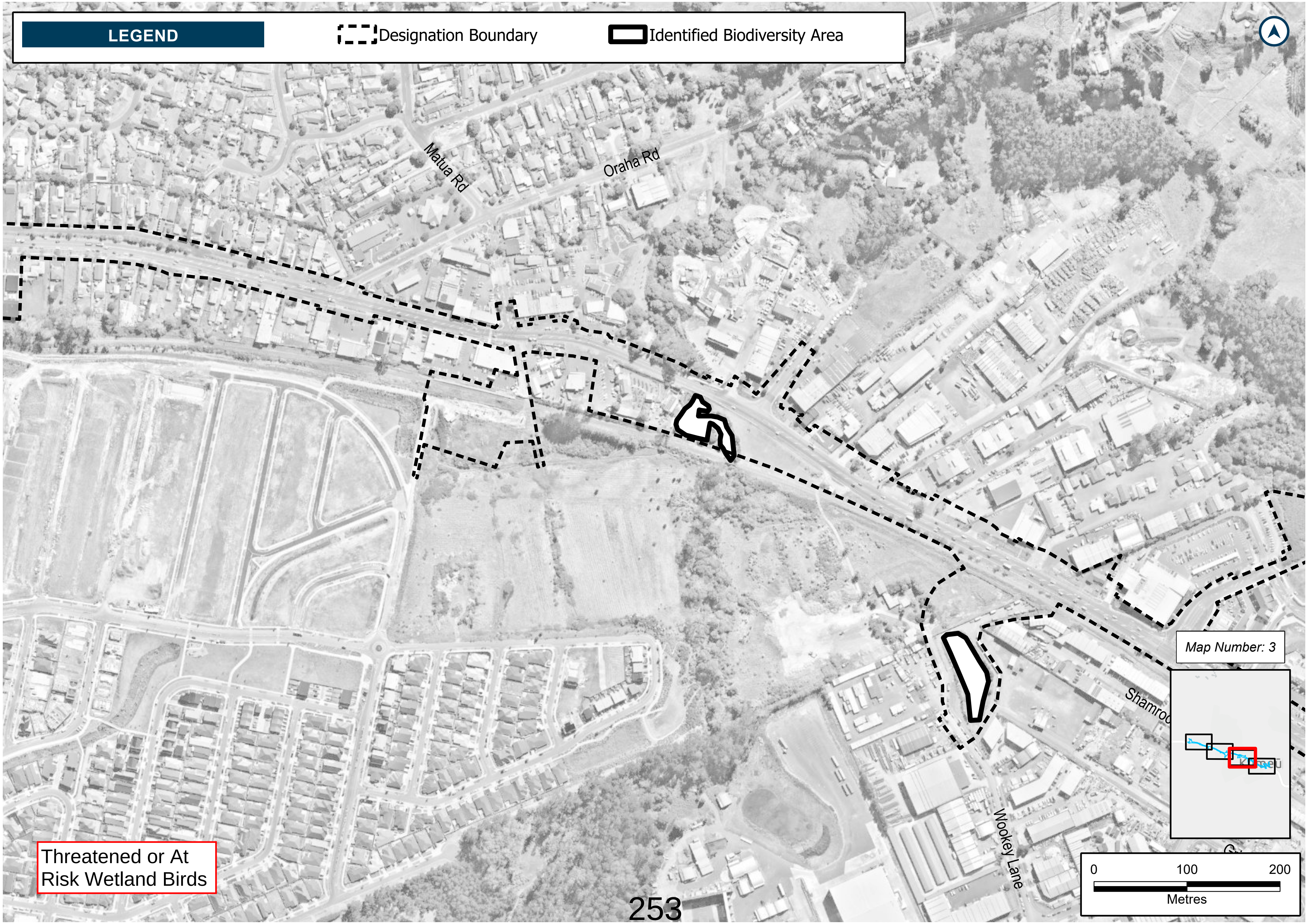
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200
Metres
Threatened or At Risk Wetland Birds


LEGEND
Designation Boundary
Identified Biodiversity Area
Shamrock Dr
Weza Lane
Riverhead Rd
Wookey Lane
Grivelle St
Waitakere Rd
SH 16
Old Railway Rd
Access Rd
Map Number: 4
0
100
200
Metres
Threatened or At Risk Wetland Birds

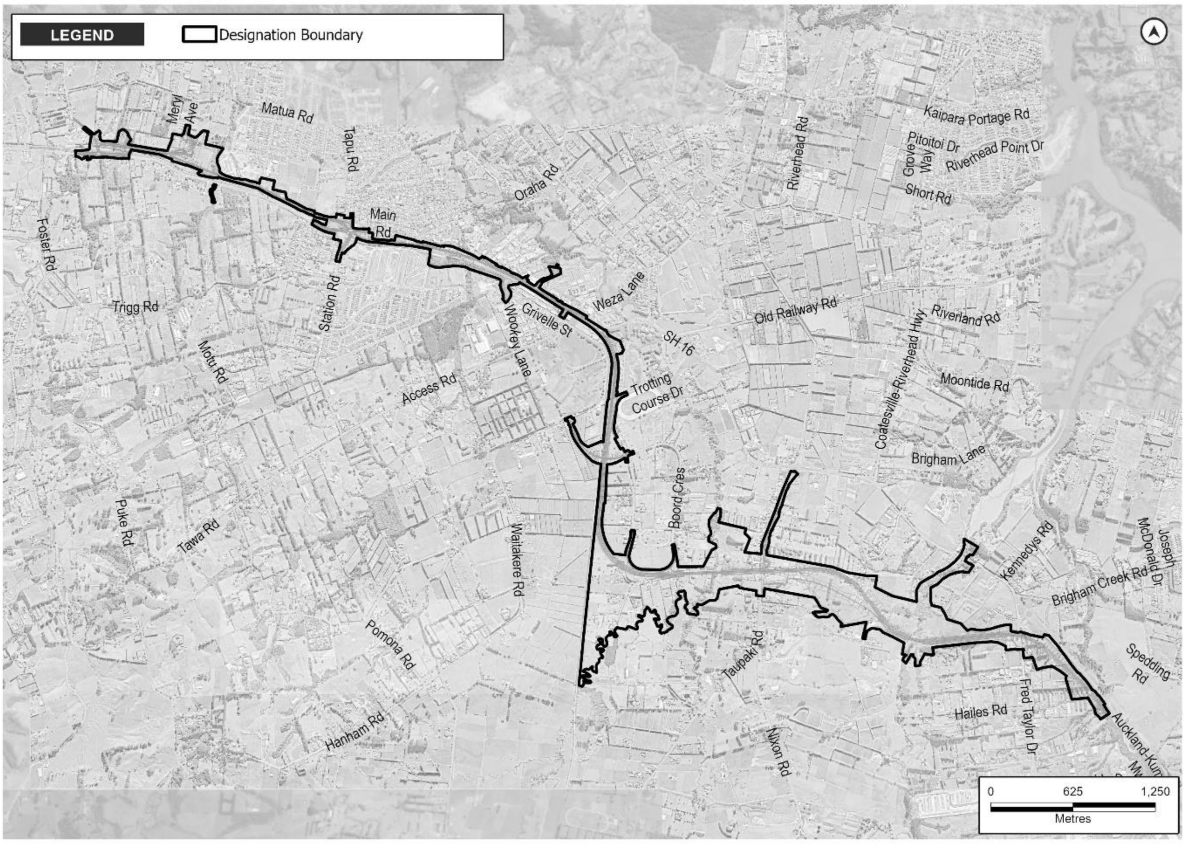
Schedule 1: General Accordance Plans and Information

Project Description

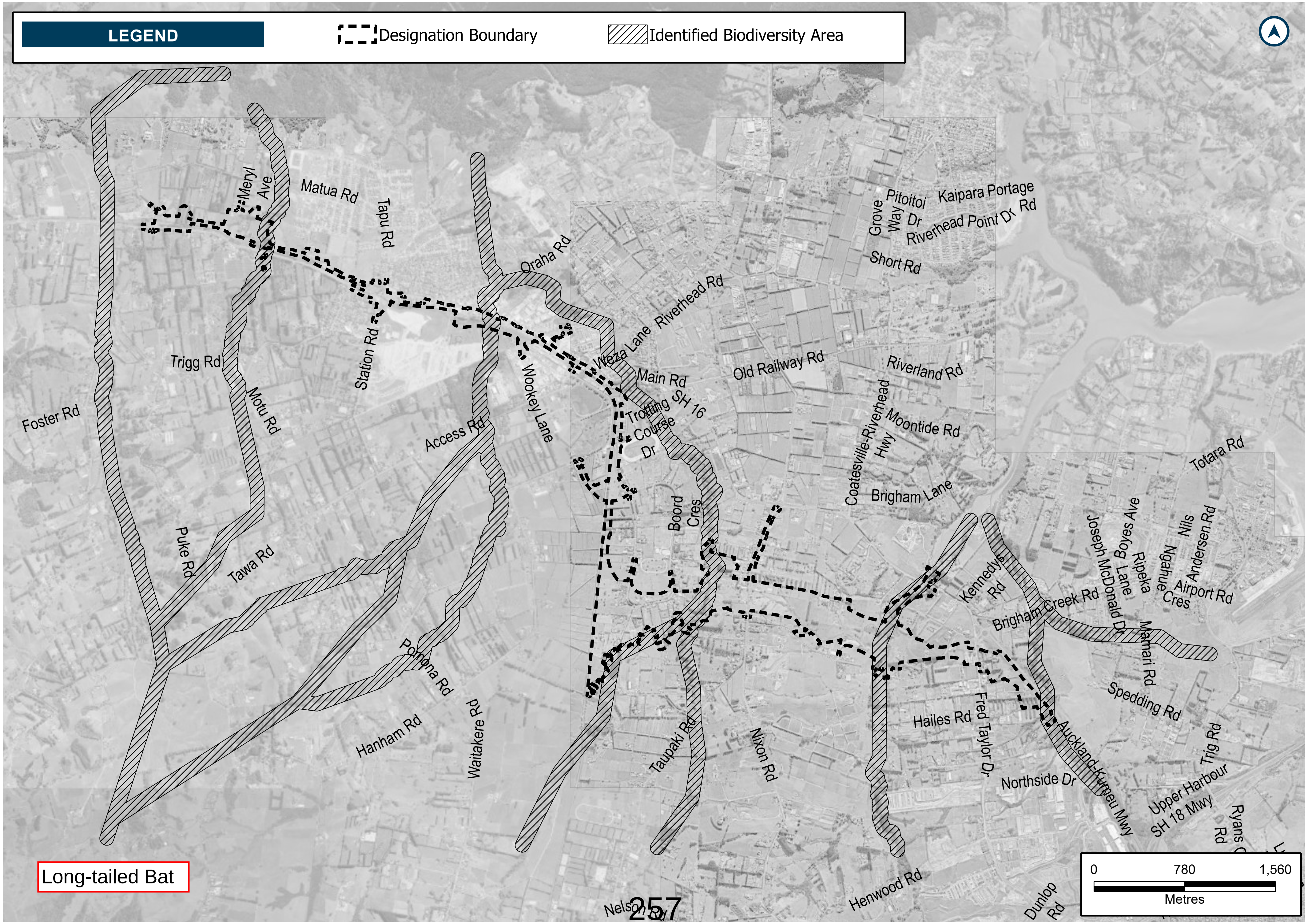
The proposed work is the construction, operation, and maintenance of a rapid transit corridor in North West Auckland, from Matua Road to Brigham Creek Interchange, including active transport facilities and associated infrastructure. The proposed work is shown in the following Concept Plan and includes:

(a) A new transport corridor and active transport facilities;
(b) Associated works including intersections, bridges, embankments, retaining, culverts, stormwater management systems; and
(c) Construction activities, including vegetation removal, construction compounds, laydown areas, bridge works area, construction traffic management and the re-grade of driveways.

Concept Plan



Schedule 2: Identified Biodiversity Areas



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Meryl Ave
Tapu Rd
Oraha Rd
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Weza Lane
Station Rd
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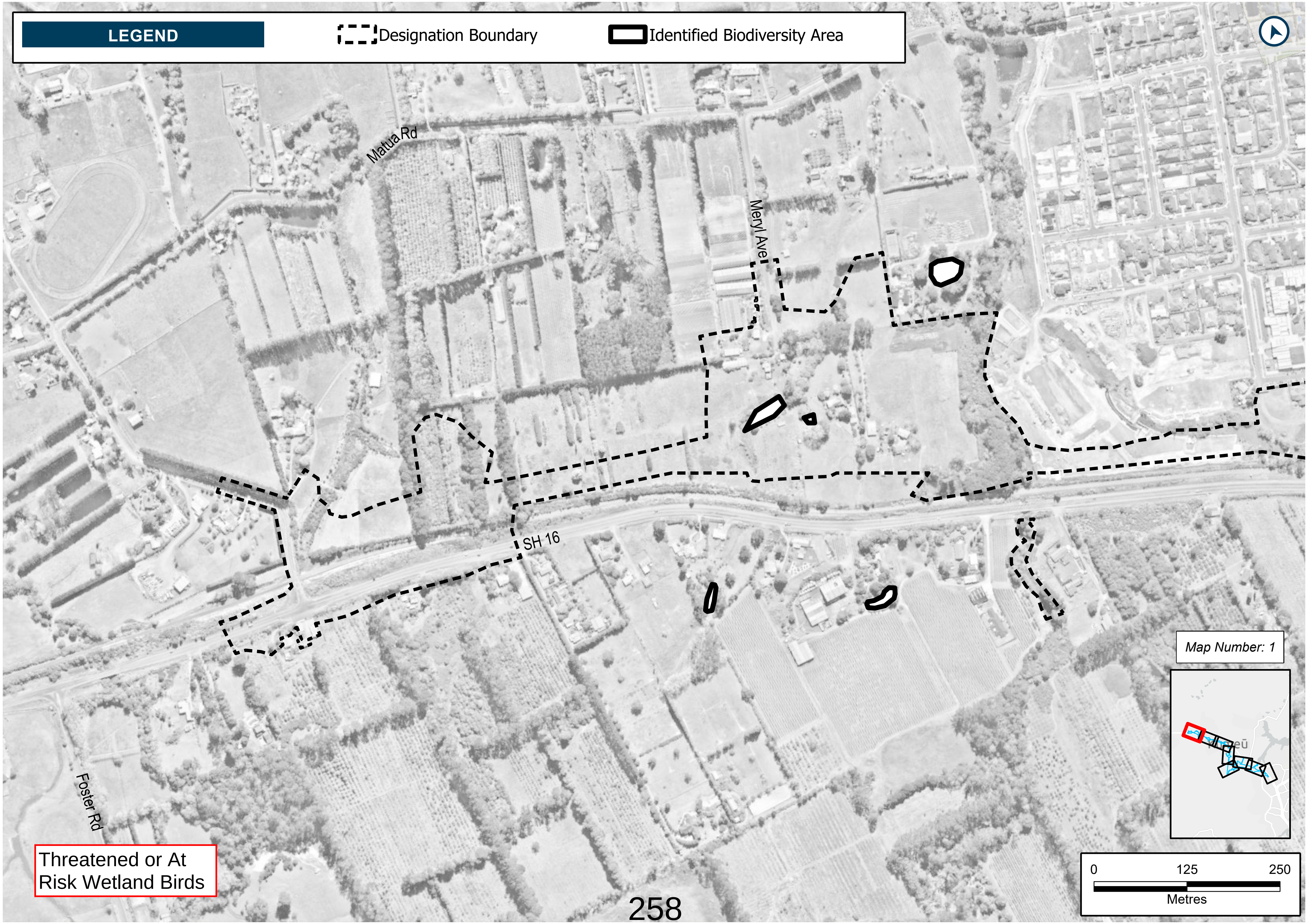
Wookey Lane
Main Rd
SH 16
Trotting Course Dr
Foster Rd
Motu Rd
Access Rd
Old Railway Rd
Riverland Rd
Moontide Rd
Coatesville-Riverhead Hwy
Brigham Lane
Pitoitoi Way
Grove
Dr
Kaipara Portage Rd
Riverhead Point Dr
Short Rd
Totara Rd
Boord Cres
Puke Rd
Tawa Rd
Kennedys Rd
Joseph McDonald Dr
Boyes Ave
Lane
Ripeka
Ngahue Cres
Nils
Andersen Rd
Airport Rd
Brigham Creek Rd
Mamari Rd
Pomona Rd
Spedding Rd
Hailes Rd
Fred Taylor Dr
Taupaki Rd
Nixon Rd
Hanham Rd
Waitakere Rd
Auckland-Kumeu Mwy
Northside Dr
Trig Rd
Upper Harbour SH 18 Mwy
Ryans Rd
Henwood Rd
Dunlop Rd
Nelson Rd
0
780
1,560
Metres
Long-tailed Bat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Designation Boundary
Identified Biodiversity Area
Matua Rd
Meryl Ave
SH 16
Foster Rd
Map Number: 1
0
125
250
Metres
Threatened or At Risk Wetland Birds

ATTACHMENT 39

NORTH-WEST STRATEGIC
PROPOSED CONDITIONS
PART 3 OF 3


LEGEND
Designation Boundary
Identified Biodiversity Area
Matua Rd
Tapu Rd
Oraha Rd
Main Rd
SH 16
Trigg Rd
Station Rd
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Metres
Threatened or At Risk Wetland Birds
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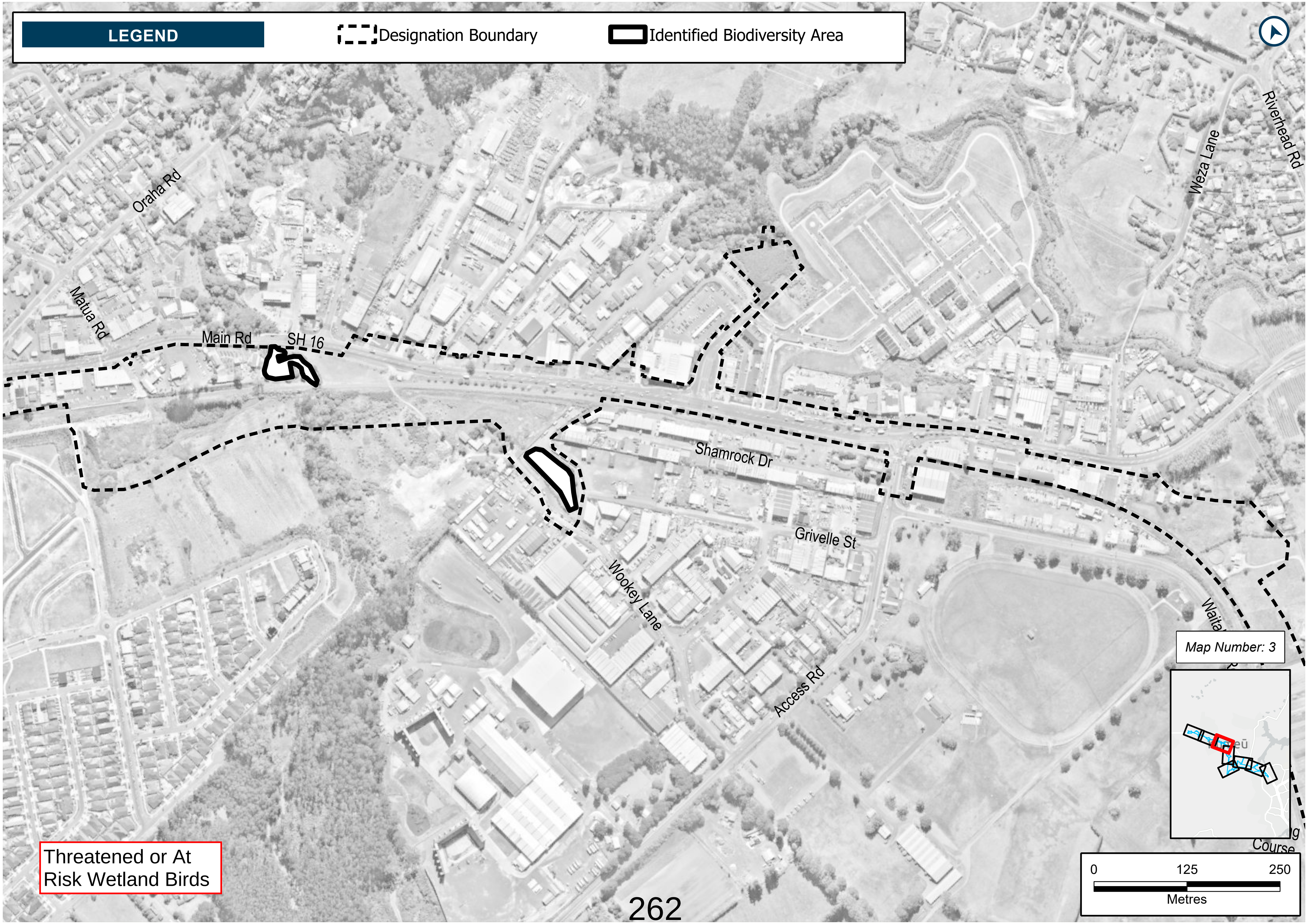
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Designation Boundary
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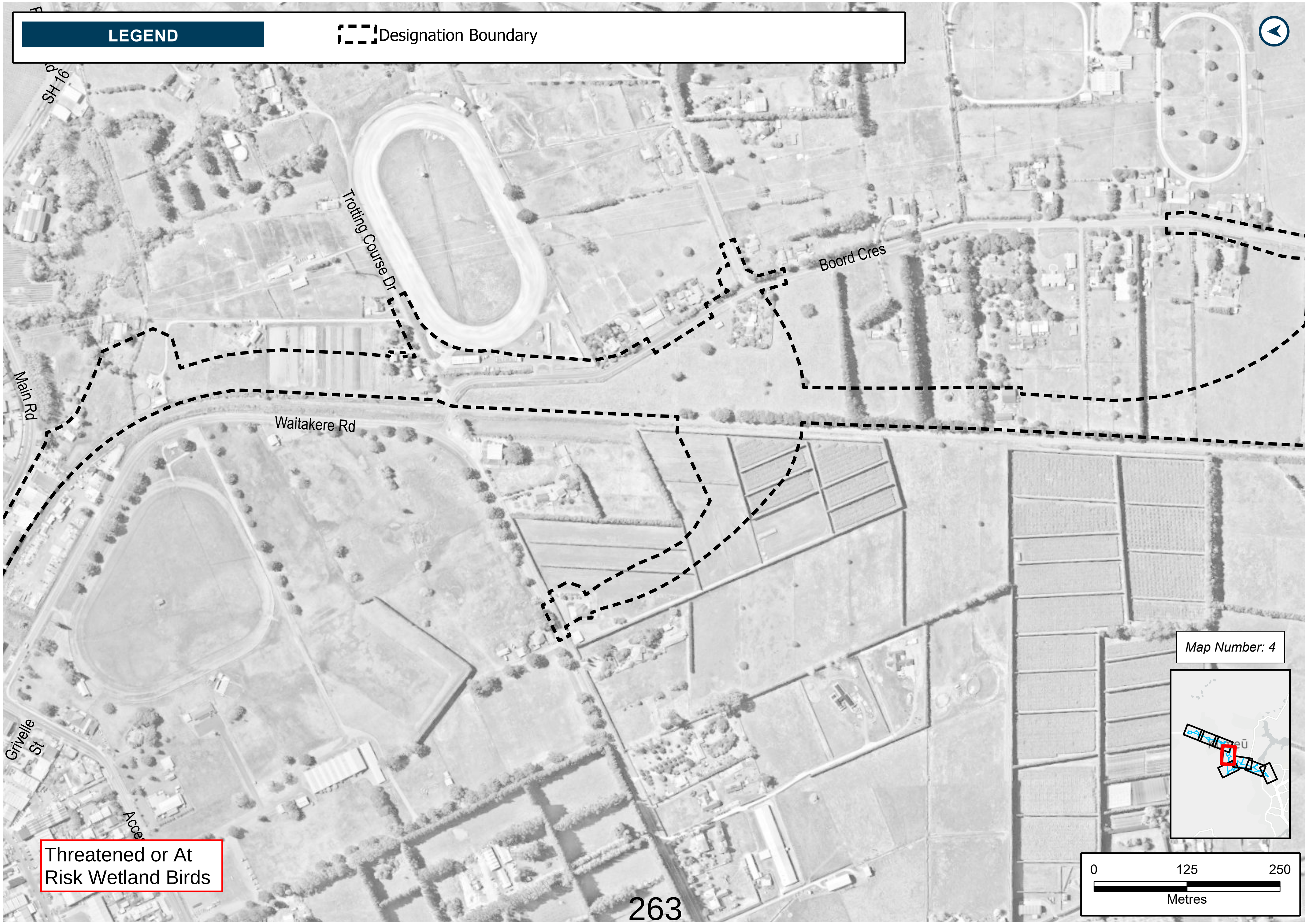
Matua Rd
Main Rd
SH 16
Shamrock Dr
Grivelle St
Wookey Lane
Access Rd
Weza Lane
Riverhead Rd
Map Number: 3
0
125
250
Metres
Threatened or At Risk Wetland Birds



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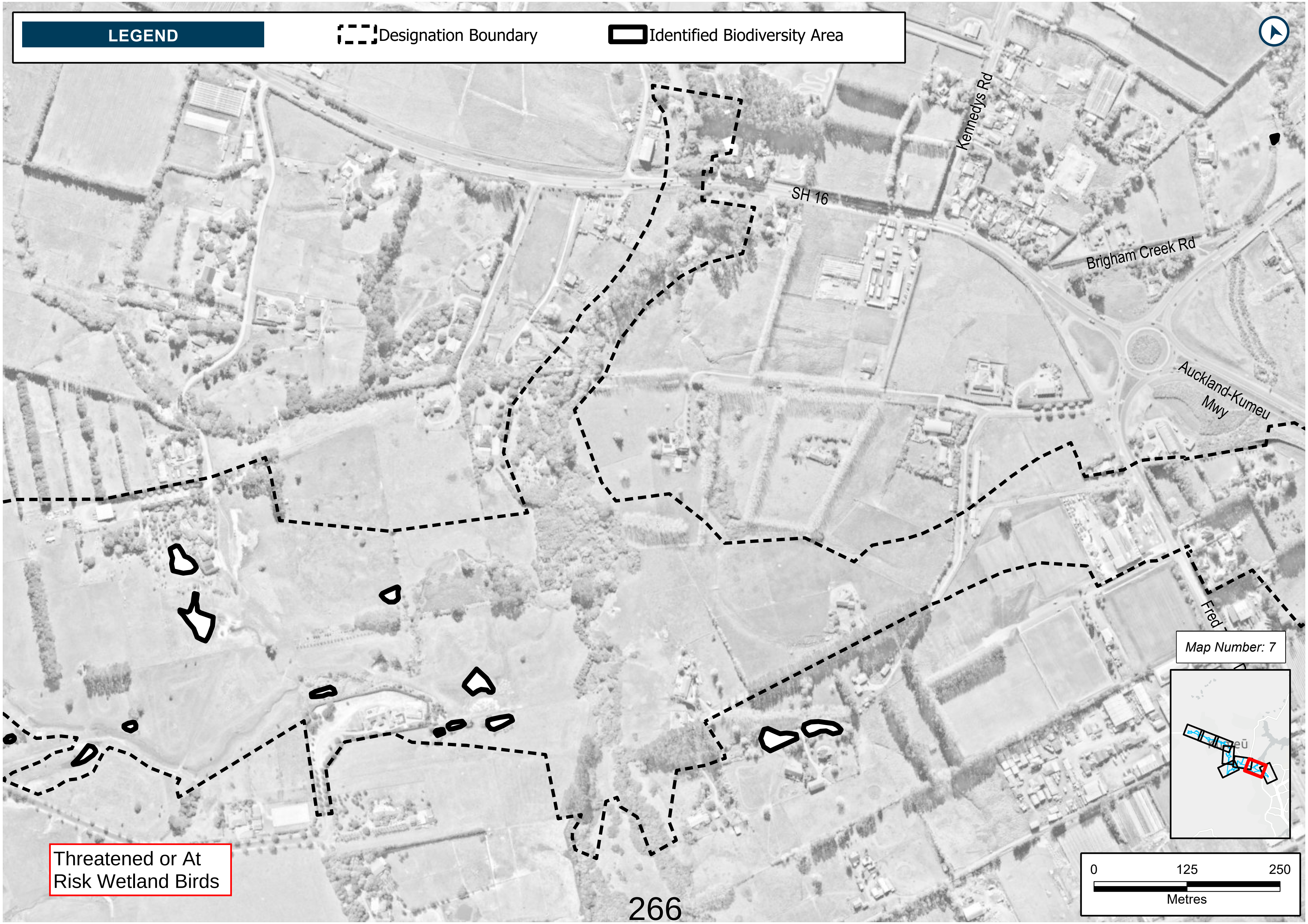
LEGEND
Designation Boundary
Map Number: 5
0
125
250
Metres
Boord Cres
Waitakere Rd
Threatened or At
Risk Wetland Birds

Name of Map: SGA-EC-NW-034-Strategic-RTN-Bird-Mitigation



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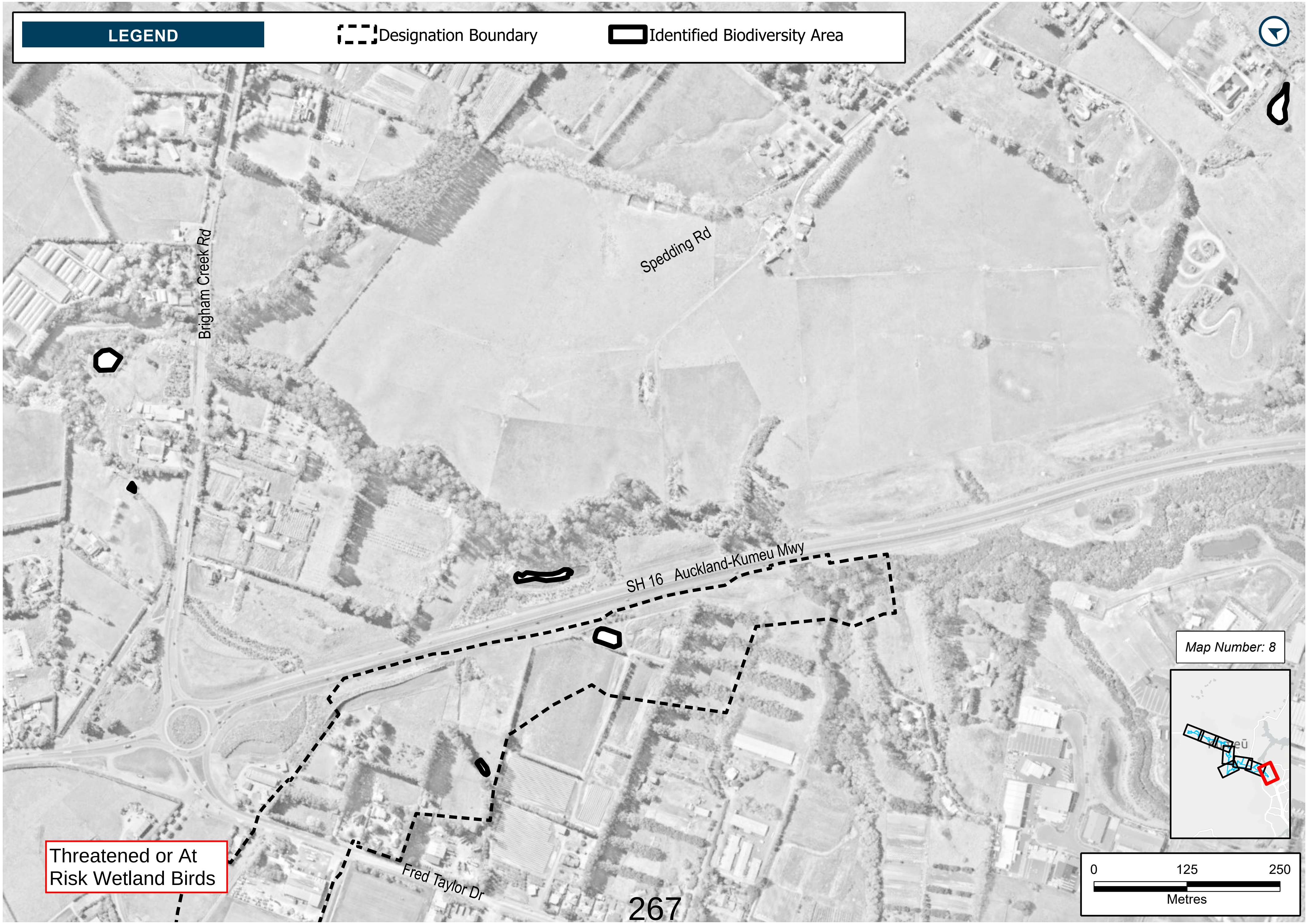


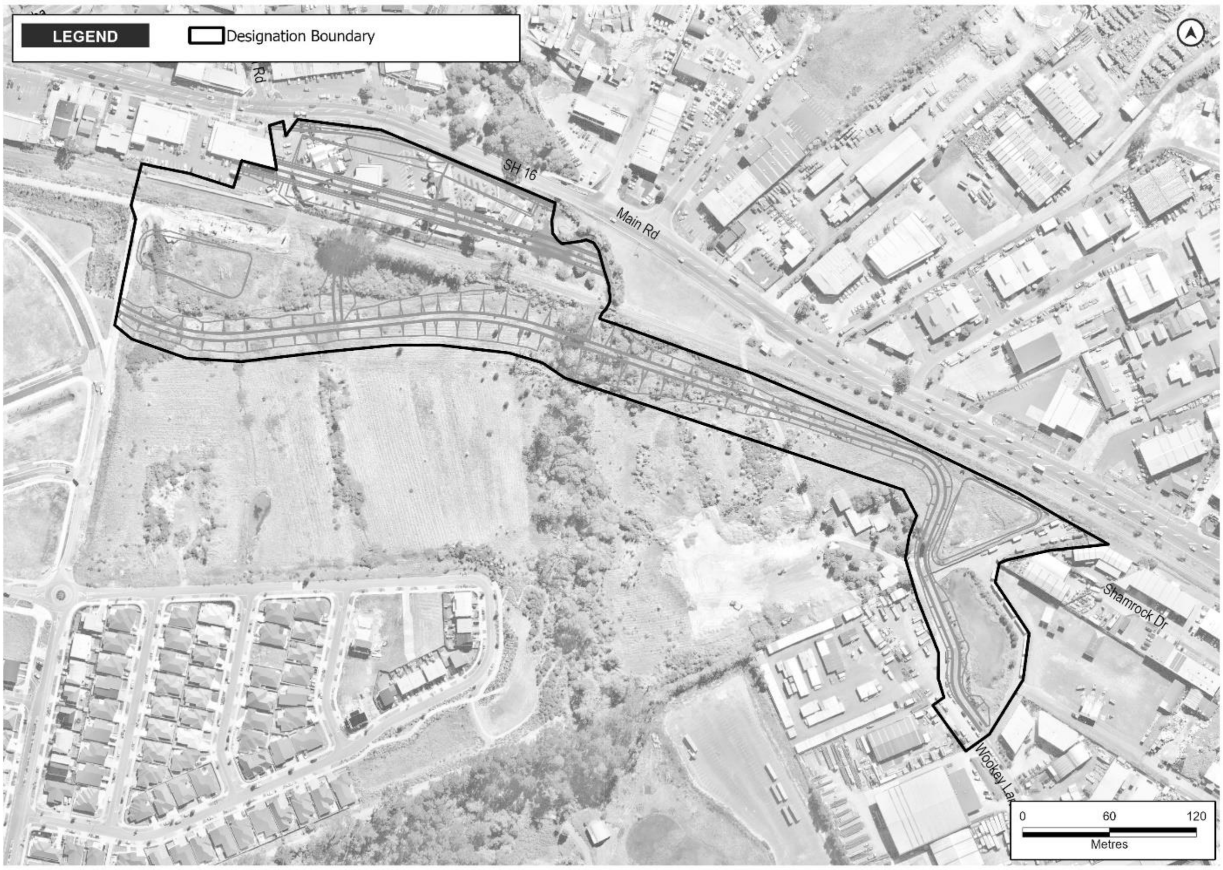
Schedule 1: General Accordance Plans and Information

Project Description

The proposed work is the construction, operation, and maintenance of a rapid transit station in Kumeū, including active transport facilities and associated infrastructure. The proposed work is shown in the following Concept Plan and includes:

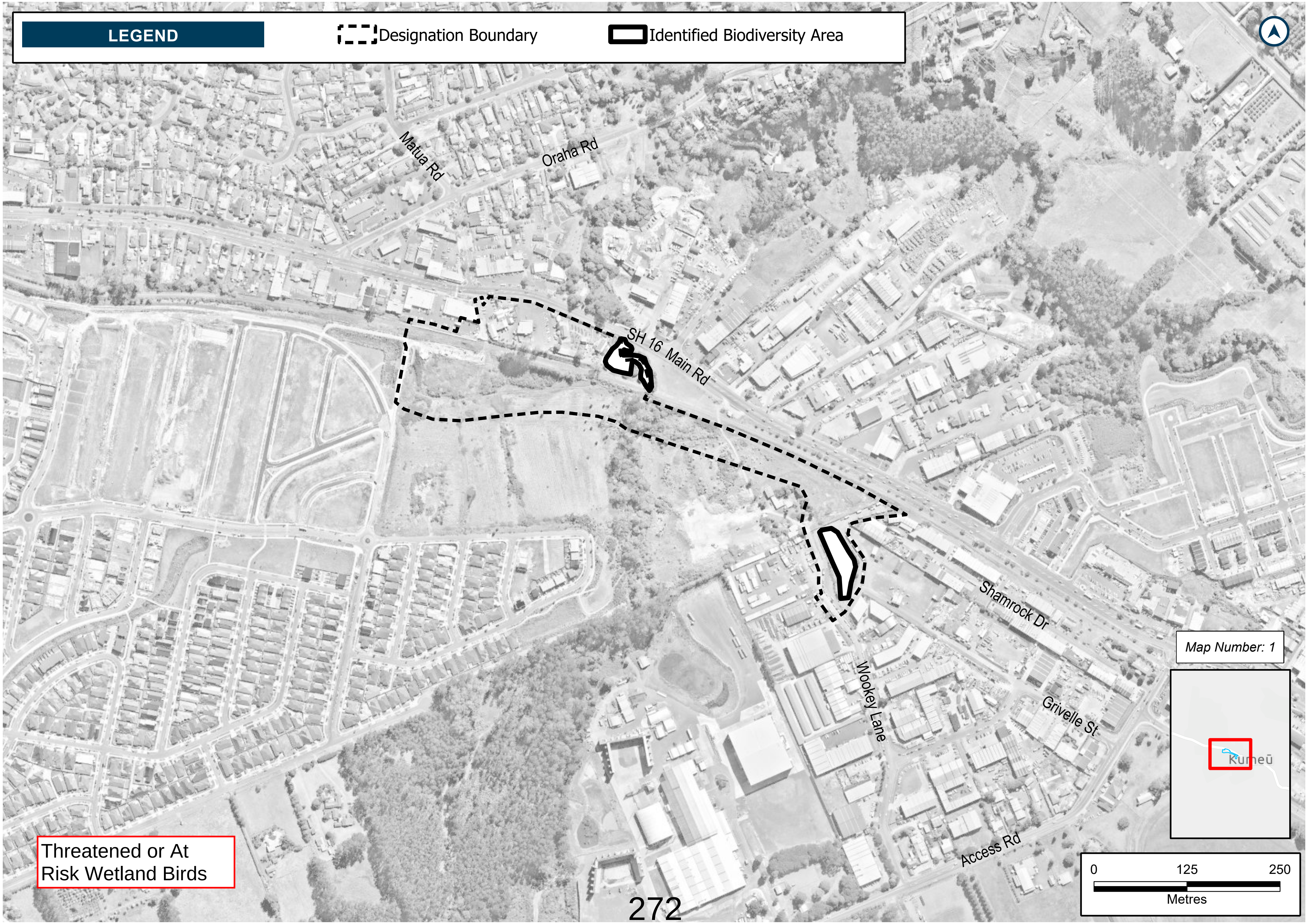
(a) A new rapid transit station, including active transport facilities;
(b) Associated works including transport interchange facilities, accessway, bridges, embankments, retaining, culverts, stormwater management systems; and
(c) Construction activities, including vegetation removal, construction compounds, laydown areas, bridge works area, construction traffic management and the re-grade of driveways.

Concept Plan



Schedule 2: Identified Biodiversity Areas


LEGEND
Designation Boundary
Identified Biodiversity Area
Matua Rd
Meryl Ave
Tapu Rd
Main Rd
Oraha Rd
Riverhead Rd
Shamrock Dr
Weza Lane
Trigg Rd
Station Rd
Grivelle St
Wookey Lane
Foster Rd
Motu Rd
Access Rd
Trotting Course Dr
SH 16
Old Railway Rd
Riverland Rd
Pitoitoi Way
Grove
Dr
Kaipara Portage Rd
Riverhead Point Dr
Short Rd
Coatesville-Riverhead Hwy
Moontide Rd
Totara Rd
Brigham Lane
Boord Cres
Puke Rd
Tawa Rd
Pomona Rd
Kennedys Rd
Brigham Creek Rd
Joseph McDonald Dr
Boyes Ave
Ripeka Lane
Nganue Cres
Nils Andersen Rd
Airport Rd
Mamari Rd
Spedding Rd
Hanham Rd
Waitakere Rd
Taupaki Rd
Nixon Rd
Hailes Rd
Fred Taylor Dr
Auckland-Kumeu Mwy
Northside Dr
Trig Rd
Upper Harbour SH 18 Mwy
Ryans Rd
Henwood Rd
Dunlop Rd
Nelson Rd
0
780
1,560
Metres
Long-tailed Bat



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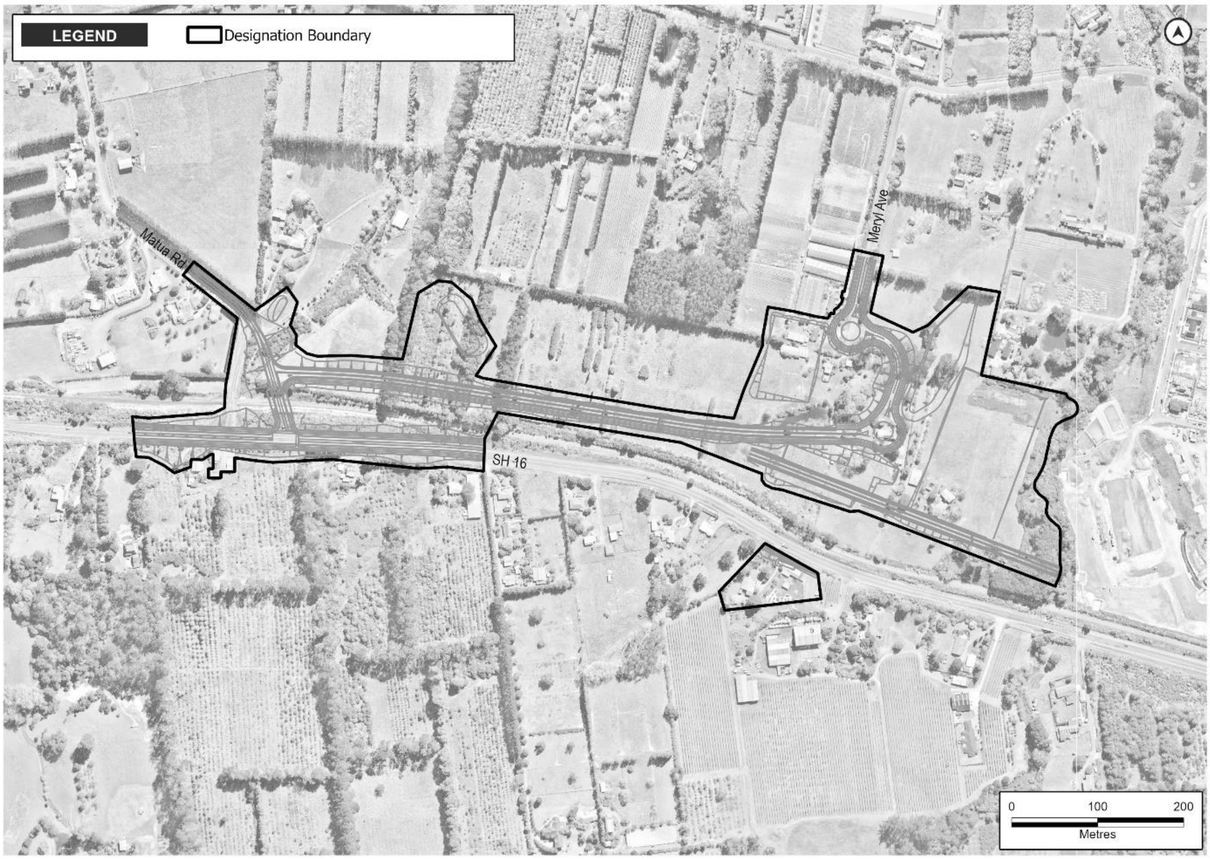
Schedule 1: General Accordance Plans and Information

Project Description

The proposed work is the construction, operation, and maintenance of a rapid transit station in Huapai, including active transport facilities and associated infrastructure. The proposed work is shown in the following Concept Plan and includes:

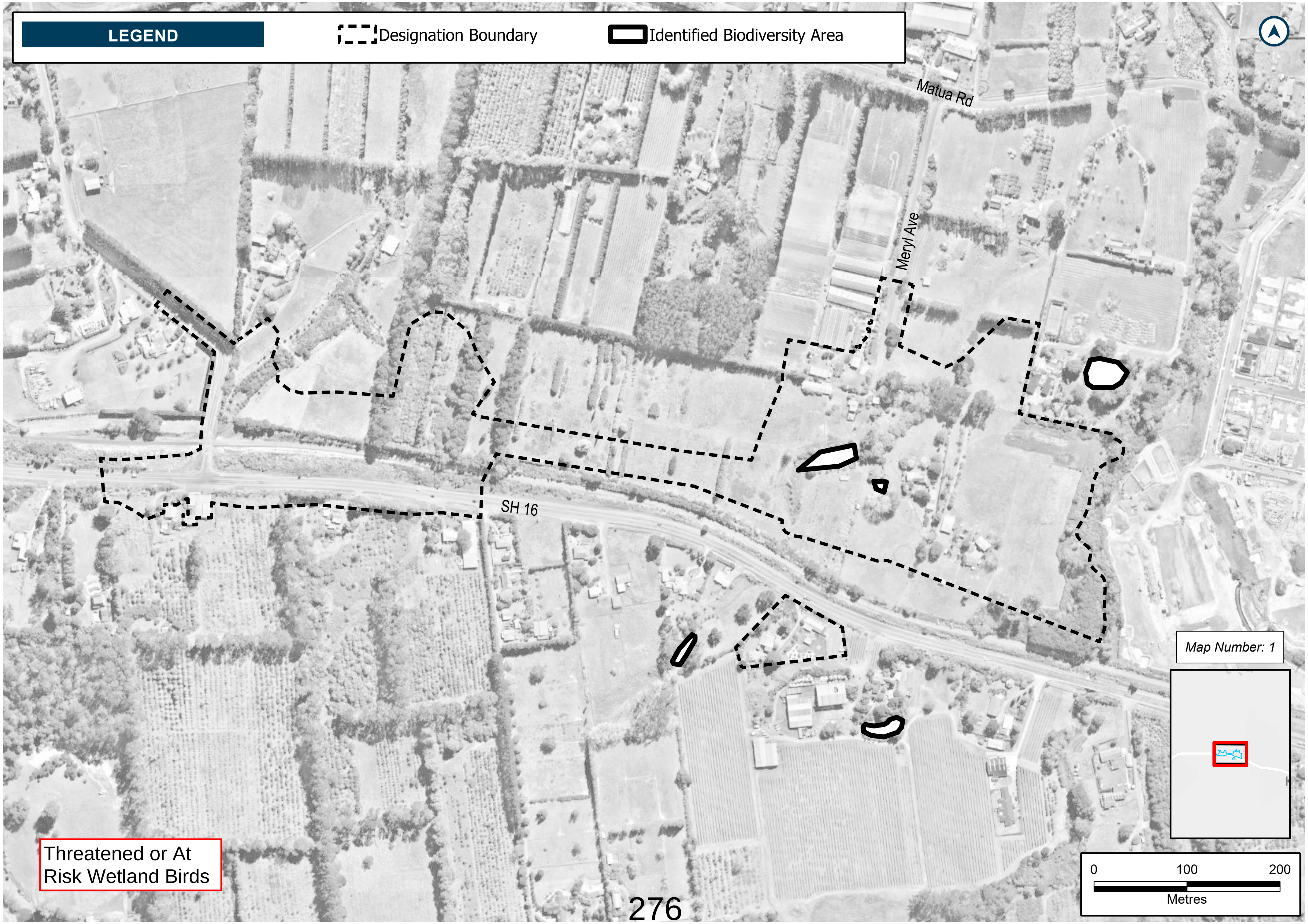
(a) A new rapid transit station, including active transport facilities;
(b) Associated works including transport interchange facilities, accessway, park and ride facilities, bridges, embankments, retaining, culverts, stormwater management systems;
(c) Changes to local roads, where the proposed work intersects with local roads; and
(d) Construction activities, including vegetation removal, construction compounds, laydown areas, bridge works area, construction traffic management and the re-grade of driveways.

Concept Plan



Schedule 2: Identified Biodiversity Areas

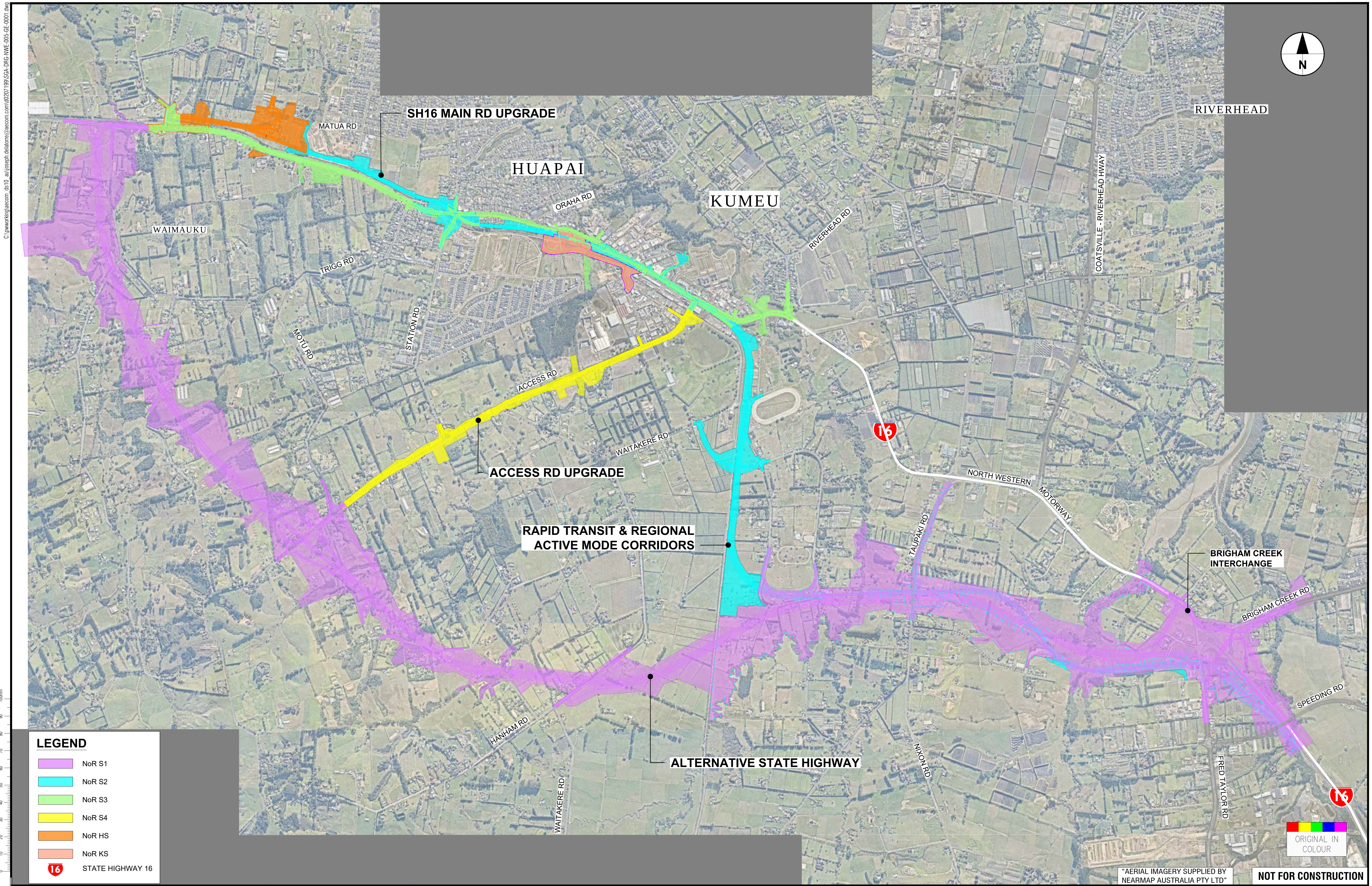
Long-tailed Bat



Threatened or At Risk Wetland Birds

ATTACHMENT 40

NORTH-WEST STRATEGIC
GENERAL ARRANGEMENT PLANS - STRATEGIC



NOT FOR CONSTRUCTION

REV	REVISIONS	DRAWN	DATE
B	ISSUED FOR NoR LODGEMENT	JDT	NOV. 2022
A	DRAFT ISSUE FOR REVIEW	VDLT	07.05.2021

ORIGINAL SIZE A1

SURVEYED	N/A	
DRAWN	V. DELA TORRE	30.04.2021
DRAWING CHECK	J. DELA TORRE	30.04.2021
DESIGN	N/A	
DESIGN REVIEW	N/A	
APPROVED	R. MASON	07.05.2021

TE TUPU NGĀTAHI Supporting Growth

WAKA KOTAHI NZ TRANSPORT AGENCY

Project:
SUPPORTING GROWTH PROGRAMME
NORTH WEST STRATEGIC NETWORK

Drawing Title: NORTH WEST STRATEGIC OVERALL LAYOUT PLAN

Drawing Status:	FOR LODGEMENT
Drawing Date:	08.08.2022
A1 Scales	NTS
A3 Scales	NTS
Discipline	GENERAL
Drawing No.	SGA-DRG-NWE-005-GE-0001
Revision	B

ATTACHMENT 41

NORTH-WEST STRATEGIC ASSESSMENT OF TRANSPORT EFFECTS

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Strategic Assessment of Transport Effects

December 2022

Version 1

Document Status

Responsibility	Name
Author	Joe Phillips, Rachel Gasson
Reviewer	Andrew Murray
Approver	John Daly

Revision Status

Version	Date	Reason for Issue
1	16/12/2022	Notice of Requirement Lodgement

Table of Contents

Appendices

Table of Figures

Table of Tables

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
CC2W	City Centre to Westgate
CTMP	Construction Traffic Management Plan
DBC	Detailed Business Case
DSI	Death and Serious Injury
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
LOS	Level of Service
IBC	Indicative Business Case
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
PT	Public Transport
RASF	Auckland Transport Roads and Streets Framework
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RTN	Rapid Transit Network
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SH16	State Highway 16

Acronym/Term	Description
SH18	State Highway 18
SSTMP	Site-Specific Traffic Management Plan
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

1 Executive Summary

1.1 Overview

This transport assessment has been prepared as part of the Assessment of Environmental Effects for the package of Notices of Requirement being lodged by Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) in Northwest Auckland. It comprises both the North West Strategic Projects and Kumeū Huapai Local Arterials elements (together being the "**Strategic Assessment Package**").

The NoRs are to designate land for future strategic and local arterial transport corridors to support the planned growth in the North West area of Auckland, as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**), to enable the construction, operation and maintenance of transport infrastructure.

The Strategic Assessment Package comprises six separate projects, which together form the North West Strategic Assessment Package. These form part of an overall network of corridors identified by Te Tupu Ngātahi for the North West, which are complemented by other projects that are being progressed through separate processes (such as State Highway 16 to State Highway 18 Connections project and the North West Rapid Transit Corridor Full Implementation.

Table 1-1 and Figure 1-1 below summarise these projects. The Assessment of Environmental Effects report provides a more detailed project description.

Table 1-1: North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway
NoR S2	SH16 Main Road
NoR S3	Rapid Transit Corridor
NoR KS	Kumeū Rapid Transit Corridor Station
NoR HS	Huapai Rapid Transit Corridor Station
NoR S4	Access Road

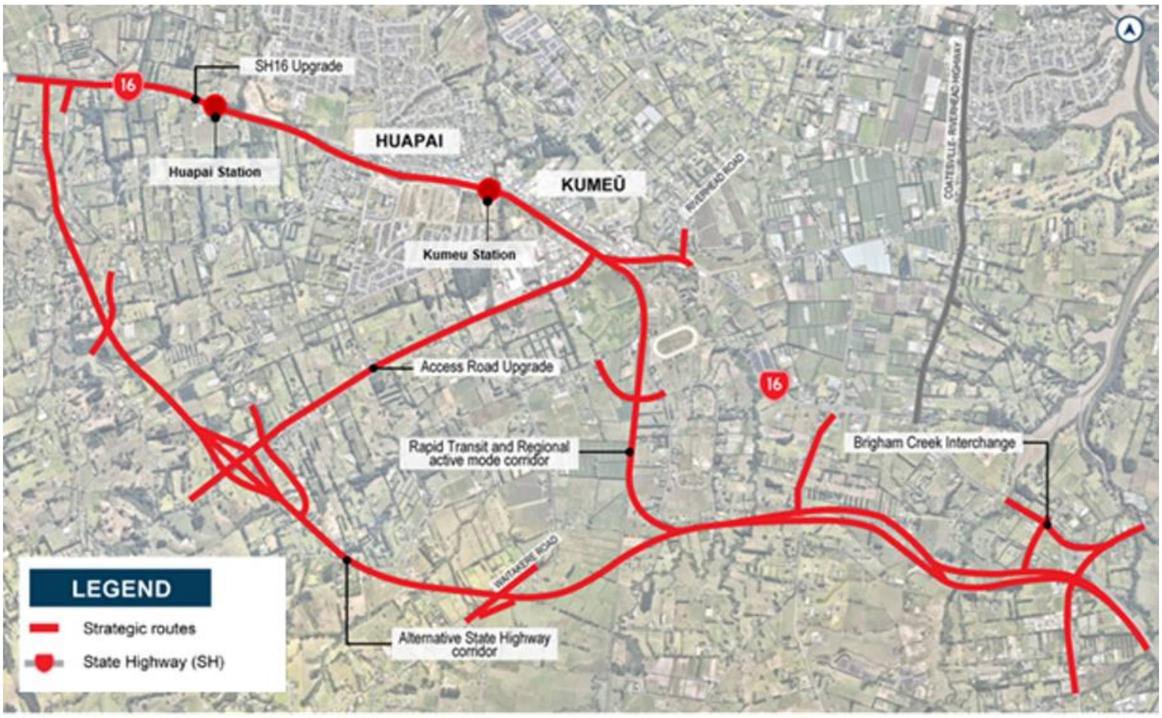


Figure 1-1: North West Strategic Assessment Package – overview

1.2 Methodology

The assessment of the North West Strategic Assessment Package considers both the operational transport effects of the projects, when completed, as well as potential temporary effects of constructing the projects.

Each of the projects were developed as part of network planning for the wider North West area. The wider networks were developed through the Business Case process that considered the key problems, benefits, outcomes and range of options to address the identified problems. As such, the Project is part of a wider long-term integrated network planned for the area, but can generally be delivered separately, and therefore assessed separately.

1.2.1 Approach to Assessment of Operational Transport Effects

Potential operational transport effects are assessed using: ·

- Transport planning assessment of expected outcomes and effects
- Transport modelling to inform future demands and network performance
- Alignment with various policy documents.

An assessment of the overall positive effects of the Strategic Assessment Package of Notices of Requirements is provided, together with consideration of the broader outcomes of the wider North West package of projects.

In respect to each individual Notice of Requirement, a separate effects assessment has been undertaken that considers both the positive and potential adverse effects of the following and how each project contributes to the future network as a whole:

- Each mode of transport
- Access for existing properties
- Existing on-street and public parking.

The assessment methodology is summarised in Table 1-2 below.

Table 1-2: Summary of Assessment Methodology

Network Component	Information Source	Assessment Method
Safety	Crash Analysis System Database Project design drawings	Assessment to determine alignment with Vision Zero standards and design compliance with Transport Design Manual.
Walking and Cycling	Walking and Cycling Network Plans Proposed Cross Sections	Assessment to determine alignment with walking and cycling strategic documents and design compliance with Transport Design Manual.
Public Transport	Transport Modelling tools Te Tupu Ngātahi Remix File[1]	Assessment to determine alignment with future network provisions and design compliance with the Transport Design Manual.
General Traffic , including freight movement	Transport Model tools Project design drawings	Assessment using key model outputs including traffic volumes, levels of service for corridor midblock performance and intersection performance. Assessment of surrounding network connections.
Access	Engineering Standards	Assessment identifying where there is a potential effect on access in the existing environment.
On-street and public parking	Regional Parking Strategy and associated policies Engineering Standards	Assessment identifying where there is a potential effect on parking provision, including in terms of providing parking to required standard in the existing environment.
Note: A Road Safety Audit and Safe System Assessment will be done as part of the implementation business case/detailed design stage prior to implementation.		

[1] Te Tupu Ngātahi Remix file provided by Auckland Transport on the draft plan of the bus network to be implemented by 2048

1.2.2 Approach to Assessment of Construction Transport Effects

Given the long-term nature of the proposed projects, it is considered appropriate to use an indicative construction methodology to assess the temporary construction effects for the Package, sufficient to support each of the Notices of Requirements. A package of management plans will be provided to address predicted adverse effects, which will be informed by this assessment.

The assessment considers:

- An overview of key considerations including speed, potential impacts to pedestrians and cyclists, residential, recreational and business property access, and on-street / public parking
- Identification of any works that should not occur at the same time
- Assessment of potential conflict areas with vulnerable road users that will need specific mitigation within a Construction Traffic Management Plan and / or Site Specific Traffic Management Plan/s.

The project specific construction effects will be managed via a Construction Traffic Management Plan and/or Site-Specific Traffic Management Plans, which will be developed immediately prior to implementation when the greatest certainty is available.

The impact of any temporary traffic management measures implemented to undertake the Projects will be re-assessed in the future, prior to construction, when a greater level of detail is available in terms of the specific construction methodology and traffic environment.

1.3 Alternative State Highway, including Brigham Creek Interchange

1.3.1 Transport Environment Overview

Currently, the State Highway 16 corridor is the only existing strategic corridor that connects Kumeū, Huapai, Riverhead and the broader North West rural area to the metropolitan centre at Westgate and rest of the region beyond. The State Highway 16 corridor is already congested, in both weekday commuter peak and other periods, as well as at weekends and during the summer period, due to its current capacity and lack of resilience, which results from the interactions at existing intersections and direct driveway access.

The current lack of capacity of State Highway 16, means that existing rural roads are currently used as alternatives, particularly during the periods of congestion on State Highway 16, as these rural roads can provide a quicker and more attractive option. However, many of these higher speed roads are not suited to the current volumes of traffic using these corridors and this also leads to safety issues.

Waka Kotahi is separately progressing the State Highway 16 Improvements project, which will provide investment to address existing safety and capacity issues along the corridor. Whilst that project will address some of the interim capacity and safety issues, it will not be able to support the longer-term growth with the development of the Future Urban Zone in Kumeū, Huapai and Riverhead. In particular, the State Highway 16 Improvements project does not include any upgrade to the existing Brigham Creek roundabout.

The planned growth in Kumeū-Huapai is expected to include 10,700 dwellings with an estimated population of 24,700 by full build out – a significant increase on the population of 1,200 (in 2016). In addition, the number of employment opportunities in Kumeū-Huapai is expected to increase by approximately 3,300 jobs over the same period.

Travel patterns are largely expected to remain similar, however, the employment growth in Westgate and Whenuapai are expected to significantly increase – resulting in a potentially much higher level of demand within the North West to access jobs. The trip demands of all Kumeū-Huapai urban trips in the weekday morning peak with full build-out (beyond 2048) show that approximately 37% stay in the North West area. Both the Alternative State Highway and the Rapid Transit Corridor will therefore provide an important strategic role in connecting Kumeū-Huapai with those employments opportunities and broader opportunities within the metropolitan centre at Westgate.

Structure planning is not yet complete in Kumeū-Huapai, Riverhead and Redhills North and is not expected to start until closer to land release, which is beyond 2028. This results in less land use certainty for these areas, but also provides significant opportunities to use transport to shape placemaking. This would enable the future land use and transport networks to work together to support growth, as identified in Auckland Council's Spatial Land Use Strategy (adopted in May 2021), in advance of structure planning.

1.3.2 Project Overview

The Project proposes the construction of a new corridor with a cross-section of approximately 50m to accommodate a four-lane, dual carriageway road with separated cycle facility and footpath.

The western parts of this corridor have integrated walk/cycle facilities, however, the eastern segment (segment 1 below) is adjacent to the Rapid Transit Corridor, so the separated walk/cycle facilities are included via the Regional Active Mode Corridor.

The form and function for the Alternative State Highway (shown on Figure 1-2 below) is summarised in Table 1-3 below. The typical cross section includes an active mode corridor, as well as central and side barriers for the road carriageway. The allocation of the proposed four lanes on Alternative State Highway will be decided upon implementation, but the additional capacity could also be used for managed lanes or interim public transport facilities.

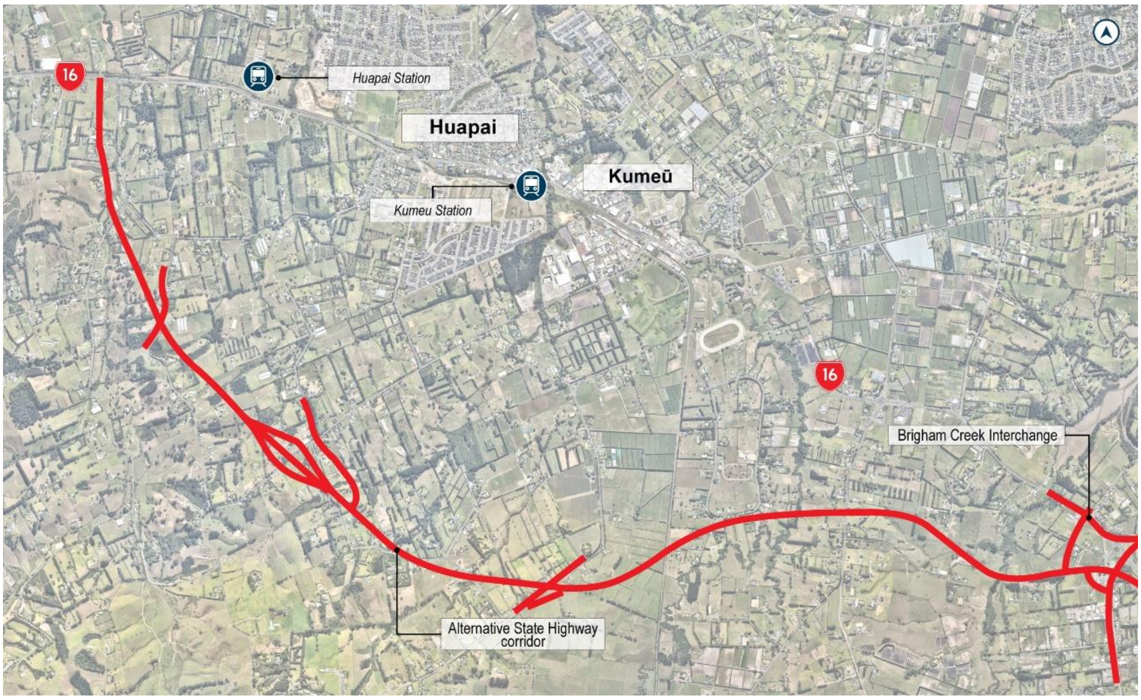


Figure 1-2: Indicative Alternative State Highway alignment

Table 1-3: Alternative State Highway – form and function

Segment Number	Comments
Brigham Creek Connection	• Grade separated interchange. • Separating higher speed state highway trips from local trips, including active modes and public transport. • Grade separation of state highway from Rapid Transit Corridor and Regional Active Modes Corridor. • Supporting safe access to residential and employment opportunities in Whenuapai and Redhills North growth areas.
Brigham Creek to North Auckland Line **North Auckland Line to Tawa Road**	• The design consists of a 4-lane dual carriageway with central and side barrier systems. • All local roads will be grade separated. • Under the ONRC Class 1 with no direct access and grade separation at all local roads / intersections, Safe and Appropriate Speed is 110 km/hr. • No at-grade access.
Tawa Road Connection	• Grade separated interchange • Separating higher speed state highway trips from local trips, including active modes • Grade separation of state highway from Rapid Transit Corridor and Regional Active Modes Corridor. • Supporting safe access to current and future employment growth along Access Road, as well as residential growth in the Kumeū and Huapai areas.
Tawa Road to SH16 existing	• Design consists of a 4-lane dual carriageway with central barrier systems and side barrier systems.

Segment Number	Comments
	• Opportunity for a 2-lane 'expressway' option for this section in the medium term to be investigated further. • Safe and Appropriate Speed is 110 km/hr. • No at-grade access.
State Highway 16 Main Road Connection	• Dual lane roundabout. • Transition from rural state highway to future Huapai urban environment • Supporting safe access to residential growth opportunities in Huapai growth area.

The form and function of the Brigham Creek and Tawa Road Interchanges and the western connection with State Highway 16 provide strategic connections at key locations to support the future growth areas and provide high quality outcomes for active modes and public transport, where necessary.

1.3.3 Overall Conclusion

Overall, the Alternative State Highway corridor project provides considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic (including freight) effects, as summarised below:

- **Safety**
  - A new state highway corridor which meets current standards and has minimal intersections reducing the number of conflict points.
  - Reduced use of less safe, high speed rural roads not designed for or suited to increasing traffic demands.
  - Enabling a significantly improved environment on State Highway 16 Main Road for pedestrians and cyclists, commensurate with an urbanised environment that will provide a safer more accessible environment for people accessing the existing and future Town and Local Centres.
- **Walking and Cycling**
  - Significantly reduced likelihood and exposure to potential crashes, as it will provide a new separated facility and enable safe movement for vulnerable road users through the area.
  - Improved integration with the future walking and cycling network, resulting in improved east-west walking and cycling connectivity.
  - Environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
  - Serving as a key enabler for greater use of active transport modes by providing a safe connector route between Kumeū-Huapai and Whenuapai / Westgate.
- **Public Transport**
  - Reduced vehicle volumes on State Highway 16, when compared to without the project, improving the capacity and reliability of this corridor for all modes including bus services.
  - The Brigham Creek Interchange upgrade will help provide opportunity for better reliability through the interchange for bus services.

  - If necessary, the additional capacity could provide the opportunity for managed lanes or interim public transport facilities in advance of the RTC / RAMC project being implemented.
- **General Traffic (including Freight)**
  - Providing an alternative strategic route for longer distance intra-regional and inter-regional connections, reducing reliance on State Highway 16 and improving resilience of the strategic network. As well as enabling future intensification along the existing State Highway 16 Main Road corridor, particularly around the future centres and Rapid Transit Corridor stations.
  - Providing sufficient corridor and intersection capacity to cater for growth on existing and Future Urban Zone growth.
  - Significantly improved journey times and reliability for existing and future local, inter- and intra-regional freight trips.
  - Direct connection for freight via the Access Road Upgrade to the future employment area in Kumeū-Huapai.

Potential adverse effects on locals roads crossing the Alternative State Highway corridor have been addressed by grade separation of the Alternative State Highway corridor and, where necessary, realignment of local roads. This enables access along public roads to be maintained.

Whilst recognising there is this uncertainty / risk with the long-term timeframe for the ASH Corridor, it is considered that the Waka Kotahi and Auckland Transport's statutory requirements and other internal processes (such as the requirement for an Implementation Business Case) will enable the above effects to be considered and addressed prior to implementation. This will allow the inter-relationships of the ASH Corridor, as it relates to the other projects and the operation and management of the transport network, to be considered and managed prior to the implementation of the corridor.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the Construction Traffic Management Plan prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

It is considered that, whilst temporary disruption to typical travel patterns will be inevitable during construction, the predominantly offline construction of the Alternative State Highway will manage the potential adverse effects, such that they will occur at these identified interfaces with the surrounding network and, where they would be able to be appropriately managed through a Construction Traffic Management Plan.

1.4 State Highway 16 Main Road Upgrade

1.4.1 Transport Environment Overview

The existing corridor is surrounded by a range of land uses including industrial, residential and greenfield land with both urban and rural sections of state highway corridor.

The corridor is generally comprised of one vehicle lane in each direction, other than between Access Road and Harikoa Street (two lanes in each direction). Within the existing urban area along the corridor, there is inconsistent provision of kerb and channel and footpath provision, whilst there are also limited cycling facilities, with cyclists only able to use the road shoulders in some urban sections. Through the current rural road sections, there is an 80kph speed limit with no kerb and channel on either side of the corridor and no footpaths.

The corridor currently passes through the Kumeū and Huapai centres, where higher levels of active mode safety and amenity would be expected. However, as the corridor currently forms part of the state highway network, it is therefore subject to high volumes of local, intra- and inter-regional vehicle trips, including freight traffic, which are not consistent to good access and safety outcomes for people moving within these urban / centre environments.

The likely future environment, with the urbanisation alongside the corridor, and wider growth within Kumeū and Huapai will further deteriorate the urban environment in providing for safe access for people within and to these centres. This will require upgrades to walking and cycling facilities to support safe access for actives modes, particularly around the future Kumeū town centre and Huapai local centre, where the Kumeū and Huapai stations will also provide access to Rapid Transit Corridor. As such, the transport features will need to include a consistent corridor form with kerb and channel on both sides and active modes facilities, including separated cycle paths, plus facilities to improve public transport access.

1.4.2 Project Overview

This Project proposes that the function of State Highway 16 Main Road will change from an existing two-lane road (which is semi-rural at the east and west extents) to a low-speed urban two-lane arterial with components for vehicles, public transport, active modes. The development of the strategic corridor design and its interfaces with the local road network has included the use of the relevant transport guidance and documents.

State Highway 16 Main Road is part of the current state highway network and is currently managed by Waka Kotahi. Waka Kotahi will manage the corridor until the Alternative State Highway is in place, at which time it is anticipated that the state highway classification will be revoked. As part of this project, if not completed as part of the Rapid Transit Corridor project, Station Road will be realigned to form a new signalised intersection with State Highway and Tapu Road.

The proposed design includes a typical 24m cross section with two traffic lanes, as well as new facilities for walking and cycling as shown in Figure 1-3 and Figure 1-4. As shown below, along the segment immediately adjacent to the Rapid Transit Corridor (between Access Road and 156 Main Road, Segment 2) the proposed corridor is 18.5m with active mode facilities along the active frontage only (north side). Additionally, given the current corridor designation, a 600m section (in Segment 3) of active mode only upgrade (south side) is proposed between Oraha Road and Station Road / Tapu Road.[2]

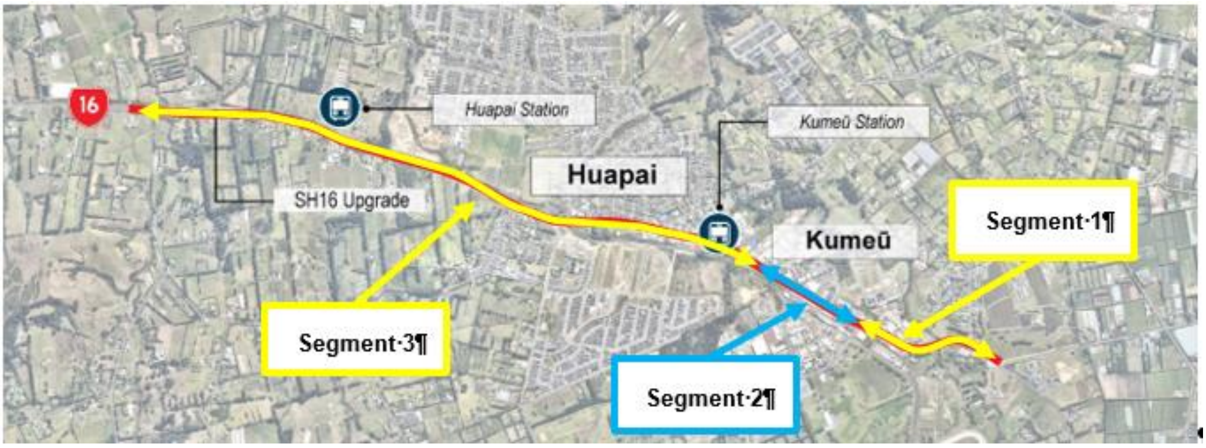
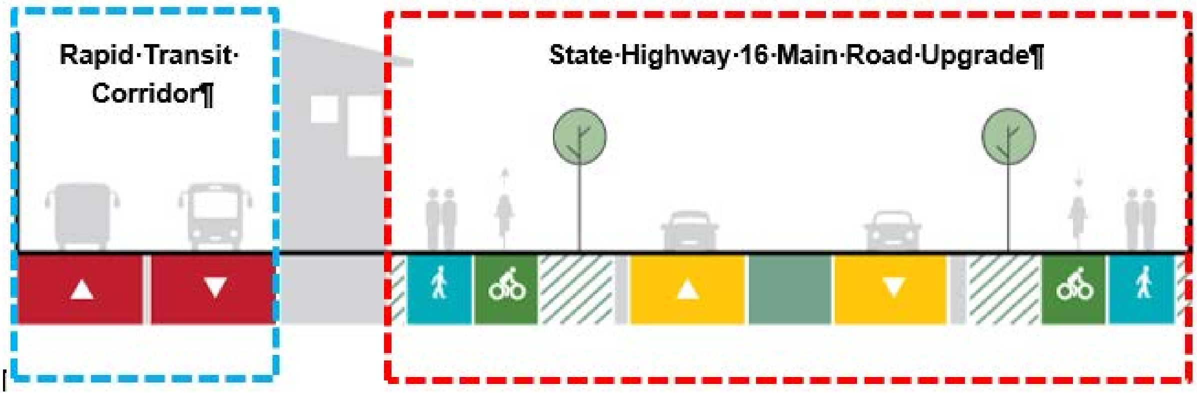


Figure 1-3: SH16 Main Road Upgrade – segments

Segments 1 and 3



[2] Active modes facilities on the north side in this section can be provided within the current road reserve, using the service lane

Segment 2

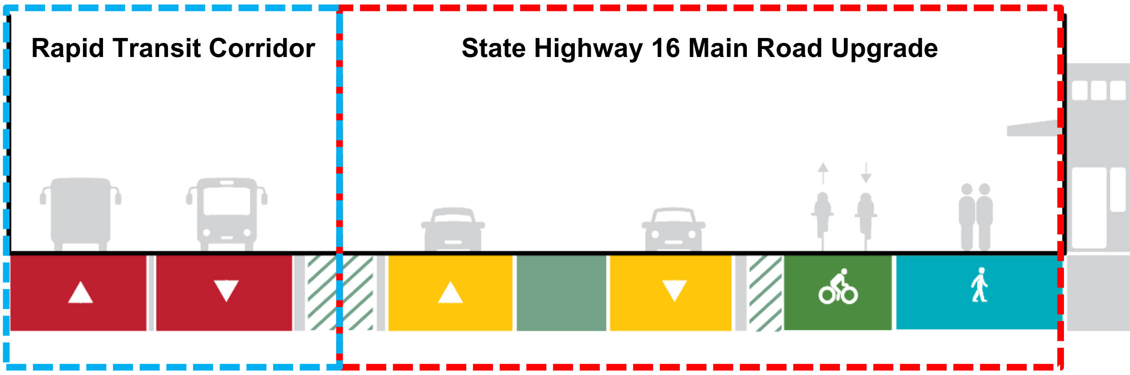


Figure 1-4: Indicative future SH16 Main Road Upgrade cross sections

1.4.3 Overall Conclusion

Overall, the State Highway 16 Main Road Upgrade provides considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic effects, as summarised below:

- **Safety**
  - Significantly improved, and new, walking and cycling facilities along State Highway 16 Main Road (including separation), resulting in improved protection for vulnerable road users.
  - Significantly improved, and new, walking and cycling crossing facilities (crossing SH16 Main Road) at intersections, resulting in a significantly safer environment for all road users.
  - A significantly improved speed environment by reducing speed limits to more appropriate urban speeds (e.g. 50km/h or less around centres) with enhanced place function and consequential reductions in the risk of deaths and serious injuries.
- **Walking and Cycling**
  - Supports a potential reduction in road hierarchy to an arterial function to de-tune State Highway 16 Main Road and support improved permeability (including north south connections over the rail line).
  - Provides high quality cycle facilities for a network to connect the residential catchments to key Town Centre, Local Centre and other destinations, as well as the Regional Active Mode Corridor.
  - Supports growth surrounding State Highway 16 Main Road and significantly improved safety and access to employment and social amenities.
  - Reduces speed environment and space for midblock crossings.
  - Focuses on active modes to shift trips away from private vehicle use and link land use to the Rapid Transit Corridor.

- **Public Transport**
  - Reduced delays and improved reliability for future bus services on State Highway 16 Main Road and the wider network.
  - Improved integration with the future public transport network (including the Rapid Transit Corridor stations) and improved east-west and north-south connectivity, as well as improved access to employment and social amenities.
  - Increased attractiveness and uptake of public transport trips, which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.
- **General Traffic**
  - The proposed two-lane corridor can efficiently accommodate the anticipated long-term demand and the intersections along the State Highway 16 Main Road corridor have been assessed and shown to provide sufficient capacity.
  - Complementary implementation of the Alternative State Highway, as part of the long-term network is predicted to result in a significant reduction in local, intra- and inter-regional freight using the State Highway 16 Main Road Upgrade corridor.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the Construction Traffic Management Plan prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

Effects on off-street and on-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

It is acknowledged that temporary disruption to typical travel patterns will be inevitable, as part of a significant strategic project of this nature and scale. Taking on board the specific matters discussed in this report, particularly the provision of two-way movement with one lane in each direction along the corridor, it is considered that the temporary effects on the surrounding network will be appropriately managed through a Construction Traffic Management Plan. These effects would be substantially reduced, should the Alternative State Highway be implemented in advance of this project, removing a significant volume of traffic from the existing State Highway 16 Main Road corridor through Kumeū and Huapai.

During construction of the SH16 Main Road Upgrade, it is anticipated that there will need to be temporary removal of some on-street car parking within the road reserve, primarily along the section of SH16 Main Road between Weza Lane and Access Road intersections. The extent to which parking will need to be temporarily removed, rearranged or relocated will depend on the more detailed construction methodology / approach at the time of implementation. As such, the need to temporarily remove car parking and any temporary mitigation is better considered at that later stage, particularly as the use of these spaces will change over the period of the proposed lapse dates.

1.5 Rapid Transit Corridor, including the Regional Active Modes Corridor, Kumeū Station and Huapai Station

1.5.1 Transport Environment Overview

The existing public transport network in the wider North West is heavily reliant on SH16 and several key arterials including Don Buck Road, Hobsonville Road and Fred Taylor Drive, whilst the existing public transport services for Kumeū-Huapai only offer an hourly frequency. In terms of heavy rail, while there is a single track that travels through Kumeū, this line does not currently offer passenger services beyond Swanson. For residents in Kumeū-Huapai, utilising this service means driving to the park and ride at Swanson.

As such, there is limited public transport access for Kumeū-Huapai residents, and little choice but to travel by private car in order to access wider economic and social opportunities.

Overall, the current public transport offerings connecting Kumeū to Westgate beyond provide a poor transport choice for existing and future residents. The current public transport network has high variability in travel time, poor levels of priority resulting in long travel times commensurate (or in some instances longer) with travelling by car, and services offer low frequencies. As a combined public transport offering this creates a choice that is unattractive and time expensive for commuters, and in its current form is unlikely to encourage any form of significant mode shift from private vehicles.

With the predicted increase in demand, additional buses are unlikely to be sufficient to cope with the additional pressure using the existing infrastructure, leading to bus bunching, and bus congestion on the network. A significant infrastructure change will be needed to support the transformational step change required in the North West. This will require a rapid transit solution that provides a high quality, frequent and reliable frequent service that connects Kumeū-Huapai with employment and social opportunities in Westgate and Whenuapai and also enables wider connectivity to the Auckland region, including Auckland city centre and the North Shore.

Should no dedicated strategic cycle facility be provided there will be a lack of safe and attractive facilities for the future communities. This will have two likely results, travellers will choose to continue to travel by car, increasing reliance on private vehicles or people will travel by foot or cycle on corridors with high safety risks.

1.5.2 Project Overview

The proposed Rapid Transit Corridor is a new corridor which aims to complete a safe and frequent rapid transit system connecting Kumeū-Huapai with Westgate, Auckland City Centre and the North Shore. The Rapid Transit Corridor will extend the proposed North West Rapid Transit Corridor Full Implementation project (a non-Te Tupu Ngātahi project) from the proposed Brigham Creek station to near the western edge of Kumeū-Huapai growth area.

The Rapid Transit Corridor predominately traverses rural land outside of the Future Urban Zone for around 6km of its total length of approximately 9.5km, with the last 3.5km being within the existing or Future Urban Zone areas. Refer to Figure 1-5. The Rapid Transit Corridor will operate in an uninterrupted free flowing manner with all road crossings grade separated along its length. The Rapid Transit Corridor will be at grade, except at key sections to pass over local and arterial roads, as well as the Alternative State Highway. The Rapid Transit Corridor is co-located and integrated with the Regional Active Modes Corridor and both projects are proposed to be route-protected as a single Notice of Requirement.

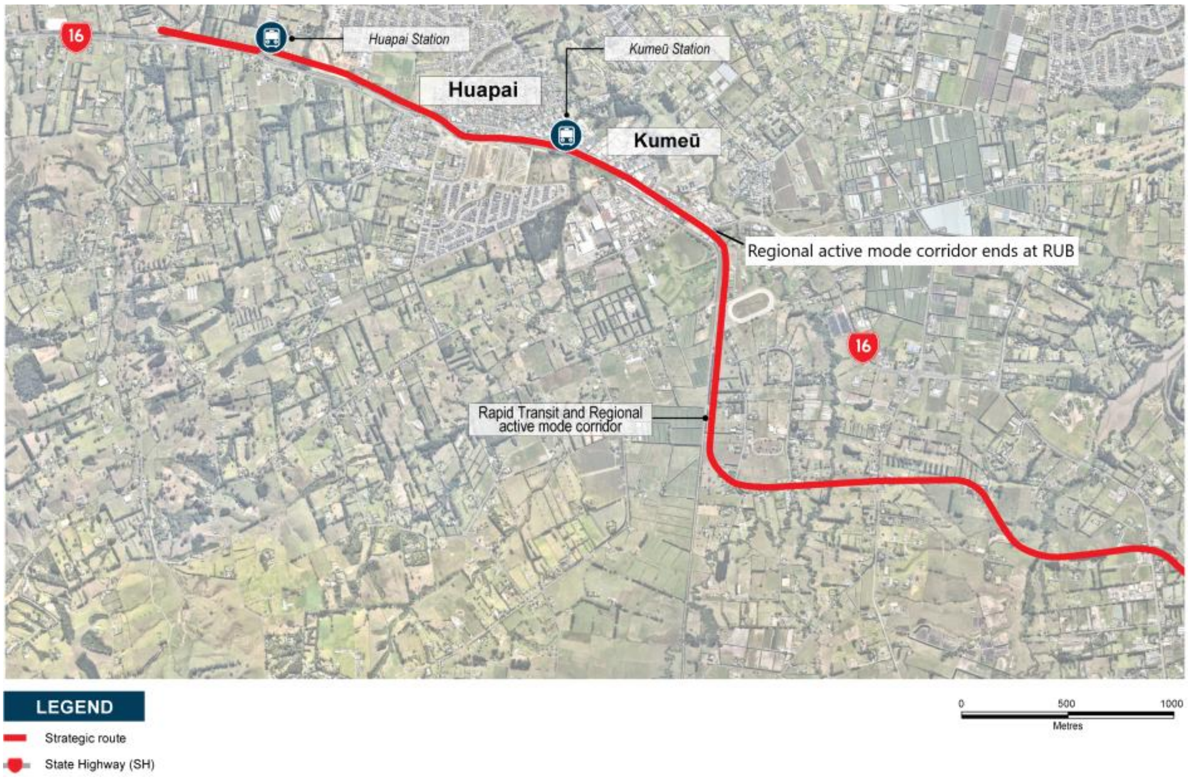


Figure 1-5: Indicative Rapid Transit Corridor and Regional Active Modes Corridor alignment

The Regional Active Modes Corridor is a segregated walking and cycling corridor that is located adjacent to the Rapid Transit Corridor alignment from the Brigham Creek Interchange to the western edge of Kumeū-Huapai, terminating at the signalised intersection of SH16 Main Road and Weza Lane. The segregated corridor provides the opportunity for long-term amenity as a key cycling corridor, while connecting to the wider North Western Cycleway and ultimately to the Auckland City Centre network.

In order to serve the existing urban and Future Urban Zone areas in Kumeū-Huapai, the Rapid Transit Corridor / Regional Active Modes Corridor is supported by Kumeū Rapid Transit Corridor Station and Huapai Rapid Transit Corridor Station. The proposed station locations are illustrated on Figure 1-5.

Within the rural section, the Rapid Transit Corridor is completely segregated with a cross-section width of 20m, including the Regional Active Mode Corridor. There are two lanes (one in each direction) and it is designed to accommodate a high-speed rapid transit system, with speeds up to around 80kph. The Regional Active Mode Corridor will have access where it crosses key local roads, including Taupaki Road, which provides connection to the State Highway 16 shared path (delivered through the State Highway 16 Improvements project). Rapid Transit Corridor stations/stops are not provided in the rural section to maintain the high-speed environment and there is grade separation at local rural roads. The indicative cross section of the Rapid Transit Corridor rural section is shown in Figure 1-6.

Figure 1-6: RTC Indicative Cross-Section – Rural Section

Within the urban section, the corridor is separated from the SH16 Main Road Upgrade corridor and is grade separated at road crossings to improve the safety, efficiency and reliability of the Rapid Transit Corridor. Generally, the corridors are separated by the adjacent land use activities or the North Auckland heavy rail line and therefore have adopted the cross section in Figure 1-4. This includes a two lane urban corridor cross section for SH16 Main Road (as described previously), with the Rapid Transit Corridor in its own separate corridor.

However, for a section of SH16 Main Road Upgrade to the west of Access Road, the two corridors run adjacent, to minimise the extent of designation required. In this section a more bespoke approach has been taken to the cross section, as shown in Figure 1-4.

The form and function for Kumeū and Huapai Stations has been subject to extensive discussion with Waka Kotahi and AT to determine the appropriate footprint for connecting transport modes interchanging for access to and from the Rapid Transit Corridor.

The development of the strategic corridor design and its interfaces with the local road network has included the use of the relevant transport guidance and documents.

1.5.3 Overall Conclusion

Overall, the Rapid Transit Corridor / Regional Active Modes Corridor, Kumeū Station and Huapai Station provide considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic effects, as summarised below:

- **Safety**
  - Provides a new Rapid Transit Corridor and Regional Active Mode Corridor which meets current standards and minimises interfaces with the local transport network, except at key strategic connections to the local network.
  - The Rapid Transit Corridor / Regional Active Modes Corridor will reduce traffic demand on the existing SH16 corridor, improving mode choice for connections to Westgate / Whenuapai and reduce the risk that people will use inappropriate and less safe rural roads.
- **Walking and Cycling**
  - The Regional Active Modes Corridor provides a new corridor which meets current standards and achieves the following significant positive effects:
    - Significantly reduces the likelihood and exposure to potential crashes, as it will provide a new separated facility and enable safe movement for vulnerable road users through the area.
    - Improves integration with the future walking and cycling network, resulting in improved east-west walking and cycling connectivity.
    - Leads to environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
  - The Regional Active Modes Corridor serves as a key enabler for greater use of active transport modes by providing a safe connector route between Kumeū-Huapai and Westgate.
  - The grade separated connections to the Rapid Transit Corridor Stations at Kumeū and Huapai will provide connections over the adjacent North Auckland Line to the stations and planned adjacent centres, which will significantly reduce walking and cycling journeys distances supporting direct, convenient and attractive access options for active mode users.
- **Public Transport**
  - The Rapid Transit Corridor will support transformational mode shift in Kumeū-Huapai through the provision of a safe, high-quality, frequent, and reliable public transport system that connects Kumeū-Huapai with Westgate, Auckland City Centre and North Shore.
  - The Rapid Transit Corridor will increase access to employment opportunities by public transport and make this a more attractive travel option, in comparison to the use of the private car.
  - The dedicated Rapid Transit Corridor will be grade separated from all local and strategic corridors providing reliable journey times
  - The Rapid Transit Corridor will support a key transport interchange at Westgate, as part of the North West the Rapid Transit Corridor Full Implementation project, as well as unlocking access to economic and social opportunities in the North West.
  - The Kumeū and Huapai Rapid Transit Corridor Stations will support transit-oriented development and will be integrated with surrounding bus, walking, and cycling networks to promote travel choice. This will provide the opportunity for urban intensification, as expected through the National Policy Statement for Urban Development, in locations that support the identified future Town Centre and Local Centre locations.
  - The Rapid Transit Corridor Stations include appropriate provision for access by local bus services that will support the local public transport system connecting the Kumeū-Huapai community and broader rural catchment with access to the Rapid Transit Corridor.
- **General Traffic**
  - The Rapid Transit Corridor and Regional Active Mode Corridor will contribute to reduced future traffic demand on the State Highway 16 corridor between Kumeū-Huapai and Westgate /

Whenuapai, which will improve the effectiveness and reliability of this corridor. Noting the full benefits for this corridor are realised with the completion of the Alternative State Highway.
  - The Rapid Transit Corridor and Regional Active Mode Corridor have been designed to be grade separated over local roads, so whilst there will be some adverse effects during construction, access will be maintained along these local roads. With the realignment of Matua Road (West) and Station Road providing improved connections / access.
  - The new access road at Boord Crescent will not significantly affect journey times, but will reduce the safety risks associated with the existing level crossing of the North Auckland Line.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the Construction Traffic Management Plan prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

Effects on off-street and on-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

Adverse effects on the Huapai Domain and the Kumeū fire station, which are important emergency services and community facilities can be addressed by viable mitigation solutions that with the agreement of FENZ and Auckland Council Parks can provide appropriate mitigation at the time of implementation.

The relative timing of the Rapid Transit Corridor, State Highway 16 Main Road Upgrade, and Alternative State Highway will be considered as part of later implementation business cases prior to implementation. The assessment has identified that depending on the timing of the Main Road Upgrade, relative to future urban growth occurring in Kumeū-Huapai, the implementation of the Alternative State Highway may be necessary in advance of this project to manage potential adverse effects on the urban areas. This can be considered and addressed at the time of implementation.

The delivery of the Rapid Transit Corridor through Kumeū-Huapai is also noted as being dependent on the completion of some segments of the SH16 Main Road Upgrade in advance. In terms of the proposed designation, each of these projects remain necessary in their own right, as part of the North West Strategic Package to support the anticipated long-term growth.

It is acknowledged that temporary disruption to typical travel patterns will be inevitable, as part of a significant strategic project of this nature and scale. However, it is considered that the predominantly offline construction of the Rapid Transit Corridor and Regional Active Mode Corridor will manage the potential temporary adverse effects, such that they will occur at these identified interfaces with the surrounding network, where they would be appropriately managed through a Construction Traffic Management Plan.

1.6 Access Road Upgrade

1.6.1 Transport Environment Overview

The existing Access Road corridor is predominantly surrounded by greenfield land, with the exception of the eastern end, which is located adjacent to the light industrial land and Kumeū Showgrounds. It comprises of one vehicle lane in each direction. The carriageway transitions from rural to urban (on both sides) near Wookey Lane.

There is a short segment of Access Road which includes a footpath on both sides, at the eastern end of the corridor, between SH16 Main Road and 21 Access Road. A footpath is then only provided along the northern side to 116 Access Road and there are no cycle facilities. South of 116 Access Road, the rural section has no footpaths or cycle facilities, and the rural speed limit is 80 kph . There are no existing bus services on Access Road.

In the likely future environment, there will be urban development along the western side of Access Road and Tawa Road to the interchange with Alternative State Highway. Access Road will therefore play a key role in connecting the existing and likely future urban area zones to both the Rapid Transit Corridor / Regional Active Mode Corridor, via the State Highway 16 Main Road Upgrade, and the Alternative State Highway. It will also provide for bus services connecting this Future Urban Zone area with the Kumeū Town Centre and Rapid Transit Corridor station.

1.6.2 Project Overview

It is proposed to widen the existing Access Road/Tawa Road corridor from its current width of 20m to accommodate a 30m wide four-lane cross-section, as shown in Figure 1-7 and Figure 1-8 below. The proposed cross-section of the corridor transitions from a rural edge cross-section to an urban cross-section at the Wookey Lane intersection.

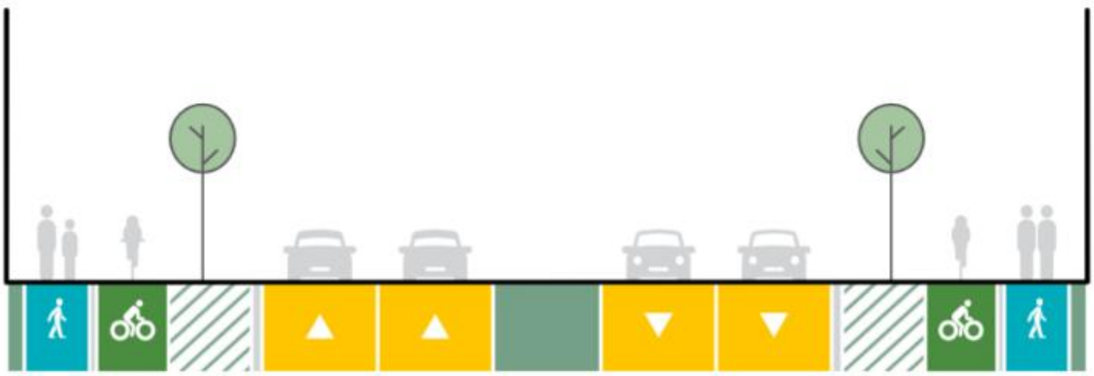


Figure 1-7: Indicative Access Road Upgrade cross section for urban section

Figure 1-8: Indicative Access Road Upgrade cross section for rural section

1.6.3 Overall Conclusion

Overall, the Access Road Upgrade provides considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic (including freight) effects, as summarised below:

- **Safety**
  - Significantly improved walking and cycling facilities along Access Road (including separation), resulting in improved protection for vulnerable road users.
  - Improved walking and cycling crossing facilities across the side roads intersecting with Access Road, where necessary, resulting in a safer environment for all road users.
  - A significantly improved speed environment by reducing speed limits to more appropriate urban speeds with enhanced place function and consequential reductions in the risk of deaths and serious injuries.

- **Walking and Cycling**
  - Significantly reducing the likelihood and exposure to potential crashes as it will enable safe movement for vulnerable road users along and, where necessary, across Access Road.
  - Improved integration with the future walking and cycling network, resulting in improved north-south walking and cycling connectivity.
  - Lead to significant environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
  - Serve as a key enabler for greater use of active transport modes by providing a safe connector route between the development land and the future Kumeū centre.
  - Support growth surrounding Access Road and significantly improve safety and access to employment and social amenities.
- **Public Transport**
  - Reduced delays and improved reliability for the future bus network on Access Road and the wider network.
  - Improved integration with the future public transport network and improved north-south connectivity, as well as improved access to employment and social amenities.
  - Increased attractiveness and uptake of public transport trips which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.
- **General Traffic (including Freight)**
  - The proposed four-lane corridor can efficiently accommodate the anticipated long-term demand and the intersections along the Access Road Upgrade corridor have been assessed and shown to provide sufficient capacity.
  - Improved reliability for existing and future local freight, including access to the southern extension of the light industrial zone adjacent to Access Road
  - Flexibility to accommodate potential interim uncertainty relating to the timing of the Alternative State Highway Corridor, and therefore potentially higher traffic demands on the northern section of the Access Road Upgrade corridor.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the Construction Traffic Management Plan prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

Effects on off-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

Adverse effects on the Kumeū Showgrounds and Kumeū Community Centre, which are important community facilities can be addressed by potentially viable mitigation solutions that with the agreement of the Kumeū Showgrounds and Kumeū Community Centre can provide appropriate mitigation at the time of implementation, if necessary.

It is acknowledged that temporary disruption to typical travel patterns will be inevitable, as part of a strategic project of this nature and scale. However, taking into account the specific matters identified above, and the intention to maintain access along the corridor, it is considered that the temporary adverse effects on the surrounding network will be appropriately managed through a Construction Traffic Management Plan.

It is noted that driveway access for several properties will be temporarily affected during the construction phase only. Temporary access arrangements will be required, as part of the construction phase for these properties. This can be satisfactorily provided for through the Construction Traffic Management Plan process. Once works are completed on Access Road, the driveways will be reinstated.

2 Introduction

This transport assessment has been prepared for as part of the Assessment of Environmental Effects (**AEE**) for the package of Notices of Requirement (**NORs**) being lodged by Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) in Northwest Auckland. It comprises both the North West Strategic Projects and Kumeū Huapai Local Arterials elements (together being the "**Strategic Assessment Package**").

The NoRs are to designate land for future strategic and local arterial transport corridors to support the planned growth in the North West area of Auckland, as part of Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**), to enable the construction, operation and maintenance of transport infrastructure. The Strategic Assessment Package will provide route protection for the strategic projects, which include:

- Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
- Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
- Kumeū Rapid Transit Station
- Huapai Rapid Transit Station
- State Highway 16 (**SH16**) Main Road Upgrade

It also includes the upgrade of Access Road, an existing local arterial corridor within Kumeū-Huapai.

This report assesses the transport effects of the North West Strategic Assessment Package identified Table 2-1 and in Figure 4-1 below. The AEE provides a more detailed project description.

Table 2-1: North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (**ASH**)
NoR S2	SH16 Main Road
NoR S3	Rapid Transit Corridor (**RTC**)
NoR KS	Kumeū RTC Station
NoR HS	Huapai RTC Station
NoR S4	Access Road

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the Assessment of Environmental Effects (**AEE**) for the Strategic Assessment Package. Its purpose is to identify and describe the potential effects of the package on the transport system.

This report considers the actual and potential effects associated with the construction, operation and maintenance of the Strategic Assessment Package on the existing and likely future environment as it relates to transport effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

Given the long term nature of the designations being sought, this assessment does not assess the interim staging of individual projects and development staged over the next three decades. Instead, places a greater focus on the ‘full build out’ of the future urban area in 2048+ (refer to section 3.1.1) to support future communities.

The key matters addressed in this report are as follows:

a) Identify and describe the existing and likely future transport network of the Strategic Assessment Package area;
b) Identify and describe the actual and potential transport effects of each Project corridor within the Strategic Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential transport effects (including any conditions/management plan required) for each Project corridor within the Strategic Assessment Package; and
d) Present an overall conclusion of the level of actual and potential transport effects for each Project corridor within the Strategic Assessment Package after recommended measures are implemented.

2.2 Report Structure

The report is structured as follows:

a) Overview of the methodology used to undertake the assessment and identification of the assessment criteria and any relevant standards or guidelines;
b) Description of each Project corridor and project features within the Strategic Assessment Package as it relates to transport;
c) Identification and description of the existing and likely future transport environment;
d) Description of the actual and potential positive effects of the Project;
e) Description of the actual and potential adverse transport effects of operation of the Project;
f) Description of the actual and potential adverse transport effects of construction of the Project;
g) Recommended measures to avoid, remedy or mitigate potential adverse transport effects; and
h) Overall conclusion of the level of potential adverse transport effects of the Project after recommended measures are implemented.

This report should be read alongside the AEE report, which contains further details on the history and context of the Project. The AEE report also contains a detailed description of works to be authorised for the Project, likely staging and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of transport effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

2.3 Preparation for this Report

In preparation for this report, several resources were used to support the assessment of transport effects. An indicative construction methodology has been provided by construction (summarised in the AEE), which was used to assess the actual and potential transport effects of the construction of each project. In terms of operational effects, the inputs used for modelling purposes are discussed in greater detail in the assessment methodology.

A series of Business Cases and public engagement have been undertaken over the past four years as part of a wider programme of transport initiatives needed to support the growth in this north-western part of Auckland. These include:

- Transport for Future Urban Growth Programme Business Case (2016), which initially identified the transport network components required to support growth in the North West.
- Whenuapai Structure Plan (2016), which identified the planned land use activities and spatial framework for future urban development in Whenuapai.
- North West Indicative Business Case (IBC) (2018), which identified the preferred package of transport network components required to support growth in the North west.
- North West Detailed Business Case (DBC) (2021), which refined the alignments / location of the preferred package of transport network components required to support growth in the North west.
- Spatial Land Use Strategy - North West (Kumeū-Huapai, Riverhead, Redhills North) (2021), which provided a high-level identification of locations for future centres and business land that will be supported by the transport network.

3 Assessment Methodology

Given the long-term nature of the designations being sought, this assessment does not assess the interim staging of individual projects and development staged over the next three decades. Instead, it places a greater focus on the 'full build out' of the future urban area in 2048+ (refer to section 3.1.1) to support future communities.

Therefore, this assessment focusses on the likely future environment (the transport modelling is based upon a full build out by 2048+) and other wider infrastructure upgrades anticipated by that time. These include the SH16 to SH18 Connections project and the North West Rapid Transit Corridor (NW RTC) Full Implementation (i.e. a RTC from the City Centre to a Brigham Creek station), which are being progressed separately to the Te Tupu Ngātahi NoR packages.

The transport response to the planned future urban growth, in combination with existing urban growth in the North west, is a combination of these various physical projects (refer to Figure 3-1), as well as other broader regional programmes (safety, active modes, public transport, including buses and ferries) that will be implemented over time. This will be supported by non-physical interventions such as travel demand management, education, enforcement and other such transport-related programmes undertaken by Waka Kotahi and AT over time in a staged manner.

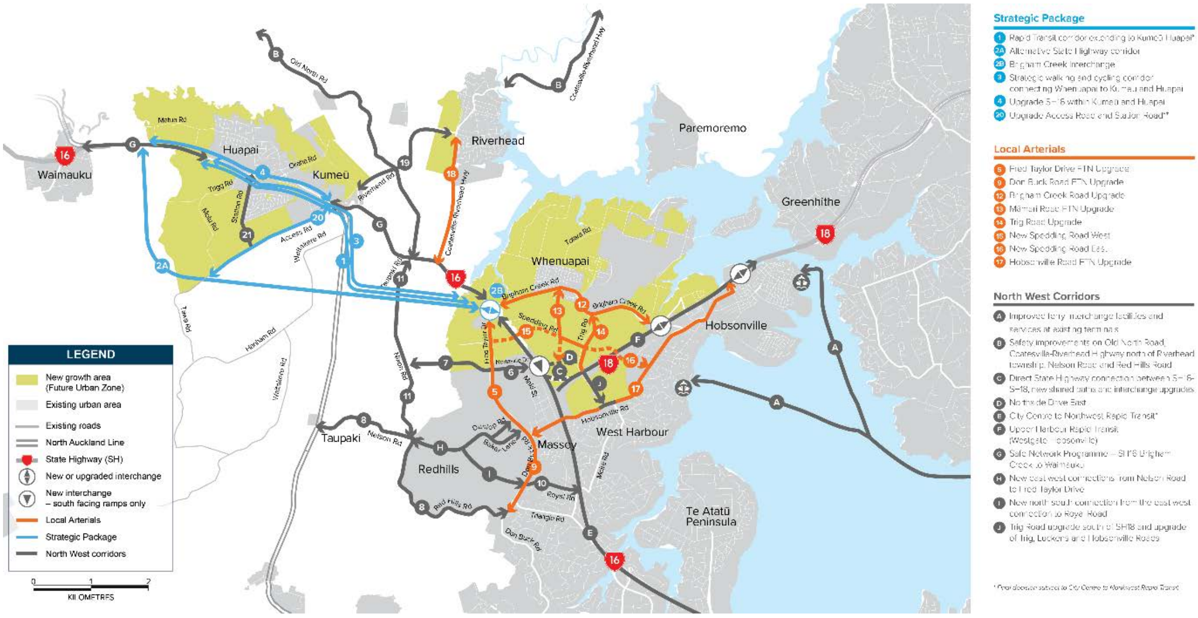


Figure 3-1: Overview of North west transport network projects

To ascertain the long-term effects of the projects, this assessment assesses the transport effects arising from each of the individual projects that comprise the Strategic Assessment Package in a future context. The approach considers that the other projects within the Strategic Assessment Package, as well as those projects being progressed separately to the Te Tupu Ngātahi NoR packages will also in place at that time. Where relevant commentary is provided relating to the potential effects of inter-relationships between these projects in the Strategic Assessment Package.

The methodology for the operational and temporary construction transport effects are applicable for each NoR specified within this document. Any NoR-specific nuances are specified throughout the assessment.

The Assessment of Transport Effects has two elements:

- Assessment of operational effects on the transport system, namely the affects when the facility is operational ·
- Assessment of temporary construction effects on the transport network, that is, impacts created by the construction of the project.

The construction effects typically have only a temporary, short-term duration, while operational affects are more long-lasting. In terms of this transportation package, many of those impacts on the transport system are deliberate and directly related to the purpose and objectives of the works.

This assessment is targeted at route protection, rather than imminent implementation. As such, the assessment:

- Makes greater use of generic cross-sections and design standards (rather than detailed designs)·
- Focuses more on desired outcomes and footprints
- Takes a longer-term view, noting that implementation may be staged over time
- Assumes more use of recommended management plans and planning processes rather than specific design details to manage potential effects.

A key element of the assessment is the definition of the 'existing / likely future environment', against which the effects are assessed. The proposed works are planned to support urban development and will be unlikely to occur without such development. Additionally, the source of the potential effects (such as people and vehicle movement), is generally (albeit not entirely) from that urban development itself, rather than from the planned infrastructure.

To isolate the effects of the planned works, the 'Existing Environment' includes the likely future urban development (and its associated transport demand), but does not include the planned projects for which designations are sought. The effects of the Projects are then the effects (positive or adverse) that result from the implementation of the project themselves.

Given the long-term perspective of the assessment, the analysis is based on the estimated 'full build out' for the future urban area. This is based on development yield estimates provided by Auckland Council, which in this case is based on scenario i11 (version 5) forecasts, extended to a full-build scenario in the greenfield growth areas.

3.1 Approach to Assessment of Operational Transport Effects

Potential operational transport effects are assessed using:

- Transport planning assessment of expected outcomes and effects
- Transport modelling to inform future demands and network performance
- Alignment with various policy documents.

An assessment of the positive effects of the Strategic Assessment Package of NoRs is provided at Section 4. In respect to each individual NoR a separate assessment has been undertaken that provides an assessment of the following and how each project contributes to the future network as a whole:

- Each mode of transport
- Access for existing properties
- Existing on-street and public parking.

This section will outline the methodology for these assessments.

3.1.1 Transport Modelling

Throughout the transport network analysis process, a range of different transport modelling tools have been used to undertake quantitative assessments of the transport system. These then inform decisions about planning transport network, corridors, and intersections.

The impacts of the Projects on the future transport environment are assessed using forecasting transport models, owned by the Auckland Forecasting Centre (AFC). The models include:

- The regional multi-modal transport model (the Macro Strategic Model (MSM)). This creates estimates of car, truck and public transport (PT) movements at a regional level based on land use, network and policy inputs. This model is the primary tool to estimate future PT usage. Generally, this model is run using regional assumptions as the per the most recent Auckland Transport Alignment Project (ATAP) planning, but with scenario-specific inputs in the growth areas.
- A local traffic model (SATURN). This uses the traffic demands from the regional MSM on a more detailed representation of the road network.
- A Strategic Active Mode[3] Model (SAMM) gives strategic-level estimates of walking and cycling demands.

The assessment of operational effects will therefore be informed by modelled estimates of travel and network performance for a future full-build-out scenario, i.e. the full-build out of the FUZ and other urban areas in the North West, based on the population and employment projections described below.

[3] walk/cycling

A SATURN (North West Area) and MSM (Regional) model with forecast year of '2048+' for the wider network was used. The '2048+' forecast includes the regional growth estimated for the year 2048, but with the addition of full build-out in the greenfield growth areas, which is currently anticipated at a time beyond 2048. The SATURN model uses the demand outputs from the regional MSM, which includes inputs of the latest land use provided by Auckland Council (in this case using scenario i11 (version 5)).

The modelling includes an overall network of infrastructure identified to support growth in the North West area. This means that the assessment assumes that all other North West Te Tupu Ngātahi Programme projects are implemented and the growth up to 2048+ will progress as planned. The approach and relevant transport projects assumed in the modelling are outlined in Appendix 1.

The regional MSM was used to inform assessment of the PT network components, such as the RTC and the associated rail stations within the Strategic Assessment Package. In addition to the SATURN modelling, SIDRA modelling has been undertaken to assess the operational outputs of key intersections along the project corridors. The SIDRA modelling takes the traffic movements identified in the SATURN model and provides a more detailed operational assessment of intersection performance.

In relation to the traffic modelling assessments, Level of service (LOS) metric are used throughout, and this refers to a qualitative measure used relating to the quality of motor vehicle traffic service. LOS is used to analyse roadways and intersections by categorising traffic flow and assigning quality levels of traffic based on performance measure ranging from A to F and can be summarised as follows:

- **LOS A: free flow**. Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes.
- **LOS B: reasonably free flow**. LOS A speeds are maintained, manoeuvrability within the traffic stream is slightly restricted. 31
- **LOS C: stable flow, at or near free flow.** Ability to manoeuvre through lanes is noticeably restricted and lane changes require more driver awareness.
- **LOS D: approaching unstable flow**. Speeds slightly decrease as traffic volume slightly increase. Freedom to manoeuvre within the traffic stream is much more limited and driver comfort levels decrease.
- **LOS E: unstable flow, operating at capacity**. Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to manoeuvre in the traffic stream and speeds rarely reach the posted limit.
- **LOS F: forced or breakdown flow.** Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity.

3.1.2 Transport Guidance and Documents

Assessment of the Projects against the relevant objectives and policies of the AUPOIP is contained in the AEE. Within this report, the Projects have also been considered against the outcomes and objectives of applicable transport design guidance and strategy / policy directives.

The following design guidance and planning documents are also relevant to all of the projects, including Access Road and SH16 Main Road Upgrades, as well as the ASH and BCI:

- Austroads Guide to Road Design (AGRD):
- Part 3: Geometric Design (2016).
- Part 4: Intersection & Crossings – General (2017).
- Part 4A: Unsignalised and Signalised Intersections (2017).
- Part 4B: Roundabouts (2015).
- Part 4C: Interchanges (2015).
- Austroads Guide to Traffic Management (AGTM):
- Part 6: Intersection, Interchanges and Crossings (2019).
- Auckland Unitary Plan Operative in part (updated 13 March 2020):
- Chapter E27 Transport, in relation to driveway access etc.

In addition to the documents applying to all project (as above), the following have been considered for the Access Road and SH16 Main Road Upgrades, the following:

- AT's Transport Design Manual (TDM), which sets out outcomes, engineering design and construction requirements for the Projects
- AT's Urban Street and Road Design Guide
- Engineering Design Code – Urban and Rural Roadway Design.
- Engineering Design Code – Cycling Infrastructure
- AT's Vision Zero, which adopts a "Safe System" approach to focus on road safety for all users
- AT's Roads and Streets Framework (RASF) was also used to qualitatively assess the typology (movement and place value) and modal priority for each corridor. A 'mandate' for each road corridor is developed and approved by the RASF Committee, comprising of senior officers from AT and AC.

In addition to the documents applying to all project (as above), in relation to the ASH and BCI, the following have been considered:

- State Highway Geometric Design Manual (SHGDM) Draft (2000):
- Traffic Control Devices (TCD) Manual:
- Part 10: Motorways and expressways, Section 2 Interchanges.

For the RTC, as this is currently being progressed as a bus-based design, the following sources of information have been considered:

- Waka Kotahi, Busway Planning and Design Manual (December 2002) by McCormick Rankin International.

3.1.3 Assessment Methodology – Transport Mode

Table 3-1 summarises how each mode/element of transport has been assessed in terms of operational effects as a result of the Projects.

Table 3-1: Summary of Assessment Methodology

Network Component	Information Source	Assessment Method
Safety	Crash Analysis System (CAS) Database Project design drawings	Assessment to determine alignment with Vision Zero standards and design compliance with Transport Design Manual.
Walking and Cycling	Walking and Cycling Network Plans Proposed Cross Sections	Assessment to determine alignment with walking and cycling strategic documents and design compliance with Transport Design Manual.
Public Transport	Transport Model tools (MSM, SATURN and SIDRA) Te Tupu Ngātahi Remix File[4]	Assessment to determine alignment with future network provisions and design compliance with the Transport Design Manual.
General Traffic	Transport Model tools (MSM, SATURN and SIDRA) Project design drawings	Assessment using key model outputs including traffic volumes, levels of service for corridor midblock performance and intersection performance. Assessment of surrounding network connections.
Access	Engineering Standards	Assessment identifying where there is a potential effect on access in the existing environment.
On-street and public parking	Regional Parking Strategy and associated policies Engineering Standards	Assessment identifying where there is a potential effect on parking provision, including in terms of providing parking to required standard in the existing environment.
Note: A Road Safety Audit and Safe System Assessment will be done as part of the implementation business case/detailed design stage prior to implementation.		

[4] Te Tupu Ngātahi Remix file provided by Auckland Transport on the draft plan of the bus network to be implemented by 2048

3.1.4 Assessment of Project Objectives

Each project included in the Strategic Assessment Package has an identified set of project objectives. From a transport perspective, these objectives are focused predominantly on the themes of supporting growth, safety, urban form, mode shift/choice and connectivity. The assessment of these, and how they align with the Project Objectives are included in the AEE.

3.2 Approach to Assessment of Construction Effects

3.2.1 Construction Traffic Effects

In order to assess the potential construction traffic effects, an indicative construction methodology has been prepared. This can be found in the AEE.

Based on the indicative construction methodology an assessment of construction effects has been completed for the Package sufficient to support each of the NoRs. This assessment will consider:

- An overview of key considerations including speed, potential impacts to pedestrians and cyclists, residential, recreational and business property access, and on-street / public parking
- Identification of any works that should not occur at the same time
- Assessment of potential conflict areas that will need specific mitigation within a CTMP and / or SSTMP.

The project specific construction effects will be managed via a CTMP and/or Site-Specific Traffic Management Plans, which will be developed immediately prior to implementation when the greatest certainty is available.

3.2.2 Temporary Traffic Management

The impact of any temporary traffic management measures implemented to undertake the Projects will be re-assessed in the future, prior to construction, when a greater level of detail is available in terms of the specific construction methodology and traffic environment.

It is noted that there may be some nuances between projects delivered 'online' (NoR S2, NoR S3 (in part), NoR S4) and those delivered 'offline' (NoR S1, NoR S3 (in part), NoR KS, NoR HS). In particular, any future assessment should be required to consider potential road closures, any capacity reductions on key corridors through lane closures, and any other ancillary effects such as shoulder closures.

4 Strategic Assessment Package Overview

An overview of the Strategic Assessment Package is provided in Figure 4-1, with a brief summary of the Strategic Assessment Package projects provided in Table 4-1.

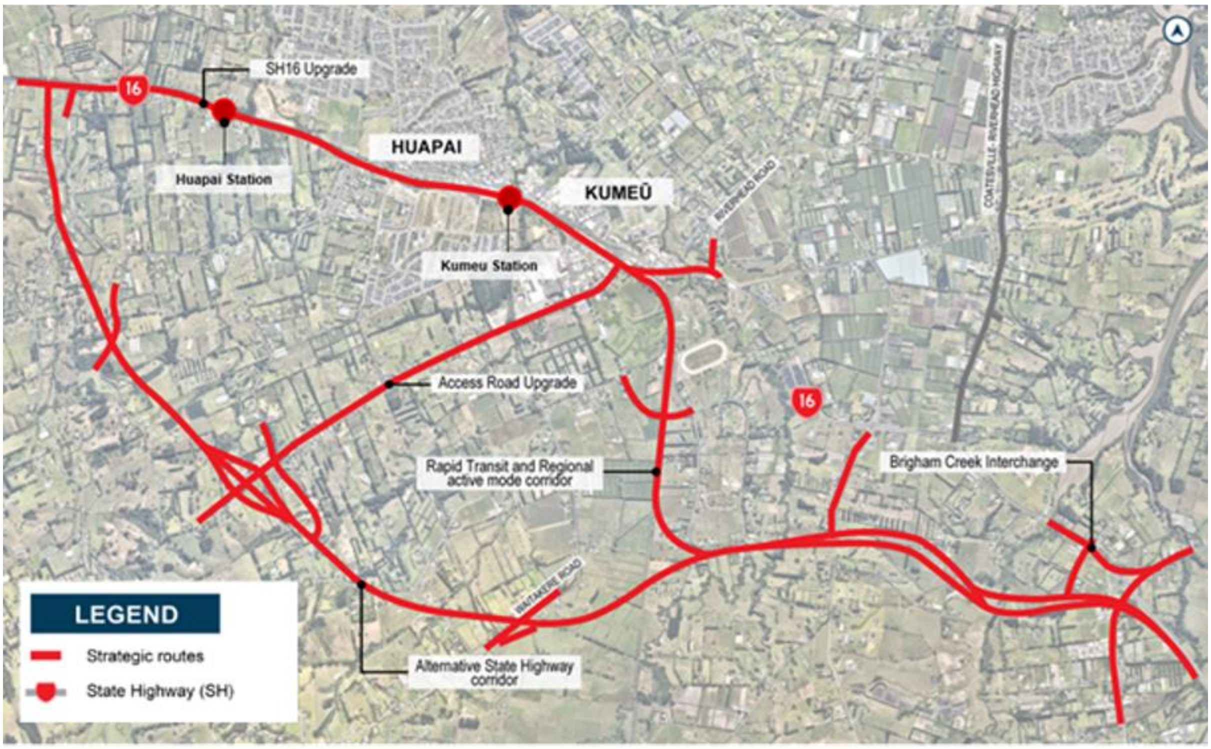


Figure 4-1: North West Strategic Assessment Package – overview of NoRs for assessment

Table 4-1: Strategic Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Alternative State Highway (ASH)	S1	A new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange.	Waka Kotahi
SH16 Main Road	S2	Upgrade to urban corridor including active modes and realignment of Station Road intersection with SH16.	Waka Kotahi
Rapid Transit Corridor	S3	New RTC and active mode corridor in one co-located corridor.	Waka Kotahi
Kumeū RTC Station	KS	New rapid transit station, including transport interchange facilities and accessway.	Waka Kotahi
Huapai RTC Station	HS	New rapid transit station, including transport interchange facilities, park and ride and accessway.	Waka Kotahi
Access Road	S4	Upgrade of Access Road to a four-lane cross-section with separated cycle lanes and footpaths on both sides of the corridor.	Auckland Transport

The AEE provides further information on these projects, including a project description, key project features and the planning context.

The six NoRs identified in this Strategic Assessment Package contribute to providing a comprehensive transport solution for the North west growth areas that deliver:

- A safe, reliable transport system that supports North West growth and urbanisation.
- A transport network that supports the planned future growth, including facilitating mode shift from private vehicles to public transport and active modes.
- Improved access by all transport modes to employment and social amenities.
- RTC stations in Kumeū and Huapai that support intensification of adjacent land uses, particularly transit oriented development and high density housing, including the opportunity to maximise walk-up catchments for future RTC stations on the RTC corridor.
- Separation of the strategic trips from the local trips to support better placemaking in urbanised centres, such as Kumeū and Huapai, by getting the "right trips using the right corridors".
- Provide more reliable and efficient freight connections that avoid the urbanised centres.
- Increased resilience through new strategic corridors and urbanised alternative routes to improve safety on the North West rural roads.
- An area-wide focus on safety through a holistic set of measures including Road to Zero safety principles, shifting modes from private vehicles, fully separated cycling facilities, well designed intersections and sufficient space for all modes to interact safely.

The outcomes achieved by the projects identified in the Strategic Assessment Package include:

- A high quality, fast and reliable RTC connecting Kumeū-Huapai to Westgate, Whenuapai and the city centre, including the Kumeū and Huapai RTC stations that will support intensification of adjacent land uses and maximise walk-up catchments.
- The ASH that will remove strategic trips from within Kumeū-Huapai. This will improve amenity and access to the Kumeū town centre, support the implementation of the RTC and provide direct and efficient heavy vehicle access from the state highway to the future industrial area via Access Road.
- A reliable bus infrastructure network that connects both existing and new land uses to key destinations and RTC stations, along SH16 Main Road. It will support both collector and local bus services and provision for intersection bus priority at key locations in the network.
- Upgraded walking and cycling facilities to improve safety, attractiveness and connectivity within and between areas. This includes the RAMC adjacent to the RTC, and a strategic facility alongside the ASH, which both support separated, uninterrupted and higher speed cycling and micro-mobility. In addition, separated cycle lanes are provided on the SH16 Main Road and Access Road urban corridors.

The North West DBC identified that the combination of the Strategic Assessment Package and the other North west NoR packages would be predicted to result in outcomes in Figure 4-2:

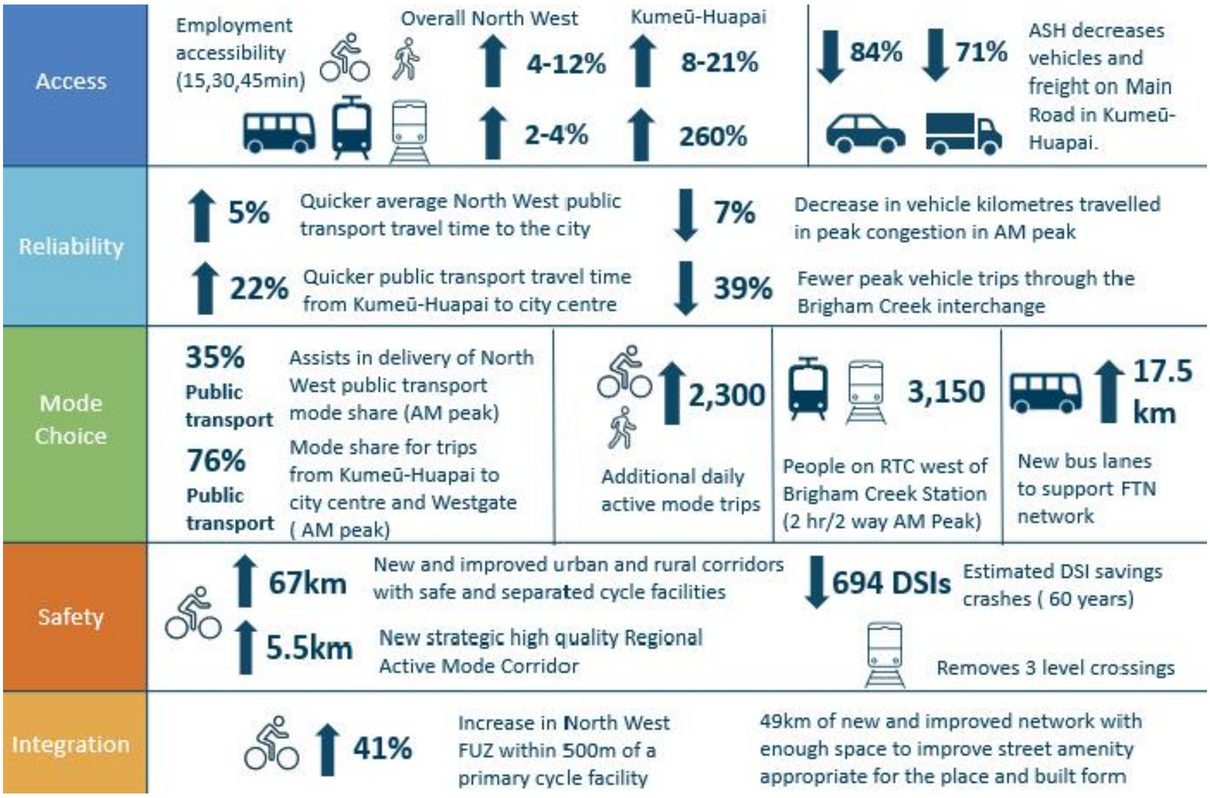


Figure 4-2: Transport network outcomes

5 NoR S1: Alternative State Highway

5.1 Project Corridor Features

The ASH extends from (and includes) the future BCI (north of Westgate) to a proposed new intersection with SH16 near Foster Road, between Huapai and Waimauku. This proposed state highway corridor will be approximately 11km long, travelling westward across rural farmlands and countryside living to the southwestern side of Kumeū and Huapai, with an additional interchange proposed at Tawa Road.

An overview of the proposed ASH (and BCI) design is provided in Figure 5-1.

Figure 5-1: Overview of the Alternative State Highway, including Brigham Creek Interchange

The proposed BCI is located in Redhills North, which is zoned FUZ. The interchange is the eastern connection of the ASH and has inter-relationships in terms of the transport and design of connections with the RTC / RAMC project, whilst also facilitating connection to Fred Taylor Drive and Brigham Creek Road. The proposed BCI currently sits within FUZ land and existing state highway designation. The existing SH16 / Fred Taylor Drive / Brigham Creek Road Roundabout will be replaced by a fully grade separated interchange with separate sets of east-facing and west-facing ramps (see Figure 5-2 below).

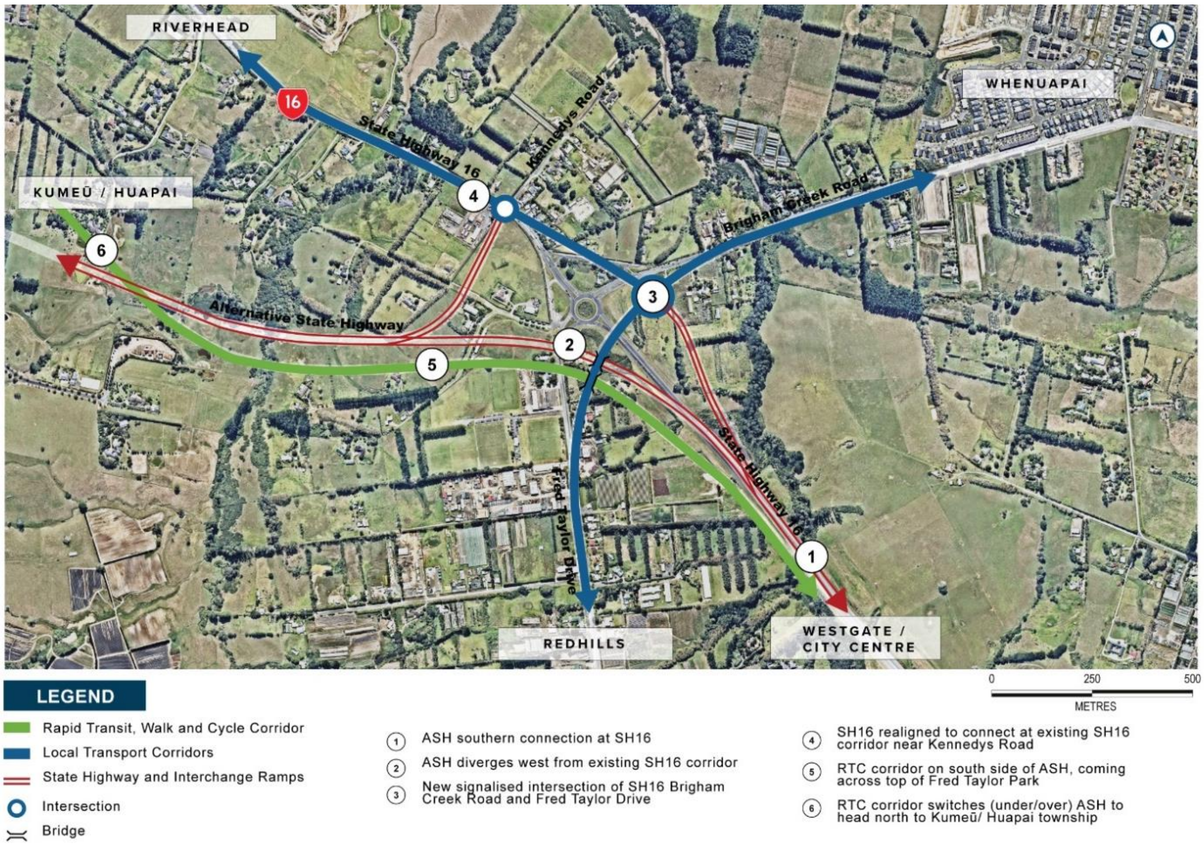


Figure 5-2: Indicative Brigham Creek Interchange arrangement

As part of the Waka Kotahi SH16 to SH18 Connections Project (not a Te Tupu Ngātahi project), SH16 (south of Brigham Creek Interchange) is expected to be widened to accommodate an extra lane in each direction. The North West RTC Full Implementation project will comprise a new City Centre to Westgate RTC and active mode facility, most likely on the southern side of SH16. The ASH / BCI project will tie in to the SH16 to SH18 Connections and North West RTC Full Implementation projects.

At the ASH interface with Tawa Road, a new grade separated interchange is proposed with both east and west facing ramps on the ASH. This will require the realignment of Pomona Road to tie into a new intersection with Motu Road (see Figure 5-3 below).

At the western termination of the ASH, there will be a new intersection on SH16, approximately 80m to the west of Foster Road. This is illustrated on Figure 5-4 below. Access between Foster Road and SH16 will be retained, but due to the proximity to the SH16 / ASH intersection, there may be restricted vehicle movements.

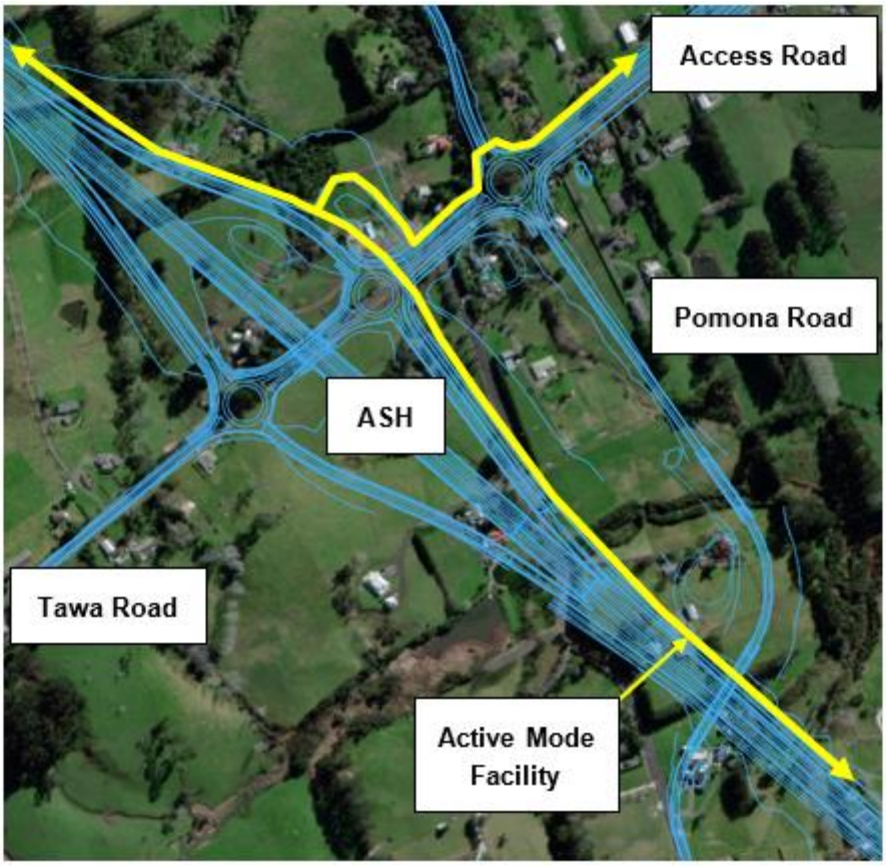


Figure 5-3: Tawa Road Interchange Overview

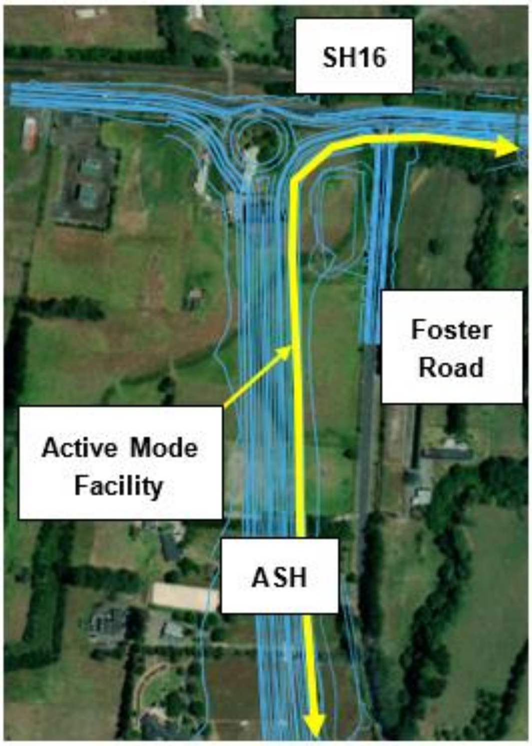


Figure 5-4: SH16 / ASH Intersection Overview

5.2 Network and Corridor Design

The Project was developed as part of network planning for the wider North West area. The wider networks were developed through the Business Case process that considered the key problems, benefits, outcomes and range of options to address the identified problems. As such, the Project is part of a wider long-term integrated network planned for the area.

The Project proposes the construction of a new four-lane state highway corridor with a cross-section of approximately 50m to accommodate a dual carriageway and separated cycle facility and footpaths. The eastern segment is adjacent to the RTC / RAMC, between the BCI and the NAL, so on this segment the RAMC provides the separated cycle facility. Once the RTC / RAMC proceed north, adjacent to the NAL, then a cycle facility continues along the ASH.

The development of the strategic corridor design and its interfaces with the local road network has included the use of the relevant transport guidance and documents, as described in Section 0. Key aspects of the network and corridor design are summarised below.

The form and function for the ASH is illustrated in Figure 5-5 and Table 5-1 below. The typical cross section includes an active mode corridor with central and side barriers (See Figure 5-6 to Figure 5-8 below). The allocation of the proposed four lanes on ASH will be decided upon implementation, but the additional capacity could also be used for managed lanes or interim public transport facilities.

Figure 5-5: Indicative Alternative State Highway alignment

Table 5-1: Alternative State Highway – form and function

Segment Number	Comments
Brigham Creek Connection	• Grade separated interchange. • Separating higher speed state highway trips from local trips, including active modes and public transport. • Grade separation of state highway from Rapid Transit Corridor and Regional Active Modes Corridor. • Supporting safe access to residential and employment opportunities in Whenuapai and Redhills North growth areas.
Brigham Creek to North Auckland Line **North Auckland Line to Tawa Road**	• The design consists of a 4-lane dual carriageway with central and side barrier systems. • All local roads will be grade separated. • Under the ONRC Class 1 with no direct access and grade separation at all local roads / intersections, Safe and Appropriate Speed is 110 km/hr. • No at-grade access.
Tawa Road Connection	• Grade separated interchange • Separating higher speed state highway trips from local trips, including active modes • Grade separation of state highway from Rapid Transit Corridor and Regional Active Modes Corridor. • Supporting safe access to current and future employment growth along Access Road, as well as residential growth in the Kumeū and Huapai areas.
Tawa Road to SH16 existing	• Design consists of a 4-lane dual carriageway with central barrier systems and side barrier systems. • Opportunity for a 2-lane ‘expressway’ option for this section in the medium term to be investigated further. • Safe and Appropriate Speed is 110 km/hr. • No at-grade access.
State Highway 16 Main Road Connection	• Dual lane roundabout. • Transition from rural state highway to future Huapai urban environment • Supporting safe access to residential growth opportunities in Huapai growth area.

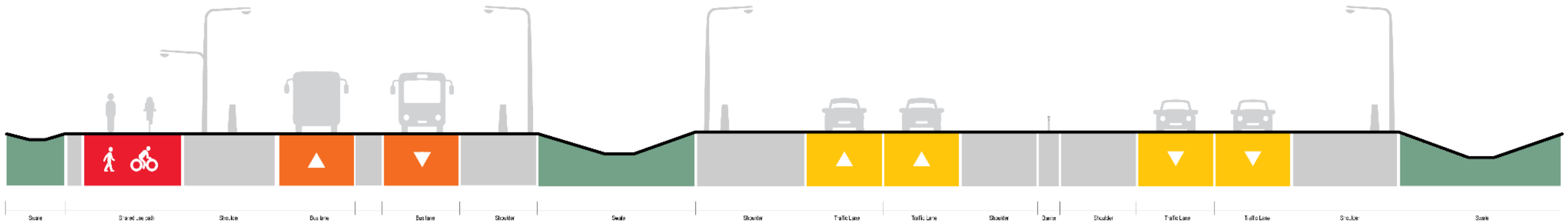


Figure 5-6: Indicative Alternative State Highway cross sections – West of Brigham Creek Interchange

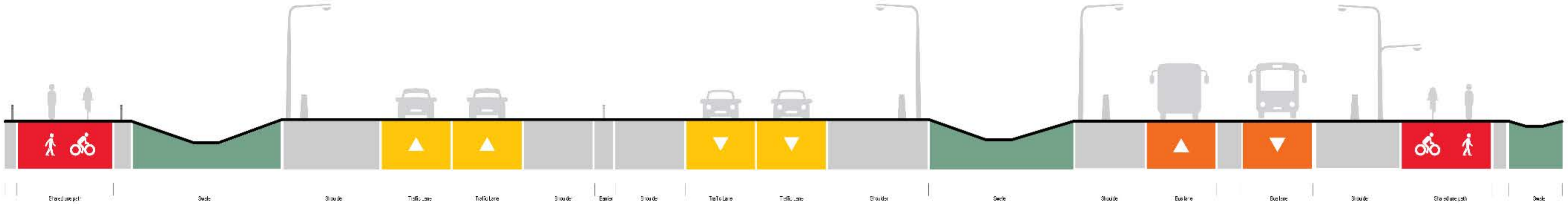


Figure 5-7: Indicative Alternative State Highway cross sections – West of Taupaki Road

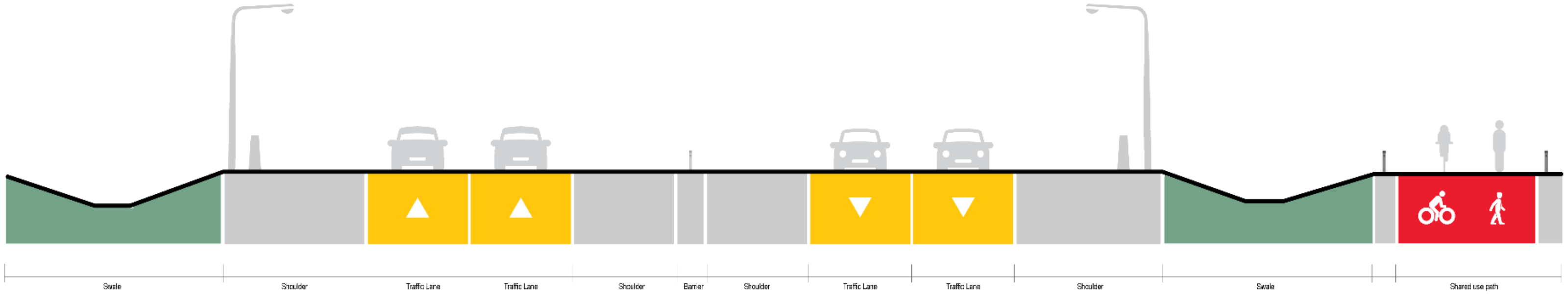


Figure 5-8: Indicative Alternative State Highway cross sections – West of North Auckland Line

In relation to the BCI, the form and function has been subject to extensive discussion with Waka Kotahi and Auckland Transport as part of the optioneering for the North West DBC. The identified form and location of the interchange has been selected for the following transport reasons:

- **BCI Form** – The purpose of the BCI is to provide reliable access and an efficient interface between the strategic and local network, as well as improved and safer access for active modes through the interchange. This has been achieved by:
  - Grade separation of the local and strategic people movement on the local and strategic corridors, enabling good quality people movement
  - Providing lower exposure / improved safety for active modes with fewer intersections and grade separation
  - Supporting mode shift for local trips between growth areas by enabling active mode and local PT connections in an efficient manner through the interchange.
- **Existing SH16 Integration** – Brigham Creek roundabout is the current termination of the North Western motorway. Connection at this location integrates with the existing state highway and makes best use of the existing motorway infrastructure.
- **SH16 / SH18 Connections Integration** – The SH16 / SH18 Connections project identified an interchange upgrade at Brigham Creek roundabout and the location provides an appropriate separation of some 1.3km from the Northside Drive Interchange east facing ramps.
- **North West Local DBC Integration** – The North West Local DBC recommended a new local arterial connection between Redhills / Westgate and Whenuapai at Spedding Road West. The separation of the Brigham Creek and Northside Drive also facilitates the provision of this local connection between these areas.
- **Strategic connections for Westgate and Whenuapai** – The overall transport demand in Westgate, Redhills and Whenuapai indicates that, in addition to the transport choices that are being provided, there is still demand to require two pairs of east-facing ramps at both the Northside Drive and Brigham Creek Interchanges.
- **Impact on Redhills / Whenuapai Urban Area** – The Brigham Creek Interchange is an important strategic connection for the Riverhead community. Around 25,000 vehicles per day are predicted to occur on the existing SH16 in the future, even with the ASH, primarily associated with Riverhead and the broader Coatesville-Riverhead Highway catchment. The location of the Brigham Creek Interchange minimises the need for these trips to pass through the Redhills / Whenuapai / Westgate urban area.

In relation to the Tawa Road Interchange, the North West DBC considered the form of the connection and identified the provision of a grade separated diamond interchange. The interchange form provides greater reliability for vehicles using the ASH and also separates strategic and local trips, including active mode trips along Tawa Road and the ASH.

The form and footprint identified provides for east and west facing ramps to enable access to the employment areas along Access Road. This enables trips from further west to avoid using other local roads from SH16. The form of the interchange includes facilities for active modes to provide connection between the Access Road Upgrade and the shared path along the northern side of the ASH. The shared path is currently proposed to pass under Access Road to the north of the eastbound ramps roundabout providing continuity of the shared path and avoiding conflicts with vehicle movements at the interchange.

5.3 Existing and Likely Future Environment

5.3.1 Planning context

The ASH corridor, including the interchanges / connection points, is largely rural and is proposed to traverse land zoned under the AUPOP as Rural – Countryside Living Zone, Rural – Mixed Rural Zone and Rural – Rural Production Zones.

The ASH corridor will also traverse two separate areas of FUZ in Redhills North and Kumeū-Huapai with the BCI also sitting within Redhills North and Whenuapai FUZ land and the existing Brigham Creek Interchange. Table 5-2 provides a summary of the existing and likely future environment as it relates to the ASH and BCI.

Table 5-2: Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[5]	Likely Future Environment[6]
Rural	Rural - Mixed Rural Zone, Rural - Countryside Living Zone Rural - Production Zone	Low	Rural
Undeveloped greenfield areas	Future Urban	**High**	Urban

5.3.2 Transport Environment

5.3.2.1 Existing

Currently, the SH16 corridor is the only existing strategic corridor that connects Kumeū, Huapai, Riverhead and the broader North West rural area to the metropolitan centre at Westgate and rest of the region beyond. This corridor is already congested, in both weekday commuter peak and other periods, as well as at weekends and during the summer period, due to its current capacity and lack of resilience, which results from the interactions at existing intersections and direct driveway access.

Waka Kotahi is separately progressing the SH16 Improvements project, which will provide investment to address existing safety and capacity issues along the corridor. This includes both safety and capacity improvements between the existing Brigham Creek roundabout and Taupaki Road, including provision of two traffic lanes in each direction, a new roundabout at the Coatesville-Riverhead Highway intersection, and safety upgrades along this section. To the west of Huapai, through to Waimauku, further safety improvements will soon be implemented.

[5] Based on AUP:OP zoning/policy direction
[6] Based on AUP:OP zoning/policy direction

The current lack of capacity of SH16, means that existing rural roads are currently used as alternatives, particularly during the periods of congestion on SH16, as these rural roads can provide a quicker and more attractive option. However, many of these higher speed roads are not suited to the current volumes of traffic using these corridors and this also leads to safety issues.

Whilst the SH16 Improvements project will address some of the interim capacity and safety issues, it will not be able to support the longer-term growth with the development of the FUZ in Kumeū, Huapai and Riverhead.

The SH16 Improvements project does not include any upgrade to the existing Brigham Creek roundabout. The roundabout has current capacity and resilience issues, particularly when incidents / crashes occur at this location, which adversely affect the surrounding local and strategic network. As discussed previously, this roundabout has previously been identified through the SH16 to SH18 Connections project for a future grade separated interchange.

5.3.2.2 Likely Future

Based on the Auckland Council Future Land Supply Strategy (FULSS), the future urban growth areas in Kumeū -Huapai and Riverhead are programmed to be released for urban development between 2028 and 2032. The planned growth in Kumeū-Huapai is expected to include 10,700 dwellings with an estimated population 24,700 by full build out – a significant increase on the existing population of 1,200 (in 2016). In addition, the number of employment opportunities in Kumeū-Huapai is expected to increase by approximately 3,300 jobs over the same period.

Travel patterns are largely expected to remain similar, however, the employment growth in Westgate and Whenuapai are expected to significantly increase – resulting in a potentially much higher level of demand within the North West to access jobs. The trip demands of all Kumeū-Huapai urban trips in the morning peak in 2048+ show that approximately 37% stay in the area. Both the ASH and the RTC / RAMC will therefore provide an important strategic role in connecting Kumeū-Huapai with those employments opportunities and broader opportunities within the metropolitan centre at Westgate.

Structure planning is not yet complete in Kumeū-Huapai, Riverhead and Redhills North and is not expected to start until closer to land release, which is beyond 2028. This results in less land use certainty for these areas, but also provides significant opportunities to use transport to shape placemaking. In the absence of Structure Plans and to ensure the future land use and transport networks work together to support growth, Auckland Council prepared a Spatial Land Use Strategy in 2020, which was adopted in May 2021.

The Strategy is a starting point for future structure plans and identifies potential locations for future centres and business land on FUZ land in Kumeū-Huapai, Riverhead and Redhills North and is shown in Figure 5-9 below. This is an iterative process and is expected to be revisited as strategy, policy and infrastructure planning progresses.

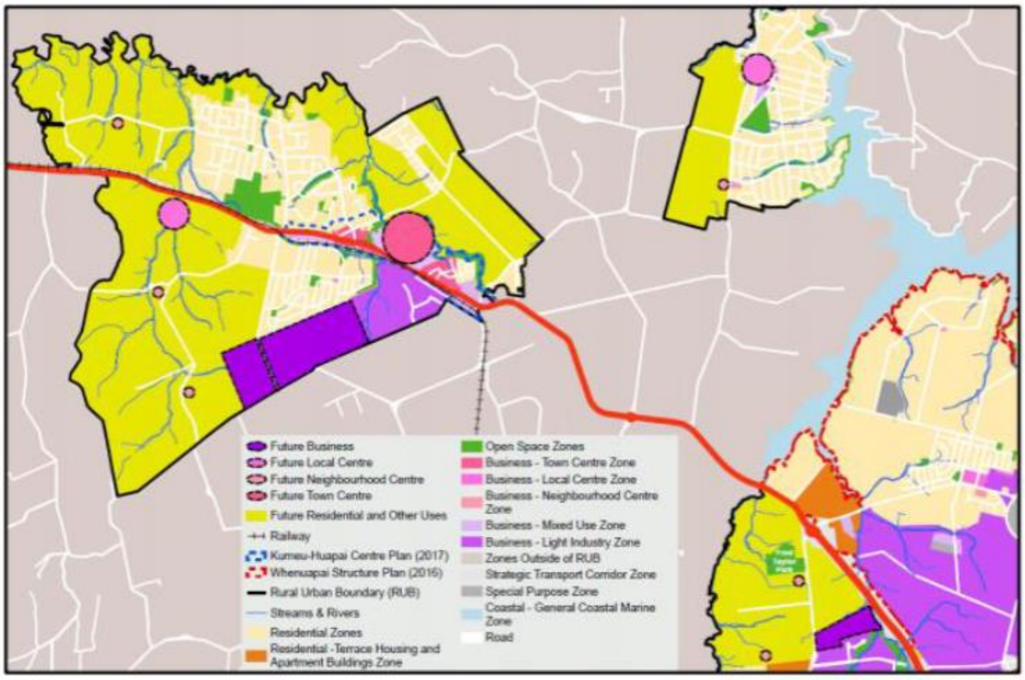


Figure 5-9: Auckland Council North West Spatial Land Use Strategy (May 2021)

5.4 Assessment of Operational Transport Effects

Overall, the key features and outcomes of the ASH, BCI and the associated connections to the local road network along the corridor include the following:

- The ASH enables the relocation of strategic trips, including freight trips, from the Kumeū town centre and through Kumeū-Huapai, improving local access options.
- The reduction in strategic trips and local trips along the existing SH16 Main Road corridor through Kumeū-Huapai will support implementation of the RTC and SH16 Main Road Upgrade. Depending on the implementation timing of the RTC and SH16 Main Road Upgrade, relative to further urban growth occurring in Kumeū-Huapai, the implementation of the ASH may be necessary in advance of those projects to manage potential adverse effects on the urban areas, which can be satisfactorily addressed at the implementation stage.
- The ASH will provide a second strategic transport corridor into Kumeū-Huapai improving reliability. It would allow freight to access existing and future industrial areas directly from the Tawa interchange, via Access Road, without having to traverse urban areas.
- The ASH will provide a route to remove strategic trips from unsuitable parallel rural roads.
- Provision of active modes on the ASH corridor, in combination with the RAMC, will provide safe alternative strategic cycling access.
- The ASH will support placemaking opportunities in Kumeū-Huapai townships by removing freight and other inter-regional trips from existing SH16 and enabling reallocation of space for walking and cycling.
- The ASH provides strategic connections to the FUZ areas in Kumeū-Huapai, where the majority of future growth will occur, while alleviating demand on the existing SH16 corridor to support the future growth of Riverhead.

- The strategic connections with the local road network focus on the main areas of future urban growth, whilst connections with the remainder of the local road network are grade separated to ensure local access on those corridors is retained.
- The ASH is part of collective strategic transport solution (including RTC / RAMC and SH16 Main Road upgrade). The role of the ASH is to remove strategic trips (including freight) from Kumeū-Huapai to allow existing SH16 to be downgraded to an arterial in the long-term to better support the operation of the RTC and encouraging walk-up and cycle-up catchment at stations.

As part of the North West network, the ASH project is expected to achieve:

- Improvement in accessibility to employment with the proportion of employment accessible by active modes increasing , such that within 15 minutes there is a 51% increase, in 30 minutes there is a 23% increase and in 45 minutes the increase is 8%, in the number of jobs accessible.
- The travel time for vehicles travelling between Brigham Creek to Waimauku improves in each of the weekday peak periods. In the AM peak, the travel time reduces by 46 minutes, in the inter peak there is a 12 minute reduction and in the PM peak there is 22 minute reduction.
- A predicted reduction in the future traffic volume on SH16 Main Road by 84% for general traffic and 71% for freight traffic.

5.4.1 Road Safety

The design of the Project has been undertaken with consideration of the latest safety guidance. This includes AT's Vision Zero and Waka Kotahi's Road to Zero. The entire length of the ASH has been designed to be a 5 star KiwiRAP dual-lane carriageway. There are several features that result in this rating such as the relatively straight alignment with good line marking, wide lanes, sealed shoulders, safe roadsides (central and side barrier systems) and occasional grade separated intersections.

The ASH is expected to result in positive effects on safety when compared to the existing network given the new corridor will be designed to current standards with minimal intersections. It will also result in a reduction in traffic through Kumeū-Huapai urban area improving safety and minimising severance. This creates a better urban outcome as the corridor carries more active mode and PT trips compared to vehicle trips. Therefore, creating a safer, more accessible environment for people using the corridor to access the growth along Main Road.

It is anticipated that the number of pedestrians and cyclists will increase significantly as the area surrounding Kumeū-Huapai, as well as the North West area in general, is developed. Given, the significant reduction in general and freight traffic, the exposure between motorists and vulnerable road users is anticipated to reduce.

Overall, the proposed design of the Project is well aligned with the transport safety principles from AT and Waka Kotahi. It will provide a much safer transport system which will likely reduce the number of Death and Serious Injury (**DSI**) crashes and result in positive effects for all road users. It is noted that the detailed design will be completed in the future to further detail measures to achieve the anticipated safety outcomes.

5.4.2 Walking and Cycling

The Project proposes a separated shared path for walking and cycling facility along the length of the ASH, provided by the RAMC between BCI and the NAL, enabling recreational opportunities by extending the network facilities for these modes. If the ASH were to be progressed in advance of the RAMC, then there is sufficient designation to facilitate an interim cycle facility between the BCI and the NAL, until this is later replaced by the RAMC in this segment.

Local connection points have been included in the ASH and RAMC, which connect with the expected future adjacent facilities at Brigham Creek Road / Fred Taylor Drive, Taupaki Road, Waitakere Road, Tawa Road and SH16 Main Road. The specific design of these connecting facilities will be developed further at detailed design prior to implementation. At the BCI and Tawa Interchange, the design provides for grade separation of the strategic cycle facility meaning there is a more reliable facility that will not need to interact with local movements to traverse the interchanges.

The proposed walking and cycling facilities along the corridor have been designed in accordance with relevant Waka Kotahi standards and policies discussed in Section 0. The exact provision of walking and cycling crossing facilities will be confirmed at the detailed design stage and will be guided the same or future equivalent documents.

The Project will have a number of significant positive effects on walking and cycling as it will:

- Significantly reduce the likelihood and exposure to potential crashes, as it will provide a new separated facility and enable safe movement for vulnerable road users through the area.
- Improve integration with the future walking and cycling network, resulting in improved east-west walking and cycling connectivity.
- Lead to environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
- Serve as a key enabler for greater use of active transport modes by providing a safe connector route between Kumeū-Huapai and Westgate.

5.4.3 Public Transport

No dedicated public transport facilities are currently proposed on the new corridor, with the intent of this corridor being to enable the opportunity for sustainable modes of travel on SH16 Main Road and other urban roads. The ASH will reduce the vehicle volumes on SH16 Main Road through Kumeū-Huapai, which will create a more urban corridor which can carry more active mode and PT trips.

It is also noted that the BCI upgrade will help provide opportunity for better PT reliability through the interchange with the proposed form of the interchange intended to minimise the interaction of key local PT services with strategic movements accessing SH16. This will benefit all modes of travel including public transport.

The allocation of the proposed four lanes on ASH will be decided upon implementation, but the additional capacity could also provide the opportunity for managed lanes or interim public transport facilities in advance of the RTC / RAMC project being implemented, if necessary.

5.4.4 General Traffic

A key function of the ASH is to provide an alternative strategic route for longer distance regional and sub-regional connections. This will reduce traffic along Main Road (SH16) providing an opportunity to support growth and improve land use integration in the Kumeū-Huapai town centre, as well as support the RTC, improve freight reliability, and improve resilience of the strategic network.

The ASH has been designed to accommodate the large traffic volumes expected along the corridor. Accordingly, there is enough capacity provided through the number of lanes to minimise congestion during the peak periods.

The ASH will consist of a dual-lane carriageway with central and side barrier systems. There will be no direct access onto the ASH from adjacent properties and the only vehicle connections will be the BCI, Tawa Road Interchange and the intersection at the termination point with SH16. As such, the ASH will be a more appropriate corridor in terms of the efficiency and reliability for inter-regional trips, as well as intra-regional to locations such as Waimauku and Hellensville. It will also address the existing situation in terms of reducing the reliance on existing unsuitable rural roads to accommodate future traffic demand, which are not designed for those volumes of traffic and will also lead to safety issues.

The intersections and interchanges along the ASH corridor have been assessed and shown to provide sufficient capacity to accommodate the anticipated future traffic demands with the growth in the existing and future urban areas in the longer-term. The traffic modelling results for the intersections associated with the ASH are provided in Appendix 2. There is the potential that upon completion of the corridor, there could initially be upstream or downstream delays at some locations, due to the improved operation along this route. However, it is expected that the overall traffic patterns would soon stabilise, as people adjusted their journeys to the overall network conditions.

5.4.5 Freight

The improved corridor capacity as a result of a new separated corridor designed for movement will result in improved journey times and reliability for existing and future freight. The corridor will be able to better accommodate freight movements with minimal interfaces with the local network, other than at key locations, improving freight reliability.

The ability of the ASH to accommodate local, inter- and intra-regional freight trips, with connection via the Access Road Upgrade to the future employment area in Kumeū-Huapai will reduce the freight using SH16 Main Road and other local roads. This will support growth and improve land use integration in Kumeū-Huapai, particularly along SH16 Main Road, near the future town and local centres.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the realisation/ implementation of individual corridor upgrades in the future.

5.4.6 Access and Parking

The dual carriageway corridor will have no direct property access. Existing properties will therefore continue to be provided access from local roads, where they do not form part of the proposed designation.

It is noted that the design of the ASH has maintained access along all existing local roads along the route via grade separation of the ASH and local road corridors, plus in some cases, permanent realignment of those local roads (such as Pomona Road).

In terms of existing property access, the overarching design philosophy for the Project has been to maintain driveway access, where practicable, either re-grading existing access or relocating the driveway access. However, in some circumstances (as discussed below), it has been necessary to provide access to via new private roads.

The key areas where effects on property access have been identified are:

- In the vicinity of the intersections and interchanges between the ASH and local roads.
- Along the ASH corridor, where large rural lots are separated from existing road corridors.

Table 5-3 summarises the potential adverse effects on properties / activities along the ASH Corridor during the operational phase. Similar adverse effects would also occur and require mitigation during the construction phase through the CTMP. Where adverse effects are only expected during the construction phase, these are separately addressed in Section 9.

Table 5-3: ASH Project – Potential Adverse Transport Effects on Access – Operational Phase

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
Adverse impacts on property access driveway	✓	16 Brigham Creek Rd (entirely within designation for construction only, but new driveway required for operational phase) 15 and 21 Brigham Creek Rd 171 SH16 218A-220 SH16 143 Fred Taylor Drive 176, 178, 180, 182 Fred Taylor Drive 375, 377 Taupaki Rd 384, 400 Taupaki Rd 691 Waitakere Rd (north of ASH) 191 Pomona Rd (driveway access can be	Re-grade existing or re-form new driveway access off public road for identified properties

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
		provided with adequate space to bridge structure and adequate sightlines) 83 Tawa Rd (new driveway access can be provided through the designation off Tawa Rd) 86 Tawa Rd (new driveway access can be provided through the designation off Motu Rd) 137 Tawa Rd 37, 41, 47, 69 Puke Rd 185 Trigg Rd (off Puke Rd) 78 Puke Rd (driveway access can be provided through the designation) 726 SH16	
Existing private access road or driveway will no longer be viable	✓	2, 4, 6, 8 Brigham Creek Rd (connection to new driveway for 171 SH16) 208 and 210 Fred Taylor Dr (new access road can be provided through the designation) 184 (Fred Taylor Park) (new access road can be provided through the designation off Fred Taylor Dr) 196, 198, 200 Fred Taylor Drive (new access road can be provided through the designation off Fred Taylor Dr) 660, 670, 682 Waitakere Rd (new access road can be provided through the designation off Waitakere Rd)	Utilise alternative private access or construct new private access road or driveway for identified properties

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
		679 and 691 Waitakere Rd (new access road can be provided through the designation off Waitakere Rd) 144, 138 and 130 Pomona Rd (new access road can be provided through the designation off Pomona Rd) 28, 48, 66 and 68 Pomona Rd (new access road can be provided through the designation off Pomona Rd) 121A, 121B, 121C and 123 Pomona Rd (new access road can be provided through the designation off Pomona Rd) 150 and 164 Motu Rd (new access road can be provided through the designation off Motu Rd) 122 Tawa Rd (new access road can be provided through the designation off Motu Rd) 727 SH16 (new access road via 733 SH16 with an access agreement)	

With only the ASH Corridor (i.e. without the RTC / RAMC), it is noted that existing access to the properties at 120, 122, 124, 124A, 130 Boord Crescent will be retained. These properties are included in the designation for the RTC / RAMC.

The proposed new private access roads and realignment of existing roads to maintain local access have been incorporated into the proposed designation boundary for the ASH and further details will be developed at later design stages and as part of the Outline Plan of Works.

Given the nature of the interfaces of the ASH and BCI with the local road network, no adverse effects have been identified in relation for on-street or public parking resulting from the Project.

5.5 Project Interdependencies

The ASH Corridor has been designed to integrate with the rest of the North West Strategic Package, but is equally able to be progressed without being dependent on those other projects. The relationships and interdependencies between the North West Strategic Package projects and other projects are discussed below.

5.5.1 SH16 to SH18 Connections

This project will deliver motorway to motorway connections and new local connections at existing and new interchanges on SH16 and SH18 that will support the growth of the existing and future growth areas around Whenuapai, Redhills and Westgate.

Many of the positive benefits for the Kumeū-Huapai and Riverhead communities, as well as wider North West rural community, would be delivered with the implementation of the ASH corridor. However, the overall benefits for the overall North West growth area will be realised with the delivery of the complementary SH16 to SH18 Connections project. There is also the potential for adverse effects resulting from the implementation of the ASH without the SH16 to SH18 Connections project.

Without those connections, the less constrained and increasing traffic demand associated with the ASH is expected to result in people continuing to utilise existing local road alternatives to the state highways, such Brigham Creek Road, Trig Road, and Fred Taylor Drive / Don Buck Road. This could result in adverse effects on these corridors, particularly should identified future upgrades to these corridors not be in place at that time. However, even with those local road upgrades, it would not be desirable for people to divert to these corridors, as this would result in intra-regional trips travelling through or near the identified centres in Whenuapai and Westgate. However, there is the ability to satisfactorily address this at the time of implementation, as discussed in Section 0.

5.5.2 SH16 Main Road Upgrade

As has been discussed throughout this section, the ASH corridor has an inter-dependency with the SH16 Main Road Corridor Upgrade. The completion of the ASH corridor will reduce strategic trips and local trips along the existing SH16 Main Road corridor through Kumeū-Huapai, thus supporting implementation of the RTC and SH16 Main Road Upgrade.

Depending on the implementation timing of the RTC and Main Road Upgrade, relative to future urban growth occurring in Kumeū-Huapai, the implementation of the ASH may be necessary in advance of those projects to manage potential adverse effects on the urban areas. However, should those projects be delivered earlier in the staging of future growth in Kumeū-Huapai (when there is less overall transport demand), then the ASH may not be necessary in advance.

5.5.3 Rapid Transit Corridor (and RAMC)

In terms of the operation of the two corridors, the ASH will be laterally and, where necessary, grade separated from the RTC / RAMC, such that neither corridor affects the performance of the other corridor, where they run parallel to each other.

The delivery of the RTC through Kumeū-Huapai is dependent on the completion of some segments of the SH16 Main Road Upgrade in advance of the RTC. Hence, similarly to the SH16 Main Road Upgrade above, depending on the relative staging of these projects (as future growth occurs), the ASH may or may not be required in advance of the RTC / RAMC project.

The relative timing of the RTC / RAMC is not confirmed and that corridor itself will have inter-relationships with both the North West Short Term Bus Improvements project and the full implementation of the City Centre to Westgate Rapid Transit Corridor. The North West Short Term Bus Improvements project will enable a connection between the RTC, should the RTC be built and operational in advance of the City Centre to Westgate RTC.

A coordinated and integrated approach with the interdependent projects to optimise the identified significant mode shift for the existing and future community in Kumeu-Huapai will be required, particularly for medium to longer distance trips, to avoid a reliance on vehicles being reinforced. This would result in greater than predicted traffic demand and adverse effects in terms of reducing accessibility to jobs and other activities within the North West and beyond. Coupled with the SH16 to SH18 Connections project, there is potential for increased adverse effects on local roads within Whenuapai and Westgate. However, there is the ability to satisfactorily address this at the time of implementation, as discussed in Section 0.

5.5.4 Access Road Upgrade

The ASH corridor interchange at Tawa Road provides connection to Access Road. The Access Road corridor complements the ASH by providing a multi-modal connection between the future residential and employment growth areas in the southern part of Kumeū-Huapai and the ASH corridor.

Whilst the NW Strategic Package has been designed as complementary components, as part of long-term network planning, the design of Access Road (as discussed in Section 8) also provides for the uncertainty regarding the funding and timing of the ASH. The route protection sought for Access Road enables the provision of an efficient and reliable connection for active modes and PT connecting with SH16 Main Road to the north, which could provide for future transport demand, in the event that the ASH corridor is not progressed until sometime after the Access Road Upgrade.

5.5.5 Implementation Considerations

Both Auckland Transport and Waka Kotahi have a statutory requirement to contribute to *an effective, efficient, and safe (Auckland) land transport system in the public interest*[7][8]. This requirement will extend to the integration of the ASH with the surrounding transport network, with or without the implementation of the identified strategic projects above.

The specific effects in relation to the operation and management of the SH16, SH18 and the ASH should also be reviewed nearer to the time of implementation to better understand the form and management that may be required in relation to the ASH to align with city-wide policy and strategy in relation to demand management.

As such, whilst recognising there is this uncertainty / risk with the long-term timeframe for the ASH Corridor, it is considered that these statutory requirements and other internal processes (such as the requirement for an Implementation Business Case) that apply to Waka Kotahi will enable the above effects to be considered and addressed prior to implementation. This will allow the inter-relationships of the ASH Corridor, as it relates to the above matters, to be considered and managed prior to the implementation of the corridor.

5.6 Summary of Operational Transport Effects (NoR S1)

The Project provides significant positive effects and there are no operational adverse effects to mitigate, given the effects on local roads and property access have been addressed through the design of the Project and hence provided for by the designation (such as through the proposed local road realignments and the grade separation of the ASH project from local roads).

The assessment of transport effects for the Project is summarised in Table 5-4 below.

Table 5-4: Assessment of Operational Effects Summary for NoR S1 (ASH)

Operational Transport Effects	
Safety	In summary, the effects of the Project on safety are: • Provide a new State Highway corridor which meets current standards and has minimal intersections reducing the number of conflict points. • Significantly improve speed environment and reduced vehicle volumes on SH16 through Kumeū-Huapai creating a safer more accessible environment for people using the corridor to access the growth along Main Road near the existing and future Town and Local Centres. • Significantly improve environment on SH16 Main Road for pedestrians and cyclists, commensurate with an urbanised environment.
Walking and Cycling	In summary, the effects of the Project on walking and cycling are:

[7] https://www.legislation.govt.nz/act/public/2003/0118/latest/DLM226236.html

[8] https://www.legislation.govt.nz/act/public/2009/0032/latest/DLM2322355.html

Operational Transport Effects	
	• Significantly reduce the likelihood and exposure to potential crashes, as it will provide a new separated facility and enable safe movement for vulnerable road users through the area. • Improve integration with the future walking and cycling network, resulting in improved east-west walking and cycling connectivity. • Lead to environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips. • Serve as a key enabler for greater use of active transport modes by providing a safe connector route between Kumeū-Huapai and Westgate.
Public Transport	In summary, the effects of the Project on public transport are: • Result in reduced vehicle volumes on SH16, when compared to without the project, improving the capacity and reliability of this corridor for all modes including PT. • The BCI upgrade will help provide opportunity for better reliability through the interchange for PT. • If necessary, additional capacity could provide the opportunity for managed lanes or interim public transport facilities in advance of the RTC / RAMC project being implemented.
General Traffic	In summary, the effects of the Project on general transport are: • Provide an alternative strategic route for longer distance intra-regional and inter-regional connections, reducing reliance on SH16 and improving resilience of the strategic network. • Reduce reliance on existing unsuitable rural roads to accommodate future traffic demand. • Provide sufficient corridor and intersection capacity to cater for growth on existing and FUZ growth.
Freight	In summary, the effects of the Project on freight are: • Significantly improved journey times and reliability for existing and future local, inter- and intra-regional freight trips. • Direct connection via the Access Road Upgrade to the future employment area in Kumeū-Huapai.
Access and Parking	In summary, the effects of the Project on access and on-street / public parking are: • Potential adverse effects on locals roads crossing the ASH corridor have been addressed by grade separation of the ASH corridor and, where necessary, realignment of local roads. • Potential adverse effects on property access can be addressed through the later design stages / Outline Plan of Works by provision of new private access roads and re-forming / re-grading property driveways. • No identified adverse effects for on-street / public parking.

5.7 Conclusions

Overall, the ASH Corridor provides considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic (including freight) effects.

Potential adverse effects on locals roads crossing the ASH corridor have been addressed by grade separation of the ASH corridor and, where necessary, realignment of local roads. This enables access along public roads to be maintained.

Whilst recognising there is this uncertainty / risk with the long-term timeframe for the ASH Corridor, it is considered that the statutory requirements and other internal processes (such as the requirement for an Implementation Business Case) that apply to Waka Kotahi will enable the above effects to be considered and addressed prior to implementation. This will allow the inter-relationships of the ASH Corridor, as it relates to the matters identified above, to be considered and managed prior to the implementation of the corridor.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the CTMP prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

6 NoR S2: SH16 Main Road Upgrade

6.1 Project Corridor Features

The SH16 Main Road Upgrade extends approximately 4.5km between Old Railway Road, east of Kumeū to Foster Road, west of Huapai. The SH16 Main Road is currently a 20m wide two-lane urban arterial with no active mode facilities on either side of the corridor.

SH16 Main Road is proposed to be upgraded to a 24m urban corridor connecting the well-established retail, commercial and residential environs. The corridor generally follows the existing SH16 Main Road alignment. As part of this project, if not completed as part of the RTC project, Station Road will be realigned to form a new signalised intersection with SH16 and Tapu Road.

An overview of the proposed design is provided in Figure 6-1.

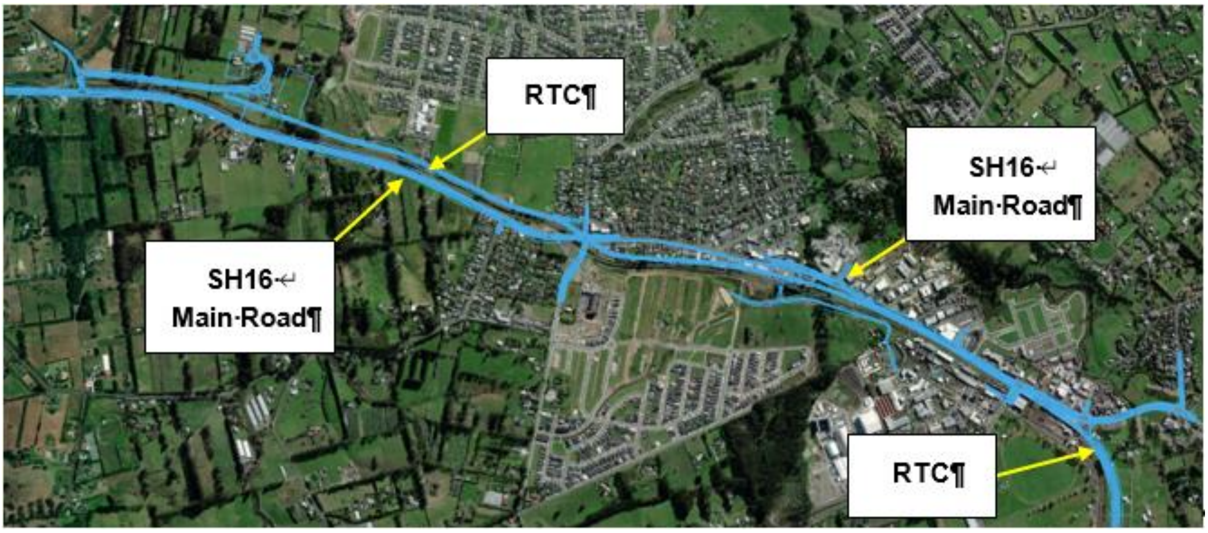


Figure 6-1: Overview of the SH16 Main Road Upgrade

6.2 Network and Corridor Design

The Project was developed as part of network planning for the wider north west area. The wider networks were developed through the Business Case process that considered the key problems, benefits, outcomes and range of options to address the identified problems. As such, the Project is part of a wider long-term integrated network planned for the area..

The Project proposes that the function of SH16 Main Road will change from an existing two-lane road to a low-speed urban two-lane arterial (using AT standards appropriate for the intended future environment) with mixed components for vehicles, PT, active modes.

SH16 Main Road is part of the current State Highway network the corridor is currently managed by Waka Kotahi. Waka Kotahi will manage the corridor until the ASH is in place, at which time it is anticipated that the corridor classification will be revoked.

The development of the strategic corridor design and its interfaces with the local road network has included the use of the relevant transport guidance and documents, as described in Section 0. Key aspects of the network and corridor design are summarised below.

The proposed design includes a typical 24m cross section with two traffic lanes, as well as new facilities for walking and cycling as shown in Figure 6-2 and Figure 6-3. As shown below, along the segment immediately adjacent to the Rapid Transit Corridor (between Access Road and 156 Main Road, Segment 2) the proposed corridor is 18.5m with active mode facilities along the active frontage only (north side). Additionally, given the current corridor designation, a 600m section (in Segment 3) of active mode only upgrade (south side) is proposed between Oraha Road and Station Road / Tapu Road.[9]

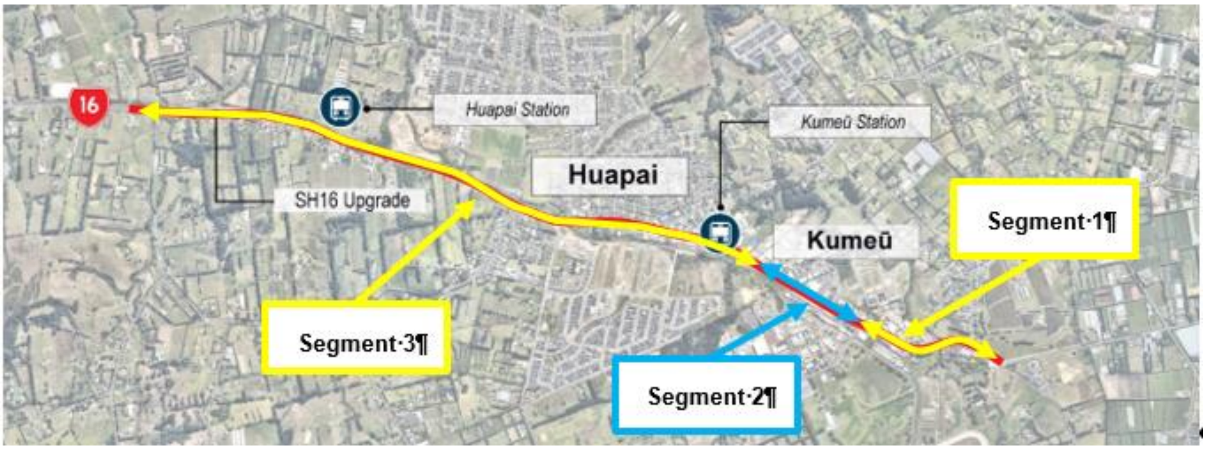
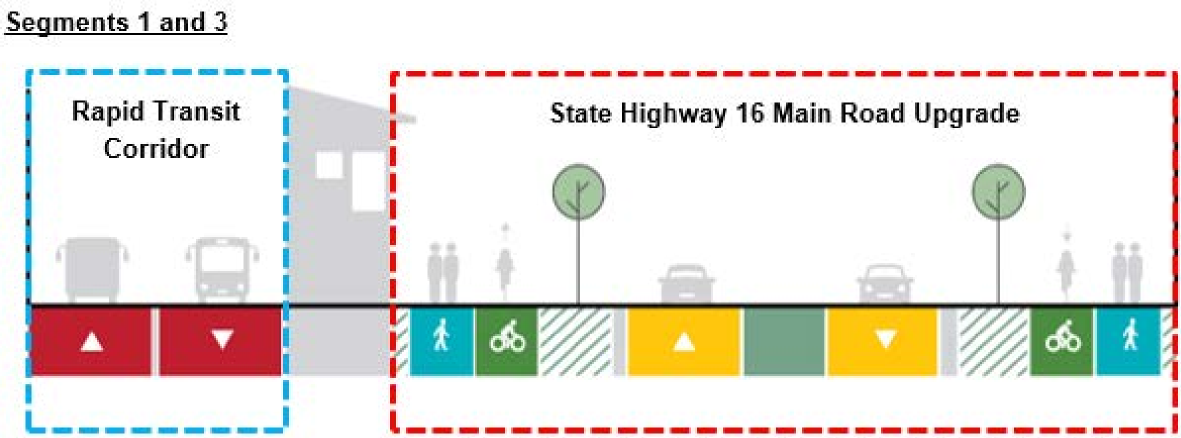


Figure 6-2: SH16 Main Road Upgrade – segments



[9] Active modes facilities on the north side in this section can be provided within the current road reserve, using the service lane

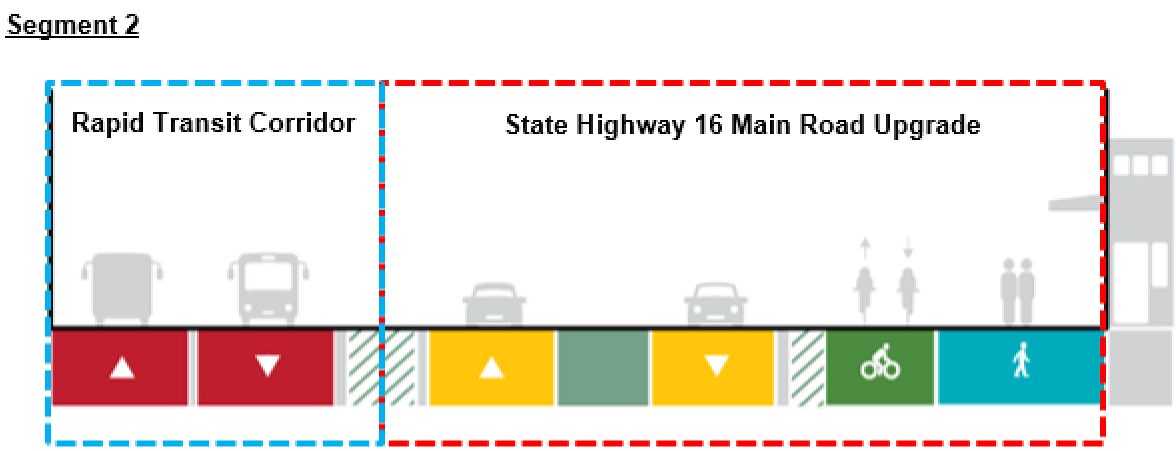


Figure 6-3: Indicative future SH16 Main Road Upgrade cross sections

The development of the corridor design has included the use of AT's Roads and Streets Framework (RASF), which qualitatively assesses the typology (movement and place value) and modal priority. The intent of that framework is to classify the expected movement and place functions from a consistent regional context and identify the likely priority applied to each mode.

The framework itself does not directly dictate a specific corridor design, but provides context and guidance regarding the intended function of the corridor that will be used to inform future development and operation of the corridor. For integrated land use and transport classification purposes, land use context uses Place Value (ranking from P1 'low' to P3 'high' importance) and for transport context uses Movement Value (ranking from M1 'low' to M3 'high' importance).

The corridor is assessed to have the following RASF typology:

- Place function – P3 (high)
- Movement function - M3 (high)

The following Figure 6-4 indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to more sustainable modes of travel.

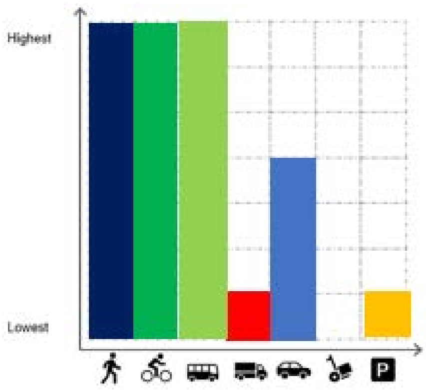


Figure 6-4: Future modal priority in 2048+ for SH16 Main Road[10]

6.3 Existing and Likely Future Environment

6.3.1 Planning context

SH16 Main Road is proposed to be upgraded to a 24m urban corridor along the urban extent of SH16 connecting well-established retail, commercial and residential environs through Kumeū-Huapai.

This corridor contains a range of business, residential and open space and rural land uses under the AUP:OP (see zoning column in Table 8-1) between the eastern extent of the Kumeū-Huapai township and the western extent of the upgraded corridor (the intersection with the proposed ASH).

Table 6-1 provides a summary of the existing and likely future environment as it relates to the SH16 Main Road Upgrade.

Table 6-1: SH16 Main Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[11]	Likely Future Environment[12]
Rural	Rural Mixed Rural Zone, Rural Countryside Living Zone	Low	Rural
Business	Business (Industrial)	Low	Urban
	Business (Local Centre)	Low	Urban
	Business (Mixed Use)	Low	Urban
Residential	Residential	Low	Urban

10 RASF symbols represent; walking, cycling, buses, heavy vehicles, cars, loading and parking
11 Based on AUP:OP zoning/policy direction
12 Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[11]	Likely Future Environment[12]
Open Space	Open Space – Sport and Active Recreation	Low	Open Space
Undeveloped greenfield areas	Future Urban	High	Urban

6.3.2 Transport Environment

6.3.2.1 Existing

The existing corridor is surrounded by a range of land uses including industrial, residential and greenfield land with both urban and rural sections of state highway corridor and is shown in Figure 6-5. It is generally comprised of one vehicle lane in each direction, other than between Access Road and Harikoa Street (two lanes in each direction). It currently forms part of the state highway network with local, intra- and inter-regional freight traffic using the corridor.

Figure 6-5: Aerial of Existing SH16 Main Road Corridor

Table 6-2 summarises the existing transport features of the SH16 Main Road corridor.

Table 6-2: SH16 Main Road: Existing Transport Features

	Existing SH16 Main Road Transport Features
Corridor Characteristics	• Town Centre and adjacent to development • Has a 50 and 60kph speed limits • Semi-urban character with two vehicle lanes (one in each direction)

	Existing SH16 Main Road Transport Features
	• Corridor form is inconsistent with formal kerb and channel along some sections • Continuous footpath on the northern side. • Rural Sections • Has an 80kph speed limit from 260m north-west of Trigg Road • Rural character with two vehicle lanes (one in each direction) • Corridor form is consistent, with no kerb and channel on either side of the corridor and no footpaths.
Traffic Volume	The latest traffic data for SH16 Main Road shows a 5 Day Average Daily Traffic of approximately around 15,000 to 20,000 vehicles per day (vpd).
Key Road Network / General Traffic	• SH16 Main Road / Riverhead Road give-way control • SH16 Main Road / Access Road signals • SH16 Main Road / Matua Road stop control • SH16 Main Road / Tapu Road stop control • SH16 Main Road / Station Road stop control • SH16 Main Road / Trigg Road stop control • SH16 Main Road / Matua Road (West) stop control • SH16 Main Road / Foster Road give-way control
Walking and Cycling	A range of footpaths are provided in some sections through the centres which are approximately 1.2-1.8 m wide. Through the rural sections there are generally no footpaths provided. There are limited cycling facilities, with cyclists only able to use the road shoulders in some urban sections.
Public Transport	Current bus services on SH16 Main Road: • Bus service 122 between Huapai, Kumeū, and Westgate. Every 2 hours 7 days a week. • Bus service 125 between Helensville, Waimauku, Huapai, Kumeū, and Westgate. Every 2 hours 7 days a week. • Bus service 125X between Helensville, Waimauku, Huapai, Kumeū, Westgate, Northwestern Motorway, and City. Services that only operate during weekday peak period.

6.3.2.2 Likely Future

Table 6-3 summarises the likely future transport features of the SH16 Main Road corridor.

Table 6-3: SH16 Main Road: Likely Future Transport Features

	Likely Future SH16 Main Road Transport Features
Corridor Characteristics	• Adjacent to the RTC • 50kph speed limit. • Urban character with two vehicle lanes (one in each direction). • Consistent corridor form with kerb and channels on both sides and a bi-directional cycle path and footpath on the opposite ride of the road to the transit corridor, next to the active edge.

	Likely Future SH16 Main Road Transport Features
	• Separated from the RTN • 50kph speed limit. • Urban character with two vehicle lanes (two in each direction). • Consistent corridor form with kerb and channels and continuous footpaths and cycle facilities on both sides. • Generic two-lane arterial with a 24m designation.
Traffic Volume	The forecast Average Daily Traffic (**ADT**) on SH16 Main Road in 2048 is 8,400 vehicles.
Key Road Network / General Traffic	• SH16 Main Road / Riverhead Road signals • SH16 Main Road / Access Road signals • SH16 Main Road / Matua Road signals • SH16 Main Road / Station Road signals (including Tapu Road) • SH16 Main Road / Trigg Road signals • SH16 Main Road / Matua Road (West) signals • SH16 Main Road / Foster Road give0-way control
Walking and Cycling	Separated 2.0m cycle lanes and 1.8m footpaths on both sides. Or 3m bi-directional cycle facility separated from 4.7m footpath and active frontage.
Public Transport	The indicative 2048 AT bus network forecasts 5 buses per hour on SH16 Main Road, or approximately 1 bus every 10-15 minutes.

6.4 Assessment of Operational Transport Effects

Overall, the key features and outcomes of the SH16 Main Road Upgrade include the following:

- Focus on connecting local land use to the transport network and distributing efficiently to the strategic network (RTC / RAMC or ASH) and key destinations within Kumeū-Huapai.
- Support a potential reduction in road hierarchy to an arterial function to de-tune SH16 Main Road and support improved permeability (including north south connections over the rail line).
- Providing around 4km of high quality cycle facilities for a network to connect the residential catchments to key Town Centre, Local Centre and other destinations, as well as the RAMC.
- Reduced speed environment and space for midblock crossings.
- Focuses on active modes to shift trips away from private vehicle use and link land use to the RTC stations.
- Bespoke widening to integrate with RTC, which is focussed on improving active mode access and placemaking opportunities, including:
  - The widening of the existing 20m wide two-lane urban arterial to a 24m wide corridor with walking and cycling facilities on both sides of the corridor.
  - The realignment of Station Road to form a new signalised intersection with SH16 and Tapu Road, improving north-south connections in Kumeū-Huapai.
  - The realignment of Matua Road (West) and grade separation over the NAL, improving north-south connections in Huapai.

6.4.1 Road Safety

The design of the Project has been undertaken with consideration of the latest safety guidance. This includes AT's Vision Zero and Waka Kotahi's Road to Zero. The upgrade of SH16 Main Road is expected to result in positive effects on safety when compared to the existing corridor, and these consist of:

- Significantly improved, and new, walking and cycling facilities along SH16 Main Road (including separation), resulting in improved protection for vulnerable road users.
- Significantly improved, and new, walking and cycling crossing facilities (crossing SH16 Main Road) at Riverhead Road, Weza Lane (connecting to RAMC), Matua Road, Station / Tapu Roads, Trigg Road, Matua Road (West), resulting in a significantly safer environment for all road users.
- A significantly improved speed environment by reducing speed limits to more appropriate urban speeds (e.g. 50km/h or less around centres) with enhanced place function and consequential reductions in the risk of DSIs.

It is anticipated that the number of pedestrians and cyclists will increase significantly as the area surrounding SH16 Main Road is developed. The traffic volumes on SH16 Main Road will likely also increase over time, prior to implementation of the RTC and ASH projects (discussed further in Section 6.5), and therefore the exposure between motorists and vulnerable road users will be higher than the existing road environment. However, the Project proposes to lower the speed limit to 50km/h and provide segregated walking and cycling facilities to reduce the likelihood and severity in the event of a crash.

Overall, the proposed design of the Project is well aligned with the transport safety principles from AT and Waka Kotahi. It will provide a much safer transport system which will likely reduce the number of DSIs and result in positive effects for all road users. It is noted that the detailed design will be completed in the future to further detail measures to achieve the anticipated safety outcomes.

6.4.2 Walking and Cycling

The Project proposes separated walking and cycling facilities on both sides of SH16 Main Road. It also includes dedicated new pedestrian and cycle crossing facilities at Riverhead Road, Weza Lane (connecting to RAMC), Matua Road, Station / Tapu Roads, Trigg Road, Matua Road (West), which connect with expected future adjacent facilities.

These will support local connections with the surrounding existing and future urban areas, which are expected to have a network of local facilities appropriate to those local corridors' form and function. The specific design of these connecting facilities will be developed further at detailed design prior to implementation.

The proposed walking and cycling facilities along the corridor have been designed in accordance with relevant Auckland Transport standards and policies discussed in Section 0. The exact provision of walking and cycling crossing facilities will be confirmed at the detailed design stage and will be guided the same or future equivalent documents.

The Project will have a number of significant positive effects on walking and cycling as it will:

- Reduce the current state highway road hierarchy to an arterial function to de-tune SH16 Main Road and support improved permeability (including north south connections over the rail line).
- Provide high quality cycle facilities for a network to connect the residential catchments to key Town Centre, Local Centre and other destinations, as well as the RAMC.
- Support growth surrounding SH16 Main Road and significantly improve safety and access to employment and social amenities.
- Reduce speed environment and space for midblock crossings.
- Focus on active modes to shift trips away from private vehicle use and link land use to the RTC stations.

6.4.3 Public Transport

Public transport services will share the general vehicles lanes on the SH16 Main Road Upgrade corridor. For future public transport services, there are two core proposed PT (bus) services, which will use SH16 Main Road. One service will connect Helensville (and Waimauku) to Kumeū-Huapai, while the second service will be a Kumeū-Huapai circuit or series of routes. A total of five buses per hour are anticipated on SH16 Main Road under the indicative 2048 AT bus network. These are part of the network of services that support the RTC and provide access to the Kumeū and Huapai Stations.

The cross-section will provide adequate spacing to facilitate public transport and associated bus stops. The exact location of bus stops will be identified as part of detailed design for the Project. Dedicated facilities are provided for interchange at the Kumeū and Huapai Station, which is incorporated in NoR-KS and NoR-HS. Once greater certainty is available on the location of key land use activities, more certainty on high demand locations for bus stops can be determined, i.e., around centres and schools for example.

The Project's potential operational effects on public transport are:

- Reduced delays and improved reliability for future PT network on SH16 Main Road and the wider network.
- Improved integration with the future public transport network (including the RTC stations) and improved east-west and north-south connectivity, as well as improved access to employment and social amenities.
- Increased attractiveness and uptake of public transport trips, which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.

6.4.4 General Traffic

As identified above, the 2048 ADT for SH16 Main Road is 8,400 vehicles per day. Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 840 vehicles. A two-lane corridor can efficiently accommodate 840 vehicles and therefore the proposed corridor design meets the forecasted needs, with the additional lane provision to accommodate greater bus priority.

The key intersections along the SH16 Main Road Upgrade corridor have been assessed and shown to provide sufficient capacity to accommodate the anticipated future traffic demands with the growth in the existing and future urban areas in the longer-term. The traffic modelling results for the key intersections associated with the SH16 Main Road Upgrade are provided in Appendix 2.

6.4.5 Freight

As discussed previously, the complementary implementation of the ASH is predicted to result in a significant reduction in local, intra- and inter-regional freight using the SH16 Main Road Upgrade corridor.

Similar to general traffic, the improved corridor capacity as a result of the Project will result in improved journey times and reliability for existing and future local freight. The corridor will be able to accommodate local freight movements along the mid-block and through the intersections.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the realisation/ implementation of individual corridor upgrades in the future.

6.4.6 Access and Parking

As a future arterial corridor, SH16 Main Road (both the current urban and rural sections) is expected to transition to be a limited access corridor. As the area develops, it is expected that future access to the network will be facilitated by other local road networks within the urbanised area to the north and south of SH16 Main Road with intersections onto the corridor. That network will likely be planned as developers progress these corridors through the plan change process, following structure planning by the Council.

Potential adverse effects of direct property access along an arterial road corridor is currently managed through the AUP(OP). However, it is recognised that many properties along the SH16 Main Road Upgrade corridor currently have direct property access. The design approach for the corridor, in combination with the proposed RTC corridor, has been to continue to facilitate direct vehicle access to existing properties, where necessary, through the inclusion of the median between the traffic lanes.

It is noted that the design of the SH16 Main Road Upgrade has maintained access via all existing local roads to this corridor, and such as in the case of Matua Road (West) provided enhancement through grade separation of this connection from the NAL.

In terms of existing property access, the overarching design philosophy for the Project has been to maintain driveway access, where practicable, either re-grading existing access or relocating the driveway access. However, in some circumstances (as discussed below), it has been necessary to provide access to via new private roads.

The key area where effects on property access and parking have been identified is:

- Along the SH16 Main Road Upgrade corridor, where it runs adjacent to the RTC, between the Access Road intersection and 156 Main Road.
- In the vicinity of the intersections and interchanges between SH16 Main Road Upgrade and local roads.

Table 6-4 summarises the potential adverse effects on properties / activities along the SH16 Main Road Upgrade corridor during the operational phase. Similar adverse effects would also occur and require mitigation during the construction phase through the CTMP. Where adverse effects are only expected during the construction phase, these are separately addressed in Section 9. Further details will be developed at later design stages and as part of the Outline Plan of Works.

Table 6-4: SH16 Main Road Upgrade Project – Potential Adverse Transport Effects on Access – Operational Phase

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
Adverse impacts on property access driveway	✓	549 SH16, Kumeū (20 Riverhead Rd, Kumeū) 550 SH16, Kumeū (incl. 43 Old Railway Rd and 2-12 Main Rd, Kumeū) 21A Riverhead Rd, Kumeū 22 and 24 Riverhead Rd, Kumeū 84, 86A-F, 88A-D, 90A-D, and 92 Main Road, Kumeū 106 Main Road, Kumeū 108, 110 Main Road (New World), Kumeū 132, 134, 154 and 156A-F Main Road, Kumeū 190 Main Road, Kumeū 248 Main Road, Kumeū 250, 250A-F Main Road, Kumeū 290, 292 Main Road, Kumeū 296, 300 (Kumeū Library) 302 to 320 Main Road, Kumeū (noting driveway / lane is in existing road reserve) 345, 347, 351, 353, 355 and 357 Main Road, Kumeū	Re-grade existing or re-form new driveway access off public road for identified properties

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
		4, 6, 8, 10, 12, 14, 20, 22, 24, 25, 26, 28, 30, 32, 34, 36, 38, Station Rd, Huapai 23 Vintry Dr (off Station Rd) (Huapai Triangle development), Huapai 1, 1A, 2, 3, 4, 6, 8 Tapu Rd, Huapai Huapai Domain, Huapai (driveway access off Tapu Rd) 395, 397 Main Road, Huapai 399 Main Road (Secret Garden Pre-School), Huapai 401 Main Road, Huapai 405, 407/407A Main Road, Huapai 529 SH16, Huapai 551 SH16, Huapai 573 SH16, Huapai 583, 587, 601 SH16, Huapai 609 Main Road, Huapai 623 SH16, Huapai 631 SH16, Huapai 665 SH16, Huapai 677 SH16, Huapai 411 Matua Road (West), Huapai	
Existing private access road or driveway will no longer be viable	✓	1/1 to 1/10 Putaki Drive, Kumeū (existing alternative access off Harikoa St will continue to provide access) 2 Putaki Drive, Kumeū (provide new driveway access off Putaki Dr or Papatupu Way) 156G Main Road, Kumeū (alternative access driveway to be provided off 156A-F driveway for residual lot)	Utilise alternative private access or construct new private access road or driveway for identified properties

There are several properties, where on-site parking has been identified to be affected by the proposed designation. The properties are sufficiently sized to potentially remain viable for activities within the current (or future) zoning. Moreover, the actual activity / use may change over the timeframes of the lapse dates sought. As such, these properties have not been included in the designation and mitigation has not been identified, as this matter can be addressed via the Public Works Act at the time of implementation. The identified properties are:

- 40 Main Road, Kumeū
- 86A-F, 88A-D, 90A-D, and 92 Main Road, Kumeū
- 1/1 to 1/10 Putaki Drive, Kumeū
- 106 Main Road, Kumeū
- 156G Main Road, Kumeū
- 190 Main Road, Kumeū
- 399 Main Road (Secret Garden Pre-School), Huapai
- 609 SH16, Huapai

Along SH16 Main Road, there is an existing area of on-street parking (around 41 car parking spaces) within the road reserve between Access Road and 92 Main Road, Kumeū. The long-term form and function identified for the corridor (Figure 6-4) has on-street parking as a low priority. This is consistent with the current AT Parking Strategy (2015), particularly as this relates to Parking on Arterial Roads (Policy 4A), which states AT will manage parking on arterial roads by extending clearways or removing parking where it:

- Inhibits the capacity of the road to carry more people (& goods) particularly in the peak periods, and/or
- Causes significant delays to the speed and reliability of public transport on the FTN, and/or
- Causes safety risks for cyclists or impedes quality improvements on the Auckland Cycle Network.

In addition, the draft AT Parking Strategy (2022) includes principles guiding the role of the road corridor, and the role of parking within the road corridor. This identifies that to align with Government and Council direction parking should be managed to encourage travel by sustainable and efficient transport modes such as PT and cycle and micro-mobility, prioritise trips by modes other than private motor vehicles and enable kerbside space to be utilised for more beneficial activities. In this regard, the principles identify kerbside space will typically be allocated in a priority order with parking (and particularly general vehicle parking), as the lowest priority. This is consistent with the approach in the long-term form and function identified for the corridor.

The draft Strategy identifies both Strategic Networks and three ‘tiers’ of readiness for change to parking strategy, which is based on the 2031 environment. The SH16 Main Road corridor and Kumeū / Huapai are not currently identified. However, within the longer-term timeframes of this project, it is considered that this part of the SH16 Main Road would be on the Strategic Network and be at least a Tier 2 location (with the nearby Kumeū town centre and Kumeū RTC Station). In this regard, the draft Strategy identifies that on the Strategic Network *“the principles for the management and supply of parking direct that all forms of kerbside parking is repurposed as necessary to accommodate projects on the Strategic Transport Network – unless exceptional circumstances are identified during consultation”*. In Tier 2 areas, there is a focus on reducing private vehicle use for commuter trips and managing parking through time limited/short stay parking, as well as reallocation to improve travel choices other than private car.

As such, given the anticipated future land use and transport context, it is considered that the identified loss of on-street parking can be satisfactorily managed in combination with broader parking strategies that will complement the locations proximity to the Kumeū town centre and Kumeū RTC Station.

Notwithstanding the above, the current AT Parking Strategy identifies that, if there is a significant loss of on-street parking on an arterial road, AT will complete a parking assessment. This would evaluate the loss of parking in the context of the broader on-street and off-street provision, as well as the land use and transport environment at that time, and identify potential parking mitigation measures, where necessary. This is a matter that can therefore be appropriately addressed at the time of implementation.

6.5 Project Interdependencies

6.5.1 Alternative State Highway and Rapid Transit Corridor

As has been discussed previously, the ASH corridor has a strong interdependency with the SH16 Main Road Corridor Upgrade. The completion of the ASH corridor will reduce strategic trips and local trips along the existing SH16 Main Road corridor through Kumeū-Huapai, thus supporting implementation of the RTC and SH16 Main Road Upgrade.

Depending on the implementation timing of the RTC and Main Road Upgrade, relative to future urban growth occurring in Kumeū-Huapai, the implementation of the ASH may be necessary in advance of those projects to manage potential adverse effects on the urban areas. However, should those projects be delivered earlier in the staging of future growth in Kumeū-Huapai, then the ASH may not be necessary in advance.

As discussed previously, the delivery of the RTC through Kumeū-Huapai is dependent on the completion of some segments of the SH16 Main Road Upgrade in advance of the RTC.

6.5.2 Access Road Upgrade

The SH16 Main Road Upgrade and the Access Road Upgrade are considered to be independent of each other, i.e. the NoR S2 project is not dependent on the completion of the Access Road Upgrade or vice versa. However, the proposed designation and design of each project complements the other and both are considered to be necessary with the long-term growth.

6.6 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The Project provides significant positive effects and there are no operational adverse effects to mitigate, given the effects on property access have been addressed through the design of the Project and hence provided for by the designation.

Whilst there are potential adverse effects on on-street and off-street parking, it is considered that this will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future on-street and off-street parking policy and strategy, given the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

The relative timing of the SH16 Main Road Upgrade, RTC and ASH will be considered as part of later implementation business cases prior to implementation. The assessment has identified that depending on the timing of the Main Road Upgrade, relative to future urban growth occurring in Kumeū-Huapai, the implementation of the ASH may be necessary in advance of this project to manage potential adverse effects on the urban areas. The delivery of the RTC through Kumeū-Huapai is also noted as being dependent on the completion of some segments of the SH16 Main Road Upgrade in advance. In terms of the proposed designation, each of these projects remain necessary in their own right, as part of the North West Strategic Package to support the anticipated long-term growth.

6.7 Summary of Operational Transport Effects (NoR S2)

The assessment of transport effects for the Project is summarised in Table 6-5 below.

Table 6-5: Assessment of Operational Effects Summary for NoR S2 (SH16 Main Road Upgrade)

Operational Transport Effects	
Safety	In summary, the effects of the Project on safety are: • Significantly improved, and new, walking and cycling facilities along SH16 Main Road (including separation), resulting in improved protection for vulnerable road users. • Significantly improved, and new, walking and cycling crossing facilities (crossing SH16 Main Road) at intersections, resulting in a significantly safer environment for all road users. • A significantly improved speed environment by reducing speed limits to more appropriate urban speeds (e.g. 50km/h or less around centres) with enhanced place function and consequential reductions in the risk of DSIs.
Walking and Cycling	In summary, the effects of the Project on walking and cycling are: • Support a potential reduction in road hierarchy to an arterial function to de-tune SH16 Main Road and support improved permeability (including north south connections over the rail line). • Provides high quality cycle facilities for a network to connect the residential catchments to key Town Centre, Local Centre and other destinations, as well as the RAMC. • Supports growth surrounding SH16 Main Road and significantly improve safety and access to employment and social amenities. • Reduces speed environment and space for midblock crossings. • Focuses on active modes to shift trips away from private vehicle use and link land use to the RTC.
Public Transport	In summary, the effects of the Project on public transport are: • Reduces delays and improved reliability for future PT network on SH16 Main Road and the wider network. • Improves integration with the future public transport network (including the RTC stations) and improved east-west and north-south connectivity, as well as improved access to employment and social amenities. • Increases attractiveness and uptake of public transport trips, which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.
General Traffic / Freight	In summary, the effects of the Project on general traffic / freight are: • The proposed two-lane corridor can efficiently accommodate the anticipated long-term demand and the intersections along the SH16 Main Road Upgrade corridor have been assessed and shown to provide sufficient capacity. • Complementary implementation of the ASH, as part of the long-term network is predicted to result in a significant reduction in local, intra- and inter-regional freight using the SH16 Main Road Upgrade corridor.
Access and Parking	In summary, the effects of the Project on access and parking are: • Potential adverse effects on property access can be addressed through the later design stages / Outline Plan of Works by re-forming / re-grading property driveways or providing new access driveways.

Operational Transport Effects	
	• Effects on off-street and on-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

6.8 Conclusions

Overall, the NoR S2: SH16 Main Road Upgrade provides considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic effects.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the CTMP prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

Effects on off-street and on-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

7 NoR S3: Rapid Transit Corridor; NoR KS: Kumeū RTC Station and NoR HS: Huapai RTC Station

7.1 Project Corridor Features

7.1.1 Project Overview

The proposed RTC is a new corridor which aims to complete a safe and frequent rapid transit system connecting Kumeū-Huapai with Westgate, Auckland City Centre and the North Shore. The RTC will extend the proposed North West RTC Full Implementation project (a non-Te Tupu Ngātahi project) from the proposed Brigham Creek station to near the western edge of Kumeū-Huapai growth area.

The RTC predominately traverses rural land outside of the FUZ for around 6km of its total length of approximately 9.5km, with the last 3.5km being within the existing or FUZ areas. The RTC will operate in an uninterrupted free flowing manner with all road crossings grade separated along its length.

It is proposed to route protect the RTC corridor for bus rapid transit. The NoR is therefore be sought for a RTC form in terms of the design requirements (width, horizontal and vertical alignment) that would provide for bus rapid transit. The RTC corridor will be at grade, except at key sections to pass over local and arterial roads, as well as the ASH. An overview of the proposed design is provided in Figure 7-1 below.

The RAMC is a segregated walking and cycling corridor that is located adjacent to the RTC alignment from the Brigham Creek Interchange to the western edge of Kumeū-Huapai, terminating at the signalised intersection of SH16 Main Road and Weza Lane. The corridor is co-located and integrated with the RTC and both projects are proposed to be route-protected as a single NoR. The segregated corridor provides the opportunity for long-term amenity as a key cycling corridor, while connecting to the wider North western Cycleway and ultimately to the Auckland city centre network.

In order to serve the existing urban and FUZ areas in Kumeū-Huapai, the NoR S3 (RTC/RAMC) is supported by NoR KS (Kumeū RTC Station) and NoR HS (Huapai RTC Station). The proposed station locations are illustrated on Figure 7-2 below.

The Kumeū Station will be accessed by active modes and feeder bus services and aligned with the future town centre, hence a Park and Ride facility is not considered appropriate at this station. The Huapai Station forms the terminus of the RTC corridor and will include Park and Ride facilities with allowance currently enabled for up to 500 car parking spaces. Both stations will also be supported by active modes and local PT access, with the proposed designation providing space for bus interchange and active mode facilities. In both cases, active mode connections are provided by bridges over the NAL to the adjacent urban catchment.

As shown in Figure 7-2 below, the Kumeū station is well aligned with Council's Spatial Land Use Strategy – North West in relation to the anticipated development of a future Town Centre location, whilst the Huapai Station provides the opportunity to integrate with an anticipated new Local Centre in the Huapai western FUZ area.

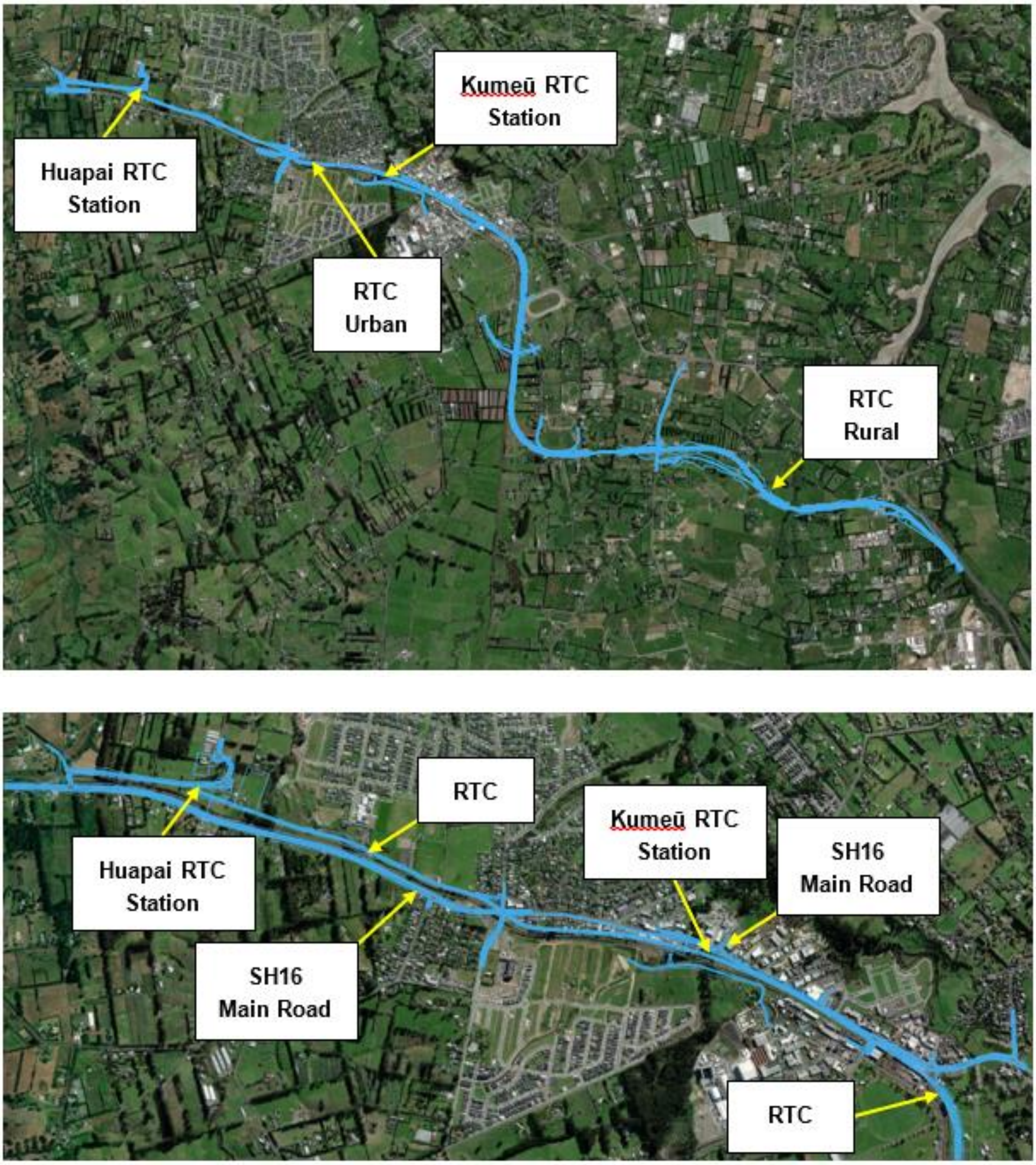


Figure 7-1: RTC and RAMC

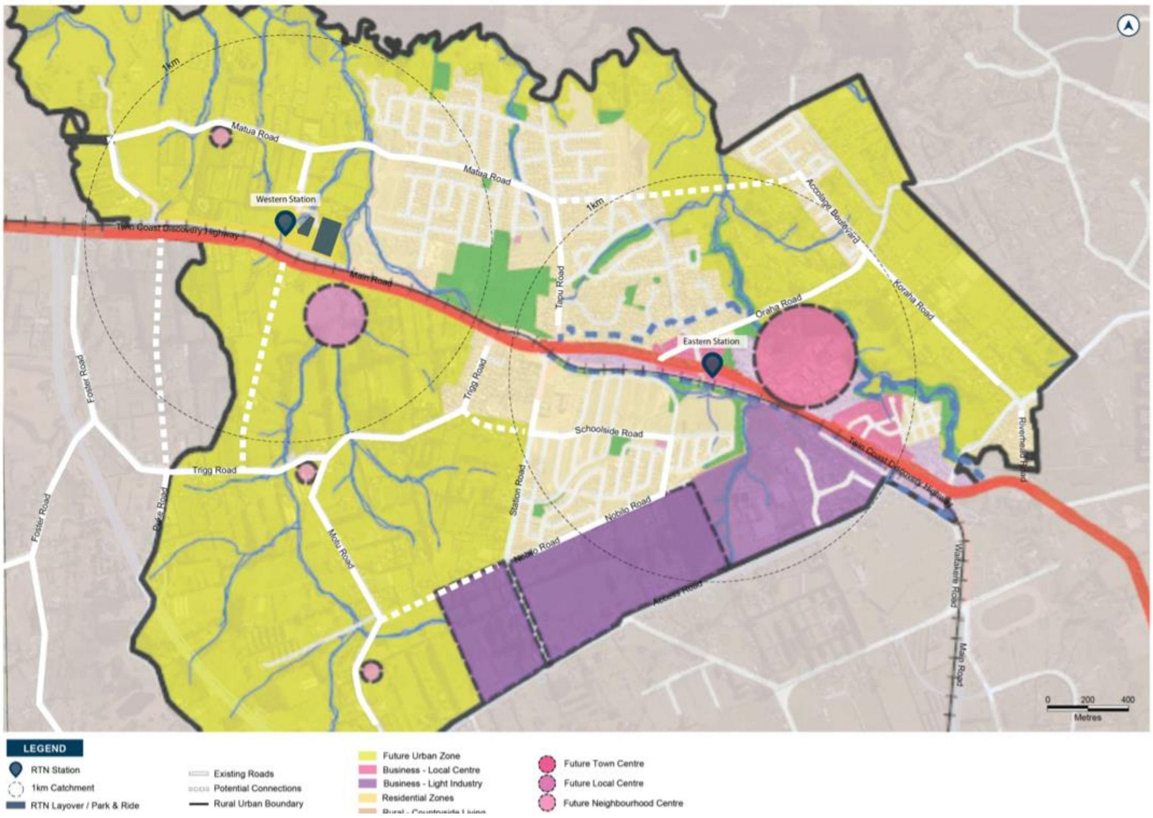


Figure 7-2: RTC Stations Overview and Council's Spatial Land Use Strategy – North West

7.2 Network and Corridor Design

The Project was developed as part of network planning for the wider area and concurrently with the structure planning undertaken by the Council. The wider networks were developed through the Business Case process that considered the key problems, benefits, outcomes and range of options to address the identified problems. As such, the Project is part of a wider integrated network planned for the area.

The North West DBC identified a RTC option that will provide for bus rapid transit. De-coupling the RTC from the SH16 Main Road Upgrade and enabling grade separation from local roads, not only significantly improves the efficiency and reliability of the RTC, but also provides safer and more efficient local active mode and bus connections at those locations, such as Access Road and Station Road.

In addition, the de-coupling of the RTC benefits access for adjacent land use along the SH16 Main Road Upgrade, allowing that project to better integrate with that adjacent land use by enabling local access. The RTC then forms a combined corridor with the NAL that already provides severance through the Kumeū / Huapai urban area.

Feeder bus services are critical to supporting the RTC as part of an overall public transport system. Te Tupu Ngātahi have worked closely with AT specialists to understand how feeder services can be configured to support the RTC, albeit this will be subject to future network planning at the time of implementation.

The development of the strategic corridor design and its interfaces with the local road network has included the use of the relevant transport guidance and documents, as described in Section 0. Key aspects of the network and corridor design are summarised below.

Within the rural section, the RTC is completely segregated with a cross-section width of 20m, including the RAMC. There are two lanes (one in each direction) and it has high-speed characteristics, with speeds up to around 80kph. The RAMC corridor will have limited access points and almost no interaction with the surrounding land use. RTC stations/stops are not provided in the rural section to maintain the high-speed environment and there is grade separation at local rural roads. The indicative cross section of the rural section is shown in Figure 7-3.

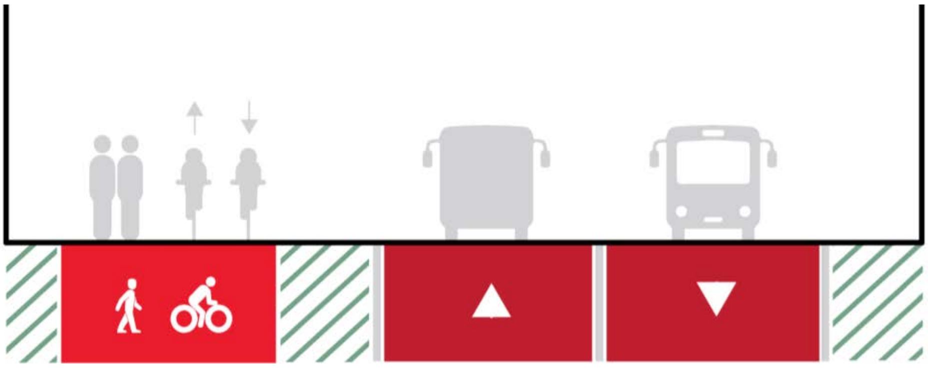


Figure 7-3: RTC Potential Cross-Section – Rural Section

Within the urban section, the corridor is separated from the SH16 Main Road Upgrade corridor and is grade separated at road crossings to improve the efficiency and reliability of the RTC. Generally, the corridors are separated by the adjacent land use activities or the NAL and therefore have adopted the cross section in the top image in Figure 7-4. This includes the Te Tupu Ngātahi standard two lane urban corridor cross section for SH16 Main Road, as described previously, with the RTC in its own separate corridor.

However, for a section of SH16 Main Road Upgrade to the west of Access Road, the two corridors run parallel, so to minimise the extent of designation required. In this section a more bespoke approach has been taken to the parallel cross sections, as shown in the bottom image in Figure 7-4, which still achieves the necessary corridor requirements for both the RTC and SH16 Main Road Upgrade.

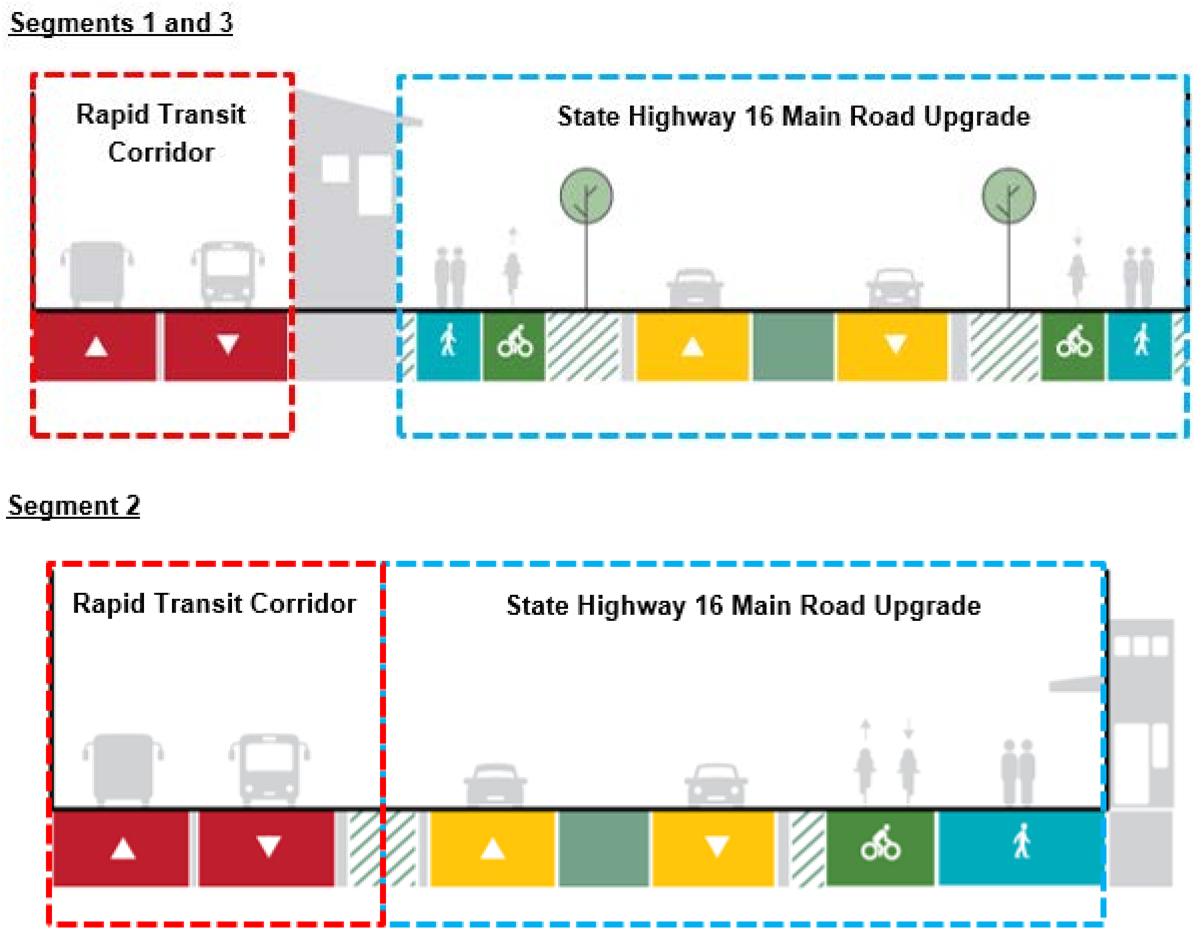


Figure 7-4: Indicative RTC cross-sections – Urban Section (Separated and Combined)

Segment 2

The form and function for NoR KS and NoR HS has been subject to extensive discussion with Waka Kotahi and AT to determine the appropriate footprint to provide for RT mode flexibility. In this regard , the following provisions have been included for each station.

- Kumeū RTC Station
  - Station building with associated station facilities
  - Overbridge connecting SH16 Main Road, station platforms and residential / employment catchments to south (over NAL), with associated stairs and lift towers. A pedestrian bridge is currently being built for the Huapai Triangle development, but this may need to be replaced, in particular, to provide more direct connectivity to future RTC station platforms
  - Cycle and shared mobility device parking provision
  - Local bus bay provision and turnaround facilities
  - Taxi and Ride Share drop-off facilities.

- Huapai RTC Station
  - Station building with associated station facilities
  - Overbridge connecting station platforms with SH16 Main Road and residential / employment catchments to south (over NAL), with associated stairs and lift towers
  - Cycle and shared mobility device parking provision
  - Local bus bay provision and turnaround facilities
  - Layover facilities for bus-based RTC mode
  - Taxi and Ride Share drop-off facilities
  - Park and Ride facility (up to 500 car parking spaces)
  - New access road connecting to Matua Road (West), plus connection to Meryl Avenue.

7.3 Existing and Likely Future Environment

7.3.1 Planning context

The RTC and RAMC form a single, integrated corridor with the RAMC only extending to the eastern entrance to Kumeū. This corridor predominately traverses rural land outside of the FUZ, however for assessment purposes it can be split into two sections:

- The **rural section** of the RTC runs from the Brigham Creek Interchange to the entry to Kumeū-Huapai township and is co-located with the RAMC along this section. This rural section traverses land zoned under the AUP:OP as Rural – Countryside Living Zone, with an area zoned as FUZ in Redhills North.
- The **urban section** of the RTC runs from northern end of Waitakere Road to Matua Road (West) and is co-located with the proposed SH16 Main Road upgrade[13] along this section. This urban section contains a range of land uses zoned under the AUP:OP as a mix of business zonings between the eastern extent of the Kumeū-Huapai township and Station Road.

Table 7-1 provides a summary of the North West existing and likely future environment as it relates to the RTC and the RAMC.

Table 7-1: RTC and RAMC Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[14]	Likely Future Environment[15]
Rural	Rural	Low	Rural
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban
Business	Business (Industrial)	Low	Urban

[13] Another North West Strategic project – refer to Section 6 of this report
[14] Based on AUP:OP zoning/policy direction
[15] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[14]	Likely Future Environment[15]
	Business (Local Centre)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential	Low	Urban
Open Space	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

The RTC stations (NoR KS and NoR HS) are located in the urban section of the RTC corridors. The existing and future environment around these are discussed and summarised in Table 7-2 and Table 7-3 below.

Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary. The land is zoned under the AUP:OP as Business - Town Centre Zone. An active modes overbridge is proposed across the NAL with active mode connections to:

- the Huapai Triangle crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and
- Wookey Lane crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and Business - Light Industry Zone.

Table 7-2: Kumeū RTC Station – Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[16]	Likely Future Environment[17]
Business	Business (Industrial)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential - Mixed Housing Suburban Zone	Low	Urban
Open Space (located to the north of the proposed station location)	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

[16] Based on AUP:OP zoning/policy direction
[17] Based on AUP:OP zoning/policy direction

Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu stream. The land is zoned under the AUP:OP as Future Urban Zone. An active modes overbridge is proposed across the NAL and SH16 to FUZ land. Future connections will be determined as part of structure plan process.

Table 7-3: Huapai RTC Station – Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[18]	Likely Future Environment[19]
Residential (located to the east of the proposed station location)	Residential – Single House Zone	Low	Urban
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

7.3.2 Transport Environment

7.3.2.1 Existing

The existing public transport network in the wider North West is shown below in Figure 7-5 below. As shown, the routes are heavily reliant on SH16 and several key arterials including Don Buck Road, Hobsonville Road and Fred Taylor Drive.

The existing public transport routes in Kumeū-Huapai include a service connecting Helensville to Westgate via Kumeū, and a local route service that travels to Kumeū – starting and terminating in Kumeū. These services combined offer an hourly service. An additional service connects Riverhead to Albany and Westgate and also operates at an hourly frequency. This service is currently funded from Rodney Local Board Targeted Rates.

In terms of access to the Auckland City Centre direct services are offered in the peak commuter periods, with all other time periods requiring a transfer at Westgate. These offerings are consistent with local services as defined in the Regional Public Transport Plan, which cater for rural townships. These service levels will need significant upgrades to reach the connector service levels of every 20 minutes in the peak periods, or frequent service levels of every 10 minutes in the peak periods.

In terms of heavy rail, while there is a single track that travels through Kumeū, this line does not currently offer passenger services beyond Swanson. For residents in Kumeū-Huapai, utilising this service means driving to the park and ride at Swanson, which currently has 136 parking spaces.

18 Based on AUP:OP zoning/policy direction
19 Based on AUP:OP zoning/policy direction

Figure 7-5: Existing Public Transport in the North West

Current travel times according to AT bus timetabling for a resident of Kumeū to access Westgate and beyond in the morning peak period by bus are shown below in Table 7-3.

Table 7-4: Huapai bus travel times based on existing timetables.

Boarding Location	Alighting Location	Travel time
Huapai	Westgate	20mins
Huapai	Hobson Street	1 hour 10 mins

Based on the lack of public transport priority and current levels of congestion experienced on SH16, these travel times are considered to occur only in optimal travel conditions with limited congestion or in incident free conditions. In reality, travel times by bus can, and often do, exceed these times.

The SH16 corridor currently experiences a high level of journey time variability, with the journey from Huapai to Westgate by car varying between 16 minutes and over 30 minutes in the peak morning period,[20] and often longer in reality , particularly when incidents occur. Given that buses currently and have no priority and travel within the general traffic lanes, buses will experience these same delays and variability with additional journey time likely for boarding/alighting passengers. Figure 7-6 demonstrates the distance a current resident of Kumeū-Huapai can travel by a public transport within 45 minutes in the morning peak – leaving Kumeū at 8am.

These figures clearly demonstrate that within an hour – there is limited public transport access for Kumeū-Huapai residents, and that there is little choice but to travel by private car in order to access wider economic and social opportunities.

A lack of segregation between public transport and general vehicles results in network resilience issues for public transport services. When an incident occurs on the network (i.e. break down or crash etc), public transport services are subject to the resultant congestion and delays.

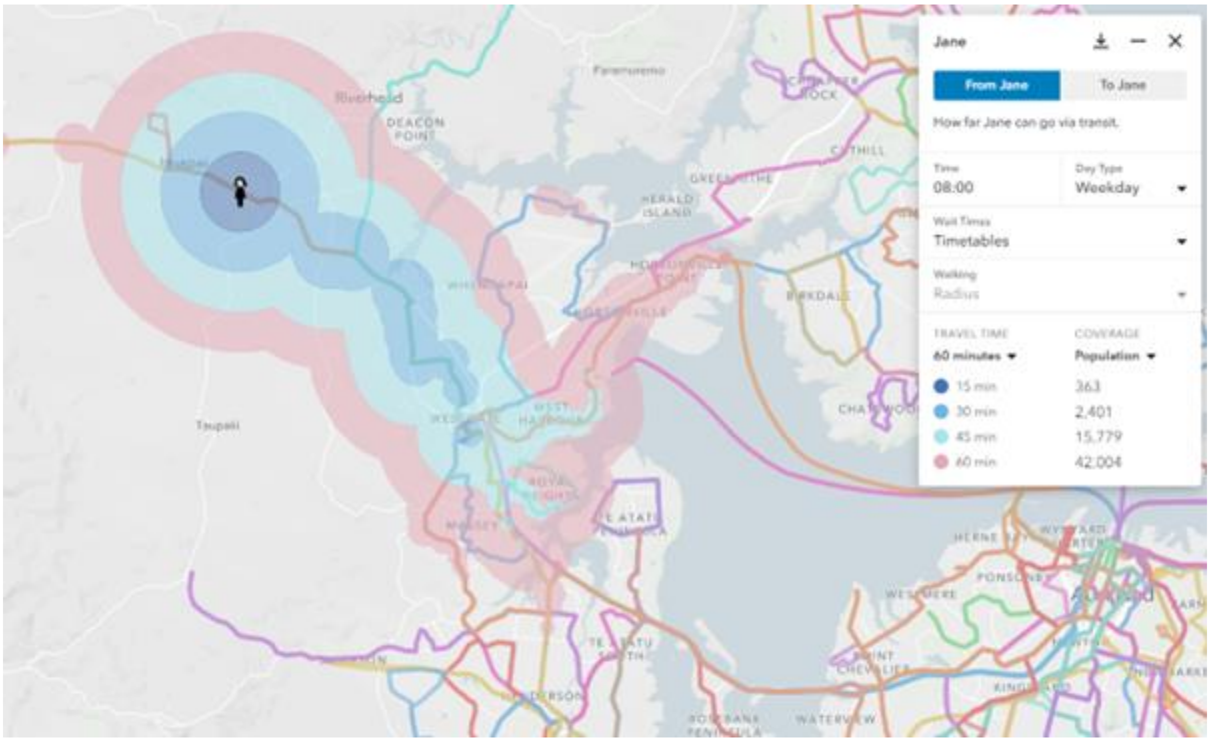


Figure 7-6: Current Public Transport accessibility in 45 minutes from Kumeū-Huapai

[20] Based on google maps travel time predictions utilising the same route as bus service 122

Another component of reliability is the susceptibility of the network to incidents. To understand this further an analysis of the TRIES database from Waka Kotahi for SH16 between Brigham Creek Road and Waimauku was undertaken. This investigation identifies that over the last five years there have been 52 events that have caused significant delays to the State Highway network. For an event that impacts the SH16 corridor, this results in an average delay of three hour to travellers on the network.

These delays are compounded by the lack of alternative routes in and around the Kumeū area and local trips using the State Highway network to undertake shorter duration trips. Currently, with all public transport services utilising this corridor, these services are subject to the same delays as general traffic.

Currently the North West has a limited provision of high quality, accessible and competitive public transport. This has resulted in a very high proportion of residents that choose to drive to employment. Census results from 2018 show that in the Kumeū- Huapai area, 87% of commuters are either accessing employment or education by private vehicles.

Buses are currently the primary provision for public transport. Given that there is limited provision for public transport on any of the key corridors in the North West, currently these buses are held up in existing traffic congestion. Current travel times for a bus to travel from Kumeū to Westgate is at least 20 minutes in the peak period, and 70 minutes from Kumeū to the Hobson Street in Auckland CBD. These times, however, do not allow for unexpected events such as breakdowns and high levels of congestion and travel times regularly exceed these times.

In addition to the travel times, current frequencies from Kumeū-Huapai to Westgate are approximately every hour. Frequencies such as this require passengers to use timetables to ensure that a bus is there at arrival on the stop. To provide an attractive public transport frequency that enables passengers to 'turn up and go', frequencies are recommended to be at least every 10 minutes.

There is also a distinct lack of strategic walking and cycling infrastructure and, in particular, there is a lack of safe and convenient connections linking Kumeū/Huapai to key destination such as Westgate and further afield. The North West benefits from two significant strategic cycling connections:

- The north-western cycleway parallel to SH16 – extending from the City Centre to Westgate.
- The SH18 shared use path – extending from Squadron Drive to Greenhithe, where the facility transitions to on road buffered cycle lanes on Upper Harbour Road.

In addition to these strategic links, the SH16 Improvements project includes the provision of a shared user path on SH16 from north of the Brigham Creek Roundabout to the urban edge of the Kumeū township (extents of the SH16 Improvements Project).

As such, the current planned strategic cycle connections end at Westgate, limiting accessibility for active modes between Westgate and Brigham Creek and through the Brigham Creek Roundabout. The shared user path, while a significant improvement on the existing lack of facilities, will still interface with intersections and driveways and follows the existing road corridor gradients.

In terms of cycling, the current cycling network as shown in the Auckland Cycleway Map[21] on Figure 7-7 below is extremely limited, and with the anticipated future growth in the North West – this level of service does not provide any incentive for future residents to choose to cycle to work, education or social events.

Currently, along the section of SH16 from Brigham Creek Road to Matua Road in Huapai, there are sub-standard pedestrian and cyclist facilities through the town centre and an almost absence of active mode facilities in the rural sections.

The lack of suitable active mode facilities has resulted in the predominant mode choice from Kumeū/Huapai being private vehicles. The lack of suitable alternatives has resulted in the continuity of this mode of travel being the preferred mode choice for residents.

Figure 7-7: Existing Local Cycle Network in the North West on Local Roads

[21] Auckland Cycleway Map, Auckland Transport https://maps.at.govt.nz/arcgis/apps/webappviewer/index.html?id=88a582e934f6473dba32cb3ab909890a

Table 7-5: Total Vulnerable Road Users Brigham Creek

Road Corridor	Total Vulnerable Road Users per year					
	2015	2016	2017	2018	2019	Total
SH16 (Old Railway Rd to Matua Rd)	1	3	6	9	1	20

Table 7-6: Crash Severity Vulnerable Road Users SH16 (Crash Severity (2015 - 2019))

Vulnerable Road User	Fatal	Serious	Minor	Non-injury	Total
Pedestrian	0	1	1	0	2
Cyclist	0	0	1	0	1
Motorcyclist	0	4	8	5	17
Total	0	5	10	5	20

A crash analysis for the three key vulnerable road users (i.e., pedestrians, cyclists and motorcyclists) for the section of SH16 from Brigham Creek Road to Matua Road was conducted for the five-year period 2015 to 2019. The tables above illustrate that of the total 20 vulnerable road user crashes, including three involving either a pedestrian or cyclist. This includes one serious injury pedestrian crash, a minor injury pedestrian crash and a minor injury cyclist crash.

While the crash history indicates that there is some risk for active mode users, the adoption of safe system thinking which acknowledges that road users are fallible challenges this. The adoption of safe system thinking encourages the provision of active mode facilities that are safe and separated by acknowledging the inherent risk for these users that the lack of these facilities creates.

7.3.2.2 Likely Future

Based on the Auckland Council Future Land Supply Strategy (FULSS), the future urban growth areas in Kumeū -Huapai and Riverhead are programmed to be released for urban development between 2028 and 2032. The planned growth in Kumeū-Huapai is expected to include 10,700 dwellings with an estimated population 24,700 by full build out – a significant increase on the existing population of 1,200 (in 2016). In addition, the number of employment opportunities in Kumeū-Huapai is expected to increase by approximately 3,300 jobs over the same period.

Future travel destinations are largely expected to remain similar, however, the employment growth in Westgate and Whenuapai are expected to significantly increase – resulting in a potentially much higher level of demand within the North West to access jobs. The trip demands of all Kumeū-Huapai urban trips in the morning peak in 2048+ show that approximately 37% stay in the area. The RTC / RAMC will therefore provide an important strategic role in connecting Kumeū-Huapai with those employments opportunities and broader opportunities within the metropolitan centre at Westgate.

Structure planning is not yet complete in Kumeū-Huapai, Riverhead and Redhills North and is not expected to start until closer to land release, which is expected beyond 2028. This results in less land use certainty for these areas, but also provides significant opportunities to use transport to shape placemaking. In the absence of Structure Plans and to ensure the future land use and transport networks work together to support growth, Auckland Council prepared a Spatial Land Use Strategy in 2020, which was adopted in May 2021, as discussed previously.

Travel demand has been extracted from the Macro Strategic Model (MSM) for the North West growth area. This model is a macro transport demand model that is integrated with land use scenarios and can consider the significant urban growth in the Kumeū-Huapai and Riverhead areas. The MSM model data considers both vehicle travel and public transport use based on the forecast population and employment numbers.

Existing and forecast 2048+ (assuming full-build out of the FUZ growth areas) travel demands across the following three screenlines (in Figure 7-8 below) have been used to illustrate the demand for travel to and from the North West. This includes a screenline which measures the total people travelling along several corridors at a certain location. Screenlines have been included on SH16 and associated rural corridors connecting with Kumeū-Huapai and Riverhead.

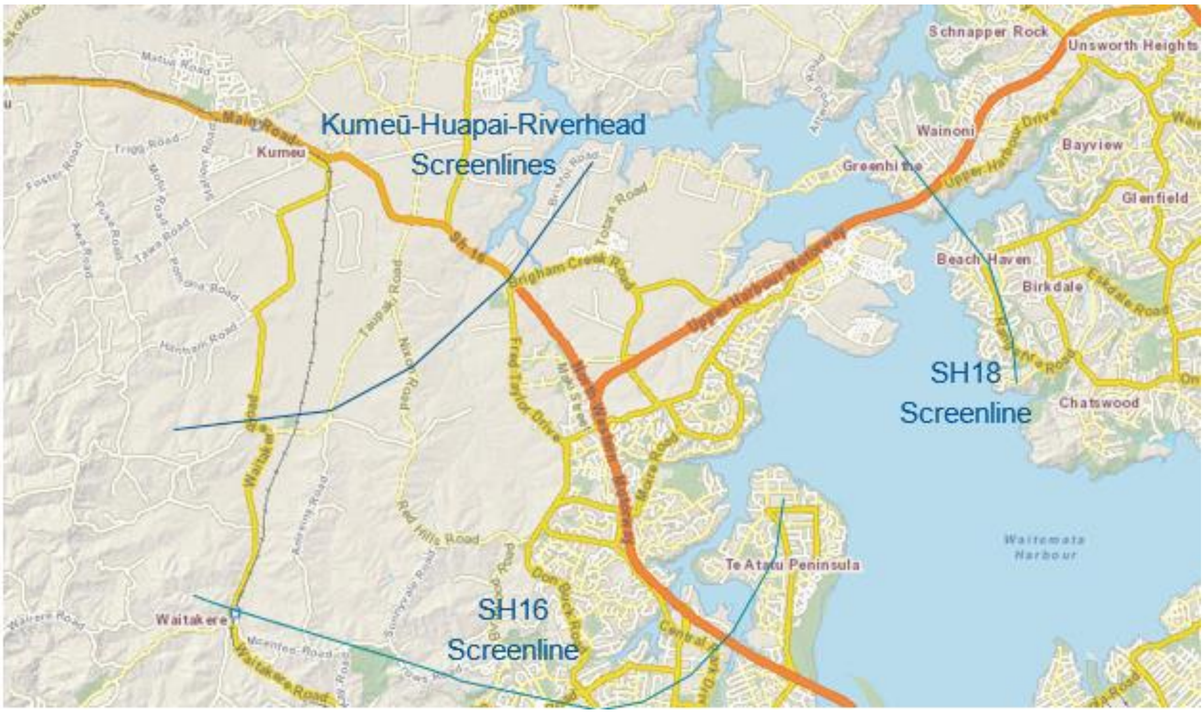


Figure 7-8: North West screenline locations

Figure 7-9 shows the volume of vehicles and public transport users travelling eastbound across the screenline, over the two-hour morning peak period for 2016 and 2048+ in the do minimum scenarios, i.e. without the NW Strategic Package projects.

The following key observations are noted for the Kumeū-Huapai-Riverhead screenline:

- Traffic demand doubles to around 9,000 vehicles in the two morning peak period.
- A lack of frequent PT services means PT demand remains very low at around 250 people.

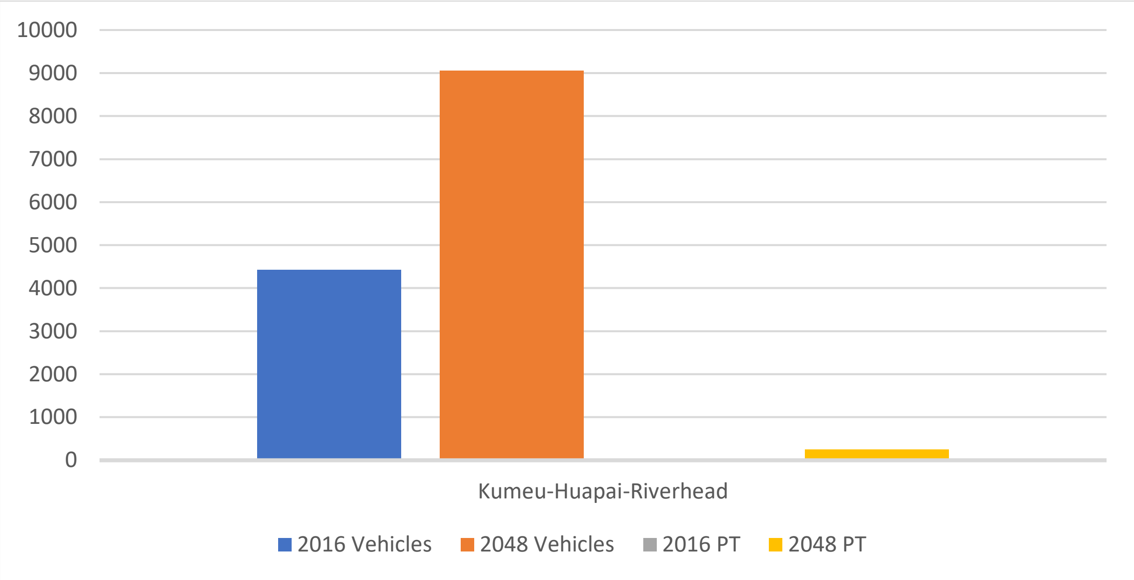


Figure 7-9: Two hour morning peak period trips across the North West screenlines

In the future, traffic modelling indicates a significant increase in journey times to the city centre by car in 2048, as significant flows of up to 48,000 vehicles per day south of Kumeū-Huapai on SH16 and associated congestion and queues are expected without any of the NW Strategic Package projects. With no segregated facilities these deteriorating travel times will also be experienced by all public transport on the road network.

Without the RTC and associated Strategic Package projects, and with the full build-out of the FUZ areas, the journey time from Waimauku to Westgate is expected to increase to 53 minutes. This is compared to 21 minutes in the interpeak. This shows significant variability of travel time experienced during the day, which is an indicator of travel time reliability. Travel time reliability is important to users / customers of the transport network, as they plan their daily activities and make life decisions about living in this area.

Should no segregated public transport facility be provided for the future residents in this community, improved frequency and reliability will be increasingly difficult to achieve. This will result in stagnating patronage levels on the PT network, and commuters choosing to travel by private vehicles. This has significant effects on the environment, as it simply increases the future communities reliance on private vehicles, as well as the liveability of these future communities.

Significant travel demand increases are therefore expected in the North West – both in vehicles and in public transport patronage. Demands for a rapid transit solution from Kumeū-Huapai in 2048 are expected to be in the region of 1,300 boarding and alighting passengers in the peak 2-hour period from Kumeū and 2,600 boarding and alighting at Huapai station (including a park and ride).

A rapid transit solution generally needs to be able to accommodate 60% of the demand in the peak hour (i.e. 2,000 people in the peak hour), have sufficient capacity to ensure that people should not have to stand more than 20 minutes and provide a minimum service level on the FTN and RTN of a service at least every 10 minutes (6am to midnight). With demand at this level, and with these requirements this would require a double decker bus every two to three minutes, articulated buses or bus rapid transit (at a lower frequency), as highlighted in Figure 7-10.

Mode	Sub-mode	Indicative configuration	Pax. per vehicle	Absolute Min	Lower ideal	Upper ideal	Absolute max
				4 vph (15 min)	12 vph (5 min)	20 vph (3 min)	30 vph (2 min)
Bus	Standard bus	12.5m rigid triple axle	55	176	528	880	1,320
	Double decker	13.5m double decker	100	320	960	1,600	2,400
	Single Artic	18m single-articulated	105	336	1,008	1,680	2,520
	Double Artic	24m double-articulated	150	480	1,440	2,400	3,600
	Advanced BRT	31m metro style 'trambus'	200	640	1,920	3,200	4,800
Light Rail	Single LRV	33m single unit LRV	225	720	2,160	4,320	5,400
	Double LRV	66m LRV (2x 33m coupled)	450	1,440	4,320	8,640	10,800
	Triple LRV	99m LRV (3x 33m coupled)	650	2,080	6,240	12,480	15,600
Heavy Rail	Single EMU	75m three-car train	375	1,200	3,600	6,000	9,000
	Double EMU	150m six-car train	750	2,400	7,200	12,000	18,000
	Triple EMU	225m nine-car train	1,125	3,600	10,800	18,000	27,000

Figure 7-10: Functional peak capacity by mode and service frequency @ 80% occupancy (passengers per hour per direction)

Overall, the current public transport offerings connecting Kumeū to Westgate beyond provide a poor transport choice for existing and future residents. The current PT network has high variability in travel time, poor levels of priority resulting in long travel times commensurate (or in some instances longer) with travelling by car, and services offer low frequencies. As a combined public transport offering this creates a choice that is unattractive and time expensive for commuters, and it its current form is unlikely to encourage any form of significant mode shift from private vehicles. With the predicted increase in demand, additional buses are unlikely to be sufficient to cope with the additional pressure using the existing infrastructure, leading to bus bunching, and bus congestion on the network.

A significant infrastructure change will be needed to support the transformational step change required in the North West. This will require a rapid transit solution that provides a high quality, frequent and reliable frequent service that connects Kumeū-Huapai with employment and social opportunities in Westgate and Whenuapai and also enables wider connectivity to the Auckland region, including Auckland city centre and the North Shore.

Should no dedicated strategic cycle facility be provided there will be a lack of safe and attractive facilities for the future communities. This will have two likely results, travellers will choose to continue to travel by car, increasing reliance on private vehicles or people will travel by foot or cycle on corridors with high safety risks.

Increasing numbers of private vehicles will require investment in vehicle capacity infrastructure and could also have a corresponding reduction in utilisation of public transport facilities as people cannot get to stations or bus stops without a car. This would be a missed opportunity to provide excellent access to the rapid transit network proposed for SH16, employment opportunities at Westgate and Whenuapai, and connectivity to existing strategic cycle links on SH18 and SH16.

As mentioned above, with the current growth projection in this area, this will place increasing pressure on the local road corridors to perform key strategic movement functions for cyclists and these corridors do not provide a safe and appropriate environment. As these rural corridors are not equipped to support walking and cycling there is likely to be a lower response for a mode shift to active modes. Based on the current mode choice from Kumeū-Huapai, if nothing is done to upgrade the existing active mode facilities then it is expected that there will be a continued use of private vehicles as the predominate travel mode.

As previously identified in Section 5.1, an integrated transport response to the over-reliance on the existing SH16 corridor is needed to provide a comprehensive solution that integrates land use and transport to maximise outcomes.

7.4 Assessment of Operational Transport Effects

Overall, the key features and outcomes of the RTC / RAMC and the associated Kumeū and Huapai RTC Stations, include the following:

- RTC / RAMC
  - The RTC supports transformational mode shift in Kumeū-Huapai through the provision of a safe, high-quality, frequent, and reliable public transport system that connects Kumeū-Huapai with Westgate, Auckland city centre and North Shore.
  - With the RTC there is predicted to be increased access to employment by PT within 15, 30 and 45 for the Kumeū-Huapai growth area in the weekday AM peak period. The proportion of jobs accessible by PT increases in each of these time intervals is predicted to increase by 11% within 15 minutes and over 100% in within 30 and 45 minutes with the NW RTC Full Implementation project.
  - The RTC is predicted to reduce the average PT journey time in weekday AM peak period to City Centre from Kumeū-Huapai from around 78 minutes to 61 minutes with the NW RTC Full Implementation project.
  - The RTC is predicted to increase the proportion of PT trips for all non-local trips (outside North West) in the weekday AM peak period from 19 to 31% (equating to 708 additional PT trips outside of the North West) with the NW RTC Full Implementation project.

  - The RTC operates within a dedicated, separated corridor that will be grade separated from all local and strategic corridors, which provides for reliable journey times on both the RTC and those other local and strategic corridors.
  - The RTC balances the transport and urban development potential of the system to support land and transport integration.
  - The RTC enables a mode shift by providing alternatives to private vehicles.
  - The RTC supports a key transport interchange at Westgate, as well as unlocking access to economic and social opportunities in the North West.
  - The RAMC provides a key strategic corridor for walking and cycling that connects Westgate to Kumeū-Huapai.
  - The RAMC provides a segregated facility that maximises safety for active modes and provides a direct link with limited vehicle conflicts.
  - The RAMC will link to the North Western cycleway and ultimately the Auckland CBD.
- Kumeū and Huapai RTC Stations
  - Support transit-oriented development around the RTC stations and will be integrated with bus, walking, and cycling networks to promote travel choice.
  - The RTC patronage for the Kumeū-Huapai stations results in a total of 3,250 passengers that travel between those stations and the future Brigham Creek RTC station. With those stations enabling passengers to board within close proximity to their place of residence, rather than having to travel to Westgate to access the RTC.
- The Kumeū RTC Station more specifically:
  - Enables access to employment in Kumeū-Huapai, within town centre and employment area to south of the NAL along Access Road.
  - Supports access for broader eastern catchment in Kumeū-Huapai, including FUZ north and south of the RTC, via local bus services and active modes using the identified active modes network.
  - Enables co-location with existing and / or future town centre areas, which is aligned with opportunity for intensification and integration, as identified in the National Policy Statement: Urban Development (NPS:UD).
- The Huapai RTC Station more specifically:
  - Supports access for the western catchment in Huapai, including FUZ north and south of the RTC, which could be enhanced by local connections north of NAL via future structure planning processes.
  - With a grade separated active modes crossing of the NAL supports access by local bus services and active modes from the southern FUZ catchment. using the identified active modes network.
  - Enables access for Park and Ride for the broader North West rural catchment, including Waimauku and Helensville, via connection from Matua Road (West).
  - Supports opportunity for co-location with local centre supporting NPS:UD.

7.4.1 Safety

The design of the RTC / RAMC and associated stations have been undertaken with consideration of the latest safety guidance. Whilst these facilities are generally in off-line alignments and incorporate grade separation along the RTC / RAMC alignment, where the projects interface with the existing transport network, such as key connection points the design has considered AT's Vision Zero and Waka Kotahi's Road to Zero.

The entire length of the RAMC is separated from other transport corridors. Where there is an interface with the local network at Taupaki Road, the RAMC alignment has been designed, so that people cycling along the corridor will not need to cross Taupaki Road, instead cycling along the eastern side between cycle ramps. The facility also includes a connection along Taupaki Road to SH16, connecting to the proposed shared path along that corridor.

The RTC / RAMC is expected to result in positive effects on safety, given the corridor will reduce traffic demand on the existing SH16 corridor, improve mode choice for connections to Westgate / Whenuapai and reduce the risk that people will use inappropriate and less safe rural roads. It also removes the existing road level crossings of the NAL at Boord Crescent and Matua Road (West).

Overall, the proposed design of the Project is well aligned with the transport safety principles from AT and Waka Kotahi. It will provide a much safer transport system which will likely reduce the number of DSIs and result in positive effects for all road users. It is noted that the detailed design will be completed in the future to further detail measures to achieve the anticipated safety outcomes.

7.4.2 Walking and Cycling

The RAMC proposes a separated shared path for walking and cycling facility between Kumeū-Huapai and Whenuapai and provides recreational opportunities by extending the network facilities for these modes.

Local connection points have been included in the RAMC, which connect with the expected future adjacent facilities at Brigham Creek Road / Fred Taylor Drive, Taupaki Road (including connection to the shared path on SH16), and SH16 Main Road. The specific design of these connecting facilities will be developed further at detailed design prior to implementation.

The proposed walking and cycling facilities along the corridor have been designed in accordance with relevant Waka Kotahi standards and policies discussed in Section 0. The exact provision of walking and cycling crossing facilities will be confirmed at the detailed design stage and will be guided the same or future equivalent documents.

The Project will have a number of significant positive effects on walking and cycling as it will:

- Significantly reduce the likelihood and exposure to potential crashes, as it will provide a new separated facility and enable safe movement for vulnerable road users through the area.
- Improve integration with the future walking and cycling network, resulting in improved east-west walking and cycling connectivity.

- Lead to environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
- Serve as a key enabler for greater use of active transport modes by providing a safe connector route between Kumeū-Huapai and Westgate.

The RTC Stations at Kumeū and Huapai will attract patronage from the surrounding existing and future residential urban areas, with people also accessing jobs in the planned industrial land, as well as in the identified existing and / or future Town and Local Centres identified by the Council. The indicative walking catchments for the two RTC stations is illustrated on Figure 7-11.

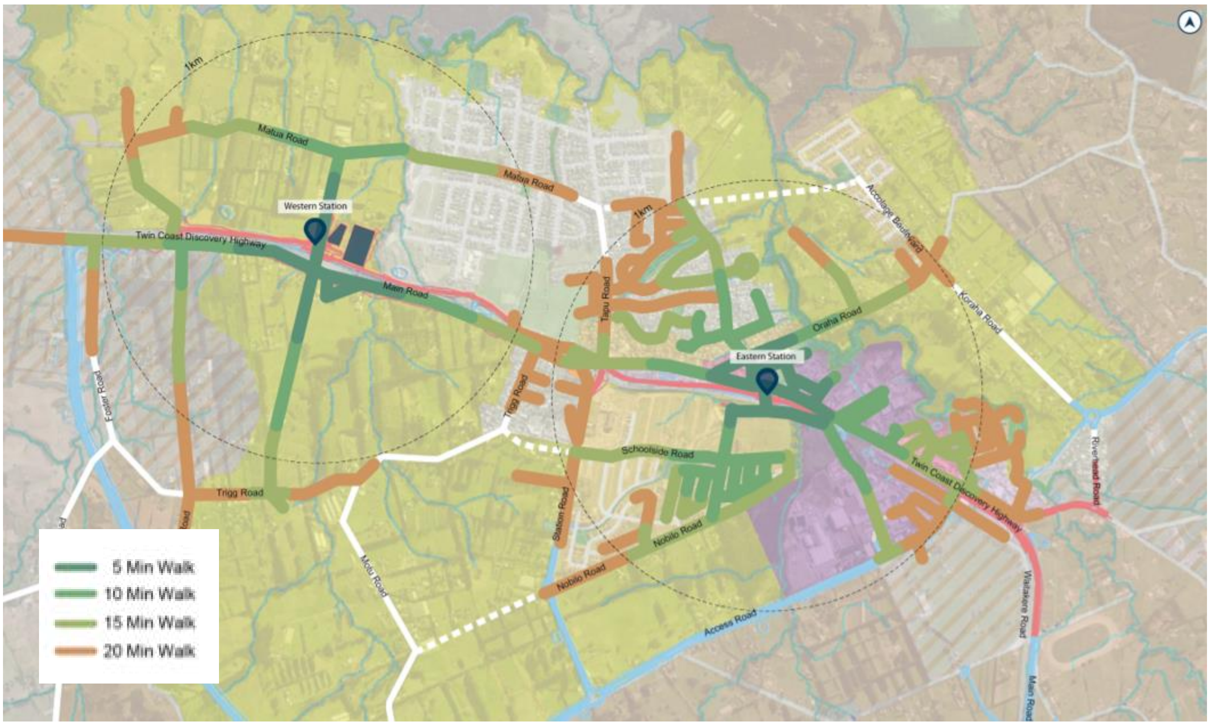


Figure 7-11: Indicative Pedestrian Catchments for Kumeū and Huapai RTC Stations

Without direct connections over the adjacent NAL, the walking and cycling catchments for these stations would be significantly reduced, with people having to take longer journeys to access the stations otherwise. The provision of the grade separated pedestrian and cycle bridges within the design therefore supports more direct, convenient and attractive routes to access the stations across the NAL.

7.4.3 Public Transport

The RTC will support transformational mode shift in Kumeū-Huapai through the provision of a safe, high-quality, frequent, and reliable public transport system that connects Kumeū-Huapai with Westgate, Auckland city centre and North shore.

It will increase access to employment opportunities by PT and make this a more attractive travel option, in comparison to the use of the private car. The RTC is predicted to reduce the average PT journey time in weekday AM peak period to City Centre from Kumeū-Huapai from around 78 minutes to 61 minutes. Whilst it is predicted to increase the proportion of PT trips for all non-local trips (outside North West) in the weekday AM peak period from 19 to 31% (equating to 708 additional PT trips outside of the North West).

The RTC operates within a dedicated, separated corridor that will be grade separated from all local and strategic corridors, which provides for reliable journey times on both the RTC and those other local and strategic corridors. It will support a key transport interchange at Westgate, as part of the NW RTC Full Implementation project, as well as unlocking access to economic and social opportunities in the North West.

The RTC Stations will support transit-oriented development and will be integrated with surrounding bus, walking, and cycling networks to promote travel choice. The stations provide the opportunity for urban intensification, as expected through the NPS:UD, in locations that support the identified future Town Centre and Local Centre locations identified by the Council in its Spatial Land Use Strategy - North West.

The RTC Stations include appropriate provision for access by local bus services that will support the broader PT system, by connecting the Kumeū-Huapai community (particularly those outside of a reasonable walk or cycle to the stations) with access to the RTC. This includes via the planned future bus services operating between Kumeū-Huapai and Waimauku / Helensville.

7.4.4 General Traffic and Freight

The RTC and RAMC will contribute to reducing the future traffic demand on the SH16 corridor between Kumeū-Huapai and Westgate / Whenuapai, which will improve the effectiveness and reliability of this corridor. However, the full benefits for the SH16 corridor are realised with the completion of the ASH, which enables intra- and inter-regional trips, including freight traffic to avoid passing along SH16 between Kumeū-Huapai and the Brigham Creek Interchange at Whenuapai.

The RTC and RAMC have been designed to be grade separated over local roads, such that whilst there will be some adverse effects during construction (refer to Section 9.2.3), with the completion of the Project, access will be maintained along these local roads. In the case of the realignment of Matua Road (West) and Station Road, this will provide for improved grade separated connection across the NAL and an improved more direct access to SH16 Main Road respectively.

At Boord Crescent, a new access road will need to be constructed to connect with Waitakere Road. However, this is not anticipated to significantly impact journey times for residents / tenants of properties on Boord Crescent, once the new road is in place and operating. Indeed, the new road will be grade separated over the NAL, meaning that the existing level crossing will no longer need to be used, reducing the safety risks associated with that existing facility. Whilst there will be some adverse effects during construction (refer to Section 9), with the completion of the Project, access will be maintained along the southern section of Boord Crescent.

The Huapai RTC Station, including its associated Park and Ride facilities will require connection to the existing road network, both for car access and local PT service connections. The proposed designation therefore includes provision of a dedicated access road, connecting with Matua Road (West). As noted above, to provide grade separation from the NAL, Matua Road (West) will therefore be realigned to connect with SH16 Main Road. This will enable a dedicated access road to be provided to the Park and Ride facility, separate to any future roads within the structure plan for the Huapai FUZ north of the NAL. This would reduce the effects of the Park and Ride users accessing the facility on those future urban areas and enable this key connection to be provided for those people in the broader North West rural catchments to reach the RTC.

Connection is also anticipated between the Huapai RTC Station and Meryl Avenue. As illustrated in Figure 7-12, Meryl Avenue is currently a single lane rural road corridor with no kerb and channel, footpath provision or street lighting. In its current form Meryl Avenue would not provide appropriate access for pedestrians, cyclists and PT users to the Huapai RTC Station.

Figure 7-12: Meryl Avenue – Existing Form (View North at 29 Meryl Avenue)

However, over time, the adjacent areas (within the Huapai FUZ) will be structure planned and developed and the form and function of Meryl Avenue will be expected to change to an urban corridor that would more appropriately provide for local access to the station. As such, in advance of the station implementation, it may be necessary for adjacent future developments to provide upgrades to Meryl Avenue. Otherwise, in the event that the station implementation occurred prior to surrounding urbanisation, then this would result in an upgrade to provide access for the nearby catchments for the RTC or for local PT services, in combination with the Matua Road (West) connection.

The current road reserve along Meryl Avenue is approximately 20m wide, which it is considered would be more than sufficient to provide for the necessary transport provision to access the station, namely, two lanes (one each direction), plus walking and cycling facilities. An example of the indicative cross section that could be enabled within the 20m corridor is shown in Figure 7-13. On this basis, it is considered that Meryl Avenue does not need to be included in the proposed designation for NoR HS.

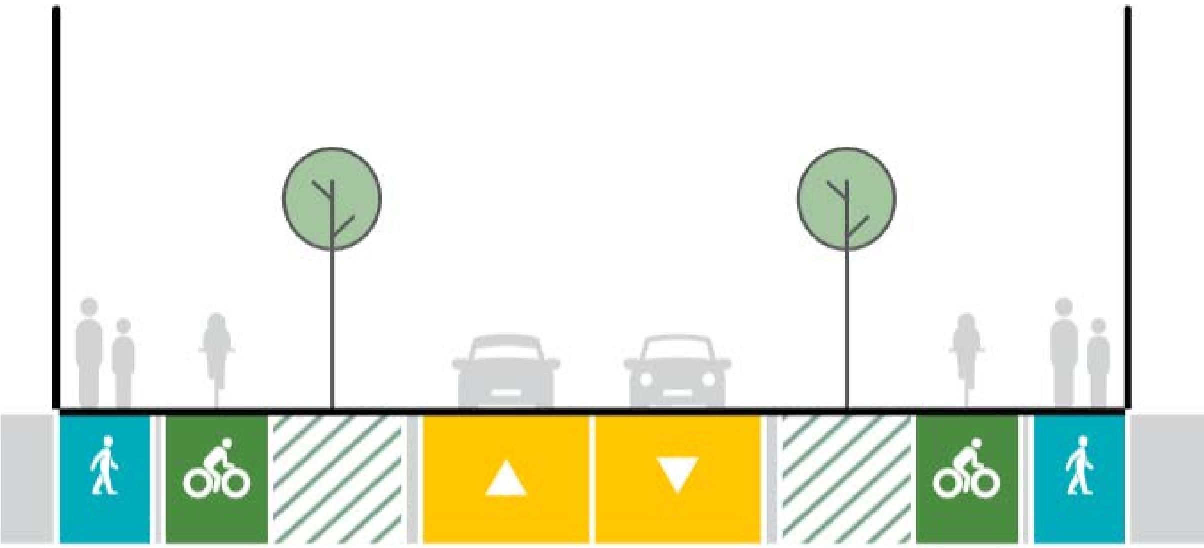


Figure 7-13: Indicative 20m Road Corridor Cross Section – Meryl Avenue

The key intersections associated with the RTC corridor and RTC Stations have been assessed and shown to provide sufficient capacity to accommodate the anticipated future traffic demands with the growth in the existing and future urban areas in the longer-term. The traffic modelling results for the key intersections associated with these projects are provided in Appendix 2.

7.4.5 Access and Parking

The design of the RTC / RAMC and RTC Stations has maintained access along all existing local roads along the route via grade separation of the ASH and local road corridors, plus in some cases, permanent realignment of those local roads (such as the new connection to Boord Crescent off Waitakere Road).

In terms of existing property access, the overarching design philosophy for the Project has been to maintain driveway access, where practicable, either re-grading existing access or relocating the driveway access. However, in some circumstances (as discussed below), it has been necessary to provide access to via new private roads.

The key areas where effects on property access have been identified are:

- In the vicinity of the intersections and interchanges between the RTC / RAMC and local roads.
- Along the RTC / RAMC corridor, where large rural lots are separated from existing road corridors.
- Where the RTC traverses the Huapai Domain (46 Tapu Road, Huapai).

Table 7-6 below summarises the potential adverse effects on properties / activities along the RTC / RAMC and in relation to the RTC Station during the operational phase. Similar adverse effects would also occur and require mitigation during the construction phase through the CTMP. Unless otherwise stated this relates to the effects of the RTC / RAMC, but where associated with the RTC Station instead, this is specifically identified. Where adverse effects are only expected during the construction phase, these are separately addressed in Section 9.

Table 7-7: RTC / RAMC, Kumeū RTC Station and Huapai RTC Station Projects – Potential Adverse Transport Effects on Access – Operational Phase

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
Adverse impacts on property access driveway	✓	375, 377 Taupaki Rd, Taupaki 384, 400 Taupaki Rd, Taupaki 190 Boord Crescent, Kumeū Lot 3 DP 495742 Boord Crescent, Kumeū 113 Boord Crescent, Kumeū 108 Boord Crescent, Kumeū 42 Boord Crescent, Kumeū (split by new Waitakere Rd link into 2 lots) 51 Boord Crescent, Kumeū 23 Boord Crescent, Kumeū 903 Waitakere Road, Kumeū (split by new Waitakere Rd link) 7 Main Rd, Kumeū 84, 86A-F, 88A-D, 90A-D, and 92 Main Road, Kumeū 106 Main Road, Kumeū 108, 110 Main Road (New World), Kumeū 132, 134, 154 and 156A-F Main Road, Kumeū 190 Main Road, Kumeū 248 Main Road, Kumeū	Re-grade existing or re-form new driveway access off public road for identified properties

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
		43 Wookey Lane (associated with Kumeū RTC Station) 4, 6, 8, 10, 12, 14, 20, 22, 24, 25, 26, 28, 30, 32, 34, 36, 38, Station Rd, Huapai 23 Vintry Dr (off Station Rd) (Huapai Triangle development), Huapai 1, 1A, 2, 3, 4, 6, 8 Tapu Rd, Huapai 395, 397 Main Road, Huapai 399 Main Road (Secret Garden Pre-School), Huapai 401 Main Road, Huapai 30, 32 Meryl Avenue, Huapai 665 and 677 SH16, Huapai (associated with Huapai RTC Station) 411 Matua Road (West), Huapai (associated with Huapai RTC Station) 405, 411, 419, 427, 443 and 449 Taupaki Rd, Taupaki (associated with active modes facility between RAMC and SH16)	
Existing private access road or driveway will no longer be viable	✓	184 (Fred Taylor Park) (new access road can be provided through the designation off Fred Taylor Dr) 196, 198, 200 Fred Taylor Drive (new access road can be provided through the designation off Fred Taylor Dr) 272 SH16, Taupaki (new access road can be provided through the	Utilise alternative private access or construct new private access road or driveway for identified properties

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
		designation off existing driveway) 186 Boord Crescent (new access road can be provided through the designation off realigned Boord Cr) 9, 13, 15 (Trotting Club), 17, 29 and 35 Trotting Club Dr, Kumeū (realignment of Boord Cr can be provided through the designation to Trotting Club Dr) 156G Main Road, Kumeū (alternative access driveway to be provided off 156A-F driveway for residual lot) 223 Main Road, Kumeū (associated with Kumeū RTC Station) (new access road can be provided through the designation off Wookey La or via existing paper road from Nobilo Drive) Huapai Domain, Huapai (driveway access off Tapu Rd) – refer to discussion below	

The proposed new private access roads and realignment of existing roads to maintain local access have been incorporated into the proposed designation boundary for the RTC / RAMC and further details will be developed at later design stages and as part of the Outline Plan of Works.

The existing Kumeū fire station (331 Main Road, Huapai) has been identified to be affected by the RTC alignment. With the implementation of the RTC, there will be insufficient manoeuvring space (and parking) within the site to accommodate the operational requirements of Fire and Emergency New Zealand (FENZ). The entire property has been included in the designation.

As this is an essential emergency service, it will be necessary to provide mitigation in order that FENZ can continue to operate its services at time the RTC is implemented (and during construction). It is understood that there is the ability to expand the existing site or identify a new site (within reasonable proximity) within parts of the designation that would in any event be required for construction purposes. As such, it is considered that with the agreement of FENZ, an appropriate site can be identified at the time of implementation.

The Huapai Domain has been identified to be affected by the RTC alignment. Parts of the Domain have been identified to be included in the designation, which with the implementation of the RTC will affect parking within the Domain and access to that parking from Tapu Road, as well as several buildings. The location of the parking affected on the southern side of the Domain, as shown in Figure 7-14.

Figure 7-14: Affected parking in Huapai Domain

As the Domain is an important community facility for Auckland Council Parks, it will be necessary to provide retain access and parking when the RTC is implemented (and during construction). There is the ability to continue to provide access off Tapu Road and replace parking by utilising parts of the designation that would in any event be required for construction purposes and within the existing Domain site. As such, it is considered that with the agreement of Auckland Council Parks, an appropriate site arrangement can be identified at the time of implementation.

There are several properties, where on-site parking has been identified to be affected by the proposed designation. The properties are sufficiently sized to potentially remain viable for activities within the current (or future) zoning. Moreover, the actual activity / use may change over the timeframes of the lapse dates sought, particularly for sites within the FUZ. As such, these properties have not been included in the designation and mitigation has not been identified, as this matter can be addressed via the Public Works Act at the time of implementation. The identified properties are:

- 400 Taupaki Rd, Taupaki
- 993 Waitakere Road, Kumeū
- 86A-F, 88A-D, 90A-D, and 92 Main Road, Kumeū
- 1/1 to 1/10 Putaki Drive, Kumeū
- 106 Main Road, Kumeū
- 156G Main Road, Kumeū
- 190 Main Road, Kumeū
- 23 Wookey Lane, Kumeū (associated with Kumeū RTC Station)
- 321A Main Road, Kumeū (associated with Kumeū RTC Station)
- 399 Main Road (Secret Garden Pre-School), Huapai
- 30 and 32 Meryl Avenue, Huapai (associated with Huapai RTC Station)

Along SH16 Main Road, there is an existing area of on-street parking (around 41 car parking spaces) within the road reserve between Access Road and 92 Main Road, Kumeū. As discussed in Section 6.4.6, this is affected by the SH16 Main Road Upgrade and hence the RTC, as this section of SH16 Main Road needs to be realigned to facilitate the RTC. As previously discussed in Section 6.4.6, given the anticipated future land use and transport context, it is considered that the identified loss of on-street parking can be satisfactorily managed in combination with broader parking strategies that will complement the locations close proximity to the Kumeū town centre and Kumeū RTC Station.

Notwithstanding the above, the current AT Parking Strategy identifies that, if there is a significant loss of on-street parking on an arterial road, AT will complete a parking assessment at the time of implementation to identify any appropriate parking mitigation measures at the time, where necessary. This is a matter that can therefore be appropriately addressed at the time of implementation.

7.5 Project Interdependencies

The RTC / RAMC and RTC Station projects have been designed to integrate with each other and the rest of the North West Strategic Package, but are equally able to be progressed without being dependent on the other projects.

The relationships and interdependencies between the North West Strategic Package projects and other projects are discussed below.

7.5.1 NW RTC Full Implementation

The RTC project identifies and seeks designations for the route for the long-term rapid transit corridor between Redhills North and Kumeū-Huapai. The RTC will form part of the wider rapid transit network, as an extension of the NW RTC Full Implementation project from a future Brigham Creek station (that station is not part of this proposal and is associated with the NW RTC Full Implementation project).

While there is an inter-dependency between the NW RTC Full Implementation project, the RTC could be used by interim services prior to the NW RTC Full Implementation project being completed. This option is discussed further below. This potential interim use and any other possible interim uses would be considered further through an implementation business case for the RTC / RAMC.

In terms of an interim RTC that could be provided. This would be an extension of (or connect with) the soon to be completed NW Short Term Improvements project, utilising the RTC corridor from Redhills North and terminating at Access Road. There is sufficient room within the designation footprint to facilitate this connection.

The decision on the staging of both projects will be made by Waka Kotahi likely via separate implementation business cases. Key considerations associated with this interim option would be:

- Costs for investigation, design, and implementation of the RTC to Access Road
- Potential opportunity to implement Kumeū RTC Station early (NoR KS) to maximise land use intensification and integration around station
- Reliance on existing SH16 Main Road corridor and local PT service connections from Access Road to west through Kumeū-Huapai.

7.5.2 ASH and SH16 Main Road Upgrade

As has been discussed previously, the ASH corridor has a strong interdependency with the SH16 Main Road Corridor Upgrade. The completion of the ASH corridor will reduce strategic trips and local trips along the existing SH16 Main Road corridor through Kumeū-Huapai. As discussed previously, the delivery of the RTC through Kumeū-Huapai is dependent on the completion of some segments of the SH16 Main Road Upgrade in advance of the RTC (particularly the section immediately west of Access Road, where the corridors are separated, but adjacent).

Depending on the implementation timing of the RTC and Main Road Upgrade, relative to future urban growth occurring in Kumeū-Huapai, the implementation of the ASH may be necessary in advance of those projects to manage potential adverse effects on the urban areas. However, should those projects be delivered earlier in the staging of future growth in Kumeū-Huapai, then the ASH may not be necessary in advance.

7.5.3 Access Road Upgrade

The RTC / RAMC and the Access Road Upgrade are considered to be independent of each other, i.e. the NoR S3 project is not dependent on the completion of the Access Road Upgrade or vice versa. However, the proposed designation and design of each project complements the other and both are considered to be necessary with the long-term growth.

7.6 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The Project provides significant positive effects and there are generally no operational adverse effects to mitigate, given the effects on local roads and property access have been addressed through the design of the Project and hence provided for by the designation.

Whilst there are potential adverse effects on on-street and off-street parking, it is considered that this will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future on-street and off-street parking policy and strategy, given the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

However, adverse effects on the Huapai Domain and the Kumeū fire station have been identified, which are important emergency and community facilities. It will be necessary to continue to enable the operation of the Kumeū fire station and provide alternative access and parking for the Huapai Domain. There is the ability to provide viable mitigation within the existing sites and/or utilising parts of the designation that would in any event be required for construction purposes. As such, it is considered that, with the agreement of FENZ and Auckland Council Parks, appropriate mitigation can be provided at the time of implementation.

The relative timing of the RTC, SH16 Main Road Upgrade, and ASH will be considered as part of later implementation business cases prior to implementation. The assessment has identified that depending on the timing of the Main Road Upgrade, relative to future urban growth occurring in Kumeū-Huapai, the implementation of the ASH may be necessary in advance of this project to manage potential adverse effects on the urban areas. The delivery of the RTC through Kumeū-Huapai is also noted as being dependent on the completion of some segments of the SH16 Main Road Upgrade in advance. In terms of the proposed designation, each of these projects remain necessary in their own right, as part of the North West Strategic Package to support the anticipated long-term growth.

7.7 Summary of Operational Transport Effects (NoR S3, NoR KS and NoR HS)

The assessment of transport effects for the Project is summarised in Table 7-7 below.

Table 7-8: Assessment of Operational Effects Summary for NoR S3 (RTC / RAMC), NoR KS and NoR HS

Operational Transport Effects	
Safety	In summary, the effects of the Projects on safety are: • Provides a new RTC and RAMC which meets current standards and minimises interfaces with the local transport network, except at key strategic connections to the local network. • The RTC / RAMC will reduce traffic demand on the existing SH16 corridor, improving mode choice for connections to Westgate / Whenuapai and reduce the risk that people will use inappropriate and less safe rural roads.

Walking and Cycling	In summary, the effects of the Project on walking and cycling are:
	• The RAMC provides a new corridor which meets current standards and achieves the following significant positive effects:
	  ◦ Significantly reduce the likelihood and exposure to potential crashes, as it will provide a new separated facility and enable safe movement for vulnerable road users through the area.
	  ◦ Improves integration with the future walking and cycling network, resulting in improved east-west walking and cycling connectivity.
	  ◦ Leads to environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
	• Serves as a key enabler for greater use of active transport modes by providing a safe connector route between Kumeū-Huapai and Westgate.
	• The grade separated connections to the RTC Stations at Kumeū and Huapai will provide connections over the adjacent NAL to the stations and planned adjacent centres, which will significantly reduce walking and cycling journeys distances supporting direct, convenient and attractive access options for active mode users.

Public Transport	In summary, the effects of the Project on public transport are: • The RTC will support transformational mode shift in Kumeū-Huapai through the provision of a safe, high-quality, frequent, and reliable public transport system that connects Kumeū-Huapai with Westgate, Auckland city centre and North shore. • The RTC will increase access to employment opportunities by PT and make this a more attractive travel option, in comparison to the use of the private car. • The dedicated RTC corridor will be grade separated from all local and strategic corridors providing reliable journey times • The RTC will support a key transport interchange at Westgate, as part of the NW RTC Full Implementation project, as well as unlocking access to economic and social opportunities in the North West. • The Kumeū and Huapai RTC Stations will support transit-oriented development and will be integrated with surrounding bus, walking, and cycling

Operational Transport Effects	
	networks to promote travel choice. This will provide the opportunity for urban intensification, as expected through the NPS:UD, in locations that support the identified future Town Centre and Local Centre locations. • The RTC Stations include appropriate provision for access by local bus services that will support the local PT system connecting the Kumeū-Huapai community and broader rural catchment with access to the RTC.
General Traffic	In summary, the effects of the Project on general transport are: • The RTC and RAMC will contribute to reduced future traffic demand on the SH16 corridor between Kumeū-Huapai and Westgate / Whenuapai, which will improve the effectiveness and reliability of this corridor. Noting the full benefits for this corridor are realised with the completion of the ASH. • The RTC and RAMC have been designed to be grade separated over local roads, so whilst there will be some adverse effects during construction, access will be maintained along these local roads. With the realignment of Matua Road (West) and Station Road providing improved connections / access. • The new access road at Boord Crescent will not significantly affect journey times, but will reduce the safety risks associated with the existing level crossing of the NAL. • Provide sufficient corridor and intersection capacity to cater for growth on existing and FUZ growth.
Access and Parking	In summary, the effects of the Project on access and parking are: • Potential adverse effects on property access can be addressed through the later design stages / Outline Plan of Works by re-forming / re-grading property driveways or providing new access driveways. • Effects on off-street and on-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support. • Adverse effects have been identified in relation to Huapai Domain and the Kumeū fire station, which are important emergency and community facilities. It is considered that there are viable mitigation solutions that with the agreement of FENZ and Auckland Council Parks can provide appropriate mitigation at the time of implementation.

The relative timing of the RTC, SH16 Main Road Upgrade, and ASH will be considered as part of later implementation business cases prior to implementation. The assessment has identified that depending on the timing of the Main Road Upgrade, relative to future urban growth occurring in Kumeū-Huapai, the implementation of the ASH may be necessary in advance of this project to manage potential adverse effects on the urban areas. The delivery of the RTC through Kumeū-Huapai is also noted as being dependent on the completion of some segments of the SH16 Main Road Upgrade in advance. In terms of the proposed designation, each of these projects remain necessary in their own right, as part of the North West Strategic Package to support the anticipated long-term growth.

7.8 Conclusions

Overall, the NoR S3 (RTC / RAMC), NoR KS and NoR HS provide considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic effects.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the CTMP prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

Effects on off-street and on-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

Adverse effects on the Huapai Domain and the Kumeū fire station, which are important emergency services and community facilities can be addressed by viable mitigation solutions that with the agreement of FENZ and Auckland Council Parks can provide appropriate mitigation at the time of implementation.

8 NoR S4: Access Road Upgrade

8.1 Project Corridor Features

8.1.1 Project Overview

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern FUZ of Kumeū-Huapai. The proposed upgrade extends from the intersection of Access Road with SH16 in the east and continues into Tawa Road to its intersection with Puke Road in the west.

Access Road plays a key role in connecting the existing and likely future urban area zones to both the RTC / RAMC, via the SH16 Main Road Upgrade, and the ASH. As shown in Figure 8-1, it is aligned along the south eastern boundary of the southern FUZ, providing for an enhanced collector network within the FUZ to connect to this corridor, when the area is structure planed by the Council.

It is proposed to widen the existing Access Road/Tawa Road corridor from its current width of 20m to accommodate a 30m wide four-lane cross-section. The cross-section of the corridor transitions from a rural edge cross-section to an urban cross-section at the Wookey Lane intersection.

Figure 8-1: Overview of Access Road Upgrade

8.2 Network and Corridor Design

The Project was developed as part of network planning for the wider north west area. The wider networks were developed through the Business Case process that considered the key problems, benefits, outcomes and range of options to address the identified problems. As such, the Project is part of a wider long-term integrated network planned for the area.

The existing corridor includes two vehicle lanes, one per direction, and a small segment with footpaths at the eastern end. Outside of the existing urban area, the corridor has a high speed rural road environment.

The development of the strategic corridor design and its interfaces with the local road network has included the use of the relevant transport guidance and documents, as described in Section 0. Key aspects of the network and corridor design are summarised below.

The Project proposes that the function of Access Road will change from an existing rural two-lane road to a low-speed four-lane arterial (using AT standards) with mixed components for vehicles, and active modes.

- As shown in Figure 8-2, through the business and industrial area, a 30m urban corridor is provided, including walking and cycling infrastructure along both sides of this eastern section.
- As shown in Figure 8-3, along the western section of Access Road, which is a low-speed rural section, the corridor has a rural southern edge (swales, typically 9m wide top width) with walking and cycling facilities along its northern urban edge.

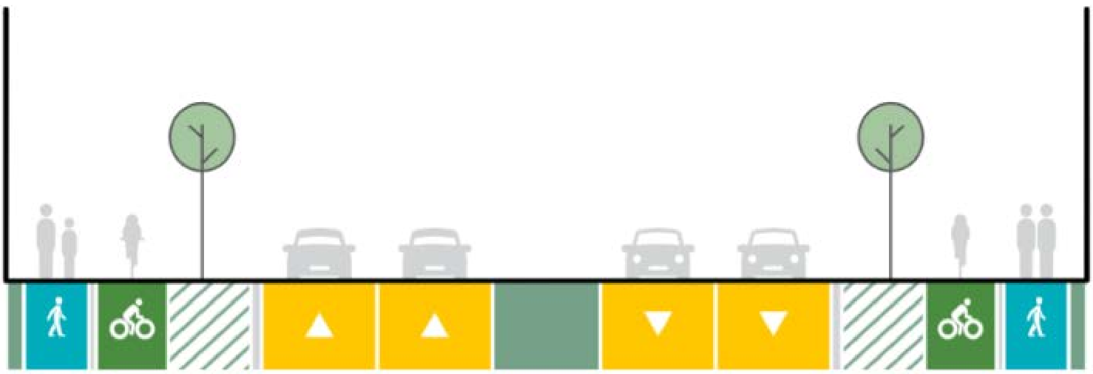


Figure 8-2: Indicative future Access Road corridor design for urban section

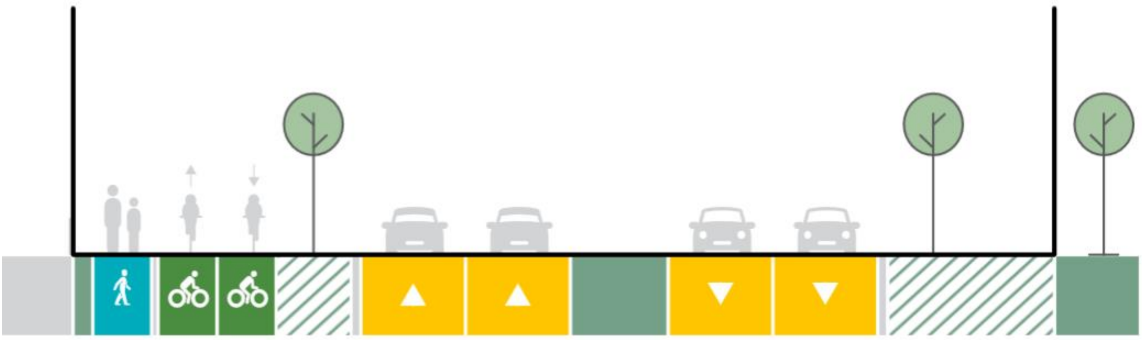


Figure 8-3: Indicative future Access Road corridor design for rural section

The development of the corridor design has included the use of AT's Roads and Streets Framework (RASF), which qualitatively assesses the typology (movement and place value) and modal priority. The intent of that framework is to classify the expected movement and place functions from a consistent regional context and identify the likely priority applied to each mode.

The framework itself does not directly dictate a specific corridor design but provides context and guidance regarding the intended function of the corridor that will be used to inform future development and operation of the corridor. For integrated land use and transport classification purposes, land use context uses Place Value (ranking from P1 'low' to P3 'high' importance) and for transport context uses Movement Value (ranking from M1 'low' to M3 'high' importance).

The corridor is assessed to have the following RASF typology:

- Place function – transitioning from P1 (low) to P2 (medium)
- Movement function – transitioning from M1 (low) to M2 (medium) long term

Figure 8-4 below indicates the likely long-term modal priorities for the corridor. Currently the mode split is heavily weighted to general traffic. As the corridor is upgraded and the area is developed, the mode split is anticipated to shift to more sustainable modes of travel as well as freight movement, the latter influenced by the access to the existing and future industrial area on Access Road.

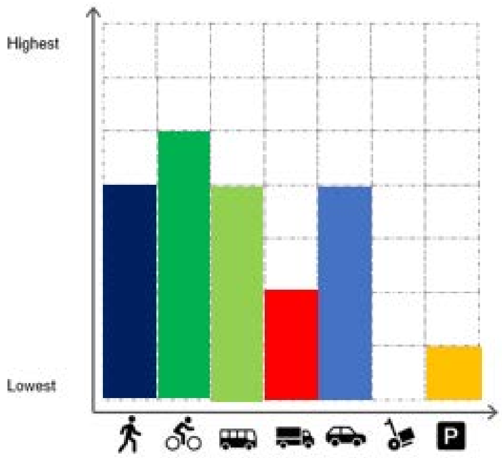


Figure 8-4: Future modal priority in 2048+ for Access Road

8.3 Existing and Likely Future Environment

8.3.1 Planning context

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai. The northern side of Access Road is zoned under the AUP:OP as FUZ, with Business – Light Industry Zoning at the north-eastern section of Access Road. The southern side of Access Road is predominantly zoned under the AUP:OP as Rural – Countryside Living, with exception to the Kumeū Showgrounds which are zoned as Rural – Mixed Rural Zone are identified as a precinct (I517 Kumeū Showgrounds Precinct) in the AUP:OP. Table 8-1 below provides a summary of the existing and likely future environment as it relates to Access Road.

Table 8-1: Access Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[22]	Likely Future Environment[23]
Business	Business (Light Industrial) Zone	Low	Business (Light Industrial)
Rural	Rural – Countryside Living Zone Rural – Mixed Rural Zone	Low	Rural
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	High	Urban

22 Based on AUP:OP zoning/policy direction
23 Based on AUP:OP zoning/policy direction

8.3.2 Transport Environment

8.3.2.1 Existing

The existing corridor is predominantly surrounded by greenfield land, with the exception of the eastern end, which is located adjacent to the light industrial land and Kumeū Showgrounds. It is comprises of one vehicle lane in each direction as shown in Figure 8-5. The carriageway transitions from rural to urban (on both sides) near Wookey Lane.

Figure 8-5: Existing Access Road Corridor (Rural Section)

Table 8-2 summarises the existing transport features of the Access Road corridor.

Table 8-2: Access Road: Existing Transport Features

	Existing Access Road Transport Features
Corridor Characteristics	• Western End (Rural Section) • Has a 70 or 80kph speed limit • Rural character with two vehicle lanes (one in each direction) • Corridor form is consistent, with no kerb and channel on either side of the corridor • Footpath on northern side only – north of 116 Access Road. • Eastern End (Urban Section) • Has an 50kph speed limit • Semi-rural character with two vehicle lanes (one in each direction) • Corridor form is inconsistent, with kerb and channel and footpaths providing in segmented sections on both sides of the corridor. • Corridor crosses the NAL at grade, just north of the proposed designation, which terminates at the Waitakere Road intersection.
Traffic Volume	The latest traffic data for Access Road was obtained from Auckland Transport[24].

[24] Auckland Transport Traffic Counts, July 2012 to March 2020, https://at.govt.nz/about-us/reports-publications/traffic-counts/

	Existing Access Road Transport Features
	The western tube count was recorded in June 2018 and shows Access Road (between Station Road and the urban/rural boundary) carried a 5 Day ADT of approximately 1,960 vehicles per day (vpd), and 210-230 vehicles per hour (vph) during the morning and afternoon peak hours. The eastern tube count was recorded in February 2019 and shows Access Road (between SH16 Main Road and the urban/rural boundary) carried a 5 Day ADT of approximately 4,130 vehicles per day (vpd), and 360-370 vehicles per hour (vph) during the morning and afternoon peak hours.
Key Road Network / General Traffic	• Access Road / SH16 Main Road signal • Access Road / Waitakere Road stop control • Access Road / Station Road give-way
Walking and Cycling	There is a short segment of road which includes a footpath on both sides, at the eastern end of the corridor, between SH16 Main Road and 21 Access Road.
Public Transport	There are no existing bus services on Access Road.

8.3.2.2 Likely Future

Table 8-3 below summarises the likely future transport features of the Access Road corridor, which connects the SH16 Main Road Upgrade with the ASH, including its strategic cycle facility.

Table 8-3: Access Road: Likely Future Transport Features

	Likely Future Access Road Transport Features
Corridor Characteristics	• Western End (Rural Section) • 60kph speed limit. • Rural character with four vehicle lanes (two in each direction) and a central median • Consistent corridor form with a swale on the southern side and a footpath and a bi-directional cycle path on the northern side adjacent to the land zoned FUZ. • Eastern End (Urban Section) • 60kph speed limit. • Generic four-lane arterial with a 30m designation. • Urban character with four vehicle lanes (two in each direction) and a central median. • Consistent corridor form with kerb and channels on both sides and continuous footpaths and cycle facilities on both sides.
Traffic Volume	The forecast Average Daily Traffic (**ADT**) in 2048 on Access Road is 7,000 vehicles north of Station Road, and 22,000 vehicles on the southern section of Access Road.
Key Road Network / General Traffic	• Access Road / SH16 Main Road signal • Access Road / Waitakere Road stop control • Access Road / Station Road roundabout
Walking and Cycling	• Western End (Rural Section)

	Likely Future Access Road Transport Features
	• Separated 3.5m bi-directional cycle lane and 1.8m footpath on northern side only • Eastern End (Urban Section) • Separated 2.0m cycle lanes and 1.8m footpaths on both sides
Public Transport	The indicative 2048 AT bus network forecasts 8 buses per hour on Access Road, or approximately 1 bus every 5-10 minutes.

8.4 Assessment of Operational Transport Effects

Overall, the key features and outcomes of the Access Road Upgrade include the following:

- Widens of Access Road from its current general width of 19m to an 30m wide four-lane cross section including separated cycle lanes and footpaths.
- Connects local land use to the transport network and distributing efficiently to the strategic network (RTC / RAMC, SH16 Main Road Upgrade or ASH) and to key destinations within Kumeū-Huapai.
- Provides around 8km of high quality cycle facilities for a network to connect the residential catchments to the Town Centre and other destinations, as well as the RAMC and ASH.
- Significantly reduces the likelihood and exposure to potential crashes as it will enable safe movement for vulnerable road users along and, where necessary, across Access Road.
- Supports the long term Rodney Greenways Plan which identifies this route as a key cycle connection.
- Reduces speed environment and provides space for midblock crossings, where necessary, particularly within the urban section.
- Focuses on active modes to shift trips away from private vehicle use and link land use to the RTC and strategic cycle corridors.
- Supports freight by connecting industrial zoned land directly to the ASH.

8.4.1 Road Safety

The design of the Project has been undertaken with consideration of the latest safety guidance. This includes AT's Vision Zero and Waka Kotahi's Road to Zero. The upgrade of Access Road is expected to result in positive effects on safety when compared to the existing corridor, and these consist of:

- Significantly improved walking and cycling facilities along Access Road (including separation), resulting in improved protection for vulnerable road users.
- Improved walking and cycling crossing facilities across the side roads intersecting with Access Road, resulting in a safer environment for all road users.
- A significantly improved speed environment by reducing speed limits to more appropriate urban speeds (e.g. 60km/h) with enhanced place function and consequential reductions in the risk of DSIs.

It is anticipated that the number of pedestrians and cyclists will increase significantly as the area surrounding Access Road is developed. The traffic volume on Access Road will likely also increase over time and therefore the exposure between motorists and vulnerable road users will be higher than the existing road environment. The Project proposes to lower the speed limit to 60km/h and provide segregated walking and cycling facilities to reduce the likelihood and severity in the event of a crash.

Overall, the proposed design of the Project is well aligned with the transport safety principles from AT and Waka Kotahi. It will provide a much safer transport system which will likely reduce the number of DSIs and result in positive effects for all road users. It is noted that the detailed design will be completed in the future to further detail measures to achieve the anticipated safety outcomes.

8.4.2 Walking and Cycling

The Project proposes separated walking and cycling facilities on both sides of Access Road through the urban section (eastern end), and bi-directional facilities on the northern side (adjacent to the FUZ area) through the rural section (western end). It connects to the ASH (NoR S1) at the Tawa Road Interchange, connecting with the strategic cycle facility on that corridor. At the northern end, it connects with the SH16 Main Road Upgrade, which also provides connection to the nearby RAMC at the eastern edge of Kumeū.

The corridor will support local connections with the surrounding existing and future urban areas, which are expected to have a network of local facilities appropriate to those local corridors' form and function. The specific design of these connecting facilities will be developed further at detailed design prior to implementation and will also be informed by later structure planning by the Council for the FUZ area.

The proposed walking and cycling facilities along the corridor have been designed in accordance with relevant Auckland Transport standards and policies discussed in Section 0. The exact provision of walking and cycling crossing facilities will be confirmed at the detailed design stage and will be guided the same or future equivalent documents.

The Project will have a number of significant positive effects on walking and cycling as it will:

- Significantly reduce the likelihood and exposure to potential crashes as it will enable safe movement for vulnerable road users along and, where necessary, across Access Road.
- Improve integration with the future walking and cycling network, resulting in improved north-south walking and cycling connectivity.
- Lead to significant environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips.
- Serve as a key enabler for greater use of active transport modes by providing a safe connector route between the development land and the future Kumeū centre.
- Support growth surrounding Access Road and significantly improve safety and access to employment and social amenities.

8.4.3 Public Transport

Public transport services will share the general vehicles lanes on the Access Road. In terms of future public transport services, there is one proposed transport service which will use the eastern section of Access Road. A total of 8 buses per hour, or approximately 1 bus every 5-10 minutes, are anticipated Access Road under the indicative 2048 AT bus network.

The cross-section will provide adequate spacing to facilitate public transport and associated bus stops. The exact location of bus stops will be identified as part of detailed design for the Project. Once greater certainty is available on the location of key land use activities, more certainty on high demand locations for bus stops can be determined, i.e. around centres and schools for example.

The Project's potential positive operational effects on public transport are:

- Reduced delays and improved reliability for the future PT network on Access Road and the wider network.
- Improved integration with the future public transport network and improved north-south connectivity, as well as improved access to employment and social amenities.
- Increased attractiveness and uptake of public transport trips which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.

8.4.4 General Traffic and Freight

As identified above, the 2048 ADT for Access Road is between 7,000 and 22,000 vehicles per day, depending on the segment of the corridor considered. The higher daily traffic demands being south of Station Road, closer to the Tawa Road Interchange on the ASH.

Given that the peak hour volume is typically approximately 10% of the daily total, it is anticipated that the vehicle volume during the peak hours will be in the order of 700 to 2,200 vehicles per hour. A four-lane corridor with limited access can efficiently accommodate up to 22,000 vehicles per day and therefore the proposed corridor design meets the forecasted needs.

As discussed below (Section 8.5), there is some inter-dependency between the Access Road Upgrade and the implementation of the ASH. Whilst the long-term traffic demands on the northern section, with full implementation of the completed North West Strategic Package corridors are anticipated to be around or below 10,000 vehicles per day, the provision of four lanes has been identified.

Typically, this threshold for four vehicle lanes would be in the order of 15,000 vehicles per day or a greater frequency of bus services. However, depending on the timing of the ASH implementation in relation to the future growth in Kumeū-Huapai, there is the potential that traffic demands on the northern section of Access Road, connecting with the current SH16 corridor, could be notably higher. The proposed designation for four vehicles lanes, therefore provides some necessary flexibility to accommodate this outcome, acknowledging this inter-dependency with the ASH timing, particularly in relation to supporting the reliability of PT services in this interim period.

The intersections along the Access Road Upgrade corridor have been assessed and shown to provide sufficient capacity to accommodate the anticipated future traffic demands with the growth in the existing and future urban areas in the longer-term. The traffic modelling results for the key intersections associated with these projects are provided in Appendix 2.

Similar to general traffic, the improved corridor capacity as a result of the Project will result in improved journey times and reliability for existing and future local freight, including access to the southern extension of the light industrial zone adjacent to Access Road, as anticipated in the Council's Spatial Land Use Strategy - North West. The corridor will be able to accommodate freight movements along the mid-block and through the intersections.

Over-dimension and overweight routes are expected to be further reviewed by Waka Kotahi and relevant stakeholder groups in alignment with the realisation/ implementation of individual corridor upgrades in the future.

8.4.5 Access and Parking

As a future arterial corridor, Access Road (both the current urban and rural sections) is expected to transition to be a limited access corridor. As the area develops, it is expected that future access to the network will be facilitated by other local road networks within the urbanised area to the north of SH16 Main Road with intersections onto the corridor. That network will likely be planned as developers progress these corridors through the plan change process, following structure planning by the Council. However, access will need to be enabled for the rural areas on the southern side of the corridor, which are not planned to be subject to the same change.

Potential adverse effects of direct property access along an arterial road corridor is currently managed through the AUP(OP). However, it is recognised that many properties along the Access Road Upgrade corridor currently have direct property access. The design approach for the corridor has been to continue to facilitate direct vehicle access to existing properties, where necessary, through the inclusion of the median between the traffic lanes. It is noted that the design of the Access Road Upgrade has maintained access via all existing local roads to this corridor.

In terms of existing property access, the overarching design philosophy for the Project has been to maintain driveway access, where practicable, either re-grading existing access or relocating the driveway access. However, in some circumstances (as discussed below), it has been necessary to provide access to via new private roads.

The key area where effects on property access and parking have been identified is:

- Along the southern / eastern side of the Access Road Upgrade corridor.

Table 8-4 summarises the potential adverse effects on properties / activities along the Access Road Upgrade corridor during the operational phase. Similar adverse effects would also occur and require mitigation during the construction phase through the CTMP. Where adverse effects are only expected during the construction phase, these are separately addressed in Section 9. Further details will be developed at later design stages and as part of the Outline Plan of Works.

Table 8-4: Access Road Upgrade Project – Potential Adverse Transport Effects on Access – Operational Phase

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
Adverse impacts on property access driveway	✓	76 Tawa Road, Kumeū 66 / 62 Tawa Road, Kumeū 63 Tawa Road, Kumeū 59 Tawa Road, Kumeū 56 Tawa Road, Kumeū 49 Tawa Road, Kumeū 48 Tawa Road, Kumeū Lot 27 DP 11870 Tawa Road, Kumeū 25 Tawa Road, Kumeū 24 Tawa Road, Kumeū 21 Tawa Road, Kumeū 17 Tawa Road, Kumeū 11 Tawa Road, Kumeū 166 Station Road, Kumeū 236 Access Road, Kumeū 218, 220 Access Road, Kumeū 211 Access Road, Kumeū 209 Access Road, Kumeū 199 Access Road, Kumeū 184 Access Road, Kumeū 181 Access Road, Kumeū 176 Access Road, Kumeū	Re-grade existing or re-form new driveway access off public road for identified properties

Potential Adverse Effects	Access Impacted	Properties Affected	Recommended Mitigation
		175 Access Road, Kumeū 174 Access Road, Kumeū 171 Access Road, Kumeū 165 Access Road, Kumeū 162 Access Road, Kumeū 161 Access Road, Kumeū 151 Access Road, Kumeū 40 Farrand Road, Kumeū 116 Access Road, Kumeū Lot 2 DP 72538 Access Road, Kumeū 95 Access Road, Kumeū 27 Access Road (Kumeū Showgrounds), Kumeū 35 Access Road (Kumeū Community Centre), Kumeū 24, 20A Access Road, Kumeū	
Existing private access road or driveway will no longer be viable	✓	121, 127A and 127B Access Road, Kumeū (new access road can be provided within designation off Access Rd)	Utilise alternative private access or construct new private access road or driveway for identified properties

The proposed new private access roads to maintain local access have been incorporated into the proposed designation boundary for the Access Road Upgrade and further details will be developed at later design stages and as part of the Outline Plan of Works.

The Kumeū Showgrounds and Kumeū Community Centre have both been identified to be affected by the Access Road Upgrade alignment. Parts of both sites have been identified to be included in the designation, which with the implementation of the Access Road Upgrade will affect access driveway (identified in Table 8-4) and parking within these sites. The location of the on-site parking affected on the sites is shown in Figure 8-6. Around 74 car parking spaces are affected at the Kumeū Showgrounds, whilst around 21 car parking spaces are affected at the Kumeū Community Centre (with 28 to 30 spaces retained).

Figure 8-6: Affected parking in Kumeū Showgrounds and Kumeū Community Centre

It is considered that the identified loss of on-site parking is unlikely to affect more regular / day-to-day activities at the Kumeū Showgrounds. However, when more occasional larger events (such as the annual Kumeū Show at the Showgrounds), it is considered that there are likely to be adverse effects of the identified reduction in parking on these sites, such as overspill parking onto Access Road. There is the potential, given the overall size of the Kumeū Showgrounds, that revised arrangements for more occasional high demand event parking could be managed within the existing site.

In terms of the Kumeū Community Centre, the site is considered to be sufficiently sized that alternative parking arrangements could be provided with re-arrangement of the site parking and access. Moreover, over time, the demand for parking for activities at the Kumeū Community Centre may change, depending on the timing of the Access Road Upgrade and other infrastructure, such as the Rapid Transit Corridor.

As such, it is considered that with the agreement of the Kumeū Showgrounds and Kumeū Community Centre, appropriate mitigation can be identified at the time of implementation, if necessary.

There are several properties, where on-site parking has been identified to be affected by the proposed designation. The properties are sufficiently sized to potentially remain viable for activities within the current (or future) zoning. Moreover, the actual activity / use may change over the timeframes of the lapse dates sought. As such, these properties have not been included in the designation and mitigation has not been identified, as this matter can be addressed via the Public Works Act at the time of implementation. The identified properties are:

- 24 Tawa Road, Kumeū
- 25 Tawa Road, Kumeū
- 166 Station Road, Kumeū
- 236 Access Road, Kumeū
- 218, 220 Access Road, Kumeū
- 24 Access Road, Kumeū

Given the nature of the Access Road Upgrade, no adverse effects have been identified in relation for on-street or public parking resulting from the Project.

8.5 Project Interdependencies

8.5.1 Alternative State Highway

The ASH will provide resilience to the transport network in the North West growth areas (particularly for Kumeū-Huapai and Riverhead), enabling intra- and inter-regional trips (including freight) to relocate from the existing SH16 corridor and supporting the growth along the SH16 Main Road Upgrade corridor through the Kumeū-Huapai growth area. The Access Road Upgrade corridor will provide a key connection between the ASH and the Kumeū-Huapai growth area, particularly the existing and future light industrial zoning along the northern side of Access Road.

As discussed above, depending on the timing of the ASH implementation in relation to the future growth in Kumeū-Huapai, there is the potential that traffic demands on the northern section of Access Road, connecting with the current SH16 corridor, could be notably higher than with the full implementation of the North West Strategic Package network. The proposed designation for four vehicles lanes, therefore provides some necessary flexibility to accommodate this outcome, particularly in relation to supporting the reliability of PT services in this interim period.

8.6 Recommended Measures to Avoid, Remedy or Mitigate Operational Effects

The Project provides significant positive effects and there are generally no operational adverse effects to mitigate, given the effects on property access have been addressed through the design of the Project and hence provided for by the designation.

Whilst there are potential adverse effects on off-street parking, it is considered that this will generally be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy, given the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

However, adverse effects on the Kumeū Showgrounds and Kumeū Community Centre have been identified, which are important community facilities. It will be necessary to continue to provide parking for these facilities to support more occasional larger-scale events. It is considered that there is the potential to provide viable mitigation within the existing sites, if necessary. As such, it is considered that, with the agreement of the Kumeū Showgrounds and Kumeū Community Centre, appropriate mitigation can be provided at the time of implementation.

The potential uncertainty relating to the timing of the ASH corridor, and therefore higher traffic demands on the northern section of the Access Road Upgrade corridor, is mitigated by the proposed designation for four vehicles lanes on this section, particularly in relation to supporting the reliability of PT services in any interim period prior to the implementation of the ASH.

8.7 Summary of Operational Transport Effects (NoR S4)

The assessment of transport effects for the Project is summarised in Table 8-5.

Table 8-5: Assessment of Operational Effects Summary for NoR S4 (Access Road)

Operational Transport Effects	
Safety	In summary, the effects of the Project on safety are: • Significantly improved walking and cycling facilities along Access Road (including separation), resulting in improved protection for vulnerable road users. • Improved walking and cycling crossing facilities across the side roads intersecting with Access Road, where necessary, resulting in a safer environment for all road users. • A significantly improved speed environment by reducing speed limits to more appropriate urban speeds (e.g. 60km/h) with enhanced place function and consequential reductions in the risk of DSIs.
Walking and Cycling	In summary, the effects of the Project on walking and cycling are: • Significantly reduce the likelihood and exposure to potential crashes as it will enable safe movement for vulnerable road users along and, where necessary, across Access Road. • Improve integration with the future walking and cycling network, resulting in improved north-south walking and cycling connectivity. • Lead to significant environmental and health benefits as a result of increased active mode trips and reduced reliance on vehicle trips. • Serve as a key enabler for greater use of active transport modes by providing a safe connector route between the development land and the future Kumeū centre. • Support growth surrounding Access Road and significantly improve safety and access to employment and social amenities.
Public Transport	In summary, the effects of the Project on public transport are:

Operational Transport Effects	
	• Reduced delays and improved reliability for the future PT network on Access Road and the wider network. • Improved integration with the future public transport network and improved north-south connectivity, as well as improved access to employment and social amenities. • Increased attractiveness and uptake of public transport trips which will reduce reliance on vehicle trips, resulting in positive environmental and health benefits.
General Traffic / Freight	In summary, the effects of the Project on general transport and freight are: • The proposed four-lane corridor can efficiently accommodate the anticipated long-term demand and the intersections along the Access Road Upgrade corridor have been assessed and shown to provide sufficient capacity. • Improved reliability for existing and future local freight, including access to the southern extension of the light industrial zone adjacent to Access Road • Flexibility to accommodate potential interim potential uncertainty relating to the timing of the ASH corridor, and therefore higher traffic demands on the northern section of the Access Road Upgrade corridor.
Access and Parking	In summary, the effects of the Project on access and parking are: • Potential adverse effects on property access can be addressed through the later design stages / Outline Plan of Works by re-forming / re-grading property driveways or providing new access driveways. • Effects on off-street and on-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support. • Adverse effects have been identified in relation to Kumeū Showgrounds and Kumeū Community Centre, which are important community facilities. It is considered that there are potentially viable mitigation solutions that with the agreement of the Kumeū Showgrounds and Kumeū Community Centre can provide appropriate mitigation at the time of implementation.

8.8 Conclusions

Overall, the NoR S4 (Access Road) provides considerable positive transport effects in particular improved safety, walking and cycling, public transport and general traffic (including freight) effects.

It is considered that property effects in relation to access driveways and private access roads can be specifically considered, as part of the further design prior to implementation, as well as part of the CTMP prior to implementation (as those effects occur during both operational and construction phases). This will enable these potential adverse effects to adequately addressed.

Effects on off-street parking will be able to be appropriately addressed, by mechanisms such as the Public Works Act and future parking policy and strategy direction, given the context of the significant change in the land use and transport environment that this and the other Strategic Package projects enable and support.

Adverse effects on the Kumeū Showgrounds and Kumeū Community Centre, which are important community facilities can be addressed by potentially viable mitigation solutions that with the agreement of the Kumeū Showgrounds and Kumeū Community Centre can provide appropriate mitigation at the time of implementation, if necessary.

9 Strategic Assessment Package Construction Effects

9.1 Approach to Managing Construction Effects

The works anticipated to be required for the Strategic Assessment Package is a mix of those delivered outside existing transport corridors (i.e, 'offline' or on new alignments) (NoR S1, NoR S3 (rural section), NoR KS, NoR HS) and those delivered on existing transport corridors (i.e. 'online') (NoR S2, NoR S3 (urban section), NoR S5).

Where each of the NoR projects are delivered 'online', i.e. adjacent to or on the live carriageway, this means that temporary traffic management will be required. The scale of temporary traffic management to delineate live traffic away from the construction zones is largely dependent on the various stages and requirements of the construction activities. It is expected that short term temporary road closure for nights or weekends may be required for some specific activities, such as road surfacing, traffic switches and gas relocations. Other activities may require stop/go or contraflow traffic management, such as drainage, utility relocation, survey and investigation work. These type of lane closures and traffic management occur throughout the region on a regular basis for activities such as general maintenance or installation of new utilities. Waka Kotahi and Auckland Transport already have well-established processes to manage the potential disruption.

Along SH16 Main Road corridor and where temporary diversion roads are provided as part of the construction phase for the ASH (particularly BCI) corridor, consideration should be given to maintaining two-way vehicle movements, when possible, to minimise the disruption to people movement along the current strategic corridors and adjacent corridors provided the effects on safety of construction workers and the public can be appropriately addressed.

The effect of temporary road closure or other traffic management methods associated with each of the NoRs for traffic and other road users on the specific corridor and adjacent road network will be assessed in the future as part of the CTMP. This will allow an assessment of construction effects of each project on the basis of the transport environment at the time of construction. This will take into account the level of growth and activities that has occurred in Kumeū and Huapai, the availability of the alternative routes, and any additional sensitive land use activities.

The construction of each of the Strategic Package NoR projects will likely require significant earthworks, particularly the ASH (including BCI) and RTC / RAMC projects. Final cut and fill volumes will be confirmed following detailed design prior to construction. The construction traffic movements to accommodate the earthworks will likely result in the increase of traffic volume on construction routes used during the construction period of each of the Projects.

Traffic Routing

Given the timing and staging of the construction of the Strategic Package corridors has yet to be determined, there is a degree of uncertainty associated with any predicted construction methodology and associated traffic routes.

This means:

- The routes that will be used by construction vehicles will depend on the location of quarries and disposal sites, which are not yet certain
- The exact configuration and extent of compound sites/lay down areas has yet to be determined
- The timing of construction of other projects could impact on likely construction vehicle routes, for example, if the ASH is in place prior to or after the SH16 Main Road or Access Road upgrade.

It is noted that the access to compound sites/laydown areas and construction zones for construction vehicles, plant and materials will be via site access points identified as part of future CTMPs.

Details of the routes and time restrictions will need to be updated and refined as part of the CTMP process. It is anticipated that the routes for construction traffic will likely be limited to the state highway (SH16), as well as arterial corridors and intersections, where possible, with the provision of adequate vehicle tracking. However, for the 'offline' construction of the ASH and RTC / RAMC, other road corridors (including existing urban and rural roads) will need to be used to travel between the access the state highway and the sites. Although, in some cases, construction traffic could use the construction corridor as the offline works are progressed.

The specific CTMPs will need to consider the suitability and effects prior to the use of those other road corridors and may require specific mitigation, such as restrictions on the number or time of day / week that construction vehicles could utilise those corridors.

Other key considerations relating to the construction traffic and transport effects of the Strategic Package corridors are discussed below, such as speed limits, pedestrians and cyclists, property access and parking, on-street and public parking, as well as parallel construction of projects. The more specific implications for each of the corridors are then discussed in Section 9.2.

Speed Limits

In order to maintain the safety of all road users, it is recommended to implement a safe and appropriate temporary speed limit during the construction period on the network within the extent of works, and along the construction routes, if needed. This should be in accordance with the latest traffic management standards at the time of construction. These recommended measures and other measures highlighted in the CTMP are expected to reduce the potential safety risks that may be associated with construction traffic.

Pedestrians and cyclists

The existing provision for pedestrian and cyclists is variable across the network. It is likely that the demand for these modes will increase, if urbanisation occurs prior to construction, but future parallel collectors could also be used as an alternative route. Therefore, effects should be re-assessed again when a greater level of detail is available about surrounding facilities and land use activities prior to construction.

However, it is recommended that residents and stakeholders be kept informed of construction times and progress, and general observations of pedestrian and cyclist activity will be used to inform, and where necessary adjust, appropriate traffic management measures in the CTMP.

Property access and parking for residents and businesses

During the time of construction, there will be temporary traffic management controls such as temporary concrete or steel barriers. Existing driveways that remain during construction will be required to have temporary access provision.

It is anticipated that the contractor will undertake a detailed property specific assessment of any affected driveways and provide temporary access, if required. The temporary access should ensure the ability for users to safely access and exit the property, including access to appropriate on-site parking and for servicing / deliveries. These requirements should be captured in the CTMP or SSCTMP, if required, and may include off-site mitigation of loss of parking.

On-street and public parking

During the time of construction, the works or associated temporary traffic management controls may result in existing on-street parking or public parking not being available. It is anticipated that the contractor will undertake a detailed assessment of any affected parking and, if necessary, provide alternatives, particularly for mobility parking or loading spaces. The loss of any general public parking will need to consider the duration of effects and the impact on specific businesses. Where temporary alternatives are necessary, this should ensure the ability for the public to safely access these spaces. These requirements should be captured in the CTMP or SSCTMP, if required.

Parallel construction of projects

It has currently been assumed that each of the Strategic Package corridors will be constructed separately, i.e. not constructed in parallel with each other. The extended lapse dates mean that there is the opportunity to provide separation between the construction of the corridors, whilst funding and implementation decisions are made.

There is the potential that some of the corridors may be constructed at the same time (depending on later implementation decisions), however, it is considered that this would most likely affect the amount of construction traffic on the transport network. Where necessary, it is considered that this could be adequately managed, through the later CTMPs and more detailed staging of construction works at that time through the well-established CTMP processes of Waka Kotahi and Auckland Transport.

The construction of projects in parallel, could potentially also provide the opportunity for efficiencies in the construction process by enabling combined compound sites/laydown areas or reducing the transport of spoil (with further efficiencies in cut and fill transport across multiple sites).

Land use activities that will need further consideration in the CTMP

The following table provides a high-level summary of the key land use or activities that are located adjacent to the corridors and will need further consideration during the development of the CTMP.

This could include additional controls at key access locations, temporary diversions of local roads, restricted truck movements during school pick up and drop off, or mitigation relating to the effects on parking within the properties. The below is not a final or complete list, with land use changes likely prior to implementation of the NoRs, so this list will change over time.

Further detail is provided in relation to specific locations in Section 9.2 for each of the Strategic Package corridors, where effects have been identified at this stage that require later management. Once again, it is considered these can be adequately addressed through the usual CTMP processes of Waka Kotahi and Auckland Transport.

Table 9-1: Sites for Consideration within future CTMP

Corridor	NoR	Sites for Consideration
Alternative State Highway, including Brigham Creek Interchange	**NoR S1**	• Business premises located along the corridor • Fred Taylor Park • North Auckland Line (NAL) • Local public transport (bus) stops
SH16 Main Road	**NoR S2**	• Business premises located along the corridor • Kumeū Showgrounds • Huapai District School, Huapai • Tau Te Arohanoa Akoranga School, Huapai • Community facilities, including Kumeū Library • Emergency services • NAL • Local public transport (bus) stops
Rapid Transit Corridor and Regional Active Mode Corridor	**NoR S3**	• Business premises located along the corridor • Fred Taylor Park • Kumeū Showgrounds • Huapai Domain • Matua Ngaru School, Huapai • Emergency services • NAL • Local public transport (bus) stops
Kumeū and Huapai RTC Stations	**NoR KS, NoR HS**	• Business premises located along the corridor • Community facilities, including Kumeū Library • Emergency services • NAL
Access Road	**NoR S4**	• Business premises located along the corridor • Kumeū Showgrounds • Community facilities, including Kumeū Community Centre • Emergency services

9.2 Temporary Traffic Management Effects Assessment

It is considered that temporary effects from the construction activities on the network can be adequately managed through the implementation of a CTMP during the construction phase of each Project. The purpose of the CTMP is to ensure the construction of each Project is managed in such a way that enables safe and efficient movement of local traffic throughout the construction period and to minimise disruption to road users, particularly the adjacent properties and local activities. If required, SSTMP should be developed to manage constraints on access to affected properties.

Further detail of more specific effects identified at this time are provided for each Strategic Package corridor below. It is noted that, where it is considered that the transport (or other) effects (either construction or operational) on affected properties are unlikely to be adequately managed or mitigated, those properties have already been identified to be included within the project designation.

The outcomes of this assessment and later more detailed assessments, at the time these corridors proceed to implementation, will inform the development of detailed CTMPs. It is considered that a CTMP will appropriately manage potential traffic / transport effects at that time, acknowledging that projects on the scale of those within the Strategic Package will inevitably result in disruption and inconvenience for the public and road users, at their interfaces with existing strategic transport networks and local road corridors.

9.2.1 Alternative State Highway, including Brigham Creek Interchange

The ASH, including BCI, (NoR S1) will include the following key construction works, which will have effects on the existing SH16 and local roads at these interfaces:

- Completion of the BCI with new ramps accessing the ASH and realignment of SH16, Brigham Creek Road and Fred Taylor Drive on the approaches to the new grade separated interchange.
- The realigned Fred Taylor Drive and Brigham Creek Road is expected to be completed early with a new overbridge (over the ASH and RTC / RAMC), which can largely be constructed offline, reducing disruption to existing users of the Brigham Creek / SH16 roundabout. It is anticipated once this is completed, traffic could divert to this overbridge, whilst the ASH is constructed through the Interchange. A temporary diversion road will be required to maintain access along Brigham Creek Road during construction of a new bridge over the Totara Creek, which will affect access to adjacent properties, as discussed further below.
- The new east and west facing ramps at the interchange can also be constructed largely offline, reducing disruption to existing users of SH16 and the surrounding local roads.
- Construction of the following structures along the ASH alignment at interfaces with other local roads and the NAL. It is expected that two-way access will generally be maintained, with potential for one-way at certain key stages of construction under traffic controls, i.e. temporary stop/go signs or traffic lights:
    - New bridge for the ASH to pass under Taupaki Road. A temporary diversion of Taupaki Road will be necessary during the construction of the new bridge to maintain access along the road. The road will return to its current alignment following construction.
    - New bridge for the ASH to pass over NAL. Any potential temporary closures of the NAL for bridge installation will be coordinated and agreed with Kiwirail.

- o New bridge for the ASH to pass under Waitakere Road. A temporary diversion of Waitakere Road will be necessary during the construction of the new bridge to maintain access along the road. The road will return to its current alignment following construction.
- o Three new bridges for the ASH, two passing over and one to pass under Pomona Road. The Pomona Road bridge over the ASH will necessitate a temporary diversion of Pomona Road during the construction of the new bridge to maintain access along the road. As discussed in Section 5, Pomona Road is proposed to be permanently realigned on this section, so access is maintained between Waitakere Road and Tawa Road.
- o For the Tawa Road Interchange, a new bridge for Tawa Road to pass over the ASH. If the ASH is constructed with a tunnel under Tawa Road, then no temporary diversion roads or permanent realignment of Tawa Road is expected for these works. However, with other construction methodologies, Tawa Road may need to be closed with temporary diversions of traffic accommodated via other local roads, such as a Puke Road / Trigg Road / Motu Road route and / or a Hanham Road / Waitakere Road route. The road will return to its current alignment following construction.
    - ▪ The temporary diversion routes would result in around an additional five to six minute journey time (or 5 to 6km) between a location just south of the proposed interchange and the Waitakere Road / Access Road intersection. It is considered with appropriate traffic management, and coordination with other construction works, the diversion routes would adequately accommodate diverted traffic during this temporary period. However, it is acknowledged this would result in temporary inconvenience, particularly for properties at around the southern end of Tawa Road. Following construction works at this location, the road will be re-opened, as part of the new interchange.
- o New bridge for the ASH to pass under Puke Road. This will necessitate a temporary diversion of Puke Road during the construction of the new bridge to maintain access along the road. As discussed in Section 5, Puke Road is proposed to be permanently realigned, so access is maintained along the road.
- o New bridge for the ASH to pass over Foster Road. No temporary diversion roads or permanent realignment of Foster Road is expected for these works.
- o New roundabout on SH16. For the construction of the roundabout and the Ahukuramu Stream, a temporary diversion of SH16 will be necessary. The road will return to its current alignment following construction.

It is considered that, whilst disruption to typical travel patterns will be inevitable, the predominantly offline construction of the ASH will manage the potential adverse effects, such that they will occur at these identified interfaces with the surrounding network and, where they would be able to be appropriately managed through a CTMP.

The construction of the ASH (including BCI) will also have more localised transport effects, such as access, for individual properties or activities. The potential transport effects have been reviewed and for these reasons (particularly where both construction and operational effects are identified), some properties have been identified to be included in the proposed designation.

For other properties, appropriate mitigation (during the construction and operational phases) has been identified, such as re-grading existing driveways, re-forming / re-locating driveways or providing new private access roads. Where properties are not included in the designation and these properties have been identified to be affected during the operational phase, discussion of these matters was previously addressed in Section 5.

In addition to those properties, it is noted that access to 12, 14 and 18 Brigham Creek Road will be temporarily affected during the construction phase. This is a result of the temporary realignment of Brigham Creek Road to construct a new bridge, as identified above. It has been identified that a temporary access road will be required, as part of the construction phase to maintain access to these properties. This can be satisfactorily provided for through the CTMP process. Once works are completed on Brigham Creek Road, new driveways would provide access in a similar manner to the current access driveways.

9.2.2 SH16 Main Road Upgrade

The construction of the section of the NoR S2 corridor between Access Road and Oraha Road will need to occur in advance of the construction of the RTC / RAMC (NoR S3). This is due to a combination of either the existing SH16 corridor needing to be relocated to facilitate the RTC / RAMC or the construction of the NoR S2 corridor requiring temporary diversion during construction utilising areas that form part of the proposed RTC / RAMC (NoR S3) designation. However, this is a matter to be considered in relation to the later implementation of the corridors and the proposed lapse times provide the flexibility to enable this to be achieved.

The SH16 Main Road Upgrade (NoR S2) will include the following key construction works, which will have effects on the existing SH16 and local roads at these interfaces:

- Construction of a new bridge on Riverhead Road over the Kumeū River, just north of its intersection with SH16 Main Road. No temporary diversion roads or permanent realignment of Riverhead Road is expected for these works.
- Construction of a new bridge on SH16 Main Road over the Kumeū River, just west of its intersection with Riverhead Road. A temporary diversion of SH16 will be necessary during the construction of the new bridge to maintain access along SH16, as a state highway corridor. The road will return to its current alignment following construction.
- A new signalised intersection with Access Road, generally in the same location as the existing signalised intersection. During the construction works, the interface with the level crossing of the NAL will need to be carefully managed through the CTMP in coordination with Kiwirail.
- Realignment of SH16 Main Road to the north, between Access Road and 156 SH16 Main Road with temporary effects on property access, on-site and public parking discussed further below.
- Construction of a new bridge on SH16 Main Road over the Kumeū River, near the Kumeū Library. A temporary diversion of SH16 will be necessary between 156 SH16 Main Road and Oraha Road

during the construction of the new bridge to maintain access along SH16, as a state highway corridor. The road will return to its current alignment following construction.
- Construction of a new bridge on the NAL and a new signalised intersection with Tapu Road and Station Road. A temporary diversion of SH16 will be necessary across the NAL during the construction of the new bridge to maintain access along SH16, as a state highway corridor. The road will return to its current alignment following construction.
- Construction of a new bridge on SH16 Main Road over the Kumeū River, near the No. 583 SH16 Main Road. A temporary diversion of SH16 will be necessary during the construction of the new bridge to maintain access along SH16, as a state highway corridor. The road will return to its current alignment following construction.
- Construction of a new bridge on Matua Road (West) over the NAL to a new intersection of SH16 Main Road. This will be a permanent realignment of Matua Road (West). No temporary diversion roads are expected for these works.

There is already congestion and queuing along SH16 Main Road, particularly in the weekday peak periods, but also outside these periods, particularly at weekends and in the summer months, when greater recreational use of the corridor occurs. Due to the expected duration of the SH16 Main Road Upgrade main works period (some 3½ years), there is limited ability to avoid the busiest days or months without substantially increasing the programme, which will only prolong the overall duration of the works required.

However, given the strategic significance of the SH16 Main Road corridor, as well as the current and increasing traffic demands, it is considered that maintaining two-way traffic with a minimum of one lane in each direction along the corridor (including adequate lane widths to accommodate heavy and more occasional over-dimensional vehicles) will be essential to minimise the potential adverse operational effects on this and surrounding corridors. Noting that outside the busier periods (say overnight), there would be the potential for one-way operation through ‘stop/go’ or traffic light control, where necessary for certain construction activities.

Moreover, the current indicative construction methodology and programme identifies a staged programme of works occurring progressively along the corridor from east to west, such that the effects of construction would be restricted to certain sections of SH16 Main Road at any time. This would have effects on immediately adjacent sections, due to lower vehicle speeds through the temporary works and potentially reduced capacity at intersections (during construction), but would reduce the geographical extent of effects to any section being worked on at a given time (i.e. by not having the whole corridor affected at the same time). This extends the duration of works / effects, so some hybrid of works at geographically separate locations simultaneously, could also manage the overall effects on the corridor, whilst expediting the overall duration of the programme.

Notwithstanding the above, it is acknowledged that disruption to typical travel patterns will be inevitable, as part of a significant strategic project of this nature and scale. Taking on board the specific matters identified above, particularly the provision of two-way movement with one lane in each direction along the corridor, it is considered that the effects on the surrounding network will be appropriately managed through a CTMP. These effects would be substantially reduced, should the ASH (NoR1) be implemented in advance of this project, removing a significant volume of traffic from the existing SH16 Main Road corridor through Kumeū and Huapai.

The construction of the NoR S2 corridor will also have more localised transport effects, such as access, for individual properties or activities. The potential transport effects have been reviewed and for these reasons (particularly where both construction and operational effects are identified), some properties have been identified to be included in the proposed designation.

For other properties, appropriate mitigation (during the construction and operational phases) has been identified, such as re-grading existing driveways, re-forming / re-locating driveways or providing new private access roads, which can be implemented through a later CTMP. Where properties are not included in the designation and these properties have been identified to be affected during the operational phase, discussion of these matters was previously addressed in Section 6.

In addition to those properties, it is noted that parking at 1 and 2 Shamrock Drive will be temporarily affected during the construction phase. This is a result of the temporary works associated with the tie-in of the new SH16 Main Road Upgrade to Shamrock Drive. Temporary parking arrangements will be required, as part of the construction phase for these properties. This can be satisfactorily provided for through the CTMP process. Once works are completed on Access Road, the existing parking will be reinstated.

During construction of the SH16 Main Road Upgrade, it is anticipated that there will need to be temporary removal of some on-street car parking within the road reserve. This is primarily along the section of SH16 Main Road, on the north side, between Weza Lane and Access Road intersections. It is currently estimated that around 20 car parking spaces may be impacted during construction. The extent to which parking will need to be temporarily removed, rearranged or relocated will depend on the more detailed construction methodology / approach at the time of implementation. As such, the need to temporarily remove car parking and any temporary mitigation is better considered at that later stage, particularly as the use of these spaces will change over the period of the proposed lapse dates.

To the west of Access Road, on the north side, there is further on-street parking that will be impacted by both the construction and operational phases of the NoR S2 corridor. This has been previously addressed in Section 6.

9.2.3 Rapid Transit Corridor, Regional Active Mode Corridor, including the Kumeū and Huapai Stations

As discussed in Section 9.2.2, the construction of the section of the NoR S2 corridor between Access Road and Oraha Road will need to occur in advance of the construction of the RTC / RAMC (NoR S3) and the Kumeū Station (NoR KS).

The RTC / RAMC Corridor (NoR S3) and the Stations (NoRs KS and HS) will include the following key construction works, which will have effects on the existing SH16 and local roads at these interfaces. It is expected that two-way access will generally be maintained, with potential for one-way working at certain key stages of construction under traffic controls, i.e. temporary stop/go signs or traffic lights:

- If the RTC / RAMC is progressed in advance of the ASH, including BCI, construction of a new bridge on Fred Taylor Drive will be required to allow the RTC / RAMC to pass over the existing Fred Taylor Drive, just south of its intersection with SH16 and Brigham Creek Road. No temporary diversion roads or permanent realignment of Fred Taylor Drive is expected for these works. The road would only be diverted to a new alignment with the construction of the BCI (NoR S1).
- The southern end of Boord Crescent will be permanently realigned further to the north, so access will be maintained. There is the potential that the new alignment could be constructed in advance of closing the existing road, which would enable access to be maintained between the eastern and western parts of Boord Crescent during construction of the RTC / RAMC. This will depend on the more detailed construction methodology / approach at the time of implementation. Should this not be the case, any temporary closure would not noticeably impact travel times for properties on the western side of Boord Crescent and Waitakere Road.
- The northern section of Boord Crescent, just south of the existing NAL level crossing and Trotting Course Drive will be realigned slightly to the east to accommodate the RTC / RAMC. This will need to be constructed to maintain access to the properties on Trotting Course Drive, prior to closure of the level crossing. This was also addressed previously in Section 7, given it is required to maintain permanent access to those properties.
- Construction of the following structures along the RTC / RAMC alignment and at the Stations at interfaces with other local roads and the NAL. It is expected that two-way access will generally be maintained, with potential for one-way at certain key stages of construction under traffic controls, i.e. temporary stop/go signs or traffic lights:
    - New bridge for the RTC / RAMC to pass under Taupaki Road. A temporary diversion of Taupaki Road will be necessary during the construction of the new bridge to maintain access along the road. The road will return to its current alignment following construction.
    - New bridge to connect Boord Crescent with Waitakere Road over the NAL. This will be constructed to provide a new permanent alignment for this connection, avoiding people having to use the existing level crossing of the NAL. No temporary diversion roads are expected for these works.
    - New bridge for the RTC / RAMC to pass over Access Road. No temporary diversion roads or permanent realignment of Access Road is expected for these works.
    - Construction of a new bridge on the NAL and a new signalised intersection with Tapu Road and Station Road for the RTC / RAMC. A temporary diversion of SH16, as a state highway corridor, will be necessary across the NAL during the construction of the new bridge to maintain access along SH16. The road will return to its current alignment following construction. This will only be required, if the RTC / RAMC construction precedes the SH16 Main Road Upgrade, which would otherwise have completed those works.
    - Construction of a new bridge on Matua Road (West) over the NAL to a new intersection of SH16 Main Road will be associated with the Huapai Station (NoR HS) to enable the access road to the Station. This will be a permanent realignment of Matua Road (West). No temporary diversion roads are expected for these works. This will only be required for this project, if the Huapai Station construction precedes the SH16 Main Road Upgrade, which would otherwise have completed those works.

It is acknowledged that disruption to typical travel patterns will be inevitable, as part of a significant strategic project of this nature and scale. However, it is considered that the predominantly offline construction of the RTC / RAMC will manage the potential adverse effects, such that they will occur at these identified interfaces with the surrounding network, where they would be appropriately managed through a CTMP. Noting that as discussed in Section 9.2.2 and above, some segments of the SH16 Main Road Upgrade will actually need to be constructed in advance of, and in order to enable, the delivery of the RTC through Kumeū and Huapai. These are generally the aspects of the RTC that result in the most disruption.

Taking on board the specific matters identified above, and similarly to the NoR S2 corridor with the provision of two-way movement with one lane in each direction along the SH16 corridor, it is considered that the effects on the surrounding network will be appropriately managed through a CTMP. Noting that outside the busier periods (say overnight) on SH16, there would be the potential for one-way operation through ‘stop/go’ or traffic light control, where necessary for certain construction activities.

The construction of the RTC / RAMC will also have more localised transport effects, such as access, for individual properties or activities. The potential transport effects have been reviewed and for these reasons (particularly where both construction and operational effects are identified), some properties have been identified to be included in the proposed designation.

For other properties, appropriate mitigation (during the construction and operational phases) has been identified, such as re-grading existing driveways, re-forming / re-locating driveways or providing new private access roads, which can be implemented through a later CTMP. Where properties are not included in the designation and these properties have been identified to be affected during the operational phase, discussion of these matters was previously addressed in Section 7.

In addition to those properties, it is noted that parking at 1 and 2 Shamrock Drive will be temporarily affected during the construction phase, as discussed in Section 9.2.2. This is a result of the temporary works associated with the tie-in of the new SH16 Main Road Upgrade to Shamrock Drive, which is required to enable the RTC. This can be satisfactorily provided for through the CTMP process.

The site at 51 Gilbransen Drive, Huapai, has been included in the designation to provide for a construction compound / laydown area for the RTC. Whilst the RTC designation corridor itself could be used for construction access to this site (from the either the east or west), there is the potential that Gilbransen Drive will be used by construction traffic, including heavy vehicles. As Gilbransen Drive is only around 5.5m wide and serves a residential area with the Matua Ngaru School at the southern end (adjacent to 51 Gilbransen Drive), any construction traffic using Gilbransen Drive will need to be carefully managed. It is considered that this could be satisfactorily managed through a later CTMP, through measures such as limiting the type, number, direction of travel and /or time of day / week construction vehicles use Gilbransen Drive.

9.2.4 Access Road Upgrade

The Access Road Upgrade (NoR S4) will include the following key construction works, which will have effects on the existing Access Road and local roads at these interfaces. It is expected that two-way access will generally be maintained, with potential for one-way at certain key stages of construction under traffic controls, i.e. temporary stop/go signs or traffic lights:

- Construction of a new roundabout at the intersection with Station Road. No temporary diversion roads or permanent realignment of Access Road or Station Road is expected for these works.
- Construction of a new bridge on Access Road near 151 Access Road. A temporary diversion of Access Road will be necessary during the construction of the new bridge to maintain access along Access Road. The road will return to its current alignment following construction.

It is acknowledged that disruption to typical travel patterns will be inevitable, as part of a strategic project of this nature and scale. However, taking into account the specific matters identified above, and the intention to maintain access along the corridor, it is considered that the effects on the surrounding network will be appropriately managed through a CTMP.

The construction of the Access Road Upgrade corridor will also have more localised transport effects, such as access, for individual properties or activities. The potential transport effects have been reviewed and for these reasons (particularly where both construction and operational effects are identified), some properties have been identified to be included in the proposed designation.

For other properties, appropriate mitigation (during the construction and operational phases) has been identified, such as re-grading existing driveways, re-forming / re-locating driveways or providing new private access roads, which can be implemented through a later CTMP. Where properties are not included in the designation and these properties have been identified to be affected during the operational phase, discussion of these matters was previously addressed in Section 8.

In addition to those properties, it is noted that driveway access at the following properties will be temporarily affected during the construction phase:

- 79 Tawa Road, Kumeū
- 73 Tawa Road, Kumeū
- 45 Tawa Road, Kumeū
- 43 Tawa Road, Kumeū
- 233 Access Road, Kumeū
- 221 Access Road, Kumeū
- 50, 44, 40, 38, 26 Access Road, Kumeū
- 18 Access Road, Kumeū

This is a result of the temporary works associated with the Access Road Upgrade. Temporary access arrangements will be required, as part of the construction phase for these properties. This can be satisfactorily provided for through the CTMP process. Once works are completed on Access Road, the driveways will be reinstated.

9.3 Recommended Measures to Avoid, Remedy or Mitigate Construction Effects

Generally, it is recommended that the potential construction traffic effects can be accommodated and managed appropriately via a CTMP.

In particular, there are segments of the SH16 Main Road Upgrade that will need to be constructed prior to the RTC / RAMC projects (including the Kumeū and Huapai Stations) to facilitate the later implementation of those projects. Moreover, given the strategic significance of the SH16 Main Road corridor, as well as the current and increasing traffic demands, it is considered that maintaining two-way traffic with a minimum of one lane in each direction along the corridor (including adequate lane widths to accommodate heavy and more occasional over-dimensional vehicles) will be essential to minimise the potential adverse operational effects on this and surrounding corridors.

The construction of the corridors will also have more localised transport effects, such as access, for individual properties or activities. The potential transport effects have been reviewed and for these reasons (particularly where both construction and operational phase effects are identified), some properties have been identified to be included in the proposed designation. For other properties, appropriate mitigation (during the construction and operational phases) has been identified, such as re-grading existing driveways, re-forming / re-locating driveways or providing new private access roads, which can be implemented through a later CTMP.

The site at 51 Gilbransen Drive, Huapai, has been included in the designation to provide for a construction compound / laydown area for the RTC. Any construction traffic using Gilbransen Drive will need to be carefully managed and it is considered that this could be satisfactorily achieved through a later CTMP.

Based on the assessment of transport construction effects, it is recommended a CTMP be prepared prior to the start of construction for each stage of work for each of the Strategic Package projects. Any potential construction traffic effects shall be reassessed prior to construction taking into account the specific construction methodology and traffic / transport environment at the time of construction. It is considered that the objectives and associated conditions for the CTMP identified in the AEE will enable the adverse transport effects to be appropriately managed.

1 Appendix 1: Transport Modelling Approach

1.1 Macro Strategic Model

The Macro Strategic Model (MSM) is a region-wide model which analyses the forecast land use and informs trip generation, trip distribution and mode choice at regional level. The MSM model responds to the network assumptions, forecasted land use and regional economic policy inputs to predict regional traffic patterns and PT patronages. The outputs from the MSM model are used as:

- Demand inputs for the traffic simulation model SATURN, which analyses them at a mesoscopic level
- PT Patronage inputs for the MPT model, which analyses these at a strategic level
- Active mode inputs for the SAMM model, which analyses these at a mesoscopic level

The MSM is a four-step multi-modal model. This model was originally developed based on extensive data collected in 2006. Using observed data, and a full model validation exercise it was recently updated to reflect 2016 inputs and data. The MSM produces demands for five periods of the day, and separate assignment models exist for the morning (AM) and evening (PM) peak and weekday interpeak (IP) periods.

The model itself comprises of the following key modules:

- Trip generation: This is where the number of person-trips are estimated as a function of the land use data (population, employment, school roll etc.)
- Mode Choice: This is where the choice of recommended travel mode is determined, based on the relative costs of the various modes. The MSM modes for mode choice are car (driver and passenger combined) and passenger transport. Trips by car are converted into vehicle trips later in the model. The model also estimates the number of active mode trips, such as walking and cycling, although these are not fully modelled through to link flows.
- Trip Distribution: This is where the trips produced in each zone (generally by households), are matched to a recommended destination. This distribution is predicted as a function of the relative attractiveness for each destination zone and the travel costs to reach each destination.
- Time of Day: This is where the proportion of daily trip making occurring in each period is calculated. These proportions change in response to changes in travel costs to represent peak spreading.
- Trip Assignment: This is where the resulting travel demand, in the form of origin to destination trip tables, are loaded to the road and public transport networks. For the road assignment, an iterative process is used to firstly identify the lowest-cost route between each origin and destination followed by an estimation of the speeds and delays on each route between origin and destination, followed by an estimation of speeds and delays on each route associated with the predicted traffic flows on the route.

1.1.1 General Network Assumptions

The following general network assumption have been made in the MSM model:

- All committed developments and respective infrastructure upgrades planned as outlined in the ATAP (Auckland Transport Alignment Project) 2.0 and RLTP (Regional Land Transport Plan) have been coded in the future MSM model
- The access points (MSM zone connectors) for each model option scenarios in the North West Detailed business case areas were reviewed and refined accordingly to reflect the future infrastructure upgrades
- The future local bus services for each model option scenarios, were updated based on inputs from the AT Metro, specifically related to routes, frequencies, bus capacities and bus speeds.
- Following discussions with Waka Kotahi and Auckland Transport, the following strategic interventions have been included in the North West Do Minimum as shown in Figure A1.1.
- SH16 Brigham Creek to Waimauku project currently being delivered by Waka Kotahi.
- Full implementation of the NWRTN from the City Centre to a Brigham Creek station (City Centre to Westgate (CC2W) project). It was agreed with the owners to use the station locations identified in the North West Rapid Transit IBC.
- SH18 Rapid transit corridor between Westgate and Constellation.
- SH16 to SH18 Connections improvements.

Figure A1-1: Map showing Do Minimum projects for the North West DBC

The inclusion of these key inter-dependent strategic projects in the Do-minimum network is to account for the fact that those projects are being developed separately by Waka Kotahi/Auckland Transport, so are not included as part of the Te Tupu Ngātahi improvements package. They are however a key part of the future transport network for the North West so are part of the overall North West response. If these projects were not to occur, the likely impact is greater demands on the projects identified in this assessment. It is noted that the SH16 Brigham Creek to Waimauku project has funding and potential seed funding for the CC2W project has been included in the RLTP as part of the 10 year capital expenditure. All projects are subject to stand alone business case processes. To understand the overall North West response, it is therefore considered appropriate to include these projects in the modelling assessment.

1.1.2 MSM Outputs

There are a number of outputs from the transport modelling, including:

- Demand patterns (Origin-Destination travel) and facility usage (flows)
- Network performance
- Travel times and costs (real and perceived) for economic analysis
- Delays, queues and Level of Service (LoS) for design and assessment
- Aggregate travel statistics on travel such as Vehicle Kilometres Travelled (VKT), Passenger Kilometres Travelled (PKT) and total travel costs
- Flow and performance for environmental analysis
- Inputs to vehicle emissions models
- Inputs to noise analysi

1.2 SATURN

SATURN is a mesoscopic traffic simulation and assignment model used to undertake a variety of area wide strategic assessments through to more detailed local area assessments. It can be used as a conventional model for the analysis of traffic-management schemes over localised networks as well as for major investment improvements at a regional level. The SATURN model ensures factual representation of vehicle flow patterns and congestion on midblock sections and intersections in the form of ‘arrival’ flows rather than ‘demand’ flows. Additionally, it is used as a high-level junction simulation model that evaluates the traffic flow behaviour on junctions. It represents ‘congested assignment’ of multiple user classes modelled separately, including bus priority and high occupancy vehicle lanes. The SATURN model has been peer reviewed.

1.2.1 SATURN Outputs

There are a number of outputs from the SATURN model, including:

- Vehicular flow pattern -Actual flow, Demand flow, Queued flow
- Network performance- Link and Node delays, Queue Statistics, V/C Ratios
- Mid-block capacities and speeds
- Aggregate travel statistics on travel such as Total Travel Time (hrs), Distance Travelled (kms)

1.3 SIDRA

Signalised (and unsignalised) Intersection Design and Research Aid (SIDRA) is a micro-analytical tool used for evaluating intersection performance. It has a comprehensive, lane-based network modelling approach applicable to all types on intersections-signal, priority or sign control and roundabouts. SIDRA allows the modelling of various movement classes (Light vehicle, Heavy vehicle, Buses, Bicycle, Large Trucks, Light Rail/ Trams) with distinctive vehicle features to be assigned to designated lanes, segments and signal phases.

The Te Tupu Ngātahi SIDRA model is used to analyse the form and function of proposed intersections along strategic corridors. Based on the demand flow outputs from the SATURN Model, the intersection turning flows are determined.

The performance measures of the intersection in terms of capacity, delay, Level of Service (LOS), queue length on approach lanes and optimum vehicle-pedestrian signal phasing is calculated.

It is noted that the SIDRA model is reliant on outputs from the SATURN model, with traffic distribution based on the network provided in SATURN. A finer grain network that includes all collectors and local roads is not provided in SATURN, and as such it can considered that intersection modelling in SIDRA results in a conservative assumption of performance.

2 Appendix 2: Intersection Modelling Summary

2.1 Alternative State Highway

The performance of the road network within the Project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted Level of Service (LoS) and anticipated queue lengths. A summary of these key performance measures is shown below in Table A2-1.

A2-1: Summary of Key Intersection Performance 2048 – Alternative State Highway

Intersection (Intersection Control)	Weekday Peak Period	Overall Level of Service	Degree of Saturation	Average Delay (seconds)
Brigham Creek Interchange – East facing ramps (Traffic signals)	Morning Peak	E	0.98	72
	Evening Peak	E	0.98	73
Brigham Creek Interchange – West facing ramps (Traffic signals)	Morning Peak	D	0.91	50
	Evening Peak	D	0.89	53
Tawa I/C – Eastbound ramps (Roundabout)	Morning Peak	A	0.59	4
	Evening Peak	A	0.37	4
Tawa I/C – Westbound ramps (Roundabout)	Morning Peak	A	0.37	9
	Evening Peak	A	0.37	9
SH16 Main Road / ASH (Dual lane roundabout)	Morning Peak	A	0.45	6
	Evening Peak	B	0.84	13

2.2 SH16 Main Road Upgrade

The performance of the road network within the Project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LoS and anticipated queue lengths. A

Table A2-2: Summary of Key Intersection Performance 2048 – SH16 Main Road Upgrade

Intersection (Intersection Control)	Weekday Peak Period	Overall Level of Service	Degree of Saturation	Average Delay (seconds)
SH16 Main Road / Foster Road (Priority Control)	Morning Peak	A*	0.40	1
	Evening Peak	A*	0.30	1
SH16 Main Road / Matua Road West (Traffic signals)	Morning Peak	C	0.84	28
	Evening Peak	B	0.68	19
SH16 Main Road / Trigg Road (Traffic signals)	Morning Peak	B	0.22	18
	Evening Peak	B	0.33	20
SH16 Main Road / Station Road (Traffic signals)	Morning Peak	D	0.56	40
	Evening Peak	D	0.63	41
SH16 Main Road / Matua Road (Traffic signals)	Morning Peak	C	0.41	22
	Evening Peak	C	0.54	22
SH16 Main Road / Access Road (Traffic signals)	Morning Peak	D	0.56	40
	Evening Peak	D	0.73	39
SH16 Main Road / Riverhead Road (Traffic signals)	Morning Peak	C	0.20	21
	Evening Peak	C	0.23	25

** Note – For priority controlled intersections, there is no overall intersection LoS reported, due to the free-flow traffic conditions along the main road approaches. The LoS for the Foster Road in both weekday peaks was predicted to be LoS A.*

2.3 Access Road Upgrade

The performance of the road network within the Project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LoS and anticipated queue lengths. A summary of these key performance measures is shown below in Table A2-3.

Table A2-3: Summary of Key Intersection Performance 2048 – Access Road Upgrade

Intersection (Intersection Control)	Weekday Peak Period	Overall Level of Service	Degree of Saturation	Average Delay (seconds)
SH16 Main Road / Access Road (Traffic signals)	Morning Peak	D	0.56	40
	Evening Peak	D	0.73	39
Waitakere Road / Access Road (Priority Control)	Morning Peak	A*	0.20	3
	Evening Peak	A*	0.18	5
Station Road / Access Road (Roundabout)	Morning Peak	A	0.51	7
	Evening Peak	A	0.32	5

** Note – For priority controlled intersections, there is no overall intersection LoS reported, due to the free-flow traffic conditions along the main road approaches. The LoS for the Waitakere Road in both weekday peaks was predicted to be LoS A, but will be influenced by the Access Road intersection.*

ATTACHMENT 42

NORTH-WEST STRATEGIC
ASSESSMENT OF CONSTRUCTION NOISE AND VIBRATION EFFECTS
PART 1 OF 3

TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Strategic Assessment of Construction Noise and Vibration Effects

December 2022

Version 1

Document Status

Responsibility	Name
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Revision Status

Version	Date	Reason for Issue
1	16/12/2022	Notice of Requirement Lodgement

Table of Contents

Appendices

Table of Figures

Table of Tables

Abbreviations

Acronym/Term	Description
AEE	Assessment of Effects on the Environment
ASH	Alternative State Highway
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan Operative in Part
BCI	Brigham Creek Interchange
BOL	Block of Line
BPO	Best Practicable Option in accordance with Section 16 of the RMA
CC2W	City Centre to Westgate
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
NAL	North Auckland Line
NoR	Notice of Requirement (under the Resource Management Act 1991)
OPW	Outline Plan of Works
PPF	Protected Premises and Facilities, including residences, schools, marae and parts of hospitals
RMA	Resource Management Act 1991
RTC	Rapid Transit Corridor
RAMC	Regional Active Mode Corridor
RUB	Rural Urban Boundary
SG	Te Tupu Ngātahi Supporting Growth
SH16	State Highway 16
The Council	Auckland Council
Waka Kotahi	Waka Kotahi NZ Transport Agency

Glossary of Acronyms / Terms

Acronym/Term	Description
Auckland Council	Means the unitary authority that replaced eight councils in the Auckland Region as of 1 November 2010.
Strategic Assessment Package	Four Notices of Requirement (for ASH, RTC, Station Road and SH16) and one alteration to an existing designation (SH16 Main Road) for the Whenuapai Arterial Transport Network for Auckland Transport.
Projects	North West Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement for Waka Kotahi NZ Transport Agency and Auckland Transport

1 Executive Summary

Construction noise and vibration has been assessed against relevant standards and guidelines, and mitigation and management measures recommended to manage effects on neighbouring buildings.

Construction noise has been assessed against the requirements of NZS 6803:1999. This Standard is referenced both in the AUP:OP and the Waka Kotahi Guide. Construction of each Project is proposed to take longer than 20 weeks, which means that the long duration criteria have been used as basis of the assessment, with the relevant daytime criterion being 70 dB L_{Aeq}. We have recommended using the same construction noise criteria for all Projects.

Construction vibration has been assessed against two criteria; Category A broadly relating to the management of amenity effects and being based on BS5228 guidance, and Category B relating to the avoidance of any (including superficial) building damage, based on DIN4150-3:1999. These criteria are applied progressively by implementing the Best Practicable Option management on site to reduce vibration levels.

An envelope of effects has been identified for both construction noise and vibration, based on noise setback distances at which compliance with the relevant noise criteria can be achieved, and vibration radii at which compliance with the Category A or B criteria can be achieved. Buildings inside these effects envelopes have been identified.

Mitigation and management measures have been recommended, ranging from common on site measures that should be commonly used on all construction sites, to the requirement of a Construction Noise and Vibration Management Plan and associated Schedules for specific activities and receivers as required.

NoR S1 Alternative State Highway (ASH) including Brigham Creek Interchange (BCI)

Results of assessment and recommended measures

The ASH corridor, including the BCI, is within a largely rural area, with the exception of the connections to the existing SH16, where residential and business uses prevail. Intermittent rural dwellings and buildings are located at some distance from most of the designation corridor boundary (generally 20m to 60m), with the closest buildings less than 10m from the potential works.

Predicted noise may intermittently be as high as 80 dB L_{Aeq} at closest dwellings where earthworks are undertaken in close proximity. At such levels, mitigation and management as recommended in Section 4.5 will need to be implemented. Noise levels inside the dwellings may be up to 55 to 60 dB L_{Aeq} and result in adjustment in behaviour (e.g. avoiding rooms facing the noise source). As construction will occur in a staged approach, predicted exceedances will be of limited duration only. Overall, as the designation width means that the majority of works will be at a sufficient distance from buildings to that for most of the time compliance with the 70 dB L_{Aeq} daytime noise criterion is predicted.

Construction vibration from the use of vibratory roller is predicted to potentially exceed the Category B criteria at a number of buildings (refer Table 7-4) without mitigation in place. We recommend that mitigation and management through the CNVMP are implemented, such as using alternative construction methodologies, undertaking building conditions surveys and monitoring vibration levels.

Conclusion

Construction noise and vibration can be managed to be at a reasonable level for most of the construction duration. Intermittent high noise and vibration levels are likely during specific activities or at distinct locations and will be managed and mitigated through the recommended CNVMP and Schedules.

The use of a management framework through the CNVMP and Schedules is considered to be the BPO approach to construction noise and vibration and this has been included in the conditions of the draft designation.

NoR S2 SH16 Main Road Upgrade

Results of assessment and recommended measures

The SH16 Main Road upgrade will occur mostly within an existing designation which already authorises the works. Some additional areas have been identified beyond the existing designation which will need to be designated. We have assessed the construction noise and vibration effects of all works, irrespective of their location inside or outside the existing designation, against the same criteria.

The SH16 Main Road corridor is an existing State highway corridor which affects the ambient noise environment of the area. It traverses well-established retail, commercial and residential areas through Kumeū-Huapai, as well as more rural zones which are currently sparsely populated.

The works required for the walking and cycling facilities generally require slightly smaller equipment than would be required for a new road. Nevertheless, predicted noise may intermittently be as high as 80 dB L_{Aeq} at closest dwellings where earthworks are undertaken in close proximity. These levels would only occur for a matter of hours or (at most) days. For the construction of the bridge, piling may generate noise levels up to 85 dB L_{Aeq} at the closest dwellings. This work would occur only for a very limited time of a few days.

At such levels, mitigation and management as recommended in Section 4.5 will need to be implemented. Noise levels inside the dwellings may be up to 55 to 60 dB L_{Aeq} and result in adjustment in behaviour (e.g. avoiding rooms facing the noise source). As construction will move along the alignment in a linear fashion, predicted exceedances will be of limited duration only. Overall, as the designation is relatively wide, the majority of works for most of the time are predicted to comply with the 70 dB L_{Aeq} daytime noise criterion.

Construction vibration from the use of vibratory rollers is predicted to potentially exceed the Category B criteria at a number of buildings (refer Table 8-4) without mitigation in place. We recommend that mitigation and management through the CNVMP are implemented, such as using alternative construction methodologies, undertaking building conditions surveys and monitoring vibration levels.

Conclusion

Construction noise and vibration can be managed to be at a reasonable level for most of the construction duration. Intermittent high noise and vibration levels are likely during specific activities or at distinct locations and will be managed and mitigated through the recommended CNVMP and Schedules.

The use of a management framework through the CNVMP and Schedules is considered to be the BPO approach to construction noise and vibration.

NoR S3 Rapid Transit Corridor (RTC) and Regional Active Mode Corridor (RAMC); NoR KS Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

Results of assessment and recommended measures

The RTC and RAMC will straddle the Rural Urban Boundary and connect Kumeū-Huapai with Westgate and Auckland City. The alignment traverses two distinct sections. The rural section connects BCI with the existing SH16 via the North Auckland Line. In this area, existing noise levels are in the 50s dB L_{Aeq} with intermittent noise from trains passing. The urban section along SH16 Main Road, with elevated noise levels of mid-60 to low 70 dB L_{Aeq}. The corridor will be co-located with other SGA North West Strategic Projects (i.e. NoR S1 ASH and NoR S2 SH16 Main Road). Should the ASH have already been implemented, existing noise levels would be higher than currently, due to the increased traffic in a currently rural area. The RTC will be used by electric buses.

The two stations are both located in the vicinity of the existing SH16. The Kumeū Station is located in a business area with ambient noise levels in the mid to high-60 dB L_{Aeq}, which is unlikely to change in the future. Huapai Station is located in land used for rural activities adjacent to SH16, with ambient noise levels affected by SH16 and in the low to mid-60 dB L_{Aeq}.

The works required for the rapid transit corridor will be as for normal road formation, with the noisiest works involving earthworks and bridge construction. Predicted noise may intermittently be as high as 75 – 80 dB L_{Aeq} at closest dwellings where earthworks are undertaken in close proximity. This work would occur only for a very limited time as works move along the alignment.

At such levels, mitigation and management as recommended in Section 4.5 will need to be implemented. Noise levels inside the dwellings may be up to 55 to 60 dB L_{Aeq} and result in adjustment in behaviour (e.g. avoiding rooms facing the noise source). As construction will occur in a staged approach, predicted exceedances will be of limited duration only. The majority of works for most of the time are predicted to comply with the 70 dB L_{Aeq} daytime noise criterion.

Station construction will occur for a more sustained period in the same location. Noise levels up to 75 dB L_{Aeq} are predicted at the few buildings in the vicinity. With mitigation, compliance with 70 dB L_{Aeq} can be achieved for most works.

Construction vibration from the use of vibratory rollers is predicted to potentially exceed the Category B criteria at three buildings (refer Table 9-6) without mitigation in place. We recommend that mitigation and management through the CNVMP are implemented, such as using alternative construction methodologies, undertaking building conditions surveys and monitoring vibration levels.

Conclusion

Construction noise and vibration can be managed to be at a reasonable level for most of the construction duration. Intermittent high noise and vibration levels are likely during specific activities or at distinct locations and will be managed and mitigated through the recommended CNVMP and Schedules.

The use of a management framework through the CNVMP and Schedules is considered to be the BPO approach to construction noise and vibration.

NoR S4 Access Road

Results of assessment and recommended measures

Access Road is an existing road in a currently rural area. Existing noise levels are relatively low, given the distance from any major transport or commercial areas. Should the ASH have been implemented already, ambient noise levels would be somewhat more elevated due to the new transport route.

A large number of dwellings front the existing Access Road and will therefore be affected by construction noise. Predicted noise may intermittently be as high as 80 dB L_{Aeq} at closest dwellings where earthworks are undertaken in close proximity. At such levels, mitigation and management as recommended in Section 4.5 will need to be implemented. Noise levels inside the dwellings may be up to 55 to 60 dB L_{Aeq} and result in adjustment in behaviour (e.g. avoiding rooms facing the noise source). As construction will occur in a staged approach, predicted exceedances will be of limited duration only. Overall, the majority of works for most of the time are predicted to comply with the 70 dB L_{Aeq} daytime noise criterion.

Construction vibration from the use of vibratory rollers is predicted to potentially exceed the Category B criteria at a number of buildings (refer Table 10-4) without mitigation in place. We recommend that mitigation and management through the CNVMP are implemented, such as using alternative construction methodologies, undertaking building conditions surveys and monitoring vibration levels.

Conclusion

Construction noise and vibration can be managed to be at a reasonable level for most of the construction duration. Intermittent high noise and vibration levels are likely during specific activities or at distinct locations and will be managed and mitigated through the recommended CNVMP and Schedules.

The use of a management framework through the CNVMP and Schedules is considered to be the BPO approach to construction noise and vibration.

2 Introduction

This construction noise and vibration assessment has been prepared for the North West Strategic Projects and Kumeū Huapai Local Arterials Notices of Requirement (**NoRs**) for Waka Kotahi NZ Transport Agency (**Waka Kotahi**) and Auckland Transport (**AT**) (the "**Strategic Assessment Package**" and the "**Projects**").

The NoRs are to designate land for future strategic and local arterial transport corridors as part of Te Tupu Ngātahi Supporting Growth Programme (Te Tupu Ngātahi) to enable the construction, operation and maintenance of transport infrastructure in the North West area of Auckland.

The Strategic Assessment Package will provide route protection for the strategic projects, which include:

- Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
- the Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC)**
- Kumeū Rapid Transit Station
- Huapai Rapid Transit Station
- State Highway 16 (**SH16**) Main Road Upgrade

It also includes the upgrade of Access Road, an existing local arterial corridor within Kumeū-Huapai.

This report assesses the construction noise and vibration effects of the North West Strategic Assessment Package identified in Figure 5-1 and Table 2-1 below.

Refer to the main AEE for a more detailed project description.

Table 2-1: North West Strategic Assessment Package – Notices of Requirement and Projects

Notice	Project
NoR S1	Alternative State Highway (**ASH**), including Brigham Creek Interchange (**BCI**)
NoR S2	SH16 Main Road Upgrade
NoR S3	Rapid Transit Corridor (**RTC**), including the Regional Active Mode Corridor (**RAMC**)
NoR KS	Kumeū Rapid Transit Station
NoR HS	Huapai Rapid Transit Station
NoR S4	Access Road Upgrade

2.1 Purpose and Scope of this Report

This assessment forms part of a suite of technical reports prepared to support the assessment of effects within the Strategic Assessment Package. Its purpose is to inform the AEE that accompanies the Strategic Assessment Package sought by Waka Kotahi and AT.

This report considers the actual and potential effects of the Strategic Assessment Package on the existing and likely future environment as it relates to construction noise and vibration effects and recommends measures that may be implemented to avoid, remedy and/or mitigate these effects.

The key matters addressed in this report are as follows:

a) Identify and describe the ambient noise context of the Strategic Assessment Package area;
b) Identify and describe the actual and potential construction noise and vibration effects of each Project corridor within the Strategic Assessment Package;
c) Recommend measures as appropriate to avoid, remedy or mitigate actual and potential construction noise and vibration effects (including any conditions/management plan required) for each Project corridor within the Strategic Assessment Package; and
d) Present an overall conclusion of the level of actual and potential construction noise and vibration effects for each Project corridor within the Strategic Assessment Package after recommended measures are implemented.

Operational noise effects are assessed against different standards and criteria and are addressed in a different report.

2.2 Report Structure

The report is structured as follows:

a) Identification of the assessment criteria and any relevant standards or guidelines;
b) Overview of the methodology used to undertake the assessment;
c) Recommended measures to avoid, remedy or mitigate potential adverse construction noise and vibration effects;
d) Description of each Project corridor and project features within the Strategic Assessment Package as it relates to construction noise and vibration;
e) Description of the existing and likely future environment and how this affects the construction noise assessment;
f) Description of the actual and potential construction noise and vibration effects of the Strategic Assessment Package; and
g) Overall conclusion of the level of potential adverse construction noise and vibration effects of the Strategic Assessment Package after recommended measures are implemented.

This report should be read alongside the AEE, which contains further details on the history and context of the Strategic Assessment Package. The AEE also contains a detailed description of works to be authorised for the Strategic Assessment Package, likely staging and the typical construction methodologies that will be used to implement this work. These have been reviewed by the author of this report and have been considered as part of this assessment of construction noise and vibration effects. As such, they are not repeated here, unless a description of an activity is necessary to understand the potential effects, then it has been included in this report for clarity.

2.3 Preparation for this Report

When preparing this report, we have relied on information from other experts, namely traffic, design and planning. We attended several team meetings where the information was discussed and undertook a site visit along all NoR alignments where this was publicly accessible.

Where information we rely on was provided by other experts, this is noted in the report.

3 Performance standards

Construction noise and vibration levels are generally higher than would be expected from ongoing day to day operations of the proposed transport corridors. However, higher noise and/or vibration levels are not necessarily unreasonable as long as they are managed and mitigated by implementing the best practicable option (**BPO**).

New designations are sought for the Strategic Assessment Package, for all NoRs, except for NoR S2 (SH16 Main Road), which is an alteration to an existing designation. Therefore, we have reviewed a variety of criteria and standards and have recommended noise and vibration performance standards that in our opinion should apply to all Projects irrespective of the road controlling authority implementing it.

3.1 Noise

3.1.1 Guidelines and Standards reviewed

We reviewed the following guidelines and standards for the assessment of construction noise:

- AUP:OP, specifically rules E25.6.27 and E25.6.29 relating to construction noise in all zones except the City Centre and Metropolitan Centre zones, and construction noise in the road
- NZS6803:1999 Acoustics – Construction Noise
- Waka Kotahi's "State Highway Construction and Maintenance Noise and Vibration Guide" (**Guide**), V1.1, August 2019

We recommend applying the requirements of the Guide to the projects. The Guide takes account of the intended application of NZS6803 criteria and provides a solid management structure to achieve the best practicable outcome for construction noise. NoR S4 (Access Road) is an AT project. The Guide and AUP:OP provide the same construction noise criteria, therefore the recommended criteria in Section 3.1.2 below are directly applicable to all NoRs.

3.1.2 Recommended Criteria

Table 3-1 below shows the relevant noise standards for long duration works (more than 20 weeks), which applies to all projects. These criteria are those of the Guide and NZS 6803, and largely reflect the AUP:OP criteria.

Table 3-1: Construction noise criteria at occupied buildings

Day of week	Time period	Noise criteria	
		dB L_{Aeq}	dB L_{AFmax}
Dwellings and other buildings containing activities sensitive to noise			
Weekdays	0630 – 0730	55	75
	0730 – 1800	70	85
	1800 – 2000	65	80
	2000 – 0630	45	75
Saturdays	0630 – 0730	45	75
	0730 – 1800	70	85
	1800 – 2000	45	75
	2000 – 0630	45	75
Sundays and public holidays	0630 – 0730	45	75
	0730 – 1800	55	85
	1800 – 2000	45	75
	2000 – 0630	45	75
Other occupied buildings			
All days	0730 – 1800	70	n/a
	1800 – 0730	75	n/a

While the Project works are generally of longer duration, each individual building would likely be affected only for brief periods of high noise levels due to staging and management of the works.

3.1.3 Exceedance of criteria

During construction some activities will likely occur close to buildings. In some instances, there is the potential for noise levels to exceed the recommended construction noise standards. For most large-scale construction projects, exceedances of the construction noise standards for brief periods of time are common, and management will ensure that effects are reasonable.

NZS6803 anticipates that at times construction noise cannot be made to comply with the recommended criteria. Statements such as *"construction noise from any site should not generally exceed the numerical noise limits"*[1] suggest that intermittent exceedances are not unreasonable, as long as the BPO has been applied to the management and mitigation of that construction noise.

The AUP:OP in its Objectives and Policies also appropriately anticipates exceedances from construction noise and states:

> *"(4) Construction activities that cannot meet the noise and vibration standards are enabled while controlling duration, frequency and timing to manage adverse effects."*

[1] NZS 6803:1999 Acoustics – Construction Noise, Section 7.1.2.

and

"(10) Avoid, remedy or mitigate the adverse effects of noise and vibration from construction, maintenance and demolition activities while having regard to:

[…]

The practicability of complying with permitted noise and vibration standards."

Whether the duration of a construction activity that exceeds the standards can be considered reasonable, depends on site specific circumstances, and may vary from site to site and activity to activity. For instance, where daytime noise standards are exceeded for several days, but neighbouring residents are not at home, no one would be affected and therefore mitigation may not be required beyond communication with the residents.

If night-time works occur, this would likely only happen for few nights in any one location. In that instance, this may be acceptable if residents have been informed and a clear time frame has been provided. However, if night-time works are expected to be ongoing for several consecutive nights, and at a noise level that affects residents' ability to sleep, then alternative strategies may need to be implemented, such as offering temporary relocation for those affected residents. Such management measures are further discussed in Section 4.5.

3.2 Vibration

3.2.1 Guidelines and Standards reviewed

We reviewed the following guidelines and standards for the assessment of construction vibration:

- AUP:OP, specifically rule E25.6.30 relating to construction vibration, with two parts: amenity and avoidance of any damage to buildings
- German Standard DIN4150-3 (1999) Structural vibration – Part 3 Effects of vibration on structures
- British Standard (BS) 5228-2: 2009 "Code of practice for noise and vibration control on construction and open sites"
- Waka Kotahi's "State Highway Construction and Maintenance Noise and Vibration Guide" (**Guide**), V1.1, August 2019

Both the AUP:OP and the Waka Kotahi Guide reference relevant vibration standards for construction works. These criteria are similar insofar as they address two vibration responses:

- One set of standards are based on the provisions of German Standard DIN 4150-3:1999 "Structural Vibration - Part 3: Effects of Vibration on Structures" which avoids cosmetic building damage (**building standards**); and
- The other set has reference criteria for human amenity which act as trigger levels for consultation and communication (**amenity standards**).

The amenity standards of the AUP:OP are slightly less stringent (2mm/s PPV vs the 1 mm/s PPV used by the Waka Kotahi Guide), while the building standards of the Guide make allowance for unoccupied buildings by allowing higher vibration levels to be generated where this is safe.

3.2.2 Recommended Criteria for NoRs S1, S2, S3, HS and KS

Table 3-2 below shows the recommended vibration criteria for all NoRs which are sought by Waka Kotahi. These criteria are based on the Guide and are underlaid by a framework of management approaches to ensure that the BPO is implemented and risk of annoyance or building damage minimised.

Table 3-2: Vibration limits for all buildings

Receiver	Location	Details	Category A	Category B
Occupied PPFs*	Inside the building	Night-time 2000h-0630h	0.3 mm/s PPV	1mm/s PPV
		Daytime 0630h-2000h	1mm/s PPV	5mm/s PPV
Other occupied buildings	Inside the building	Daytime 0630h-2000h	2mm/s PPV	5mm/s PPV
All other buildings	Building foundation	Vibration – transient	5mm/s PPV	BS 5228-2 Table B.2*
		Vibration – continuous		BS 5228-2 50% of Table B.2 values*

* Protected Premises and Facilities

In general terms, the Category A standards aim to avoid annoyance of receivers. Because these criteria are conservative, there is a provision in the Guide to relax the criteria if they cannot be practicably met, provided a vibration expert is engaged to assess and manage construction vibration to comply with the Category A standards as far as practicable. In addition, affected people should receive communication about the proposed works and anticipated effects, to avoid concern.

If Category A is not practicably achievable, the focus is then shifted to avoiding building damage rather than avoiding annoyance by applying the Category B standards. If the Category B standards are complied with, then building damage is unlikely to occur. If Category B standards are predicted to be exceeded, prior to the relevant construction activities commencing, building condition surveys, must be undertaken and vibration levels must be monitored during those works. This allows an assessment of and response to any effects.

The DIN 4150-3:1999 Standard, which the 5mm/s Category B criterion is taken from, is a conservative standard designed to avoid all (including cosmetic) damage to buildings, e.g. superficial damage like cracking in plaster. Significantly higher standards would be applied if damage to structural foundations was the only consideration.

3.2.3 Recommended Criteria for NoR S4

NoR S4 is sought by AT. AT generally applies the requirements of the AUP:OP which sets criteria similar to those of the Guide, relating to the avoidance of building damage and protection of amenity. Table 3-3 shows the recommended vibration criteria for NoR S4.

Table 3-3: NoR S4 Vibration standards at all buildings

Receiver	Details	Category A	Category B
Occupied activities sensitive to noise	Night-time 2000h-0630h	0.3 mm/s PPV	2mm/s PPV
	Daytime 0630h-2000h	2mm/s PPV	5mm/s PPV
Other occupied buildings	Daytime 0630h-2000h	2mm/s PPV	5mm/s PPV
All other buildings	At all times	Tables 1 and 3 of DIN4150-3:1999	

4 Assessment Methodology

We have used the following methodology for the construction noise and vibration assessment for all of the NoRs in the Strategic Assessment Package:

- We reviewed noise and vibration emission data for each construction task / process based on data previously measured by MDA for similar activities. Data from appropriate noise and vibration standards (e.g. BS5228-1:2009) has also been considered, where relevant;
- We measured ambient noise levels along the route to determine the existing environment which forms the basis of the effects assessment;
- We predicted noise and vibration levels from construction based on relevant standards and guidelines and determined setback distances where compliance with the relevant standards can be achieved. These setback distances have been plotted on the Project drawings and are shown in Appendix 1 for noise and Appendix 2 for vibration; and
- Where construction is predicted to exceed the noise or vibration standards, we recommend management and mitigation through a framework of management plans.

4.1 Assumptions

The assessment of construction noise and vibration effects is based on assumptions of construction activities and equipment, particularly for projects that will be implemented many years in the future. We have assumed that the Projects are not constructed concurrently, or, where they are, that the construction activities are sufficiently separated to avoid increased noise levels at individual receivers. In any event, effects will be managed through the CNVMP required by the designation conditions, For NoRs that are adjacent to each other (e.g. NoRs S1, S2 and S3), construction may occur at the same time. However, the space required for equipment to operate safely will ensure that no more than the assumed maximum construction activity would occur in any one area. Therefore, our predictions are also relevant should this occur.

We have also assumed that all existing buildings inside each designation boundary will be removed or will be vacant during the time of construction. We have therefore not assessed these buildings. Should they be retained and occupied during construction, they will need to be assessed at the time of construction. Some of these buildings may be affected by more than one NoR. We have identified the buildings in each of the NoRs that may affect them.

The detailed methodology for works is not confirmed; therefore, we have based this assessment on similar construction projects we have worked on. Although contractors have not been appointed, it is considered that the methodology set out is representative of activity that has occurred on similar projects and forms a reasonable baseline for the purposes of assessment during the design phase of the Projects.

Information sufficient for the NoR stage has been provided (e.g. the location of potential compounds and stockpile areas, and an indicative construction methodology) in a Construction Method Statement and drawings provided by the Project team and has been incorporated in this assessment as relevant.

4.2 Construction Sequence and Methodology

The construction methodology provided by the Project team is proposed to follow the following sequence, which is similar for all NoRs. Only noise and/or vibration generating aspects are included in the list below:

Site establishment

- Site access construction.
- Establishment of site compound and laydown areas:
  - Each Project will require site compounds and one or more laydown areas
  - The main site compound will contain office and meeting room facilities, break rooms, ablution block and carparking facilities
  - Satellite site offices or compounds will contain portable office blocks, lunchroom, ablution facilities and parking as well as laydown areas for storage or stockpile of relevant materials for that site.
  - Laydown areas/construction yards will contain material storage and are generally located inside the designation.
- Tree removal and vegetation clearance.
- Remove footpath, streetlights, grass verge berm (where required).
- Property/ building modification or demolition, including fencing, driveways and gates.
- Construct access tracks/ haul roads (if any).

Advance works

- Relocation of utilities services.
- Major earthworks (generally only undertaken during the summer earthworks season from October to April) to include the following:
  - Ground improvements, undercuts, embankment foundations.
  - Cut and fill works along the alignment to formation level, including preload if required.
  - Remove preload upon settlement completion, and subgrade preparation.

Main works

- Minor earthworks (cut and fill).
- Remove verge and prepare subgrade formation.
- Construct new longitudinal drainage facilities.
- Construct new pavement, widening works in available areas. (Following that, move traffic to newly constructed pavement areas and continue with the remaining widening works.)
- Pavement reconstruction or reconfiguration of existing road furniture.
- Complete tie in works, footpaths, cycleways, lighting and landscaping.
- Construct permanent stormwater wetlands.
- Construct new culverts including rip rap and headwalls.
- Install road safety barriers (if any).
- Bridge construction works (if any) as follows:
  - Mobilisation and site establishment.
  - Enabling works such as access construction, staging areas and temporary works.
  - Piling, pile caps, and abutment construction.
  - Columns and pier headstock construction.

  - Bridge beam installation.
  - Deck construction and barrier installation.
  - Finishing works, such as approach construction, settlement slabs, and end terminals
- Retaining wall construction (if any).
- Accommodation works.
- Install signage and lighting.

Finishing works and demobilisation

- Final road surfacing and road markings.
- Finishing works e.g. landscaping, street furniture, fencing and outstanding accommodation works.

Construction times

Construction hours will generally be 7am to 6pm, Monday to Saturday. During the summer earthworks seasons, extended hours may be worked (6am to 8pm, Monday to Sunday) where this can be undertaken in compliance with the relevant noise and vibration limits.

Only critical work will occur outside these hours (or on public holidays) where it cannot be undertaken safely within normal working hours.

Similarly, night-time works will only be undertaken where it is impractical to undertake the works during daytime, e.g. where road closures are required.

Where works are undertaken outside normal working hours, they will need to be assessed and mitigated through a Schedule (refer Section 4.5.4).

Construction duration

Construction for all projects will generally be in a linear nature, moving along the alignments. This means that high noise and/or vibration levels are experienced by individual buildings only for a short period (e.g. weeks or months) compared with the overall construction duration of the projects (generally years).

The exception are laydown areas and site yards, which will remain in place for generally the full duration of construction of any one project. However, these yards do not generate high noise level (refer Section 4.3.2).

4.3 Construction Noise

4.3.1 Predictions

Noise level predictions for construction projects take into account the sound power levels of each item of equipment, and model the noise propagation characteristics over distance, including the effects of ground and air absorption. We have calculated indicative noise levels in accordance with NZS6803:1999 and ISO 9613-2:1996 *"Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation"* for all relevant construction scenarios, assuming multiple items of equipment operating simultaneously, but taking account of spatial separation and time component. This approach is deliberately conservative to represent the reasonable worst-case noise levels that may infrequently occur.

Other than the variations in noise level due to the factors discussed above, there are numerous additional aspects that affect construction noise generation. Some of these aspects are variations among individual items of equipment, the state of equipment repair, exact locations of each item and operator idiosyncrasies. Generally, these factors cannot be accounted for as they cannot be reasonably quantified. However, the conservative approach outlined above is considered to generally provide for these variables.

Predictions are based on existing buildings in the vicinity of the projects. However, if new buildings in the vicinity of a project are occupied by the time of construction, these will also be assessed and considered when mitigation is determined.

4.3.2 Activity noise levels

We have predicted construction noise levels based on experience with similar projects and in similar circumstances. We assembled a list of likely equipment that would be used on a large-scale roading project throughout New Zealand. Table 4-1 sets out this list of equipment and its respective sound power levels. It is important to keep in mind that this list is indicative only and is essentially the “best estimate” of equipment that could be used.

Table 4-1: Construction Equipment Noise Levels

Activity	Plant type	Sound power level (dB L_{WA})
Site establishment (clearance, haul roads, compound construction)	Chain saw Chipper Dump trucks Hydraulic excavator Vibratory roller	114 117 106 113 108
Earthworks (alignment works, haul roads, drainage and culvert construction)	Dump truck Hydraulic excavator Bulldozer Compactor Water truck	106 113 114 112 105
Retaining Wall Construction	Vibration piling rig Rotary Piling Rig Concrete trucks Crane On road trucks	120 111 107 106 100
Bridge foundations (piling)	Rotary piling rig Concrete trucks	111 107
Foundations and structures (bridge construction)	Crane Concrete pump Vibratory pokers Concrete trucks	106 100 114 107
Pavement preparation	Vibratory roller Water trucks	108 105

Activity	Plant type	Sound power level ($dB L_{WA}$)
Surfacing	Paver Road rollers Asphalt delivery trucks	113 106 108
Yard activities	Vehicle movements Material handling Administration area Workshop	102 105 50 80

Based on the sound power levels in Table 4-1, we predicted combined "activity sound power levels" (refer Table 4-2 below). We note that not all equipment will operate consecutively and continuously. For instance, for the site establishment, the chain saws and chipper will operate at the same time, but trucks and vibratory rollers will be used at a later stage of the site establishment when site compounds are constructed.

Although the contractor may use different plant from what is on this list, based on experience on other infrastructure construction projects we consider that noise emissions will be similar for each activity.

From the activity sound power levels, we determined the distance at which the 70 dB L_{Aeq} day-time noise criterion can be complied with, without mitigation by noise barriers.

Table 4-2: Activity Sound Power Levels and Compliance Distance

Activity	Activity Sound Power Level	Distance at which compliance with day-time limit (70 dB L_{Aeq}) is achieved without noise barriers
	dB L_{WA}	**metres**
Site establishment	115	76
Earthworks	116	83
Retaining wall construction	116	83
Bridge foundations (piling)	111	52
Foundations and structures (concreting)	108	40
Pavement construction	108	40
Surfacing	110	48
Compounds/construction yard	100	18

Some buildings are close to the potential works. While some may receive screening from natural features, others will be exposed to the works and will need mitigation in the form of barriers or similar.

4.3.3 Envelope of noise effects

Based on the predicted noise levels, we have developed effects envelopes, i.e. distances at which compliance with the daytime noise criteria can be achieved without noise mitigation in place. These distances have been plotted onto aerial photographs to show those areas where mitigation would need to be considered and implemented (refer Appendix 1). We note that any shielding of intervening buildings has not been included in the predictions, which means that the distances are conservative.

For those areas not included in Appendix 1, we predict that noise levels will comply with the relevant limits, and no noise mitigation beyond normal best practice site management would be required. We recommend that these figures be updated for the Construction Noise and Vibration Management Plan (**CNVMP**) to reflect the proposed scope of works, at the time when the CNVMPs are prepared just prior to construction. In any event, Section 16 of the RMA (Duty to avoid unreasonable noise) applies and the BPO will need to be implemented to manage noise effects on all areas, irrespective of compliance.

The following activities have been used to determine the envelope of effects. These are the activities we consider have the greatest impact on construction noise or will be used across the widest part of the NoRs;

- Piling and construction of bridges and retaining walls may generate high noise levels due to the likely direct line-of-sight between dwellings and machinery and the high sound power levels of the equipment – these activities will be localised and apply only for small areas within each NoR; and
- Earthworks will occur across all NoRs and generate elevated noise levels due to the equipment noise levels and the number of equipment items likely used across the network. However, works will move along the alignments and therefore only be in any one location for limited times (e.g. a few weeks out of several years of construction).

4.4 Construction vibration

4.4.1 Predictions

Construction vibration is a separate issue from construction noise. Construction equipment that produces high noise levels does not necessarily also produce high vibration levels and vice versa.

Vibration prediction is less reliable than noise prediction as it is dependent on accurate modelling of ground conditions. Ground conditions are often non-homogeneous and complex in three dimensions, and consequently difficult to quantify across large construction extents.

As a result, we have determined "safe distances" based on vibration measurements[2] previously performed for high vibration sources such as vibropiling and vibratory rollers. The safe distances are based on vibration prediction tools as contained in Hassan (2006)[3]. These have been cross-checked against empirically derived relationships as contained in BS 5228-2:2009 *Code of practice for noise and vibration control on construction and open sites* Part 2: Vibration, the Transport Research Laboratory Report referenced by that standard, and previous measurements carried out by MDA. In addition, a 100% safety margin has been applied to the regression curve derived from the measured data, to take account of ground condition uncertainty, making the predictions conservative. That means that measured vibration levels were not used directly to predict potential vibration levels, but rather that the measured levels have been increased by 100%.

2 Measurements performed at State Highway 18, MacKays to Peka Peka, AMETI and other projects

3 Hassan, O., "Train Induced Groundborne Vibration and Noise in Buildings", Multi-Science Publishing Co Ltd, ISBN 0906522 439, 2006.

We have used the results from these measurements and predictions to determine risk radii within which buildings are at medium or high risk of receiving vibration levels within Category B (refer Table 3-2). The risk radii also consider human annoyance effects.

4.4.2 Equipment vibration levels

The activities that pose the greatest risk of exceeding the vibration criteria are vibratory rolling and vibropiling. This assessment has focused on these activities. The regression curves for vibratory rollers and vibropiling are shown in Figure 4-1.

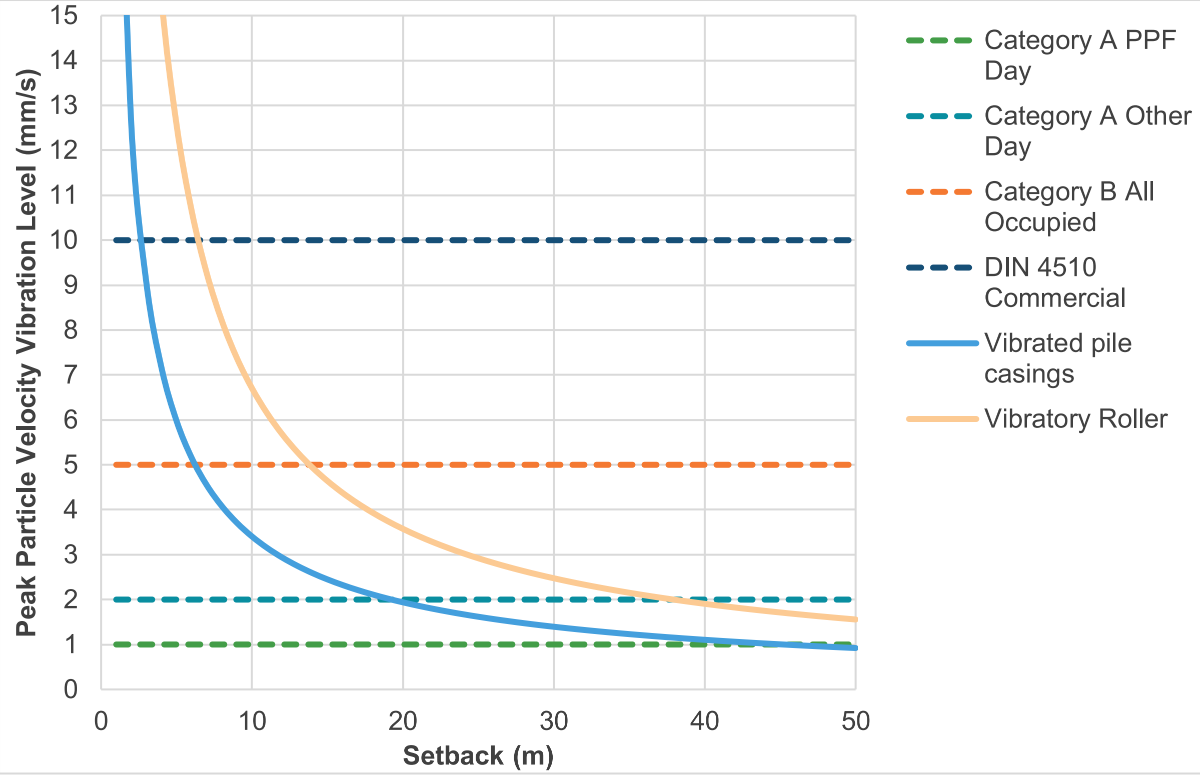


Figure 4-1 Vibration Regression Curves (Criteria for occupied buildings)

4.4.3 Envelope of vibration effects

There is a risk that the Category A criteria may be exceeded at dwellings close to retaining wall construction where vibropiling may be used, and where vibratory rollers are used for the compaction of new or widened traffic lanes.

The risk categories in Table 4-3 relate to the risk of exceeding Category A and B criteria for occupied buildings at various distances from the vibration inducing works. Note that these distances include a 100% safety factor a described in Section 4.4.2 above.

The risk categories are defined as follows:

- High Risk — Predicted to exceed both Category A (amenity) and Category B (building) criteria (refer Section 3.2);
- Medium Risk — Predicted to exceed Category A (amenity) criteria, but comply with the Category B (building) criteria; and
- Low Risk — Predicted to comply with both Category A and B criteria.

Table 4-3: Activity and risk zones

Activity/Equipment	Risk Zones	
	Occupied PPFs	**Other Occupied Buildings**
Vibratory Roller	High: <15m Med: 15 – 80m Low: >80m	High: <15m Med: 15 – 40m Low: >40m
Vibropiling	High: <7m Med: 7 – 45m Low: >45m	High: <7m Med: 7 – 20m Low: >20m

Drawings showing the approximate risk zones for the highest vibration inducing equipment (vibratory rollers) along each NoR extent are included in Appendix 2. Most residential buildings are more than 15 metres from the closest extent of the works, and there are only a few areas where dwellings are in the high-risk zone where the Category B criteria may be exceeded without adjusting the construction methodology or equipment.

Vibration criteria are significantly more stringent at dwellings during the night (0.3 mm/s PPV) and have the potential to be exceeded at distances greater than 200m from any works using vibratory rollers or piling. On this basis, vibration intensive activities adjacent residential areas should be generally scheduled for the daytime wherever practicable.

4.5 Mitigation and management

The most effective way to control construction noise is through good on-site management and communication between managers, staff and affected receivers. We have included recommended measures in this report, based on the assumed construction equipment and methodologies.

Good noise and vibration management is essential in reducing adverse effects as far as practicable, irrespective of the low number of dwellings potentially affected or if noise levels may already be compliant with the relevant criteria.

The following mitigation and management measures would apply to each of the NoRs.

4.5.1 Mitigation and Management Measures

The following general noise mitigation measures will be required to be implemented throughout the construction of all Projects. These measures should be implemented as a matter of good practice and are considered the baseline mitigation for most circumstances.

Where an exceedance of the construction noise or vibration standards is likely due to a specific activity or in a specific area, and the general mitigation measures as discussed below are not sufficient to achieve full compliance, further mitigation and management should be investigated and implemented where practicable. Such information would be contained in the Schedule as attachment to the CNVMP.

4.5.1.1 Communication and Consultation

The most important and effective management measure is public liaison and communication with people occupying buildings in the vicinity of the projects. Providing timely and detailed information to those potentially affected helps to alleviate uncertainty and concerns and builds trust between the contractor and the receivers.

A contractor environmental manager or appointed representative should be available for residents to contact by phone and/or email at times when construction occurs. Communication also includes complaints responses, which should be included in the CNVMP.

At sensitive times (e.g. when night-time or Public holiday works are required), communication is particularly important, and needs to increase in frequency and content, to ensure residents have the ability to plan around the works where that is practicable.

4.5.1.2 Training

All staff should participate in an induction training session prior to the start of construction, with attention given to the following matters:

- Construction noise and vibration limits;
- Activities with the potential to generate high levels of noise and/or vibration;
- Noise and vibration mitigation and management procedures; and
- The sensitivity of receivers and any operational requirements and constraints identified through communication and consultation.

Awareness of current noise and vibration matters on, or near active worksites, should be addressed during regular site meetings and/or ‘toolbox’ training sessions.

4.5.1.3 Equipment Selection

When selecting construction equipment, where practicable:

- Prioritise quieter construction methodologies (e.g. bored piling instead of drop hammer piling);
- Prioritise electric motors over diesel engines;
- Prioritise rubber tracked equipment over steel tracked equipment;
- Equipment will be suitably sized for the proposed task;
- Equipment will be maintained and fitted with exhaust silencers and engine covers; and
- Avoid tonal reversing or warning alarms (suitable alternatives may include flashing lights, broadband audible alarms or reversing cameras inside vehicles).

4.5.1.4 Timing of Works

Where practicable, we recommend that night-time works are avoided. However, where projects affect existing major transport corridors (e.g. at tie ins and intersections or during the construction of new bridges) where potential closures or limitations are required to construct the projects, night-time works will likely be required from time to time. Where necessary, noisy works should be prioritised early in the evening or night-time period to avoid sleep disturbance. People tend to be less disturbed by low frequency, continuous engine noise, than intermittent noise or activities with special audible character (e.g. reversing beepers, whistling, banging tailgates or shouting).

Stakeholder engagement should be undertaken for occupiers of properties within 200m of any high noise night (and weekend) works and within the setback distance for buildings receiving vibration levels meeting or exceeding 1mm/s PPV (Category A for occupied PPFs).

4.5.1.5 Noise Barriers

Temporary noise barriers should be used where a construction noise limit is predicted to be exceeded and the barriers would noticeably reduce the construction noise level. They should be installed prior to the relevant works commencing and maintained throughout those works. Effective noise barriers typically reduce the received noise level at ground level by up to 10 decibels.

Where practicable, the following guidelines should be incorporated in the design and utilisation of temporary noise barriers:

- to be constructed from materials with a minimum surface mass of 6.5 kg/m^2.
- a minimum height of 2 m, and higher if practicable to block line-of-sight;
- abutted or overlapped to provide a continuous screen without gaps at the bottom or sides of the panels; and
- positioned as close as practicable to the noisy construction activity to block line-of-sight between the activity and noise sensitive receivers. Where positioned on the site boundary, additional local barriers will be considered near the activity to ensure effective mitigation for sensitive receivers on upper floor levels.

If traffic noise barriers are recommended (refer to the relevant report), these should be installed as early as practicable during construction as they would be effective to also mitigate construction noise.

4.5.1.6 Alternative mitigation options

Where all practicable noise and vibration mitigation measures have been implemented and considered, and noise or vibration levels are predicted to exceed relevant limits by a significant margin or for an extended period (e.g. more than two consecutive nights), an offer of temporary resident relocation should be considered. Such a measure should be considered as a last resort as it will generally inconvenience the building occupiers. Note that temporary relocation offers are generally associated with night-time works and sleep disturbance rather than daytime noise levels, and that this will be similar for these projects.

4.5.1.7 Best Practice General Measures

Complaints can arise irrespective of compliance with the noise and vibration limits. To minimise complaints, general mitigation and management measures include, but are not limited to, the following:

- Avoid unnecessary noise, such as shouting, the use of horns, loud site radios, rough handling of material and equipment, and banging or shaking excavator buckets;
- Avoid high engine revs through appropriate equipment selection and turn engines off when idle;
- Maintain site accessways to avoid potholes and corrugations;
- Mitigate track squeal from tracked equipment, such as excavators (may include tensioning and watering or lubricating the tracks regularly);
- Minimise construction duration near sensitive receivers;
- Stationary equipment (e.g. generators) will be located away from noise sensitive receivers and site buildings and material stores used to screen them;
- Orient mobile machinery to maximise the distance between the engine exhaust and the nearest sensitive building façade (e.g. excavators);
- Utilise noise barriers where appropriate;

- Implement specialised mitigation measures for particularly high noise and vibration generating activities such as concrete breaking, piling and vibratory roller use;
- Ensure advanced communication is complete prior to commencing activities that are predicted to exceed the noise and vibration performance standards; and
- Undertake monitoring as appropriate.

4.5.2 Building Condition Surveys

For construction activities with buildings within the High and Medium Risk zones (refer Section 4.4.3 and Appendix 2) we recommend that low vibration construction methods be investigated and implemented wherever practicable, with the aim of achieving Category A compliance. This may include using screw piling methods, non-vibrating rollers or pre-drilling piles.

However, if low vibration methodologies are not deemed practicable, for dwellings in the High and Medium Risk zones we recommend that the following process be implemented before construction commences:

- Engage with the building owner and occupier to discuss the proposed construction activities and likely vibration effects;
- Undertake a pre-construction building condition survey. This will be required where the proposed construction methodology is predicted to reach or exceed the Category B vibration limits, and should be undertaken at a trigger level lower than the Category B limits; and
- Monitor vibration levels during the construction activities which are within the High Risk distance (refer Table 4-3).

If low vibration methodologies are not deemed practicable for buildings in the Medium Risk Zone of a construction activity, we recommend that all buildings within the Medium Risk Distance be notified of the works in advance via a letter drop which outlines the proposed construction activities and likely vibration effects.

Detailed management and mitigation options for construction vibration will be contained in the CNVMP but follow the guidelines in Section 4.5 of this report.

Additional vibration monitoring and follow-up building condition surveys will need to be undertaken at all buildings that had pre-construction building condition surveys. They should also be undertaken in response to complaints, to ensure construction activities comply with the Category B criteria and that no building damage has occurred. If any construction-induced damage were shown to have occurred as a result of Project construction activities, this should be remedied by the contractor.

4.5.3 Construction Noise and Vibration Management Plan

All appropriate mitigation and management are generally set out in a CNVMP, which would be used to manage works on site and sets out how the construction contractor interacts with the neighbouring affected parties. A CNVMP is a condition of the proposed designations.

The CNVMP should also include information set out in NZS6803:1999 in Section 8 and Annex E, and the requirements of the AUP:OP such as:

- Summary of noise and vibration standards;
- Summary of assessments/predictions;
- General construction practices, management and mitigation that will be used for the Project;

- Noise management and mitigation measures specific to activities and/or receiving environments, particularly for high noise and/or vibration activities, and all night-time works;
- Monitoring and reporting requirements;
- Procedures for handling complaints; and
- Procedures for review of the CNVMP throughout the works.

Where appropriate, the CNVMP should also follow the approach outlined in the relevant Waka Kotahi Guide.[4] This includes a requirement for high noise and vibration risk construction projects to have an independently peer reviewed CNVMP and include a comprehensive risk-based quality assurance programme to ensure risks are appropriately managed.

Each NoR should have its own CNVMP. While the base information in each CNVMP will be similar, management and mitigation depend on the works undertaken and the receiving environment. The construction methodology is not yet finalised, therefore, the CNVMPs should be prepared when more detail is available. In addition to the CNVMPs, Waka Kotahi standard procedures for the management of noise and vibration should be implemented. These will be relied on to avoid, remedy and mitigating adverse effects where appropriate.

4.5.4 Schedules

In addition, Site Specific Noise and/or Vibration Management Schedules (**Schedules**) are a useful tool in determining how the noise and vibration effects from specific activities or in specific areas will be managed and potentially affected parties communicated with. Schedules would generally be prepared where there is a high risk of exceeding the noise and/or vibration standards.

The Schedules are specific to the activity or receiver they relate to, and would therefore contain detailed information on communication, management and mitigation specific to a certain task or area.

The following information would normally be included in a Schedule:

- The activity start and finish dates;
- The nearest neighbours to the activity;
- A location plan;
- The activity equipment and methodology;
- Predicted noise/vibration levels
- Recommended BPO mitigation;
- Documented communication and consultation with affected persons;
- Monitoring details; and
- Any pre-activity building condition survey for any buildings predicted to receive vibration levels exceeding the Category A criteria and receiving noise levels towards the Category B criteria.

They would be attached to the CNVMP, providing additional information that would sit alongside the general management and mitigation options within the CNVMP.

4 https://www.nzta.govt.nz/assets/Highways-Information-Portal/Technical-disciplines/Noise-and-vibration/Standards/Templates/Construction-noise-and-vibration/NZTA-Construction-noise-and-vibration-management-plan-v1.2.doc

5 Strategic Assessment Package Overview

An overview of the Strategic Assessment Package is provided in Figure 5-1 below, with a brief summary of the Strategic Assessment Package projects provided in Table 5-1 below.

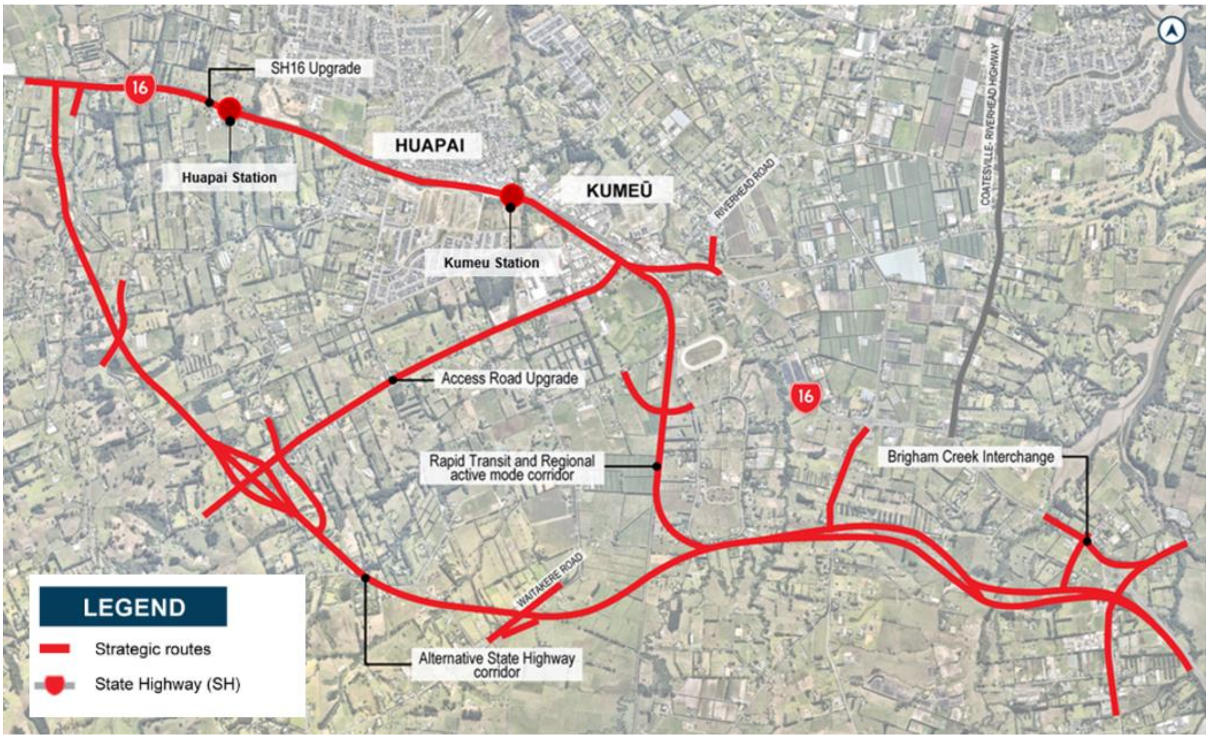


Figure 5-1: North West Strategic Assessment Package – Overview of NoRs for Assessment

Table 5-1: Strategic Assessment Package Project Summary

Corridor	NOR	Description	Requiring Authority
Alternative State Highway	S1	A new four-laned dual carriageway motorway and the upgrade of Brigham Creek Interchange	Waka Kotahi
State Highway 16 Main Road Upgrade (alteration to existing designation 6766)	S2	Upgrade to urban corridor including active modes and realignment of Station Road intersection with SH16.	Waka Kotahi
Rapid Transit Corridor	S3	New Rapid Transit Corridor and active mode corridor in one co-located corridor.	Waka Kotahi
Kumeū RTC Station	KS	New rapid transit station, including transport interchange facilities and accessway.	Waka Kotahi
Huapai RTC Station	HS	New rapid transit station, including transport interchange facilities, park and ride and accessway.	Waka Kotahi
Access Road Upgrade	S4	Upgrade of Access Road to a four-lane cross-section with separated cycle lanes	Auckland Transport

Corridor	NOR	Description	Requiring Authority
		and footpaths on both sides of the corridor.	

Please refer to the AEE for further information on these projects, including a project description, key project features and the planning context.

6 Construction Effects

Construction noise and vibration effects are dependent on several factors. These include the sensitivity of the receiving environment (e.g. an inpatient hospital may be more sensitive than an office), the construction of buildings (e.g. a solid concrete or brick façades reduces noise significantly better than a lightweight façade with louvred windows) and the presence of people near construction (e.g. if all people in the area are at work during daytimes, they are not affected by the construction activity).

Construction effects are assessed for all occupied buildings present at the time of construction. Therefore, for future projects such as these the receiving environment may have changed, in some instances significantly, by the time construction commences.

This can be responded to appropriately by preparing and implementing a CNVMP (refer Section 4.5.3) and additional Schedules (refer Section 4.5.4). Since these documents are prepared and finalised at the time of construction, with input from the contractor, the actual environment present at that time will form their basis.

Nevertheless, in the following sections we provide an overview of the potential effects in relation to likely responses of people to various noise and vibration levels.

6.1 Noise Effects

6.1.1 Daytime

Noise levels affect people in their place of residence or work. Construction noise is inherently higher than ongoing operational noise, which is reasonable due to its limited duration.

Generally, construction noise is assessed in relation to people inside buildings. It is assumed that people will choose to not spend any extended periods in an outdoor area next to high noise construction activities. It is also assumed that people will keep their windows and doors closed to reduce internal noise levels. Generally, New Zealand dwelling facades reduce noise levels by 20 to 25 decibels. We have assumed conservatively a noise level reduction of 20 decibels, though any new dwellings would achieve 25 to 30 decibels noise level reduction, and commercial buildings with concrete or brick façades can even achieve noise level reductions of more than 35 decibels if there are no windows or doors facing to the works.

How people may experience noise inside or outside a building is described in Table 6-1. That table does not take account of non-sensitive activities such as factories, storage spaces and similar uses.

Table 6-1: Potential noise effects for varying noise levels

External Façade Noise Level dB L_{Aeq}	Potential Daytime Effects Outdoors	Corresponding Internal Noise Level dB L_{Aeq}	Potential Daytime Effects Indoors
Up to 65	Conversation becomes strained, particularly over longer distances.	**Up to 45**	Noise levels would be noticeable but unlikely to interfere with residential or office daily activities.
65 to 70	People would not want to spend any length of time outside, except when unavoidable through workplace requirements.	**45 to 50**	Concentration would start to be affected. TV and telephone conversations would begin to be affected.
70 to 75	Businesses that involve substantial outdoor use (for example garden centres such as Bunnings) would experience considerable disruption.	**50 to 55**	Face to face and phone conversations and TV watching would continue to be affected. Office work can generally continue.
75 to 80	Some people may choose hearing protection for long periods of exposure. Conversation would be very difficult, even with raised voices.	**55 to 60**	Phone conversations would become difficult, and face to face conversations would need slightly raised voices. For residential activities TV and radio sound levels may need to be raised. Continuing office work may become difficult.
80 to 90	Hearing protection would be required for prolonged exposure (8 hours at 85 dB) to prevent hearing loss.	**60 to 70**	Face to face conversations would require raised voices. In a residential context, people may actively seek respite if these levels are sustained for more than a period of a few hours. Concentration would start to be affected, continuing office work would be difficult and may become unproductive.

6.1.2 Night-time

The noise level received inside a noise sensitive space (e.g. bedroom) will depend on the external noise level, sound insulation performance of the façade (particularly the glazing) and room constants (such as the room dimensions and surface finishes). These factors can vary widely.

The Construction Noise Standard (NZS 6803) recommends noise limits assessed at 1m from the external façade of a building, assuming a façade sound level difference of 20 decibels. However, a 20-decibel reduction is particularly conservative for modern buildings. The sound insulation performance can be measured, or generally be estimated with knowledge of the façade glazing type as follows:

- Sealed glazing: 30 decibels façade sound level difference
- Closed windows (openable): 20 – 25 decibels façade sound level difference
- Open windows: 15 decibels façade sound level difference

Table 6-2 provides guidance on the potential night-time effects inside sensitive spaces, depending on the external noise level and façade glazing type. The potential effects are colour coded as follows:

Typically acceptable

Sleep disturbance for some occupants

Sleep disturbance for most occupants

Table 6-2 Night-time noise levels in bedrooms of dwellings

External Noise Level (dB L_{Aeq})	Estimated Internal Noise Level (dB L_{Aeq})			
	Sealed glazing	**Openable windows (modern building)**	**Openable windows (older style building)**	**Open windows**
70 – 75	40 – 45	45 – 50	50 – 55	55 – 60
65 – 70	35 – 40	40 – 45	45 – 50	50 – 55
60 – 65	30 – 35	35 – 40	40 – 45	45 – 50
55 – 60	25 – 30	30 – 35	35 – 40	40 – 45
50 – 55	20 – 25	25 – 30	30 – 35	35 – 40
45 – 50	15 – 20	20 – 25	25 – 30	30 – 35

The above table shows that consultation and management may be required if night-time works are proposed in the vicinity of dwellings, where internal noise levels would affect sleep.

6.2 Vibration Effects

Vibration levels can be perceived well below a level at which cosmetic building damage may occur. For structural damage to occur, vibration levels would need to be magnitudes higher again. People tend to react to low vibration levels, and it is important to inform residents in the vicinity of the works of the potential for construction vibration to be felt.

The below table shows how people may react to various vibration levels. These effects do not consider less sensitive uses such as factories, manual works (e.g. the concrete batching plant) and similar.

Table 6-3: Vibration effects

Vibration level (mm/s PPV)	Potential effects indoors
0.14	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3	Vibration might be just perceptible in residential environments This is the AUP:OP limit for construction vibration generated at night-time for sensitive receivers.
1	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents. What people feel would be subject to the source/activity (i.e., continuous motion or a one-off event) and associated frequency (i.e., fast or slow vibration), but could include a steady vibration from sources such as vibratory compaction, or a small jolt such as from the movement of a large digger. Vibration at this level could rattle crockery and glassware. Sleep disturbance would be almost certain for most people.
2	Vibration would clearly be felt in all situations. Can be tolerated in indoor environments such as offices, houses, and retail, where it occurs intermittently during the day and where there is effective prior engagement. This is the AUP:OP limit for occupied buildings for construction projects generating vibration.
5	Unlikely to be tolerable in a workplace or residential environment without prior warning and explanation. If exposure was prolonged, some people could want to leave the building affected. Computer screens would shake, and light items could fall off shelves. This is the AUP:OP limit for construction activities generating vibration for three days or less between the hours of 7:00 am – 6:00 pm
10	Likely to be intolerable for anything more than a very brief exposure.

For dwellings where the Category A (amenity) criteria are predicted to be exceeded, residents may be disturbed by vibration if no prior warning is given. We recommend notification to avoid such a situation. It is noted, however, that vibration inducing equipment generally moves along the alignment, i.e. vibration levels will not remain high for any length of time.

7 NoR S1: Alternative State Highway, including Brigham Creek Interchange

7.1 Project Corridor Features

The ASH extends from the existing State Highway 16 (**SH16**) / BCI (north of Redhills) to a proposed new intersection with SH16 near/at Foster Road on the western edge of the FUZ, west of Huapai. This proposed state highway corridor will be approximately 11km long, travelling westward across rural farmlands to the southwestern side of Kumeū and Huapai, with an additional interchange proposed at Tawa Road.

An overview of the proposed design is provided in Figure 7-1 below.

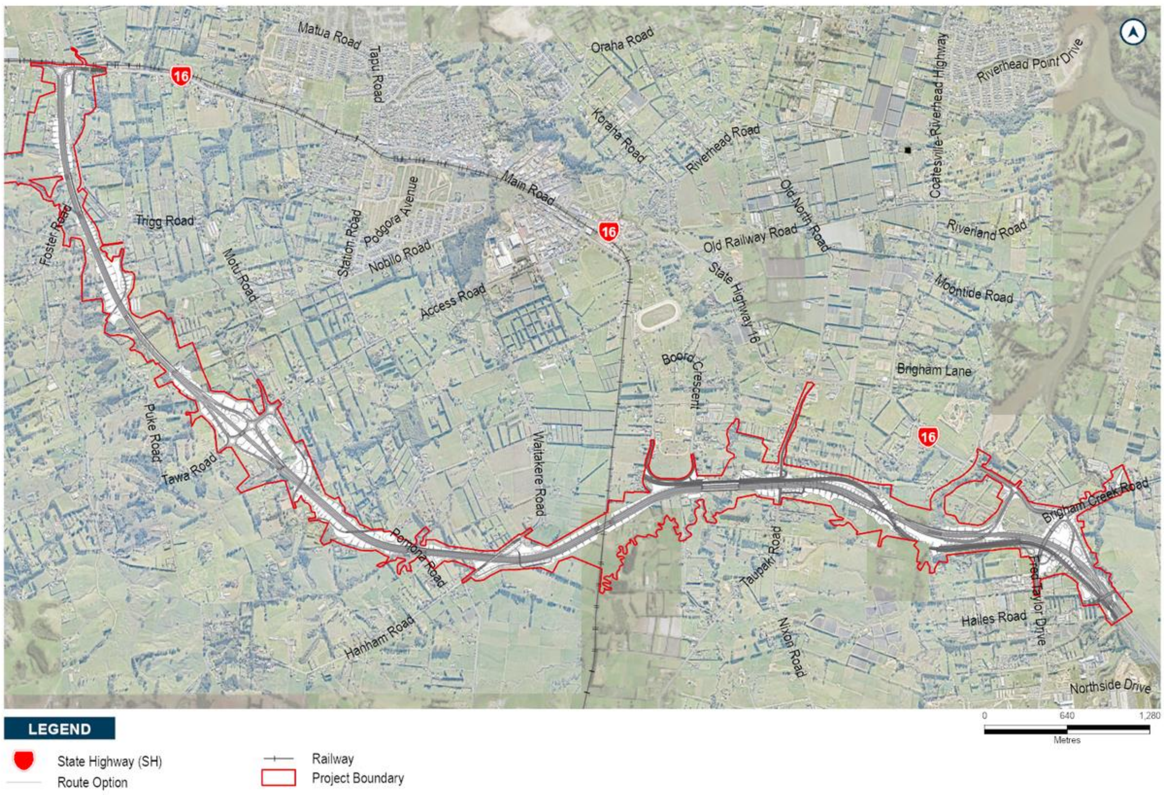


Figure 7-1: Overview of the Alternative State Highway, including Brigham Creek Interchange

Key features of the proposed new ASH corridor and BCI likely to generate construction noise and/or vibration effects include the following:

- The construction of a new four-lane motorway corridor with a cross-section of approximately 50m to accommodate a four-lane dual carriageway and separated cycle lanes and footpaths. The typical cross section includes an active mode corridor with central and side barriers.
- The replacement of the existing SH16 / Fred Taylor Drive / Brigham Creek Road Roundabout with a fully grade separated interchange with on and off ramps in a ‘Split-Fork” type arrangement

- An underpass at Taupaki Road and bridges over the NAL with further grade separations at Waitakere Road, Pomona Road, Tawa Road, Puke Road and Foster Road. Tawa Road is designed to future proof for a full diamond interchange.
- The western end of the alignment ties-in at a proposed three-legged roundabout with SH16 Main Road, immediately west of Foster Road.
- The re-alignment of the following local roads:
  - Pomona Road, approximately 1.5km (two sections);
  - Motu Road, approximately 200m; and
  - Puke Road, approximately 500m.
- Construction of stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable the construction of the corridor, and associated cut and fill activities.
- Vegetation removal within the proposed corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas. Proposed laydown areas and site office locations are shown on the General Arrangement Layout Plans.

The construction of this NoR is proposed to take approximately 5.5 years; however, the construction timeframes will be confirmed at the detailed design / Outline Plan of Works (**OPW**) stage.

7.2 Existing and Likely Future Environment

7.2.1 Planning context

The ASH corridor, including the BCI, is largely rural and is proposed to traverse land zoned under the AUP:OP as Rural – Countryside Living Zone, Rural – Mixed Rural Zone and Rural – Rural Production Zones.

The ASH corridor will also traverse two separate areas of FUZ in Redhills North and Kumeū-Huapai with the BCI also currently sitting within the Redhills North FUZ land.

Table 7-1 below provides a summary of the existing and likely future environment as it relates to the ASH and BCI.

Table 7-1: Alternative State Highway and Brigham Creek Interchange Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[5]	Likely Future Environment[6]
Rural	Rural - Mixed Rural Zone, Rural - Countryside Living Zone Rural - Production Zone	Low	Rural
Undeveloped greenfield areas	Future Urban	**High**	Urban

[5] Based on AUP:OP:OP zoning/policy direction
[6] Based on AUP:OP:OP zoning/policy direction

7.2.2 Existing and Future Noise Environment

The alignment traverses a range of areas with different ambient noise environments. These range from existing high noise levels in the mid-60 dB L_{Aeq} at the BCI, connecting with the existing SH16 near Foster Road, to mid-40 dB L_{Aeq} away from any major current roads.

These noise levels are expected to remain largely unchanged for most of the alignment. Only limited parts of the alignment will be within the Future Urban Zone, where the environment is expected to change significantly once developed and occupied.

Where the existing environment is materially different at the time of construction, any new occupied buildings will need to be assessed against the relevant noise and vibration limits and included in the relevant CNVMP.

7.2.3 Buildings inside designation

The following Table 7-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or unoccupied during construction. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

We assume that the relevant requiring authority will acquire the parcels of land that these buildings are located on. In addition, auxiliary buildings are not generally occupied, so would not be relevant receivers in relation to this assessment,

Table 7-2: Buildings inside designation (not assessed)

Address	Address
134, 138, 142, 146, 149, 152, 154, 156, 162, 171, 176, 178, 182, 176A Boord Cres, Kumeū	36, 37, 41, 47, 54, 69, 78 Puke Rd, Kumeū
5, 7, 18, 21 Brigham Creek Rd, Whenuapai	191, 272, 278, 280, 727 SH16, Kumeū
30, 40, 62, 80, 104, 113 Foster Rd, Kumeū	380, 388, 389, 400, 401 Taupaki Rd, Kumeū
148 – 155 (uneven nos. only), 155, 159, 186, 188, 192, 202, 204, 206, 212 Fred Taylor Dr, Whenuapai	87, 97, 122 Tawa Rd, Kumeū
87 Joseph Dunstan Dr, Taupaki	249 Trigg Rd, Kumeū
146 Motu Rd, Kumeū	656, 660, 670, 691, 703 Waitakere Rd, Kumeū
2, 9, 34, 37, 55, 73, 103, 107, 121, 130, 138, 142, 144, 170, 191 Pomona Rd, Kumeū	

7.3 Assessment of Construction Noise and Vibration Effects

7.3.1 Construction Noise Effects

7.3.1.1 Predicted noise level exceedances

Overall, as the designation area is extensive to allow for the construction and associated areas such as laydown areas, wetlands and stormwater ponds, the majority of existing buildings will be more than 100m from the proposed works. Works in closer proximity are proposed at the following areas:

- BCI covers the area between Fred Taylor Drive, Brigham Creek Road and SH16. Closest buildings are as close as 60m from the works.
- At Waitakere and Pomana Roads, a small number of dwellings are within 40 to 60m from the road alignment and wetlands.
- A new interchange consisting of three roundabouts at Tawa and Motu Roads means that several buildings will be close to the works. Closest works include the construction of the ramps and connections with existing roads. Closest houses would be less than 10m from the works, with most houses at 20 to 40m distance.
- Where the project passes under Puke Road, a new local road bridge will need to be constructed, and Puke Road partially realigned. This means that a number of dwellings are as close at 10m from construction works in the vicinity of the Puke Road tie in.
- In the vicinity of Foster Road and the tie in with the existing SH16, a small number of dwellings are between 45 and 55m from the potential works.

The figures in Appendix 1.1 show the construction noise envelope within which mitigation will need to be implemented.

Based on the construction activities summarised in the bullet points above, we have identified 146 properties where construction noise levels have the potential to exceed the relevant criteria. These are shown in Table 7-3. Some buildings identified are auxiliary buildings (e.g. garages, or sheds) that may not be occupied during construction but have been included for completeness. These are shown in grey in the table.

At the time of construction the buildings existing at the time will need to be reassessed to ensure all relevant receivers are included in the CNVMP. Since part of the Project traverses the FUZ, additional buildings may have been developed by the time of construction. However, the designation is generally wide enough to avoid significantly larger effects than those predicted, i.e. noise levels received at future dwellings would not be substantially higher than predicted for existing dwellings.

Table 7-3: Potential noise criteria exceedances (based on earthworks activities)[7]

Address	Address
99, 102, 108, 111, 113, 186, 190, 202, 210, 214 Boord Cres, Kumeū	96, 228 Boord Cres, Kumeū
2, 4, 15, 26 Brigham Creek Rd, Whenuapai	6, 12, 14, 15, 18, 21, 23-27 Brigham Creek Road
116, 130, 131 Foster Rd, Kumeū	74 Brookvale Lane, Taupaki
133 – 143 (uneven nos. only), 172, 200, 208, 210 Fred Taylor Dr, Whenuapai	59, 81 Foster Road, Kumeū
2, 6 Hanham Rd, Kumeū	180 – 184 (even nos. only), 198 Fred Taylor Dr, Whenuapai
75, 91 Joseph Dunstan Dr, Taupaki	9 Hanham Rd, Kumeū
1, 3, 5, 9, 11 Kennedys Rd, Whenuapai	88 Joseph Dunstan Dr, Taupaki
135, 150, 158, 164 Motu Rd, Kumeū	2-6 Kennedys Rd, Whenuapai
28, 48, 66, 95, 96, 123, 191, 194 Pomona Rd, Kumeū	170 Motu Rd, Kumeū
18, 21, 22, 27, 37, 80, 104, 107, 157 Puke Rd, Kumeū	75, 90, 123, 130, 151 Pomona Rd, Kumeū
171 – 181 (uneven nos. only), 218, 222 SH16, Whenuapai	69 Puke Rd, Kumeū
238, 238A, 246, 393, 693, 695 SH16, Kumeū	239, 272, 284, 393, 726 – 728, 733, 741, 751 SH16, Kumeū
370, 374, 375, 377, 405, 412, 418, 419, 422, 434, 440, 443, 448, 454, 455, 466 Taupaki Rd, Kumeū	422 Taupaki Rd, Taupaki
73, 76, 79, 83, 86, 137, 141, 145 Tawa Rd, Kumeū	83, 148 Tawa Rd, Kumeū
637, 646, 670, 710 Waitakere Rd, Kumeū	221 Trigg Rd, Kumeū
	646 Waitakere Rd, Kumeū

7.3.1.2 Daytime works

The loudest activity across the entire project are earthworks, which move along the alignment. Because of that, mitigation in the form of barriers is not efficient unless there are special circumstances.

Piling for the construction of bridges is also a notable noisy activity. However, this will occur for only a brief period over the overall construction duration, and can be mitigated with equipment choice, barriers and placement of equipment.

Mitigation as set out in Section 4.5 will be implemented across the works. There are no specific construction activities close to buildings that would require mitigation in addition to common best practice.

[7] Black addresses reflect dwellings or other noise sensitive receivers, while grey addresses reflect auxiliary buildings such as garages or sheds that may not be occupied during construction

Predicted noise levels may be as high as 80 dB L_{Aeq} at the closest dwellings, during times of earthworks in close proximity. However, these works would occur only for a few days and then move along the alignment. Only a small number of buildings may be affected by such levels where works are particularly close, and then only for a brief period. The exceedances will be limited and passing. Good communication and timing of activities can assist in reducing effects. We consider that effects would therefore be reasonable provided relevant measures as set out in Section 4.5 are implemented.

For most of the construction works and construction duration, we predict that noise levels can comply with the 70 L_{Aeq} noise criterion at the surrounding receivers.

7.3.1.3 Night-time works

Night works may be required where major local roads or rail would need to be closed for the construction. We have identified the following locations where this may be the case:

- Southern tie in with SH16
- Tie in with Fred Taylor Drive
- Bridge construction across the North Auckland Rail Line (will require a Block of Line (**BOL**) and may occur at night or on a long weekend)
- Bridge construction across Pomana Road
- Bridge construction across Foster Road
- Northern tie in with SH16

These works are limited in duration, often requiring only two or three nights' work. In any event, such works will need to be managed through the CNVMP and require the preparation of a Schedule (refer Section 4.5.4).

We consider that with appropriate management the construction can be undertaken within reasonable noise levels that would be expected from construction of such infrastructure.

7.3.2 Construction Vibration Effects

Vibratory rollers are the most common high vibration generating equipment across the Project. In addition, piling for bridges also causes high vibration levels.

As discussed in Section 4.4.3, we have provided for a 100% safety margin when determining the envelope of vibration levels. For Category B for all occupied buildings, this is at a distance of 15m. For Category A, for occupied PPFs the relevant distance is 80m and for occupied other buildings it is 40m.

Appendix 2 includes figures showing the vibration envelopes for these three criteria.

Table 7-4 shows the addresses of identified buildings that, if existing at the time of construction and occupied, may receive vibration levels exceeding Category B. Eight of these buildings are identified as PPFs, while the remainder are auxiliary buildings and non-PPFs (shown in grey in the table below).

Table 7-4: Potential Category B vibration criteria exceedances (based on vibratory roller activities)[8]

Address	Address
141 Fred Taylor Dr, Whenuapai	139, 143, 180, 182 Fred Taylor Dr, Whenuapai
3 Kennedys Rd, Whenuapai	1 Kennedys Rd, Whenuapai
175, 179 State Highway 16, Whenuapai	170 Motu Rd, Kumeu
419, 455 Taupaki Rd, Taupaki	741 State Highway 16, Kumeū
79, 137 Tawa Rd, Kumeū	145 Tawa Rd, Kumeū
	646 Waitakere Rd, Kumeū

If on-site measurements confirm the predicted vibration levels, then alternative compaction methods should be considered, e.g. non-vibratory compaction.

An additional 57 PPFs have been identified that may receive vibration levels exceeding the Category A vibration criteria. Category A criteria should be used as a trigger to engage with potentially affected people.

Vibration generally occurs intermittently, when equipment passes the building, and can be tolerable if prior notification is given. However, high vibration generation is not appropriate for night-time and should be avoided as far as practicable.

7.4 Conclusions

We have predicted construction noise and vibration levels for the Project, based on the likely construction sequence and methodology set out in Section 4.2.

The construction activities likely to generate the highest levels of effects are earthworks and bridge constructions, with likely limited night works required where major roads or the rail would need to be closed for the works.

Overall, we predict that most activities can comply with the relevant noise and vibration criteria. Where non-compliance is predicted, this would occur for limited and defined periods only, when equipment operates close to occupied buildings or where works outside normal hours are required.

Common best practice mitigation and management should be implemented across the construction site, and this should be documented in the CNVMP. Schedules will need to be prepared for those activities that are predicted to exceed the criteria. This will involve communication with the affected persons.

[8] Black addresses reflect dwellings or other sensitive receivers, while grey addresses reflect auxiliary buildings such as garages or sheds that may not be occupied during construction

8 NoR S2: SH16 Main Road Upgrade

8.1 Project Corridor Features

It is proposed to submit a Notice of Requirement (NoR S2) to designate the land required to implement the upgrade of the existing State Highway 16 (**SH16**) to a two-lane corridor with walking and cycling facilities. Our assessment only relates to the alteration of the existing designation (Designation 6766), i.e. the additional area that has been identified for corridor widening beyond the existing designation. We understand that the noise and vibration effects of works inside the existing designation are already authorised. We note, however, that the management of noise and vibration effects within the existing designation will be confirmed through an Outline Plan of Works (**OPW**) process and will include the preparation and implementation of a CNVMP for the overall works and Schedules for specific activities and receivers as required.

The SH16 Main Road Upgrade extends approximately 4.5km between Old Railway Road, east of Kumeū to Foster Road, west of Huapai. The SH16 Main Road is currently a 20m wide two-lane urban arterial with no active mode facilities on either side of the corridor.

SH16 Main Road is proposed to be upgraded to a 24m urban corridor traversing through well-established retail, commercial and residential environs. The corridor generally follows the existing SH16 Main Road alignment and also includes a 600m section of active mode only upgrade between Oraha Road and Tapu Road. As part of this project, Station Road will be realigned to form a new signalised intersection with SH16 and Tapu Road.

An overview of the proposed design is provided in Figure 8-1 below.

Figure 8-1: Overview of the SH16 Main Road Upgrade

Key features of the proposed upgrade include the following:

- The widening of the existing 20m wide two-lane urban arterial to a 24m wide corridor with walking and cycling facilities on both sides of the corridor.
- The realignment of Station Road to form a new signalised intersection with SH16 and Tapu Road.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal along the existing road corridor.
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas. Proposed laydown areas and site office locations are shown on the General Arrangement Layout Plans.

The construction of this NoR is proposed to take approximately 5 years; however, the construction timeframes will be confirmed at the detailed design / Outline Plan of Works (**OPW**) stage.

8.2 Existing and Likely Future Environment

8.2.1 Planning context

SH16 Main Road is proposed to be upgraded to a 24m urban corridor along the urban extent of SH16 traversing through well-established retail, commercial and residential environs through Kumeū Huapai. This corridor contains a range of business, residential and open space and rural land uses under the AUP:OP (see zoning column in Table 8-1) between the eastern extent of the Kumeū-Huapai township and the western extent of the upgraded corridor (the intersection with the proposed ASH).

Table 8-1 below provides a summary of the existing and likely future environment as it relates to the SH16 Main Road Upgrade.

Table 8-1: SH16 Main Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[9]	Likely Future Environment[10]
Rural	Rural Mixed Rural Zone, Rural Countryside Living Zone	Low	Rural
Business	Business (Industrial)	Low	Urban
	Business (Local Centre)	Low	Urban
	Business (Mixed Use)	Low	Urban
Residential	Residential	Low	Residential

[9] Based on AUP:OP zoning/policy direction
[10] Based on AUP:OP zoning/policy direction

Environment today	Zoning	Likelihood of Change for the environment[9]	Likely Future Environment[10]
Open Space	Open Space – Sport and Active Recreation	Low	Open Space
Undeveloped greenfield areas	Future Urban	**High**	Urban

8.2.2 Existing and Future Noise Environment

The alignment follows the existing heavily trafficked route of SH16. This means that neighbouring buildings are already affected by elevated noise levels from the road, and this is unlikely to change in the future. The surrounding area is unlikely to change in terms of it already being an existing urban area as it is already well developed for much of the alignment. Ambient sound levels range from 60 to 70 dB L_{Aeq} during daytime, with some buildings particularly close to the road predicted to experience noise level above 70 dB L_{Aeq} during daytime.

Only limited parts of the alignment will be within the Future Urban zone, where the environment is expected to change significantly once developed and occupied.

Where the existing environment is materially different at the time of construction, any new occupied buildings will need to be assessed against the relevant noise and vibration limits and included in the relevant CNVMP.

8.2.3 Buildings inside designation

The following Table 8-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or unoccupied during construction. We only note the addresses where the main building is inside the designation, and not those where auxiliary buildings such as sheds, or garages may be removed.

We assume that the relevant requiring authority will acquire the parcels of land that these buildings are located on. In addition, auxiliary buildings are not generally occupied, so would not be relevant receivers in relation to this assessment,

Table 8-2: Buildings inside designation (not assessed)

Address	Address
21 Riverhead Rd, Kumeū	1 Trigg Road, Kumeū
619 SH16, Kumeū	

8.3 Assessment of Construction Noise and Vibration Effects

8.3.1 Construction Noise Effects

8.3.1.1 Predicted noise level exceedances

This assessment relates to the new designation area that is intended to be added to the existing designation. In some areas there will be no material change in the designation area, which would result to unnoticeable changes to the already authorised effects of construction being carried out in the existing designation.

However, proposed road and bridge realignments, and a wider footprint for laydown areas will mean that in some areas additional land will be required during construction. This is particularly the case where land will be required outside the existing designation for stockpile areas and site compounds, and three temporary road realignments to facilitate Kumeu River bridge construction.

All works will be in close proximity to buildings as most of the alignment is bordered by established residential and commercial areas.

The figures in Appendix 1.2 show the construction noise envelope within which mitigation will need to be implemented. Note that this envelope does not take account of shielding from intervening buildings or structures and is therefore conservative. It is likely that less buildings will be affected by high construction noise levels given the smaller scale of works for parts of the project (where only walking and cycling will be established).

Based on the construction activities summarised above, we have identified 224 properties where construction noise levels have the potential to exceed the relevant criteria. These are shown in Table 8-3. Some buildings identified are auxiliary buildings (e.g. garages, or sheds) that may not be occupied during construction but have been included for completeness. These are shown in grey in the table.

At the time of construction the buildings existing at the time will need to be reassessed to ensure all relevant receivers are included in the CNVMP. A section of the Project traverses the FUZ. This means that additional buildings may have been developed by the time of construction and will need to be assessed and mitigated at the time of construction.

Table 8-3: Potential noise criteria exceedances (based on earthworks activities)[11]

Address	Address
7 Main Road, Kumeū	1 – 8 (all no.), 10, 12, 14 Trigg Rd, Huapai
342 – 348 (even no. only) Main Road, Kumeū	1-7 Vintner Cl, Huapai (uneven no. only)
350 – 362, 364 – 368 Main Road, Kumeū (all no.)	22 – 28 (even no. only), 32, 36, 40 Weza Lane, Kumeū
370, 372, 376, 382, 395, 399, 401, 405, 407, 407A Main Rd, Huapai	22 Wookey Lane, Kumeū
402, 411 Matua Road, Kumeū	1 Grivelle St. Kumeū
30 Meryl Avenue, Kumeū	40, 42, 46, 48, 64, 66, 68, 74, 78 – 88 (even no. only), 106, 132, 134, 154, 190, 223, 246, 248, 250, 280, 282, 296, 300, 304, 322, 326, 330, 332, 334, 338, 340, 378, 380, 384, 395, 108-110, 134-152, 156A, 156B, 156G, 302-318, 50-54, 58-56, 90-92 Main Road, Kumeū
5 – 21 Oraha Rd, Kumeū	3, 392 Matua Road, Huapai
22 – 24, 26 – 45, 47, 21A, 39A Riverhead Road, Kumeū (all no.)	43 Old Railway Road, Kumeū
529, 573, 583, 587, 601, 623, 631, 641, 643, 647, 665, 677, 695, 631A State Highway 16, Kumeū	1 Putaki Drive, Kumeū
4 – 10 Station Road, Huapai (even no. only)	31 Riverhead Rd, Kumeū
14, Station Road, Huapai	1 – 5, 7 – 11, 8A, 18, 19, 22, 14-16 Shamrock Drive, Kumeū
20 – 28, 34 – 38 Station Road, Huapai (even no. only)	550, 641 State Highway 16, Kumeū
25 Station Road, Huapai	4, 16 Sunny Crescent, Huapai
8 Sunny Crescent, Huapai	1, 1A, 2 ,20 Tapu Road, Huapai
3 – 21 Tapu Road, Huapai (uneven no. only)	9 Tokay Place, Huapai
2 – 14 Trigg Rd, Huapai (even no. only)	993 Waitakere Rd, Kumeū
3, 5 Trigg Rd, Huapai	1, 9A, 11A-C Weza Lane, Kumeū
1 – 7 Vintners Close, Huapai (uneven no. only)	16 – 23, 35, 43 Wookey Lane, Kumeū
10, 14, 16, 16A, 18, 22, 24, 30 Tapu Road, Huapai	

8.3.1.2 Daytime works

The loudest activity across the entire project are the proposed road realignments and bridge constructions, which will occur over an extended period of several weeks or months in the relevant locations. Earthworks will be somewhat more minor for this project, particularly in areas where only

[11] Black addresses reflect dwellings or other noise sensitive receivers, while grey addresses reflect auxiliary buildings such as garages or sheds that may not be occupied during construction

walking and cycling improvements are proposed. For these activities, smaller equipment can be used (e.g. smaller rollers and excavators) which generate lower noise levels.

Mitigation as set out in Section 4.5 will be implemented across the works. Bridge construction both for the temporary bridges and ultimate permanent bridges will require careful management where existing buildings are close by.

Predicted noise levels may be as high as 85 dB L_{Aeq} at the closest dwellings, during times of bridge piling. However, these works would occur only for a limited period. Only a small number of buildings may be affected by such levels.

Other activities such as the earthworks required to form the proposed walking and cycling tracks may reach noise levels up to 75-80 dB L_{Aeq} when passing individual houses. However, such noise level would only be experienced for a matter of a few hours or at most days.

The exceedances will be limited and passing. Good communication and timing of activities can assist in reducing effects. We consider that effects would therefore be reasonable provided relevant measures as set out in Section 4.5 are implemented.

For most of the construction works and construction duration, we predict that noise levels can comply with the 70 L_{Aeq} noise criterion at the surrounding receivers.

8.3.1.3 Night-time works

Night works may be required where major local roads or rail would need to be closed for the construction. We have identified the following locations where this may be the case:

- Bridge construction across the North Auckland Rail Line in the vicinity of Station Road. which will likely require a Block of Line (**BOL**) and may occur at night or on a long weekend
- Resurfacing of SH16 following the upgraded bridges where the new and existing roads tie in together

These works are limited in duration, often requiring only two or three nights' work. In any event, such works will need to be managed through the CNVMP and require the preparation of a Schedule (refer Section 4.5.4)

We consider that with appropriate management the construction can be undertaken within reasonable noise levels that would be expected from construction of such infrastructure.

8.3.2 Construction Vibration Effects

If (small) vibratory rollers are to be used to form the walking and cycling facilities, they may generate elevated vibration levels at closest houses. In addition, bridge piling can cause high vibration levels depending on the methodology chosen.

As discussed in Section 4.4.3, we have provided for a 100% safety margin when determining the envelope of vibration levels. For Category B for all occupied buildings, this is at a distance of 15m. For Category A, for occupied PPFs the relevant distance is 80m and for occupied other buildings it is 40m.

Appendix 2 includes figures showing the vibration envelopes for these three criteria.

Table 8-4 shows the addresses of identified buildings that, if existing at the time of construction and occupied, may receive vibration levels exceeding Category B. Twenty-eight of these buildings are identified as PPFs, while the remainder are auxiliary buildings and non-PPFs (shown in grey in the table below).

Table 8-4: Potential Category B vibration criteria exceedances (based on vibratory roller activities)[12]

Address	Address
351 – 361 (uneven no. only) 365, 367,382, 399, 401, 405, 407, 407A Main Road, Huapai	40, 42, 68, 80, 82, 84, 86, 106, 108-110, 132, 134-152, 156G, 190, 250, 280, 302-318, 322, 384 Main Rd, Kumeū
24, 26, 34, 36 Riverhead Road, Kumeū	30 Meryl Avenue, Kumeū
665, 677 State Highway 16, Kumeū	43 Old Railway Road, Kumeū
22, 24, 38 Station Road, Huapai	1 Putaki Drive, Kumeū
10, 11, 14 Tapu Road, Huapai	1, 2 Shamrock Drive, Kumeū
1, 3 Trigg Road, Huapai	550 State Highway 16, Kumeū
	1A Tapu Road, Huapai, Kumeū
	1, 9A Weza Lane, Kumeū
	402 Matua Road, Kumeū

If on-site measurements confirm the predicted vibration levels, then alternative construction methods should be considered, e.g. non-vibratory compaction or bored piling.

An additional 104 PPFs have been identified that may receive vibration levels exceeding the Category A vibration criteria. Category A criteria should be used as a trigger to engage with the occupiers of potentially affected buildings.

Vibration generally occurs intermittently, when equipment passes the building or where there is particular ground resistance during piling and can be tolerable if prior notification is given. However, high vibration generation is not appropriate for night-time and should be avoided as far as practicable.

There are two heritage buildings within the existing heritage overlay along SH16 Main Road that are proposed to be repositioned along the corridor following works commencing on the RTC (NoR S3) to enable the construction of the Project. The buildings are transported to their new site, which will involve high levels of vibration through the loading, transport and unloading. Therefore, we consider that with appropriate siting and careful construction management, construction vibration is unlikely to cause damage to these buildings.

8.4 Conclusions

We have predicted construction noise and vibration levels for the Project, based on the likely construction sequence and methodology set out in Section 4.2.

[12] Black addresses reflect dwellings or other sensitive receivers, while grey addresses reflect auxiliary buildings such as garages or sheds that may not be occupied during construction

The works are generally of a smaller scale involving generally only the construction of walking and cycling facilities. However, the replacement of various bridges, and construction of temporary bridges in the meantime, are identified as the likely highest noise and vibration generating activities. Only limited night-time works may be required where the rail would need to be closed for installation, or where traffic on SH16 would be significantly affected.

Overall, we predict that most activities can comply with the relevant noise and vibration criteria. Where non-compliance is predicted, this would occur for limited and defined periods only, when equipment operates close to occupied buildings, e.g. during piling for bridge installation.

Common best practice mitigation and management should be implemented across the construction site, and this should be documented in the CNVMP. Schedules will need to be prepared for those activities that are predicted to exceed the criteria. This will involve communication with the affected persons.

9 NoR S3: Rapid Transit Corridor and Regional Active Mode Corridor; NoR KS: Kumeū Rapid Transit Station and NoR HS: Huapai Rapid Transit Station

9.1 Project Corridor Features

It is proposed to submit a Notice of Requirement (NoR S3) to designate the land required to implement the new Rapid Transit Corridor (**RTC**) and Regional Active Mode Corridor (**RAMC**) in one co-located and integrated corridor. In addition, new designations for two rapid transit stations, one each at Huapai (NoR HS) and Kumeū (NoR KS), are sought.

9.1.1 Rapid Transit Corridor

The proposed RTC is a new corridor which aims to complete a safe and frequent rapid transit system connecting Kumeū-Huapai with Westgate, Auckland City Centre and the North Shore. The RTC will extend the proposed City Centre to Westgate (**CC2W**) rapid transit corridor from the Brigham Creek Frequent Transit Network Station to the western edge of Kumeū-Huapai growth area near the Rural Urban Boundary (**RUB**).

The RTC will extend from the existing SH16 / Brigham Creek Interchange to the west of Huapai. The RTC predominately traverses rural land outside of the FUZ at a total length of approximately 9.5km and is intended to operate in an uninterrupted free flowing manner with all road crossings grade separated.

The RTC is split into the following sections:

- The **rural section** of the RTC runs from the BCI to NAL (and will be co-located with the ASH[13]) and along the eastern side of the NAL to the entry to Kumeū-Huapai township. The RTC is co-located with the RAMC for the entirety of the rural section. Within the rural section, the RTC requires an extended width to accommodate both the RTC and RAMC.
- The **urbanised section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade[14] along this section. Within this section, the RTC requires approximately 38m width to locate two FTN lanes, separated active mode facilities and the SH16 Main Road Upgrade.

It is proposed to route protect the RTC corridor for electric bus use.

[13] Another North West Strategic project – refer to Section 7 of this report

[14] Another North West Strategic project – refer to Section 8 of this report

The RTC corridor will be at grade except at key sections to pass over local arterial roads or the Alternative State Highway, including Brigham Creek Road. An overview of the proposed design is provided in Figure 9-1.

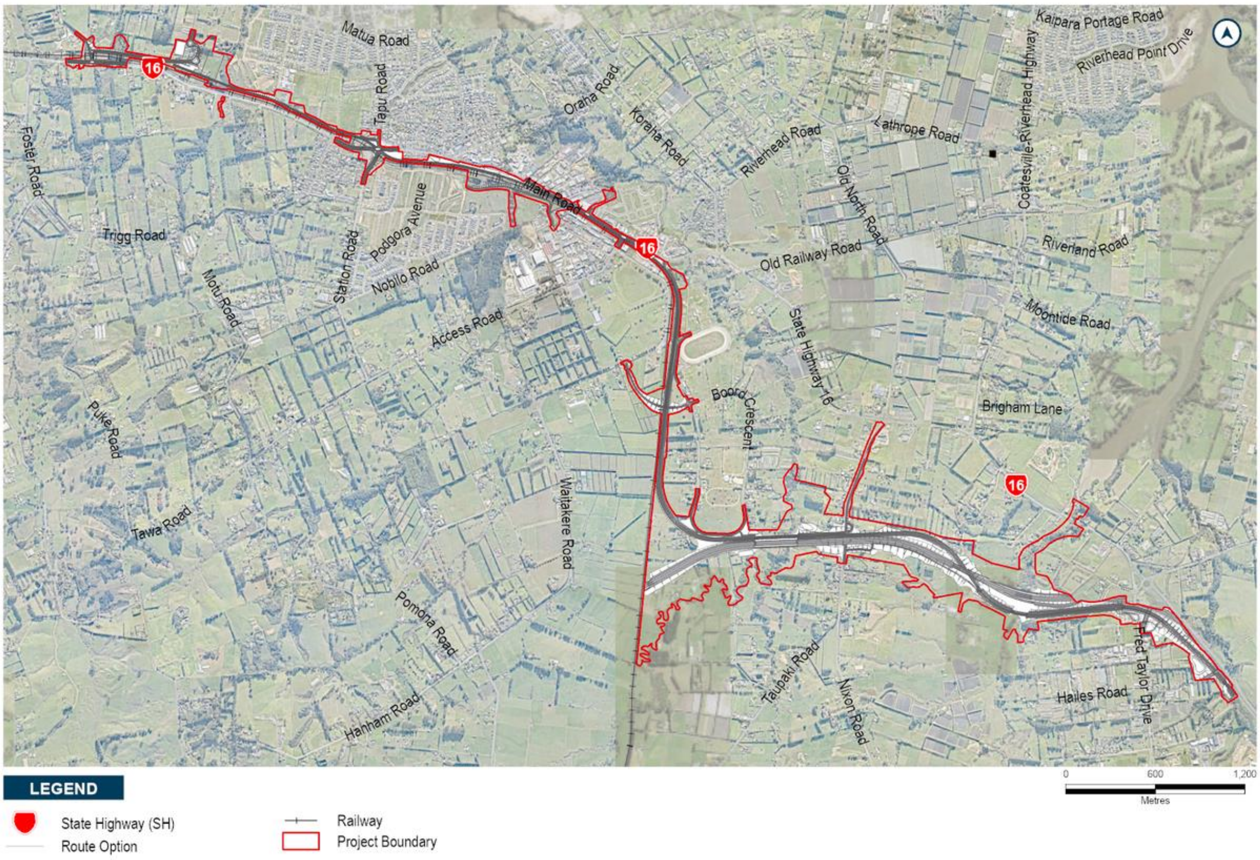


Figure 9-1: Rapid Transit Corridor and Regional Active Mode Corridor Overview

Key features of the proposed upgrade include the following:

- An approximately 9.5km long corridor intended to operate in an uninterrupted free flowing manner.
- The RTC will be at ground level except at key sections to pass over or under arterial roads (Fred Taylor Dr, Taupaki Rd, new Waitakere-Boord Cres Link Rd, Access Rd and Station Rd).
- The ASH goes over the RTC in the rural section.
- Grade separated road crossings at all intersections with adjoining roads.
- Within Kumeū-Huapai Township, upgrades of:
  - SH16 between Access Rd and John MacDonald Lane. At this section, the RTC abuts the KiwiRail boundary and the proposed SH16 upgrade which will need to be realigned north of its existing alignment.
  - Realignment of Station Road and Tapu Road to form a signalised cross-intersection. The RTC will pass under this proposed intersection to deviate to the north.
- Batter slopes to enable the construction of the corridor, and associated cut and fill activities (earthworks).
- Vegetation removal within the proposed new corridor
- Stormwater dry ponds, wetlands and culverts.
- The area to be route protected will include the transport corridor, FTN stations and additional land for tie-ins, stormwater infrastructure, batter slopes and retaining walls, and for other construction

related activities including re-grade of private driveways, construction of area for traffic manoeuvring and laydown areas.

The construction duration is anticipated to be around 5 to 5.5 years; however, the construction timeframes will be confirmed at the detailed design / Outline Plan of Works (**OPW**) stage.

9.1.2 Rapid Transit Stations

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

- Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary.
- Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu stream.

The construction of the stations is included in the overall construction duration of approximately 5.5 years.

9.1.3 Regional Active Mode Corridor

The RAMC is a segregated walking and cycling corridor that is located adjacent to the RTC alignment from the Brigham Creek Interchange to the western edge of Kumeū-Huapai, terminating at the signalised intersection of SH16 Main Road and Weza Lane. The corridor is co-located and integrated with the RTC and is proposed to be route-protected as a single NoR. The segregated corridor provides the opportunity for long-term amenity as a key cycling corridor, while connecting to the wider North Western Cycleway and ultimately to the Auckland city centre network.

The key features in terms of construction will be similar to those of the RTC and will be constructed simultaneously with the RTC.

9.2 Existing and Likely Future Environment

9.2.1 Planning context

The RTC, Rapid Transit Stations and RAMC form a single, integrated corridor (note the RAMC only extends to the eastern entrance to Kumeū). This corridor predominately traverses rural land outside of the FUZ, however for assessment purposes it can be split into two sections:

- The **rural section** of the RTC runs from the BCI to the entry to Kumeū-Huapai Township and is co-located with the RAMC along this section. This rural section traverses land zoned under the AUP:OP as Rural – Countryside Living Zone, with an area zoned as FUZ in Redhills North.
- The **urban section** of the RTC runs from northern end of Waitakere Road to Foster Road and is co-located with the proposed SH16 Main Road upgrade (NoR S2)[15] along this section. This urban section contains a range of land uses zoned under the AUP:OP as a mix of business zonings between the eastern extent of the Kumeū-Huapai township and Station Road.

[15] Another North West Strategic project – refer to Section 8 of this report

Table 9-1 below provides a summary of the North West existing and likely future environment as it relates to the RTC and the RAMC.

Table 9-1: RTC and RAMC Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[16]	Likely Future Environment[17]
Rural	Rural	Low	Rural
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban
Business	Business (Industrial)	Low	Urban
	Business (Local Centre)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential	Low	Urban
Open Space	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

The RTC stations - Kumeū Rapid Transit Station and Huapai Rapid Transit Station - are located in the urban section of the RTC corridors.

Kumeū Station is proposed to be located on land at 299 and 301 Main Road on the western side of a Kumeū River tributary. The land is zoned under the AUP:OP as Business - Town Centre Zone. An active modes overbridge is proposed across the NAL with active mode connections to:

- the Huapai Triangle crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and
- Wookey Lane crossing land zoned in the AUP:OP as Green Infrastructure Corridor and Residential - Mixed Housing Suburban Zone; and Business - Light Industry Zone.

Table 9-2: Kumeū Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment	Likely Future Environment
Business	Business (Industrial)	Low	Urban
	Business (Town Centre)	Low	Urban
Residential	Residential - Mixed Housing Suburban Zone	Low	Urban

16 Based on AUP:OP zoning/policy direction
17 Based on AUP:OP zoning/policy direction

Open Space (located to the north of the proposed station location)	Open Space – Informal Recreation Open Space – Sport and Active Recreation	Low	Open Space

Huapai Station is proposed to be located on land at 29 and 31 Meryl Avenue on the western side of the Ahukuramu. The land is zoned under the AUP:OP as Future Urban Zone. An active modes overbridge is proposed across the NAL and SH16 to FUZ land. Future connections will be determined as part of structure plan process.

Table 9-3: Huapai Rapid Transit Station Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment	Likely Future Environment
Residential (located to the east of the proposed station location)	Residential – Single House Zone	Low	Urban
Future Urban Zone / Undeveloped greenfield areas	Future Urban	High	Urban

9.2.2 Existing and Future Noise Environment

The alignment traverses a range of areas with different ambient noise environments. These range from existing high noise levels in the mid-60 to low-70 dB L_{Aeq} adjacent to the existing SH16, to lower noise environments around the 50s dB L_{Aeq} with intermittent noise from trains adjacent to the NAL. While the noise levels adjacent to the proposed alternative state highway would be currently low due to the rural character, this would change significantly in the future if the alternative motorway was in place.

The Kumeū Station is located in a business area bordered to the north and south by SH16 and the NAL respectively. Ambient noise levels are affected by both existing transport corridors and would be in the mid to high-60 dB L_{Aeq}. This is unlikely to change significantly in the future.

The Huapai Station is located in land currently used for rural activities adjacent to SH16. While the existing noise levels are still affected by SH16, they are likely to be in the low to mid-60 dB L_{Aeq} due to lack of other high noise activities in the area. This is unlikely to change with the future urbanisation as noise levels will still be controlled by traffic noise from the state highway.

Where the existing environment is materially different at the time of construction, any new occupied buildings will need to be assessed against the relevant noise and vibration limits and included in the relevant CNVMP.

9.2.3 Buildings inside designation

The following Table 9-4 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or unoccupied during construction. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds or garages may be removed.

We assume that the relevant requiring authority will acquire the parcels of land that these buildings are located on. In addition, auxiliary buildings are not generally occupied, so would not be relevant receivers in relation to this assessment,

Table 9-4: Buildings inside designation (not assessed)

Address	Address
42, 120, 122, 124, 130, 134, 138, 142, 146, 149, 152, 154, 156, 162, 176, 176A, 178, 182 Boord Cres, Kumeū	29, 30, 31 Meryl Ave, Kumeū
149 – 155 (uneven no. only), 186, 186, 188, 202, 204 Fred Taylor Dr, Whenuapai	191, 272, 278, 280, 609 SH16, Kumeū
51 Gilbransen Rd, Kumeū	2, 4, 6, 8 Tapu Rd, Huapai
87 Joseph Dunstan Dr, Taupaki	380, 388, 389, 400, 401 Taupaki Road, Taupaki
7 Main Road, Kumeū	9 Trotting Course Dr, Kumeū
335 – 347 (uneven no. only) Main Road, Huapai	903 Waitakere Road, Kumeū

9.3 Assessment of Construction Noise and Vibration Effects

9.3.1 Construction Noise Effects

9.3.1.1 Predicted noise level exceedances

The proposed designation allows for the construction area required, laydown yards and stormwater ponds, as well as connections with existing roads. Therefore, most buildings are at a sufficient distance to receive noise levels that are compliant with the relevant criteria.

Works in closer proximity are proposed where tie ins with existing roads occur (e.g. Fred Taylor Drive, Taupaki Road and Boord Crescent). Where the works occur adjacent to the existing SH16, the area is well developed and occupied by a mix of residential, commercial and industrial buildings.

The traffic lanes in the RTC would be constructed like any other road with asphalting equipment. In order to remain conservative and identify the widest potential construction noise envelope, we have based our predictions on the loudest activity (i.e. earthworks and bridge piling works). We anticipate that irrespective of transport mode similar earthworks extents will be required.

The figures in Appendix 1.3 show the construction noise envelope within which mitigation will need to be implemented.

Based on the construction activities summarised above, we have identified 181 properties where construction noise levels have the potential to exceed the relevant criteria. These are shown in Table 9-5. Some buildings identified are auxiliary buildings (e.g. garages, or sheds) that may not be occupied during construction but have been included for completeness. These are shown in grey in the table.

At the time of construction the buildings existing at the time will need to be reassessed to ensure all relevant receivers are included in the CNVMP. Since part of the Project traverses the FUZ, additional buildings may have been developed by the time of construction. However, the designation is generally wide enough to avoid significantly larger effects than those predicted, i.e. noise levels received at future dwellings would not be substantially higher than predicted for existing dwellings.

Table 9-5: Potential noise criteria exceedances (based on earthworks activities)[18]

Address	Address
23, 37, 51, 51A, 62, 82, 99, 102, 108, 111, 113, 186, 190, 202, 210, 214 Boord Crescent, Kumeu	27 Access Rd, Kumeū
196, 200 Fred Taylor Dr, Whenuapai, Auckland	15, 96, 228 Boord Crescent, Kumeū
47, 50 Gilbransen Rd, Kumeū	119, 198 Fred Taylor Dr, Whenuapai, Auckland
75, 91 Joseph Dunstan Dr, Taupaki	1, 15, 33 Grivelle Street, Kumeū
7 Main Rd, Kumeu	88 Joseph Dunstan Dr, Taupaki
342, 344, 348, 351, 352, 353, 355, 357, 359, 361, 365, 367 370, 372, 376, 382, 399, 401, 405, 407, 407A Main Rd, Huapai	40, 42, 46, 48, 50-54, 56-58, 64, 66, 68, 74, 78, 80, 82, 84, 86, 88, 90-92, 106, 108-110, 132, 134-152, 156G, 154, 190, 223, 248, 250, 280, 282, 296, 300, 302-318, 322, 326, 330, 332, 334, 338, 340, 346, 378, 380, 384 Main Rd, Kumeū
239 Matua Rd, Kumeū	3, 4, 8-12, 14-20 Matua Rd, Huapai
6 Oraha Rd, Huapai	5-21 Oraha Rd, Kumeū
222, 238, 238A, 246, 293, 573, 583, 587 State Highway 16, Kumeū	1 Putaki Dr, Kumeū
16, 20 Sunny Crescent, Huapai	1 – 5, 7 – 11, 8A, 14 – 19, 22 Shamrock Dr, Kumeū
3, 5, 10, 12, 14, 18, 16A, 20, 16A Tapu Rd, Huapai	218, 239, 272, 284, 393, 601, 647 State Highway 16, Kumeū
370, 375, 405, 412, 418, 419, 422, 434, 440, 443, 448, 454, 455, 466 Taupaki Rd, Taupaki	1, 1A, 2 Tapu Rd, Huapai
13, 15 Trotting Course Dr, Kumeū	374 422, Taupaki Rd, Kumeū
901, 906 Waitakere Rd, Kumeū	903, 927, 933, 993 Waitakere Rd, Kumeū
22 Wookey Lane, Kumeū	1 Weza Lane, Kumeū
	20, 21-23, 25, 35, 43 Wookey Lane, Kumeū

9.3.1.2 Daytime works

The loudest activities across the entire project will be earthworks. These activities move along the alignment. Because of that, mitigation in the form of barriers is not efficient unless there are special circumstances.

Piling for the construction of bridges is also a notable noisy activity. However, this will occur for only a brief period over the overall construction duration, and can be mitigated with equipment choice, barriers and placement of equipment.

[18] Black addresses reflect dwellings or other noise sensitive receivers, while grey addresses reflect auxiliary buildings such as garages or sheds that may not be occupied during construction

Mitigation as set out in Section 4.5 will be implemented across the works. There are no specific construction activities close to buildings that would require mitigation in addition to common best practice.

Predicted noise levels may be as high as 75 to 80 dB L_{Aeq} at the closest dwellings, during times of earthworks in close proximity. However, these works would occur only for a few days and then move along the alignment. Only a small number of buildings may be affected by such levels, where works are particularly close.

Station construction will occur for a more sustained period in the same location. This means that neighbouring buildings will receive elevated construction noise levels for a longer time than those adjacent to the alignment only. For Kumeū Station, closest buildings are all commercial in nature (e.g. shops and Atlas Concrete at present) but also include the Huapai library. Construction works will be beyond SH16, which means that the receivers are currently experiencing elevated noise levels. Barriers can be employed to mitigate noise levels, as well as other commonly used BPO mitigation and management.

Huapai Station is in a currently semi-rural area, with some dwellings in close proximity. Exceedances of the daytime noise criterion are predicted at 239 Matua Road, with levels up to 75 dB L_{Aeq} predicted due to earthworks. Other dwellings in the vicinity are predicted to receive noise levels that comply with 70 dB L_{Aeq}. Daytime levels of up to 75 dB L_{Aeq} are unlikely to cause significant adverse effects given that the duration of such level would be limited to the time when earthworks occur close to the designation boundary only. We consider that effects would therefore be reasonable provided relevant measures as set out in Section 4.5 are implemented. For most of the construction works and construction duration, we predict that noise levels can comply with the 70 L_{Aeq} noise criterion at the surrounding receivers.

Should the area surrounding the Station have been urbanised prior to its construction, all buildings existing at the time of construction need to be assessed for construction noise effect. This is be done through the CNVMP and Schedules (refer Sections 4.5.3 and 4.5.4).

9.3.1.3 Night-time works

At this stage, we do not anticipate that night works would be required. All works appear to be offline from any major road or rail alignments, and are therefore unlikely to affect traffic on those corridors.

Should night works be required, these works would be of limited duration as they would relate to specific activities. In any event, such works will need to be managed through the CNVMP and require the preparation of a Schedule (refer Section 4.5.4). With appropriate management the construction can be undertaken within reasonable noise levels that would be expected from construction of such infrastructure.

9.3.2 Construction Vibration Effects

Vibratory rollers are the most common high vibration generating equipment across the Project. In addition, piling for bridges also causes high vibration levels.

As discussed in Section 4.4.3, we have provided for a 100% safety margin when determining the envelope of vibration levels. For Category B for all occupied buildings, this is at a distance of 15m. For Category A, for occupied PPFs the relevant distance is 80m and for occupied other buildings it is 40m.

Appendix 2 includes figures showing the vibration envelopes for these three criteria.

Table 9-6 shows the addresses of identified buildings that, if existing at the time of construction and occupied, may receive vibration levels exceeding Category B. Six of these buildings are identified as PPFs, while the remainder are auxiliary buildings and non-PPFs (shown in grey in the table below).

The construction of the rapid transit network is relatively narrow in a wide designation, with very few (three) buildings within 15m of the works.

Table 9-6: Potential Category B vibration criteria exceedances (based on vibratory roller activities)

Address	Address
51, 111 Boord Crescent, Kumeū	86, 353, 359, 361 Main Rd, Kumeū
419, 455 Taupaki Road, Kumeū	30 Meryl Ave, Kumeū
13 Trotting Course Drive, Kumeū	2, 4, 8, 8A, 10, 14-16, 18 Shamrock Dr, Kumeū
906 Waitakere Road, Kumeū	903, 993 Waitakere Rd, Kumeū
	20 Wookey Lane, Kumeū

If on-site measurements confirm the predicted vibration levels, then alternative construction methods should be considered, e.g. non-vibratory compaction or bored piling.

In relation to the corridor construction, an additional 51 PPFs have been identified that may receive vibration levels exceeding the Category A vibration criteria. Category A criteria should be used as a trigger to engage with potentially affected people.

The construction of the station is predicted to generate vibration levels that comply with the Category A and B vibration criteria at all times.

Vibration generally occurs intermittently, when equipment passes the building or where there is particular ground resistance during piling and can be tolerable if prior notification is given. However, high vibration generation is not appropriate for night-time and should be avoided as far as practicable.

There are two heritage buildings within the existing heritage overlay along SH16 Main Road that are proposed to be repositioned along the corridor following works commencing on the RTC (NoR S3) to enable the construction of the Project. The buildings are transported to their new site, which will involve high levels of vibration through the loading, transport and unloading. Therefore, we consider that with appropriate siting and careful construction management, construction vibration is unlikely to cause damage to these buildings.

9.4 Conclusions

We have predicted construction noise and vibration levels for the Project, based on the likely construction sequence and methodology set out in Section 4.2.

The identified noisiest activities covering the largest extent of the works will be earth works. We have therefore based our assessment on this activity.

Overall, we predict that most activities can comply with the relevant noise and vibration criteria. Noise effects are more extensive than vibration effects, due to the wider earthworks area. Only a very small number of PPFs are predicted to potentially receive vibration levels above the Category B criteria without mitigation.

Where non-compliance is predicted, this would occur for limited and defined periods only, when equipment operates close to occupied buildings.

Common best practice mitigation and management should be implemented across the construction site, and this should be documented in the CNVMP. Schedules will need to be prepared for those activities that are predicted to exceed the criteria. This will involve communication with the affected persons.

10 NoR S4: Access Road Upgrade

10.1 Project Corridor Features

It is proposed to submit a Notice of Requirement (NoR S4) to designate the land required to implement the upgrade of Access Road to a four-lane corridor with separated walking and cycling facilities.

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern Rural Urban Boundary (**RUB**) of Kumeū- Huapai. The proposed upgrade extends from the intersection of Access Road with SH16 (and entry to the Kumeū-Huapai township) in the east and continues into Tawa Road to its intersection with Puke Road in the west. Access Road plays a key role in connecting the existing and likely future business zones to both the RTC and ASH. It is aligned along the south-eastern boundary of the southern FUZ, providing for an enhanced collector network to connect to it.

It is proposed to widen the existing Access Road/Tawa Road corridor from its current width of 20m to accommodate a 30m wide four-lane cross-section. The cross-section of the corridor transitions from the rural edge cross-section to an urban cross-section at Wookey Lane intersection. Along the western section of Access Road, which is a low-speed rural section, the corridor has a rural southern edge (swales, typically 9m wide top width) with walking and cycling facilities along its northern urban edge. Through the business and industrial area, a 30m urban corridor is provided, including walking and cycling infrastructure along both sides of this eastern section.

An overview of the proposed design is provided in Figure 10-1 below.

Figure 10-1: Overview of Access Road Upgrade

Key features of the proposed upgrade include the following:

- Upgrading the existing Access Road corridor to a 30m wide four-lane arterial road with walking and cycling provisions.
- Swales typically with a 9m wide top width along the western section of Access Road on the southern edge.
- Tie-ins with existing roads, stormwater dry ponds, wetlands and culverts.
- Batter slopes to enable widening of the corridor, and associated cut and fill activities.
- Vegetation removal along the existing road corridor
- Other construction related activities required outside the permanent corridor including the re-grade of driveways, construction traffic manoeuvring and construction laydown areas.

Construction is anticipated to take approximately 3 years.

10.2 Existing and Likely Future Environment

10.2.1 Planning context

Access Road/Tawa Road is an existing arterial corridor that runs along the eastern RUB of Kumeū-Huapai.

- The northern side of Access Road is zoned under the AUP:OP as FUZ, with Business – Light Industry Zoning at the north-eastern section of Access Road.
- The southern side of Access Road is predominantly zoned under the AUP:OP as Rural – Countryside Living, with exception to the Kumeū Showgrounds which are zoned as Rural – Mixed Rural Zone are identified as a precinct (I517 Kumeū Showgrounds Precinct) in the AUP:OP.

Table 10-1 below provides a summary of the existing and likely future environment as it relates to Access Road.

Table 10-1: Access Road Upgrade Existing and Likely Future Environment

Environment today	Zoning	Likelihood of Change for the environment[19]	Likely Future Environment[20]
Business	Business (Light Industrial) Zone	Low	Urban
Rural	Rural – Countryside Living Zone Rural – Mixed Rural Zone	Low	Rural
Undeveloped greenfield areas (Future Urban Zone)	Future Urban	**High**	Urban

[19] Based on AUP:OP zoning/policy direction
[20] Based on AUP:OP zoning/policy direction

10.2.2 Existing and Future Noise Environment

The existing environment is generally removed from major transport corridors apart from the immediate connection with the existing SH16. While the eastern section of the Project is somewhat affected by traffic and commercial noise, most of the Project is in a currently rural area with lower noise levels.

When the FUZ north of Access Road is developed, the environment is expected to change significantly. We anticipate increased noise levels from more intensive occupation. In addition, should the ASH (NoR S1)[21] have been implemented already, the ambient noise level would be elevated in the vicinity of that road

Where the existing environment is materially different at the time of construction, any new occupied buildings will need to be assessed against the relevant noise and vibration limits and included in the relevant CNVMP.

10.2.3 Buildings inside designation

The following Table 10-2 shows the buildings that are inside the proposed designation. We have not assessed them further as the assumption is that they will be removed or unoccupied during construction. We only note the addresses where the main building is inside designation, and not those where auxiliary buildings such as sheds or garages may be removed.

We assume that the relevant requiring authority will acquire the parcels of land that these buildings are located on. In addition, auxiliary buildings are not generally occupied, so would not be relevant receivers in relation to this assessment,

Table 10-2: Buildings inside designation (not assessed)

Address	Address
21, 123, 185, 187, 236 Access Road, Kumeū	166 Station Road, Kumeū

10.3 Assessment of Construction Noise and Vibration Effects

10.3.1 Construction Noise Effects

10.3.1.1 Predicted noise level exceedances

The designation area generally extends both to the south and north of Access Road, into the Rural zone and FUZ. Since part of the alignment borders established rural and residential areas, a number of dwellings are close to the proposed works and will be affected by them.

The figures in Appendix 1.4 show the construction noise envelope within which mitigation will need to be implemented.

Based on the construction locations described above, we have identified 76 properties where construction noise levels have the potential to exceed the relevant criteria. These are shown in Table 10-3. Some buildings identified are auxiliary buildings (e.g. garages, or sheds) that may not be

[21] Another North West Strategic Project, refer Section 7 of this report

occupied during construction but have been included for completeness. These are shown in grey in the table.

At the time of construction the buildings existing at the time will need to be reassessed to ensure all relevant receivers are included in the CNVMP. Since part of the Project traverses the FUZ, additional buildings may have been developed by the time of construction. However, the designation is generally wide enough to avoid significantly larger effects than those predicted, i.e. noise levels received at future dwellings would not be substantially higher than predicted for existing dwellings.

Table 10-3: Potential noise criteria exceedances (based on earthworks activities)[22]

Address	Address
24, 26, 27, 40, 44, 60, 64, 95, 116, 121, 127A, 127B, 161, 162, 165, 171, 174, 176, 181, 184, 199, 211, 218, 233, 236 Access Road, Kumeū	18, 26, 27, 35, 38, 50, 68, 72, 97-99, 121, 184, 221 Access Road, Kumeū
8 Grivelle Street, Kumeū	2 – 6, 29, 33 Grivelle Street, Kumeū (even no. only)
152 Station Road, Kumeū	4 – 6, 5 – 12 Loft Place, Kumeū
17, 25, 49, 56, 59, 63, 66, 73, 76, 79, 83, 86 Tawa Road, Kumeū	1 – 5, 7, 9 Shamrock Drive, Kumeū
	166 Station Road, Kumeū
	43, 48 Tawa Rd, Kumeū
	1 – 9 Wookey Lane, Kumeū

10.3.1.2 Daytime works

The loudest activity across the entire Project are earthworks, which move along the alignment. Therefore, mitigation in the form of barriers is not efficient unless there are special circumstances.

Mitigation as set out in Section 4.5 will be implemented across the works. There are no specific construction activities close to buildings that would require mitigation in addition to common best practice.

Predicted noise levels may be as high as 80 dB L_{Aeq} at the closest dwellings, during times of earthworks in close proximity. However, these works would likely occur only for a few days and then move along the alignment. The exceedances will be limited and passing. Good communication and timing of activities can assist in reducing effects. We consider that effects would therefore be reasonable provided relevant measures as set out in Section 4.5 are implemented.

For most of the construction works and construction duration, we predict that noise levels can comply with the 70 L_{Aeq} noise criterion at the surrounding receivers.

[22] Black addresses reflect dwellings or other noise sensitive receivers, while grey addresses reflect auxiliary buildings such as garages or sheds that may not be occupied during construction

10.3.1.3 Night-time works

Night works may be required where the road would need to be closed for the construction, e.g. during final surfacing and at the tie ins with SH16.

These works are limited in duration, often requiring only two or three nights' work. In any event, such works will need to be managed through the CNVMP and require the preparation of a Schedule (refer Section 4.5.4).

We consider that with appropriate management the construction can be undertaken within reasonable noise levels that would be expected from construction of such infrastructure.

10.3.2 Construction Vibration Effects

Vibratory rollers are the most common high vibration generating equipment across the Project.

As discussed in Section 4.4.3, we have provided for a 100% safety margin when determining the envelope of vibration levels. For Category B for all occupied buildings, this is at a distance of 15m. For Category A, for occupied PPFs the relevant distance is 80m and for occupied other buildings it is 40m.

Appendix 2 includes figures showing the vibration envelopes for these three criteria.

Table 10-4 shows the addresses of identified buildings that, if existing at the time of construction and occupied, may receive vibration levels exceeding Category B. Ten of these buildings are identified as PPFs, while the remainder are auxiliary buildings and non-PPFs (shown in grey in the table below).

Table 10-4: Potential Category B vibration criteria exceedances (based on vibratory roller activities)[23]

Address	Address
24, 64, 116, 184, 218 Access Road, Kumeū	18, 35, 72, 184, 236 Access Road, Kumeū
49, 56, 59, 76 Tawa Road, Kumeū	4, 6, 29, 33 Grivelle Street, Kumeū
	1 Shamrock Dr, Kumeū
	25, 63 Tawa Road, Kumeū

If on-site measurements confirm the predicted vibration levels, then alternative compaction methods should be considered, e.g. non-vibratory compaction.

An additional 33 PPFs have been identified that may receive vibration levels exceeding the Category A vibration criteria. Category A criteria should be used as a trigger to engage with potentially affected people.

Vibration generally occurs intermittently, when equipment passes the building, and can be tolerable if prior notification is given. However, high vibration generation is not appropriate for night-time and should be avoided as far as practicable.

[23] Black addresses reflect dwellings or other sensitive receivers, while grey addresses reflect auxiliary buildings such as garages or sheds that may not be occupied during construction

10.4 Conclusions

We have predicted construction noise and vibration levels for the Project, based on the likely construction sequence and methodology set out in Section 4.2. The works controlling the noise and vibration predictions are earthworks and vibratory rolling respectively. Both activities will be used across the entire project.

Overall, we predict that most activities can comply with the relevant noise and vibration criteria. Where non-compliance is predicted, this would occur for limited and defined periods only, when equipment operates close to occupied buildings while moving along the alignment.

Common best practice mitigation and management should be implemented across the construction site, and this should be documented in the CNVMP. Schedules will need to be prepared for those activities that are predicted to exceed the criteria. This will involve communication with the affected persons.

11 Conclusion

Construction noise and vibration has been assessed against relevant standards and guidelines, and effects have been assessed from the residual noise and vibration levels after mitigation and management measures as recommended have been implemented. The assessment takes into consideration the existing environment and makes allowances for potential changes to the environment that may occur prior to implementation of any of the Projects.

Construction noise and vibration will need to be managed and mitigated to achieve compliance, as far as practicable, with recommended standards and guidelines. Construction noise and vibration within all of the NoRs is predicted to largely comply with the relevant criteria, with only limited and specific activities predicted to generate high noise and/or vibration levels where buildings are in close proximity. These levels would only occur for limited and finite times and not extend across the full duration of construction.

The recommended management and mitigation measures are set out in Section 4.5. It is recommended that the management of construction noise and vibration effects is based on the methodology and framework of the recommended CNVMP and Schedules to ensure that the BPO is implemented.

The CNVMP for each NoR will be prepared prior to construction when more detailed information is available. At that time, effects and mitigation will need to be updated to incorporate all receivers that are present at the time of construction, i.e. if additional buildings are occupied adjacent to the construction site, these will need to be included in the CNVMP.

The effects from the construction noise and vibration levels are set out in Section 6. Overall, while for most of the works, compliance with 70 dB L_{Aeq} and Category A vibration levels can be achieved, at times noise levels may be up to 80-85 dB L_{Aeq} which would translate to approximately 55-60 dB L_{Aeq} inside if no further mitigation can be implemented. A number of buildings are predicted to receive vibration levels above Category A for certain activities (e.g. vibratory rolling). In both instances, the exceedances will be limited and passing, and management such as good communication and timing of activities can assist in reducing effects to a reasonable level.

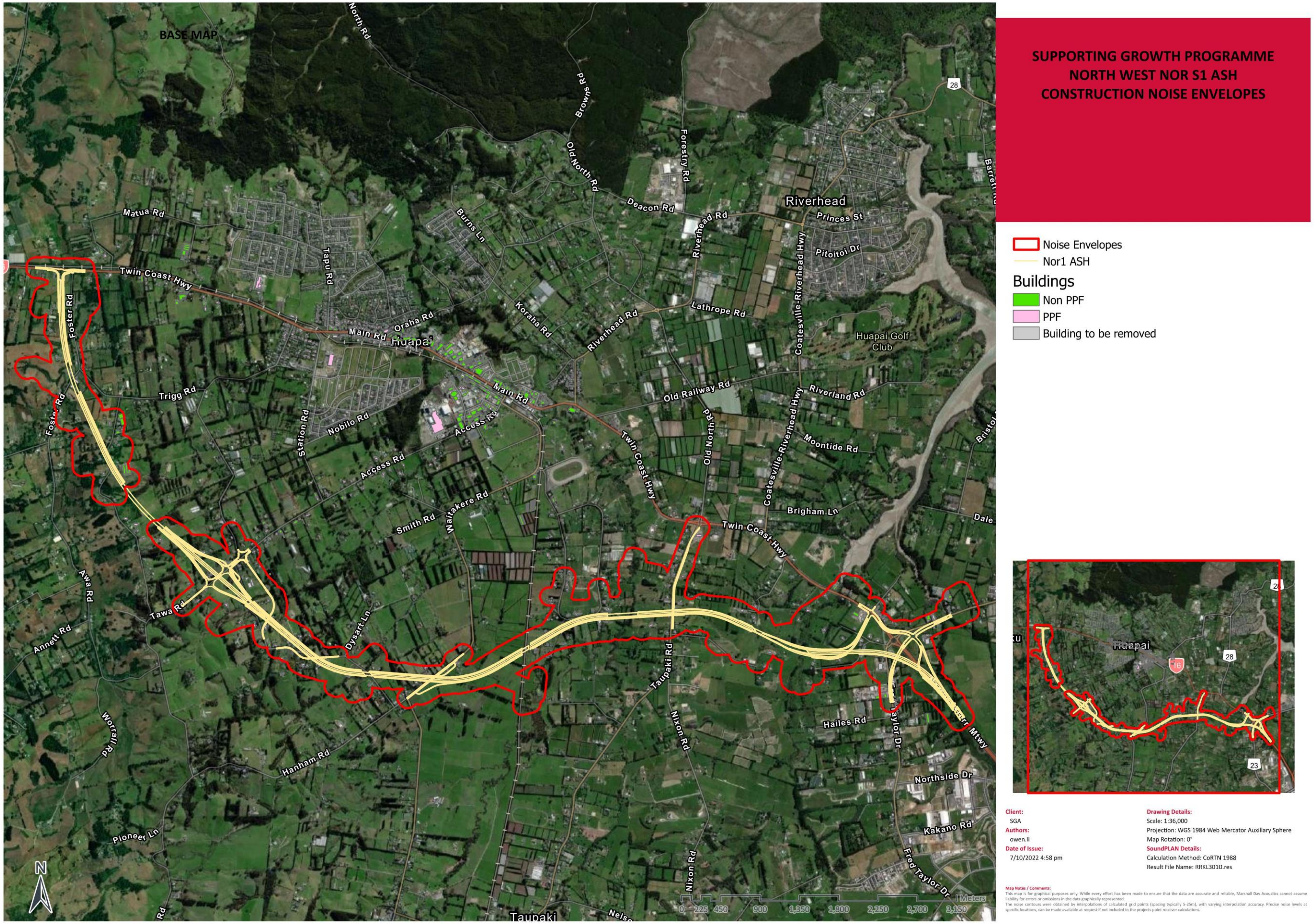
Overall, construction noise and vibration can be managed and mitigated to a reasonable level, provided recommended mitigation is implemented.

ATTACHMENT 43

NORTH-WEST STRATEGIC
ASSESSMENT OF CONSTRUCTION NOISE AND VIBRATION EFFECTS
PART 2 OF 3

1 Setback Distances – Construction Noise

1.1 NoR S1


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Riverhead
Huapai
Huapai Golf Club
Taupaki
Twin Coast Hwy
Matua Rd
Foster Rd
Trigg Rd
Main Rd
Oraha Rd
Tapu Rd
Station Rd
Nobilo Rd
Access Rd
Koraha Rd
Riverhead Rd
Lathrope Rd
Coatesville-Riverhead Hwy
Old Railway Rd
Riverland Rd
Moontide Rd
Brigham Ln
Old North Rd
Deacon Rd
Forestry Rd
Browns Rd
Burns Ln
Princes St
Pitoitoi Dr
Waitakere Rd
Smith Rd
Dysart Ln
Tawa Rd
Awa Rd
Annett Rd
Worrall Rd
Hanham Rd
Pioneer Ln
Taupaki Rd
Nixon Rd
Hailes Rd
Northside Dr
Kakano Rd
Fred Taylor Dr
Meters
0 225 450 900 1,350 1,800 2,250 2,700 3,150
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:36,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


BASE MAP
Twin Coast Hwy
Matua Rd
Foster Rd
Trigg Rd
Puke Rd
16
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Meters
0 50 100 200 300 400 500 600 700
N
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
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BASE MAP
Puke Rd
Motu Rd
Awa Rd
Tawa Rd
0 50 100 200 300 400 500 600 700 Meters
N
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
28
23
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
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BASE MAP
Tawa Rd
Motu Rd
Puke Rd
Pomona Rd
Dysart Ln
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Meters
0 50 100 200 300 400 500 600 700
N
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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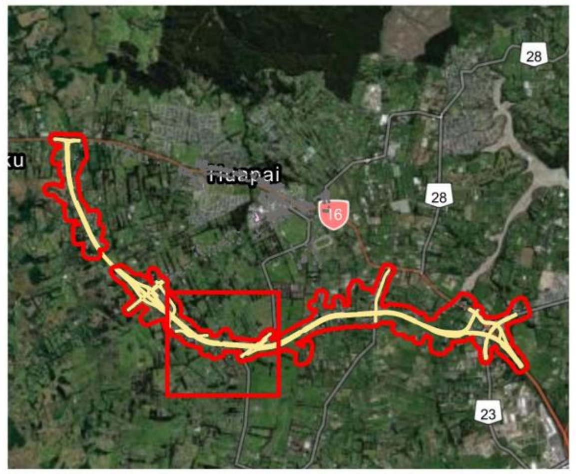
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES

Noise Envelopes
Nor1 ASH

Buildings
Non PPF
PPF
Building to be removed



Client: SGA
Authors: owen.li
Date of Issue: 7/10/2022 4:58 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°

SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
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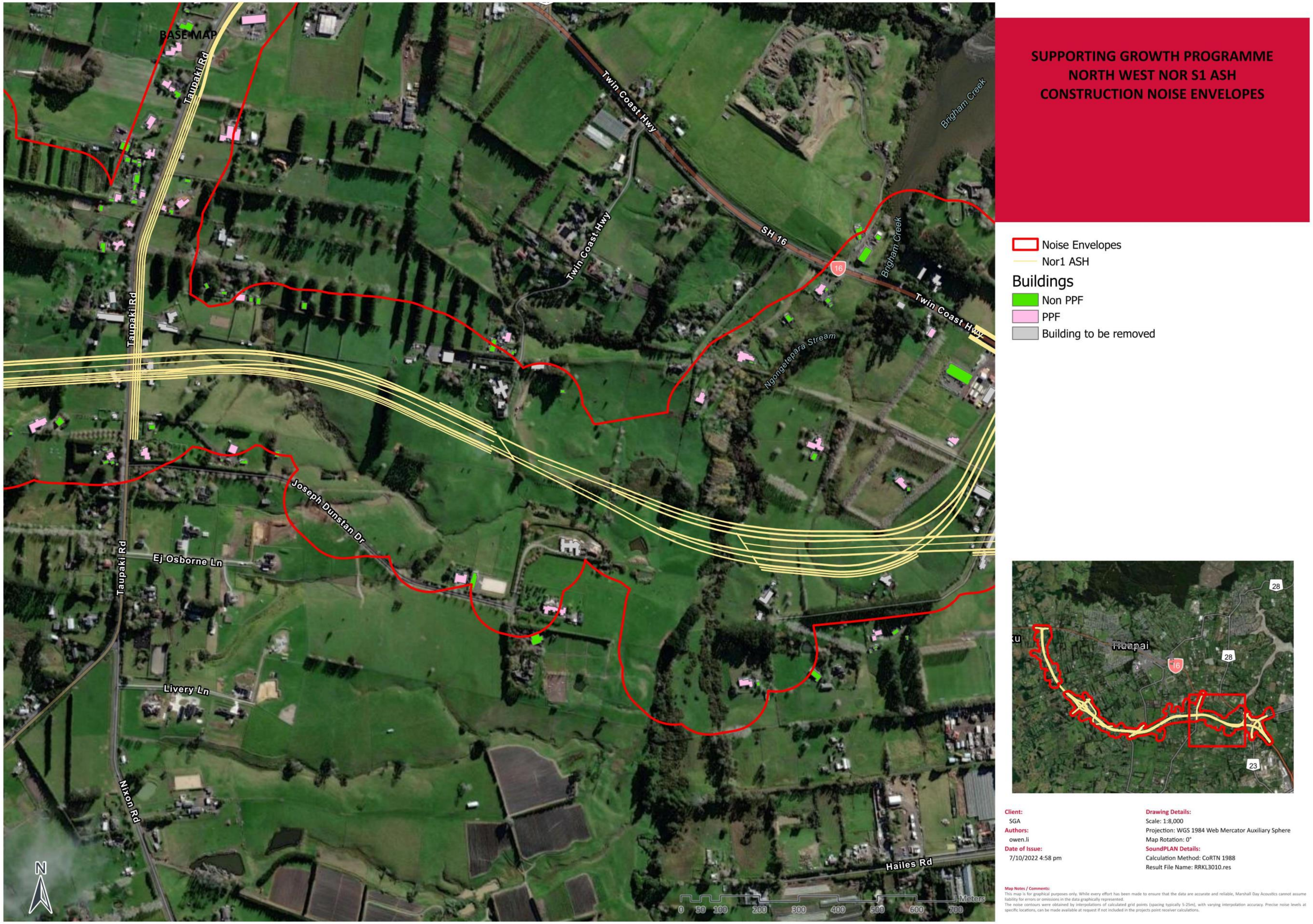
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Waitakere Rd
Boord Cres
Boord Cres
Waitakere Rd
Taupaki Rd
N
0 50 100 200 300 400 500 600 700 Meters
28
28
23
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Twin Coast Hwy
Twin Coast Hwy
Boord Cres
Boord Cres
Boord Cres
Boord Cres
Taupaki Rd
Taupaki Rd
Taupaki Rd
Joseph Dunstan Dr
Ej Osborne Ln
Livery Ln
N
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Taupaki Rd
Twin Coast Hwy
SH 16
Brigham Creek
Ngongetepara Stream
Joseph Dunstan Dr
Ej Osborne Ln
Livery Ln
Nixon Rd
Hailes Rd
N
0 50 100 200 300 400 500 600 700
Meters
28
16
23
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION NOISE ENVELOPES
BASE MAP
Noise Envelopes
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Twin Coast Hwy
SH 16
Brigham Creek
Kennedys Rd
Noongetepara Stream
Brigham Creek Rd
Northwestern Mtwy
Fred Taylor Dr
Hailes Rd
16
23
28
N
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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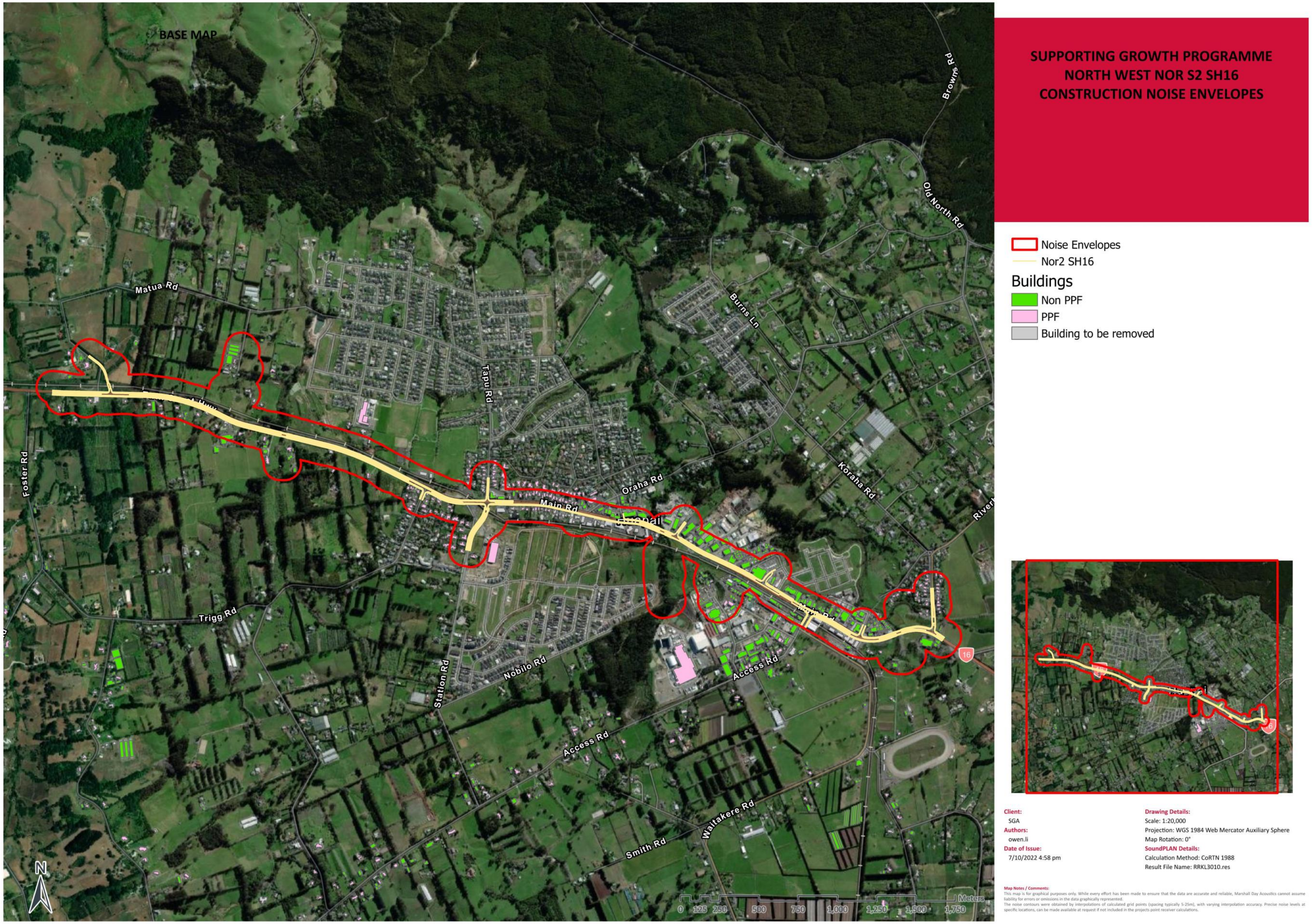
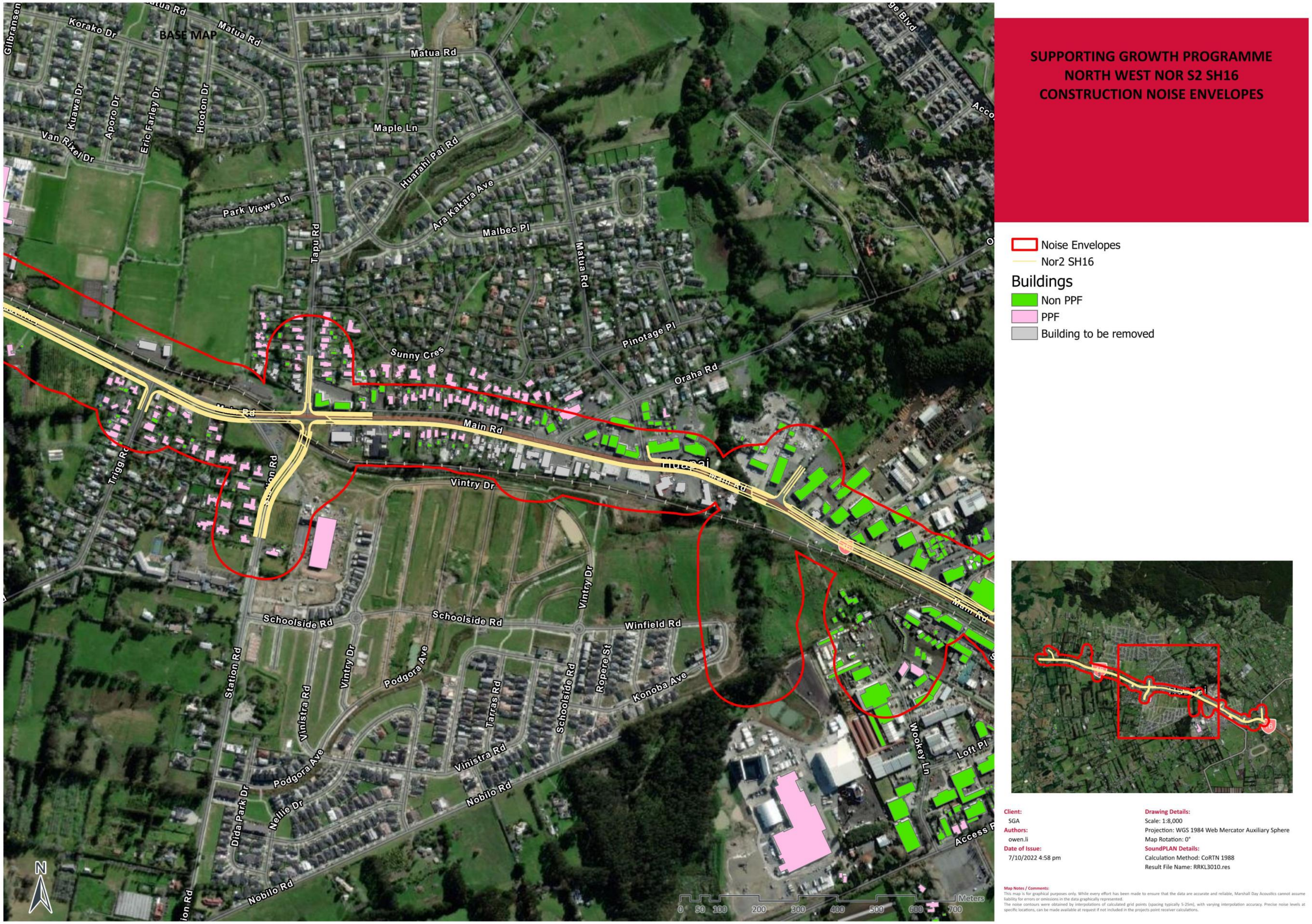
1.2 NoR S2

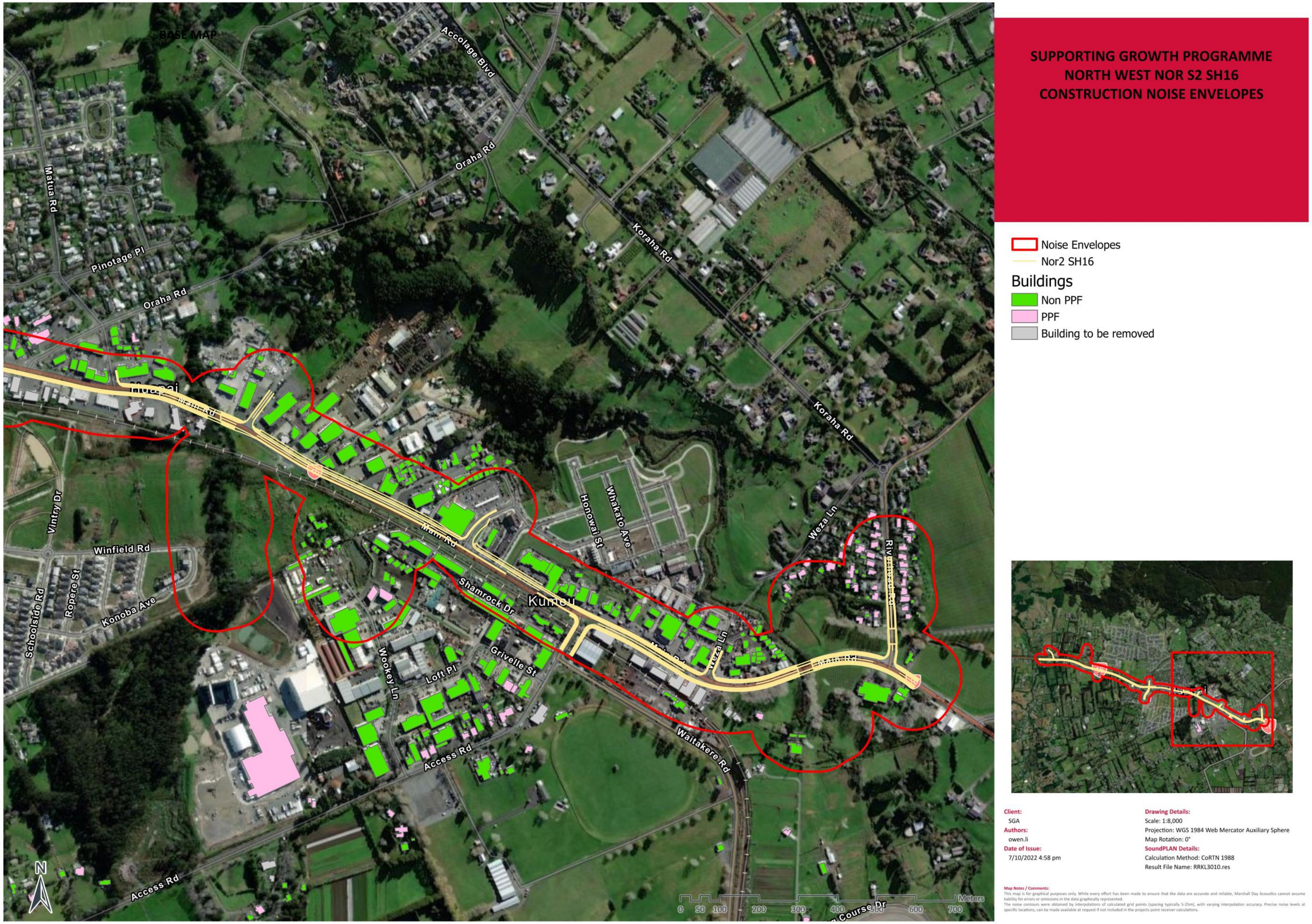


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Matua Rd
Tapu Rd
Foster Rd
Trigg Rd
Station Rd
Nobilo Rd
Access Rd
Smith Rd
Waitakere Rd
Oraha Rd
Main Rd
Burns Ln
Koraha Rd
Old North Rd
Browns Rd
16
N
0 125 250 500 750 1,000 1,250 1,500 1,750 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:20,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION NOISE ENVELOPES
BASE MAP
Noise Envelopes
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
Matua Rd
Matua Rd
Matua Rd
Matua Rd
Fruitlands Rd
Robert Might Rd
Meryl Ave
McIndoe Rd
Lewis Younie Rd
Cutfield Ln
Gilbransen Rd
Korako Dr
Madden Ave
Lockyer Rd
Gilbransen Rd
Van Rixel Dr
Kuawa Dr
Aporo Dr
Coast Hwy
Foster Rd
Trigg Rd
Trigg Rd
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.



SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Korako Dr
Matua Rd
Maple Ln
Huarahi Pai Rd
Park Views Ln
Ara Kakara Ave
Malbec Pl
Tapu Rd
Sunny Cres
Pinotage Pl
Oraha Rd
Main Rd
Vintry Dr
Schoolside Rd
Winfield Rd
Station Rd
Podgora Ave
Vinistra Rd
Konoba Ave
Nobilo Rd
Wookey Ln
Loft Pl
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
Accolage Blvd
Oraha Rd
Matua Rd
Pinotage Pl
Koraha Rd
Huapai
Main Rd
Honowai St
Whakato Ave
Weza Ln
Riverhead Rd
Vintry Dr
Winfield Rd
Schoolside Rd
Ropere St
Konoba Ave
Shamrock Dr
Kumeu
Wookey Ln
Loft Pl
Grivelle St
Access Rd
Waitakere Rd
N
0 50 100 200 300 400 600 700
Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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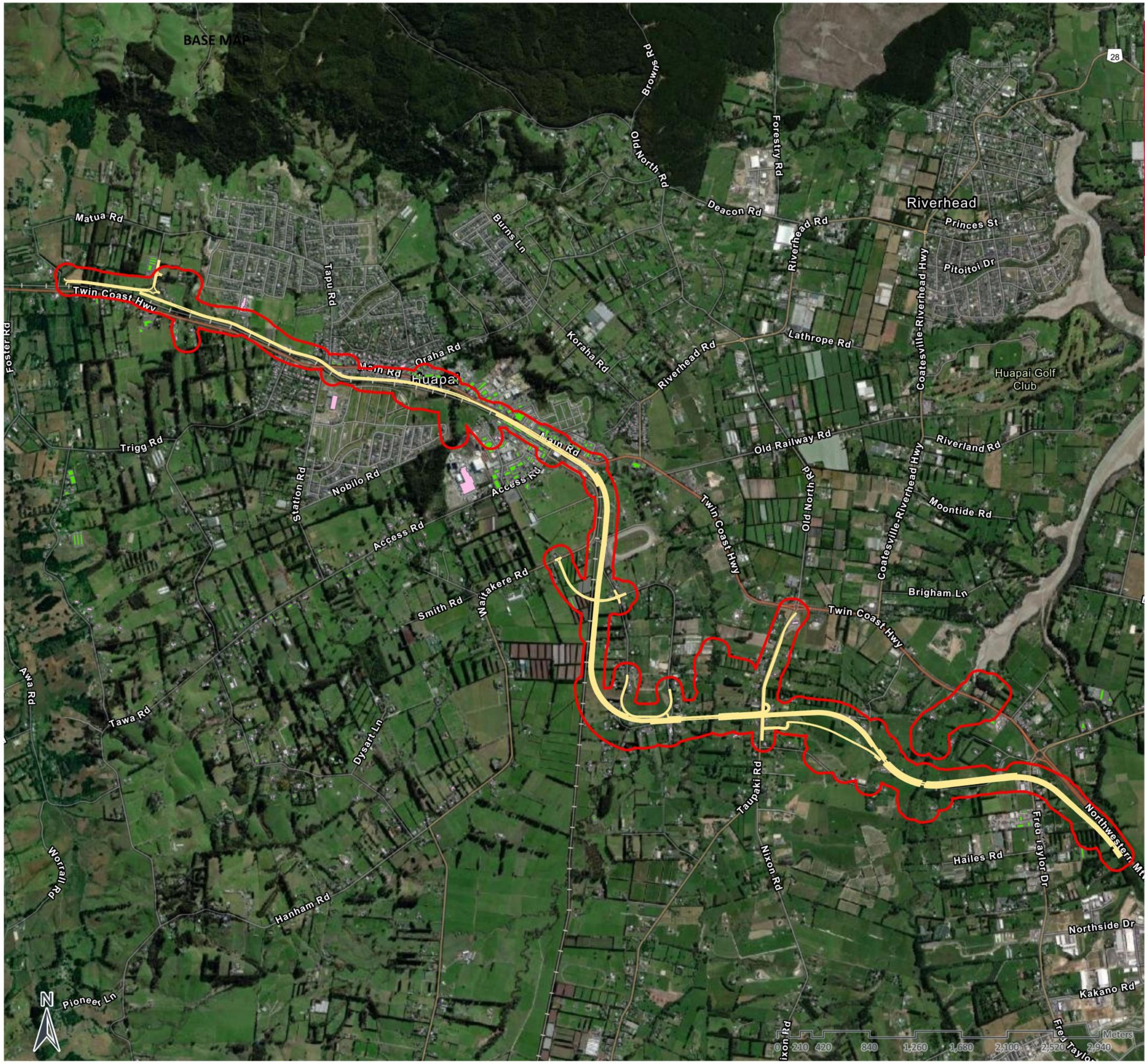
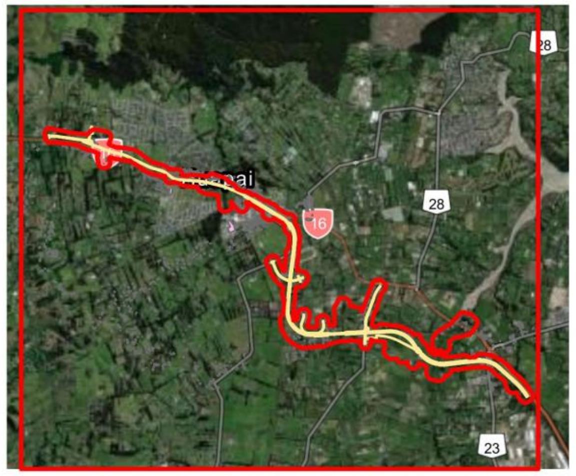
1.3 NoR S3



SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION NOISE ENVELOPES

Noise Envelopes
Nor3 RTC

Buildings
Non PPF
PPF
Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm

Drawing Details:
Scale: 1:33,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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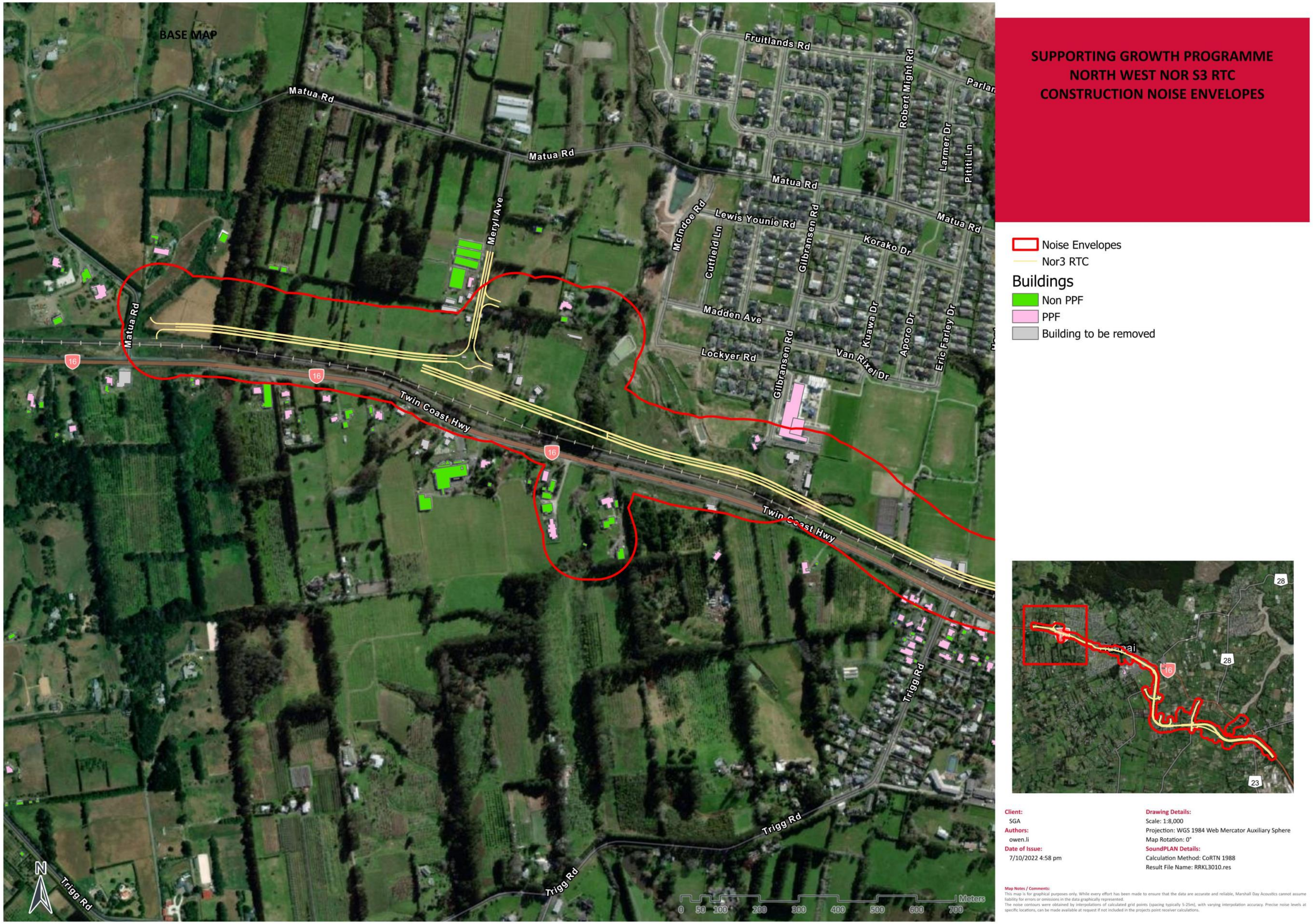
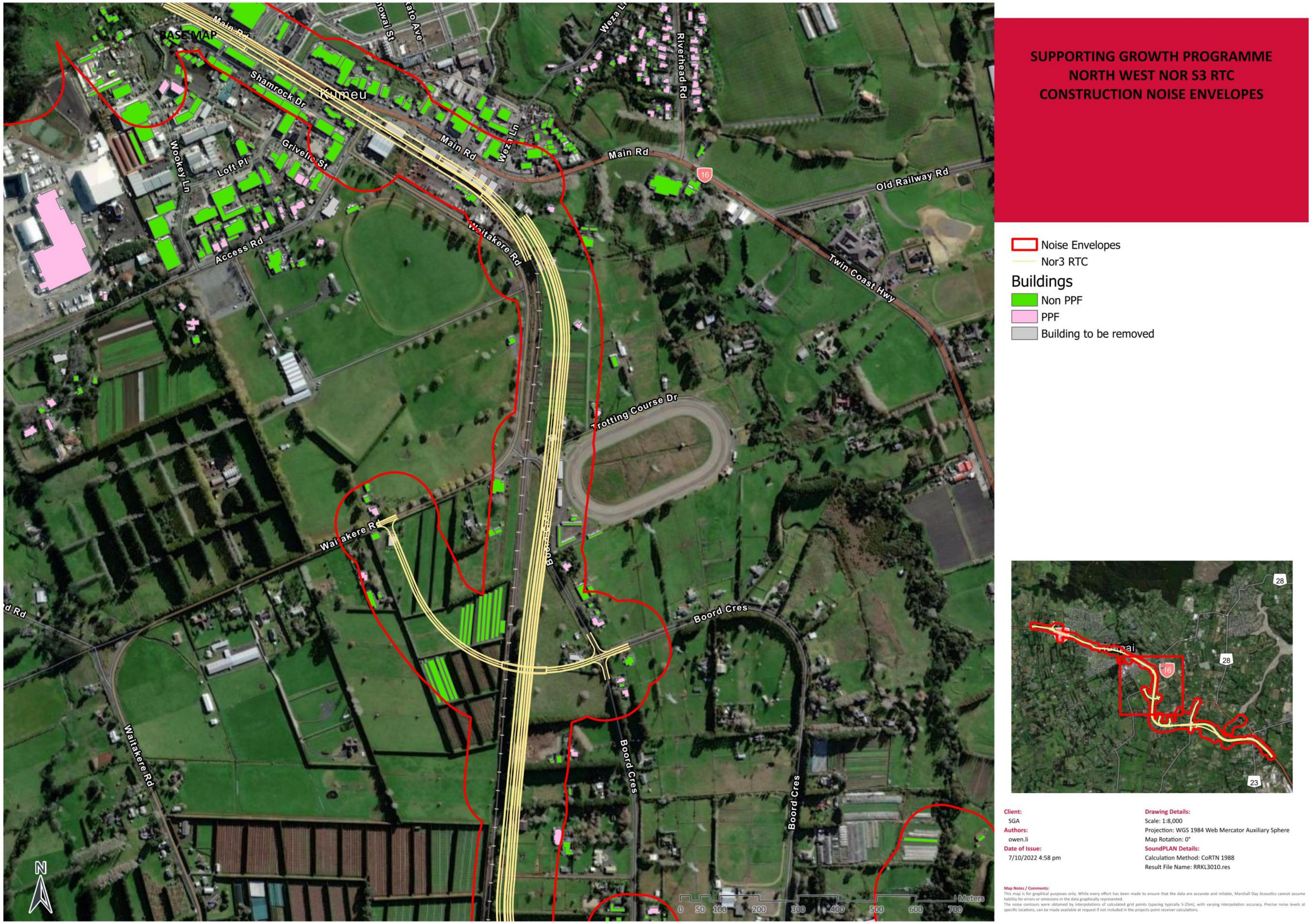


Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Huapai
Kumeu
Main Rd
Vintry Dr
Station Rd
Schoolside Rd
Winfield Rd
Konoba Ave
Podgora Ave
Vinistra Rd
Nobilo Rd
Access Rd
Shamrock Dr
Grivelle St
Loft Pl
Wookey Ln
Oraha Rd
Pinotage Pl
Sunny Cres
Malbec Pl
Ara Kakara Ave
Huarahi Pai Rd
Maple Ln
Park Views Ln
Tapu Rd
Matua Rd
Accolage Blvd
Honowai St
Whakato Ave
Tarras Rd
Ropere St
Nellie Dr
Dida Park Dr
Hooton Dr
N
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Kumeu
Main Rd
Shamrock Dr
Grivelle St
Loft Pl
Wookey Ln
Access Rd
Weza Ln
Riverhead Rd
Old Railway Rd
Twin Coast Hwy
Waitakere Rd
Trotting Course Dr
Boord Cres
16
28
23
Meters
0 50 100 200 300 400 500 600 700
N
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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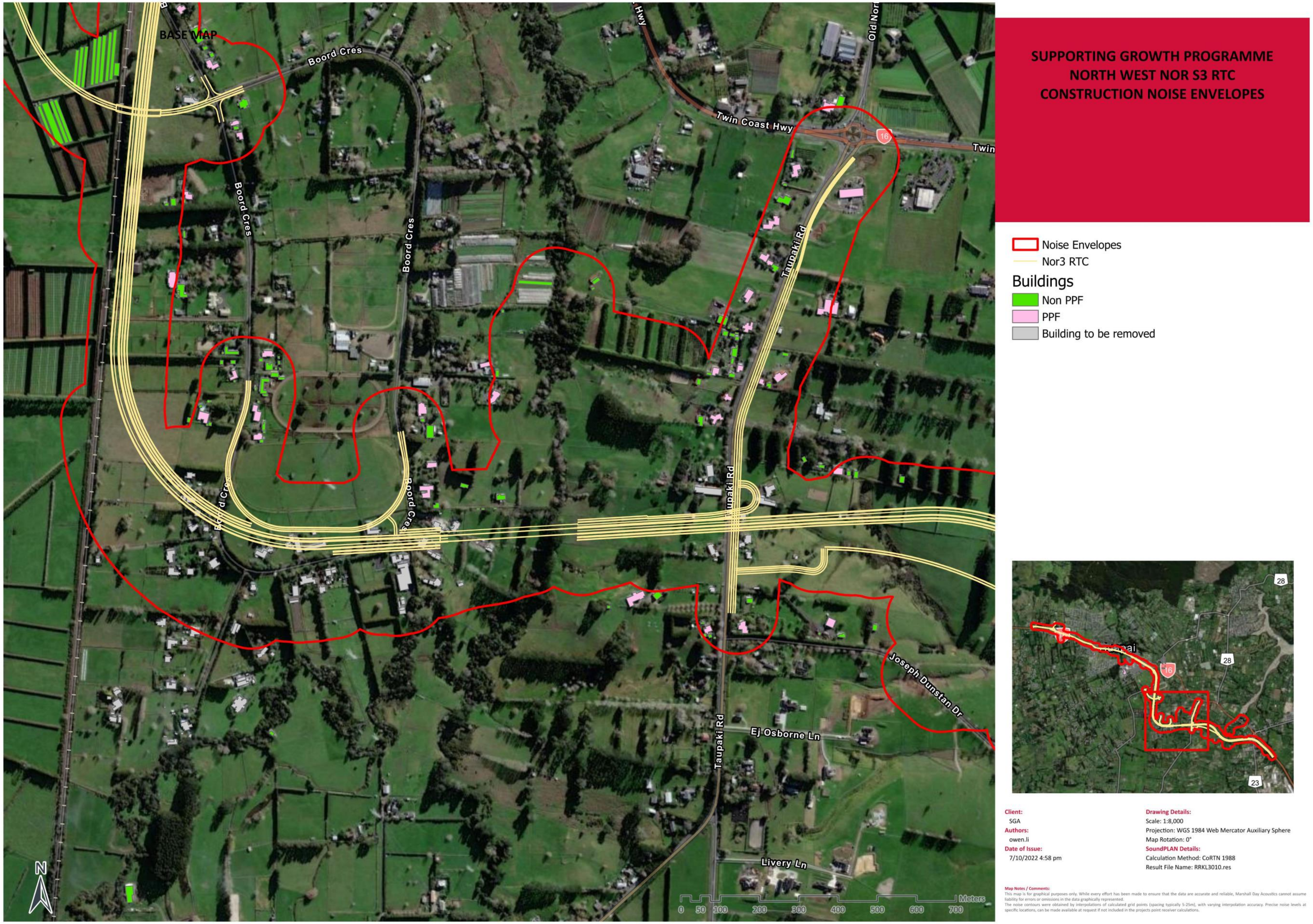
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Boord Cres
Twin Coast Hwy
Twin
Old Nor
16
Taupaki Rd
Joseph Dunstan Dr
Ej Osborne Ln
Livery Ln
N
0 50 100 200 300 400 500 600 700 Meters
28
23
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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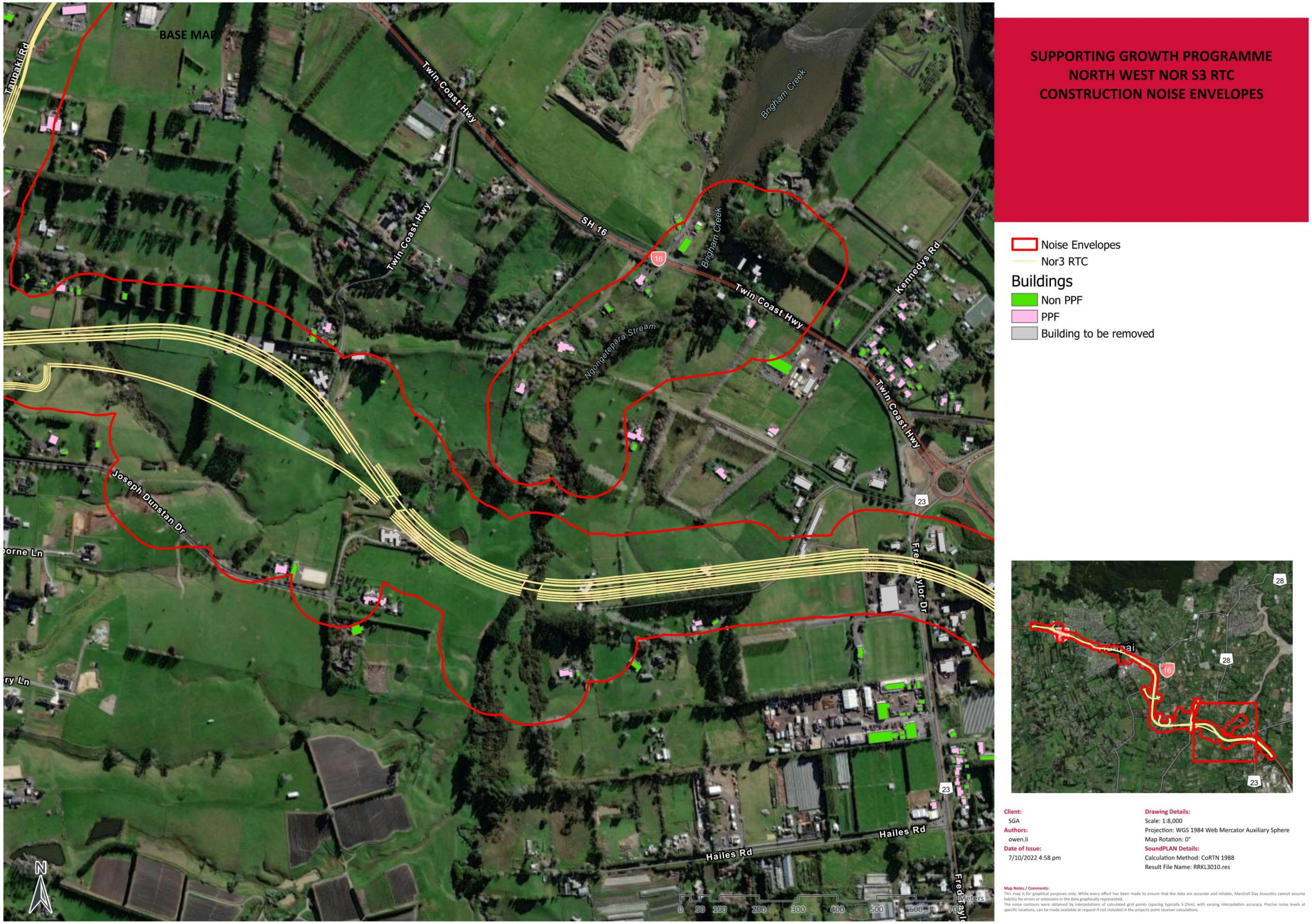
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Taupaki Rd
Twin Coast Hwy
SH 16
Brigham Creek
Ngongetepara Stream
Kennedys Rd
Joseph Dunstan Dr
Fred Taylor Dr
Hailes Rd
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION NOISE ENVELOPES

Noise Envelopes
Nor3 RTC

Buildings
Non PPF
PPF
Building to be removed

Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

1.4 NoR S4

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S4 AR
CONSTRUCTION NOISE ENVELOPES

Noise Envelopes
Nor4 AR

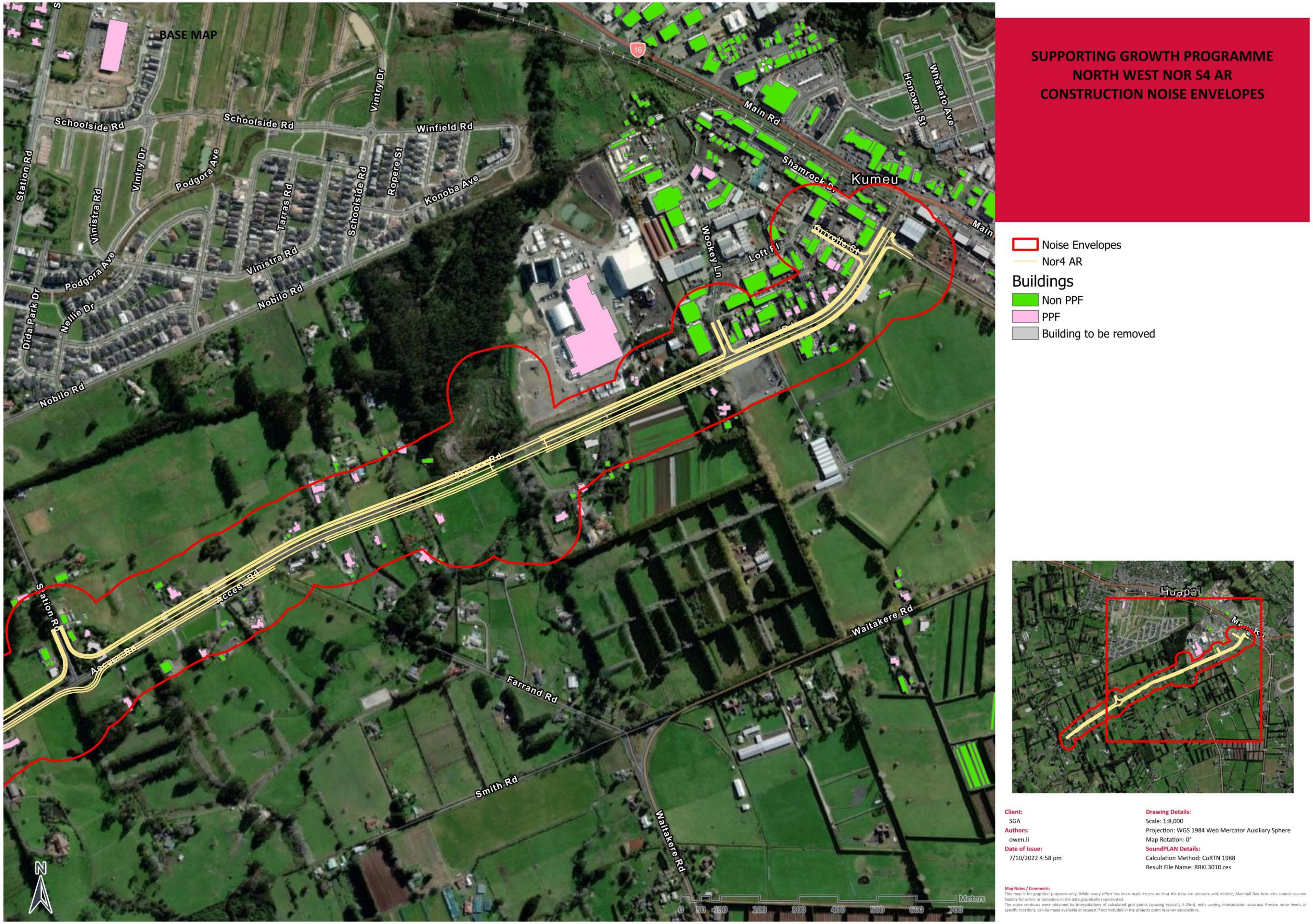
Buildings

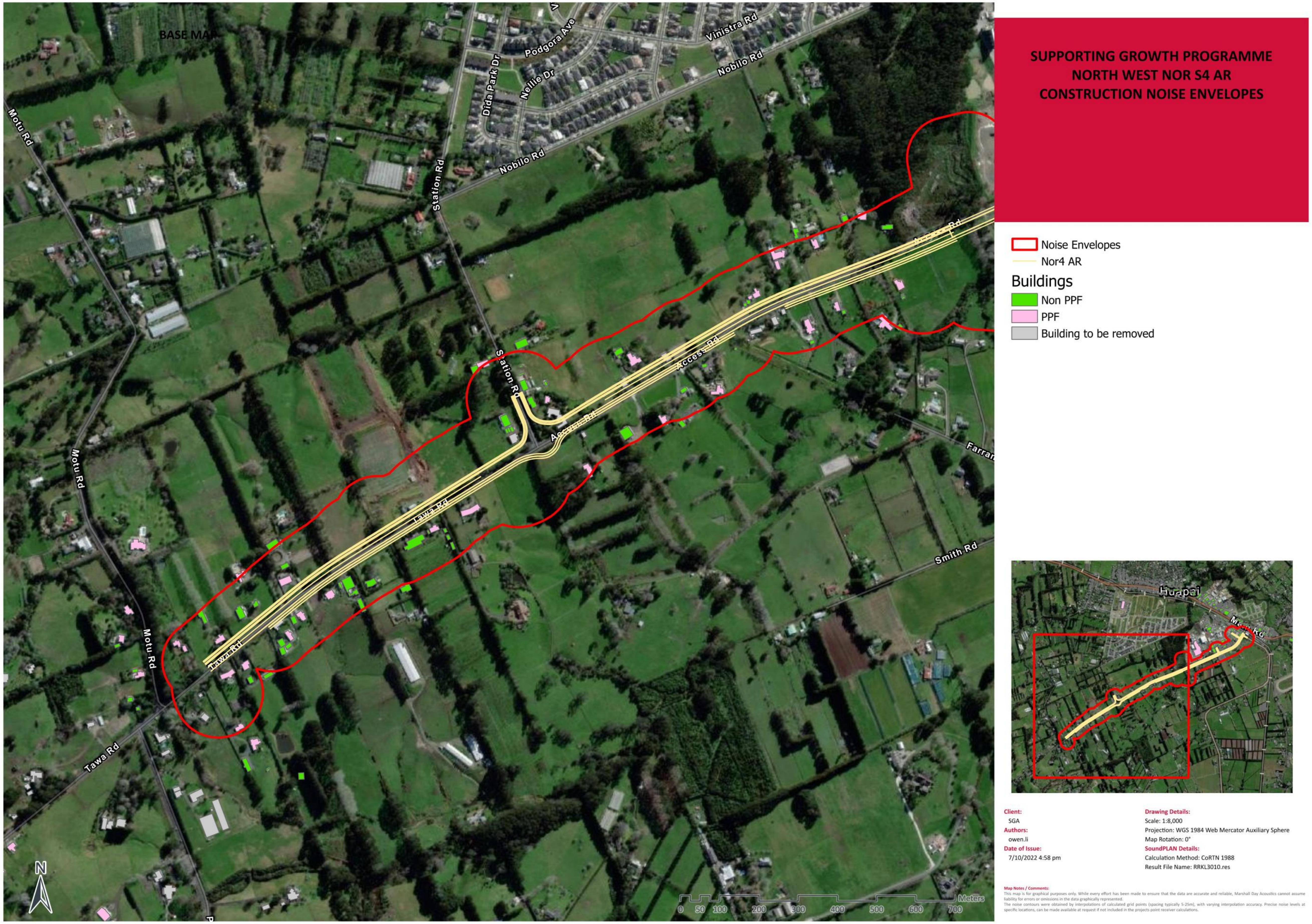
Non PPF
PPF
Building to be removed

Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm

Drawing Details:
Scale: 1:13,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

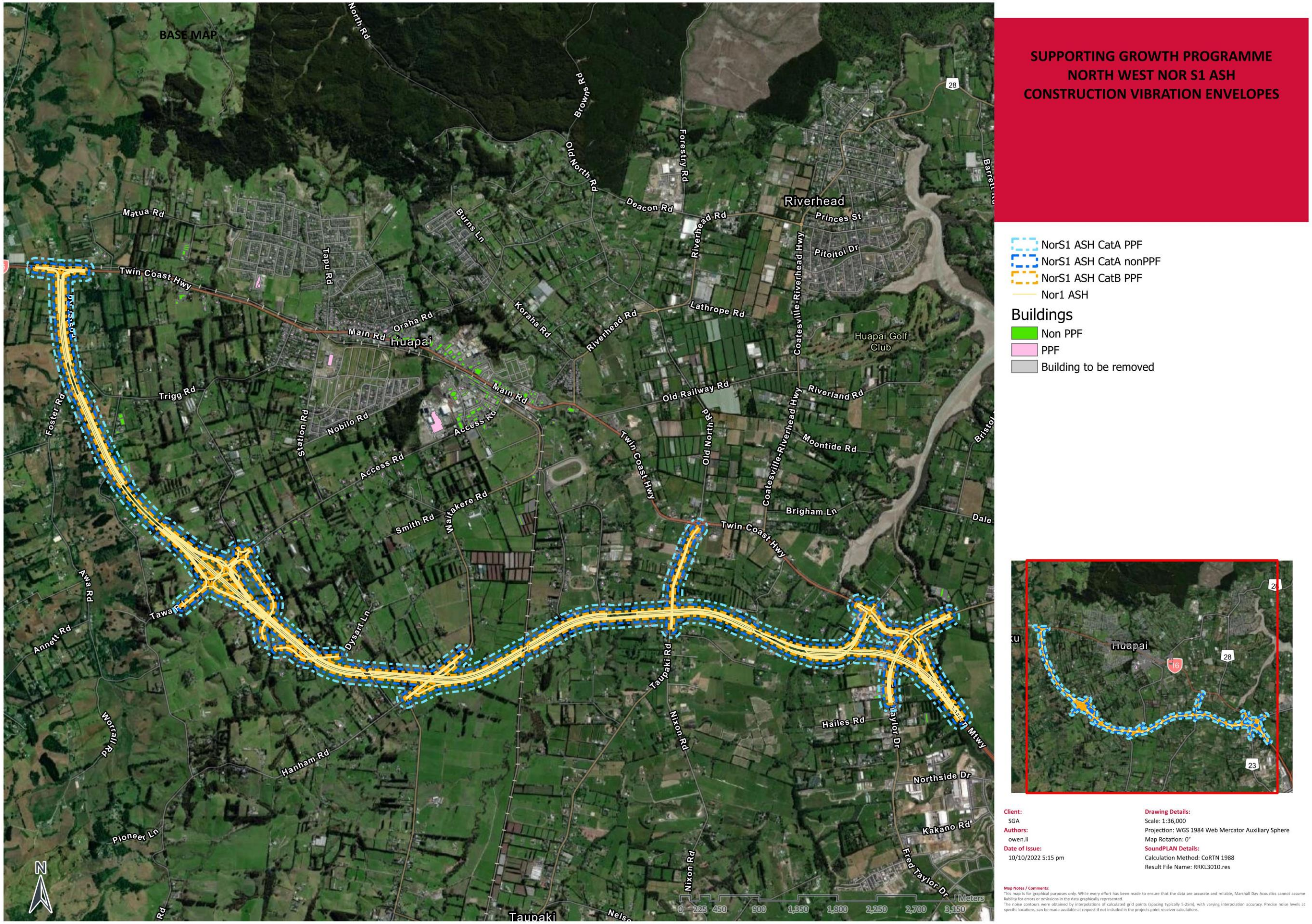
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

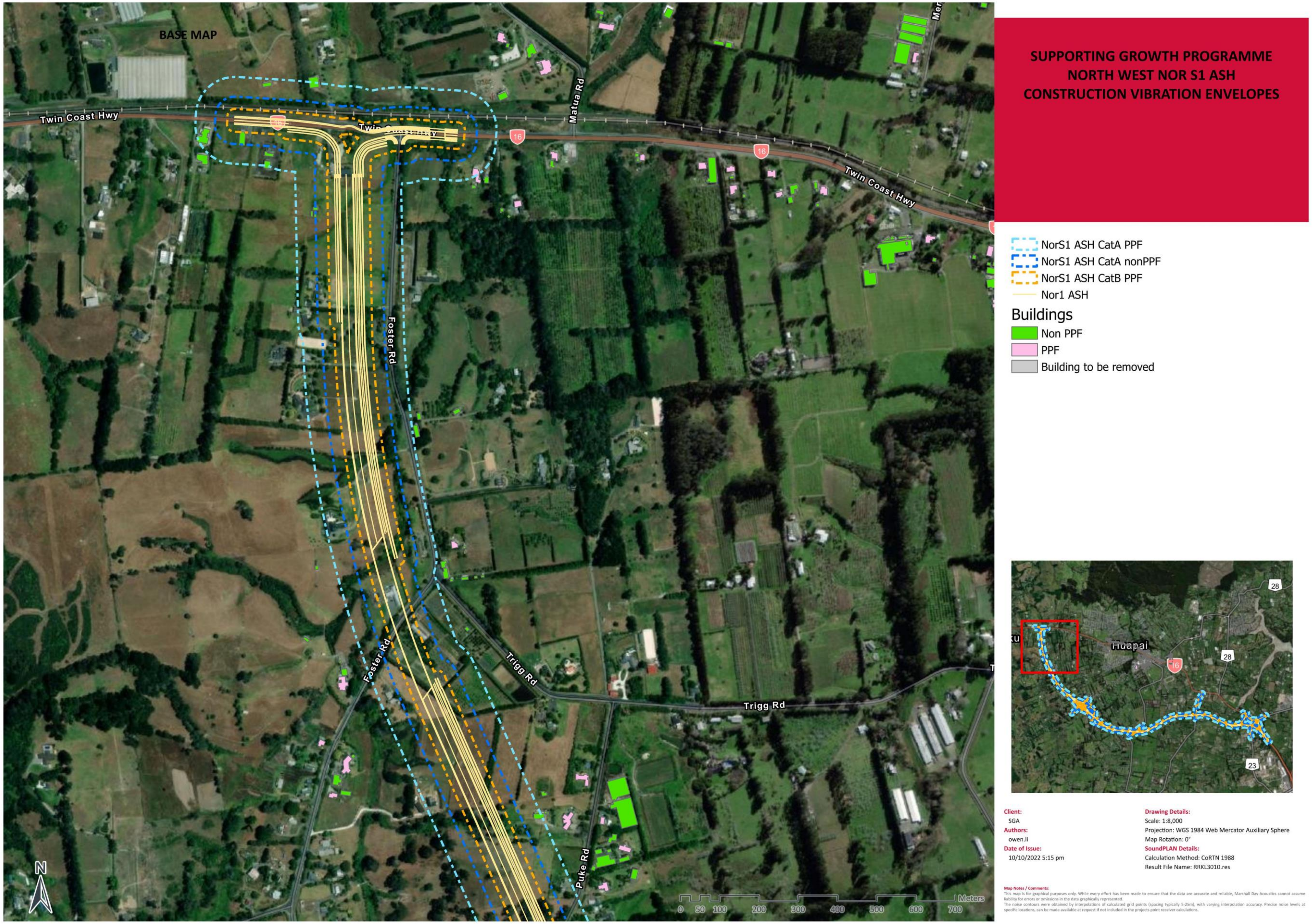

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S4 AR
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor4 AR
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Schoolside Rd
Winfield Rd
Vintry Dr
Station Rd
Vinistra Rd
Podgora Ave
Tarras Rd
Schoolside Rd
Ropere St
Konoba Ave
Nellie Dr
Dida Park Dr
Nobilo Rd
Main Rd
Shamrock Dr
Kumeu
Honowai St
Whakato Ave
Wookey Ln
Loft Pl
Access Rd
Station Rd
Farrand Rd
Waitakere Rd
Smith Rd
Huapai
N
Meters
0 50 100 200 300 400 500 600 700
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

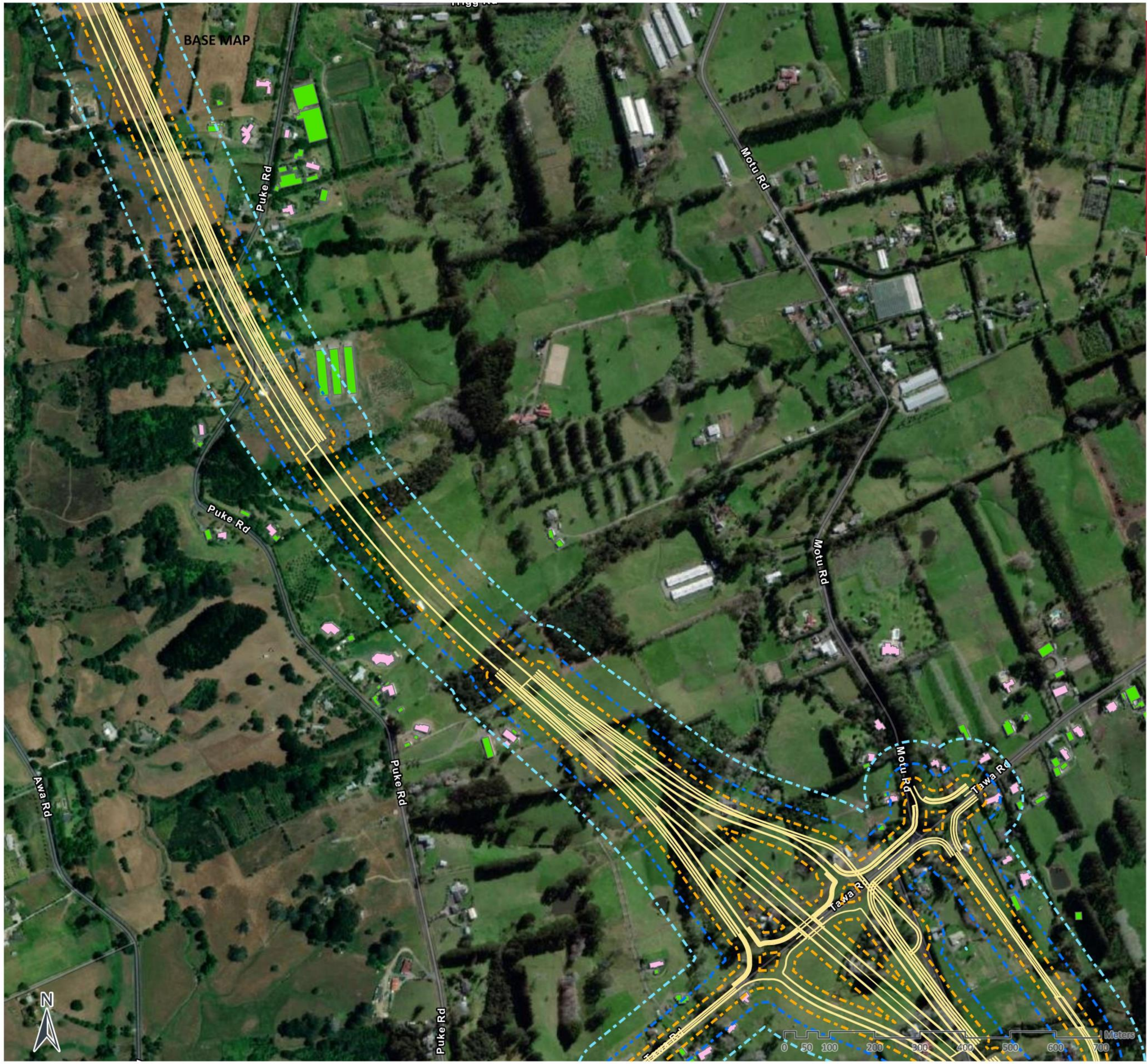

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S4 AR
CONSTRUCTION NOISE ENVELOPES
Noise Envelopes
Nor4 AR
Buildings
Non PPF
PPF
Building to be removed
Client:
SGA
Authors:
owen.li
Date of Issue:
7/10/2022 4:58 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.
Motu Rd
Station Rd
Nobilo Rd
Vinistra Rd
Podgora Ave
Dida Park Dr
Nellie Dr
Access Rd
Tawa Rd
Smith Rd
Huapai
N
Meters
0 50 100 200 300 400 500 600 700

2 Construction Vibration Setbacks

2.1 NoR S1


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES
BASE MAP
NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Riverhead
Huapai
Huapai Golf Club
Taupaki
Matua Rd
Twin Coast Hwy
Tapu Rd
Burns Ln
Deacon Rd
Forestry Rd
Old North Rd
Browns Rd
North Rd
Riverhead Rd
Princes St
Pitoitoi Dr
Lathrope Rd
Coatesville-Riverhead Hwy
Koraha Rd
Oraha Rd
Main Rd
Trigg Rd
Foster Rd
Station Rd
Nobilo Rd
Access Rd
Old Railway Rd
Riverland Rd
Moontide Rd
Brigham Ln
Waitakere Rd
Smith Rd
Awa Rd
Annett Rd
Dysart Ln
Taupaki Rd
Nixon Rd
Hailes Rd
Taylor Dr
Worrall Rd
Hanham Rd
Pioneer Ln
Northside Dr
Kakano Rd
Fred Taylor Dr
Dale
Meters
0 225 450 900 1,350 1,800 2,250 2,700 3,150
N
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:36,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES
NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Twin Coast Hwy
Matua Rd
Foster Rd
Trigg Rd
Puke Rd
16
Huapai
28
23
N
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

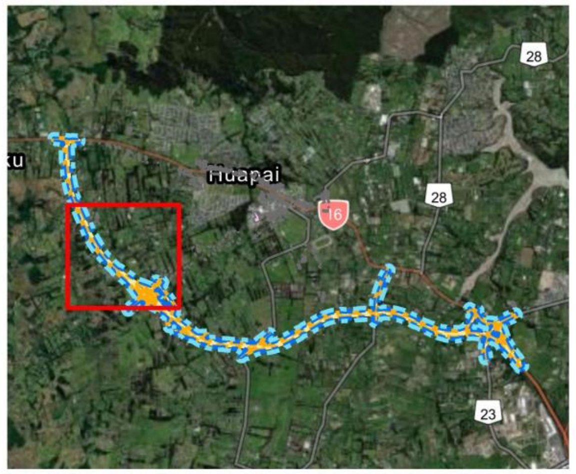


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES

NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH

Buildings

Non PPF
PPF
Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

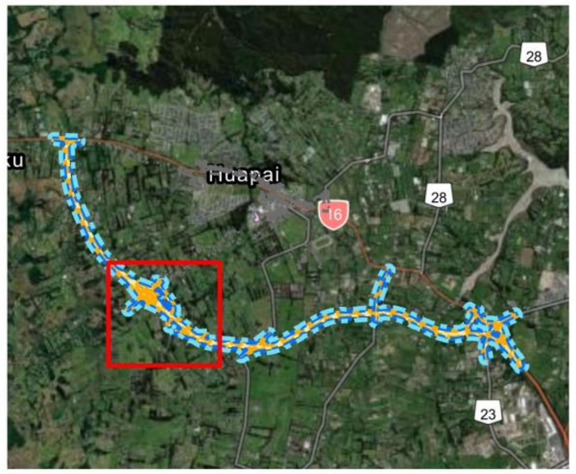
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES

NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH

Buildings
Non PPF
PPF
Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES
NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Pomona Rd
Dysart Ln
Waitakere Rd
Hanham Rd
Huapai
28
16
23
N
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

ATTACHMENT 44

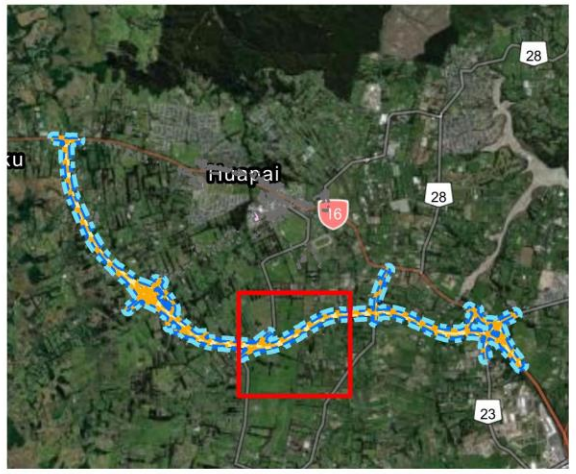
NORTH-WEST STRATEGIC
ASSESSMENT OF CONSTRUCTION NOISE AND VIBRATION EFFECTS
PART 3 OF 3

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES

NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH

Buildings

Non PPF
PPF
Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
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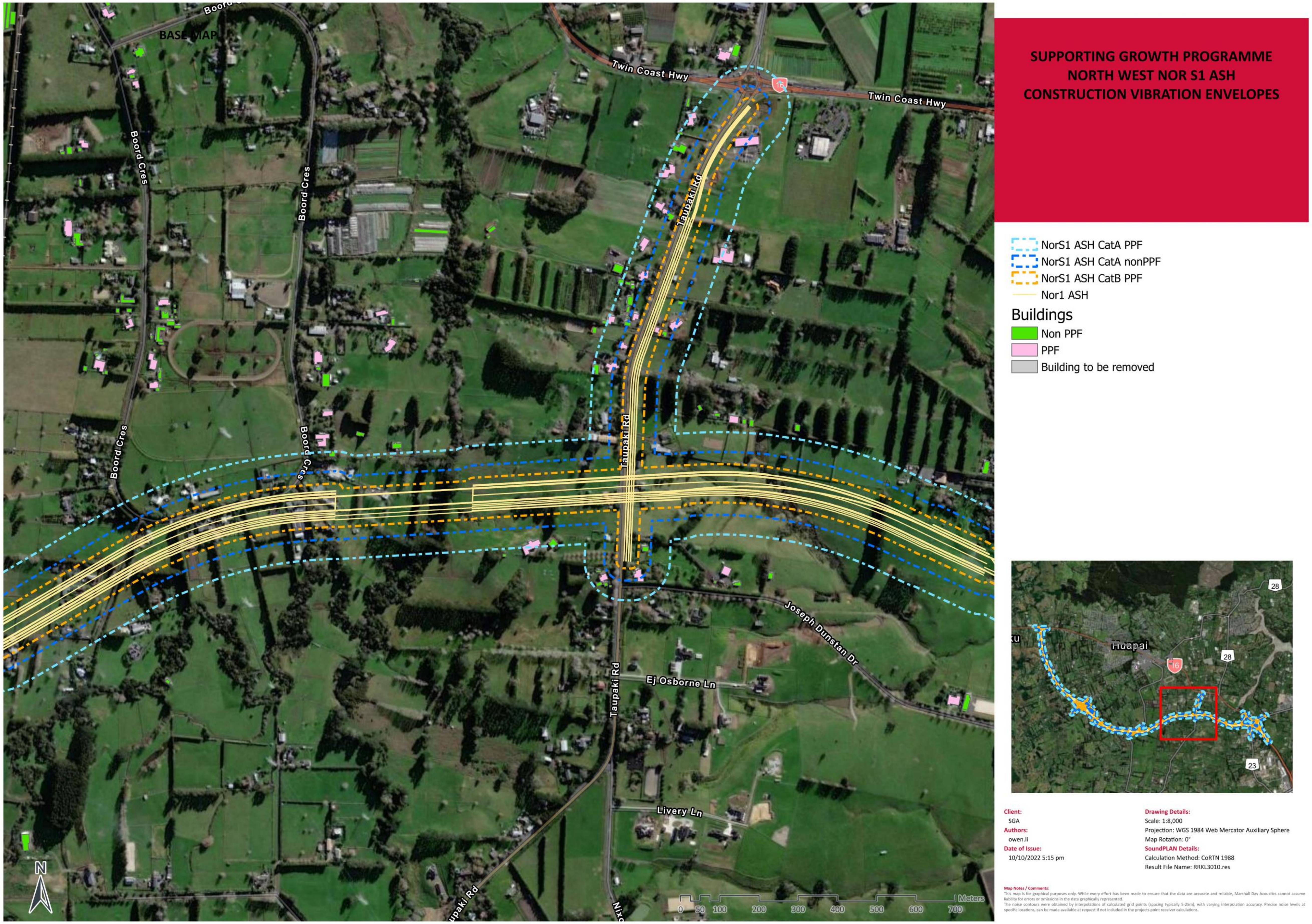
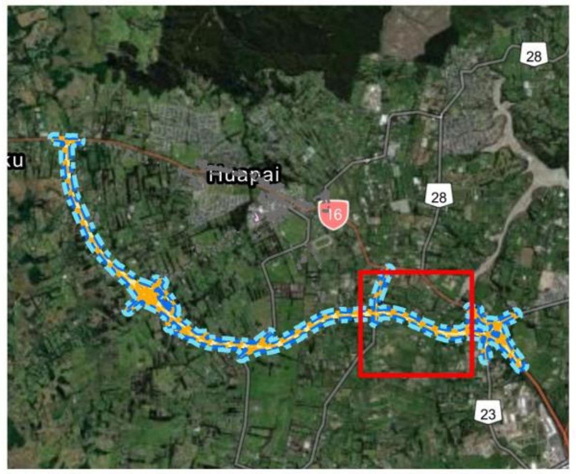

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES
BASE MAP
Twin Coast Hwy
Twin Coast Hwy
Boord Cres
Boord Cres
Boord Cres
Boord Cres
Taupaki Rd
Taupaki Rd
Taupaki Rd
Joseph Dunstan Dr
Ej Osborne Ln
Livery Ln
NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH
Buildings
Non PPF
PPF
Building to be removed
Huapai
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES

NorS1 ASH CatA PPF
NorS1 ASH CatA nonPPF
NorS1 ASH CatB PPF
Nor1 ASH

Buildings
Non PPF
PPF
Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
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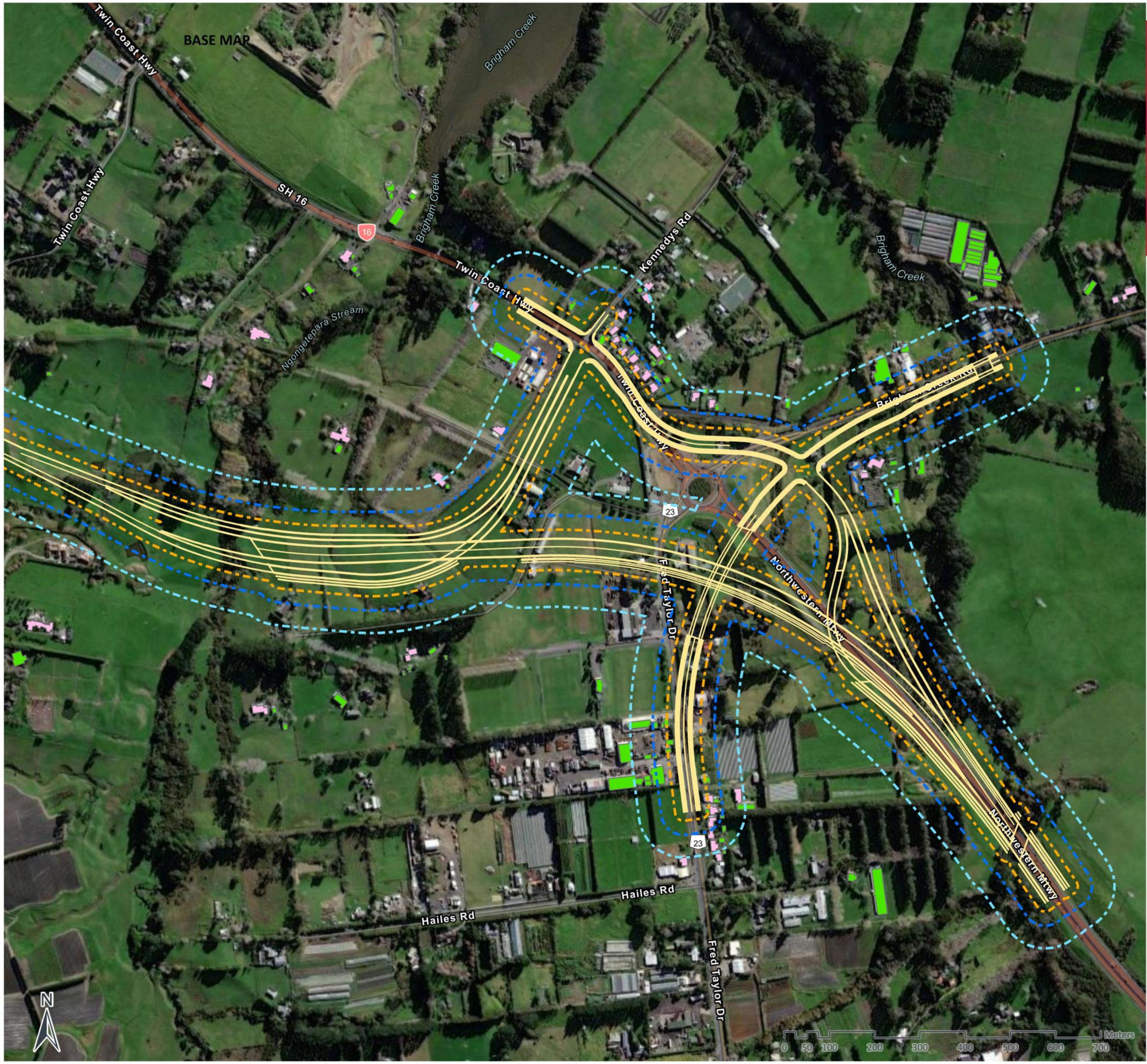
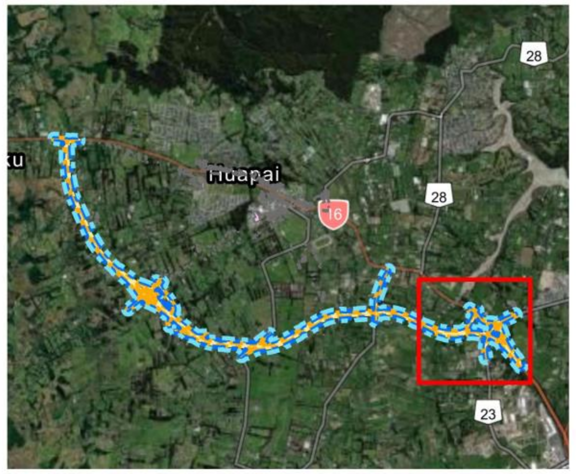


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S1 ASH
CONSTRUCTION VIBRATION ENVELOPES

- NorS1 ASH CatA PPF
- NorS1 ASH CatA nonPPF
- NorS1 ASH CatB PPF
- Nor1 ASH

Buildings

- Non PPF
- PPF
- Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
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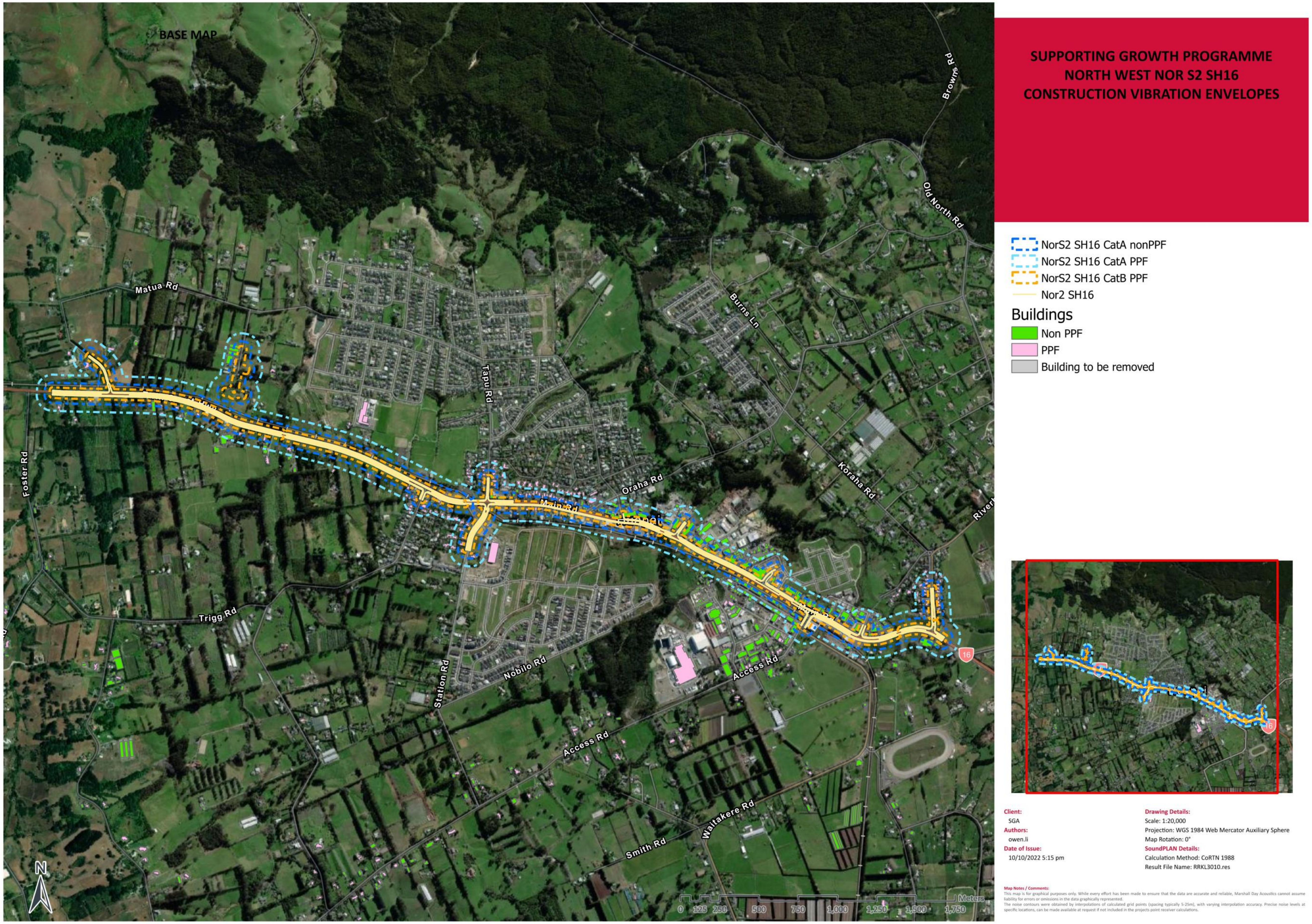
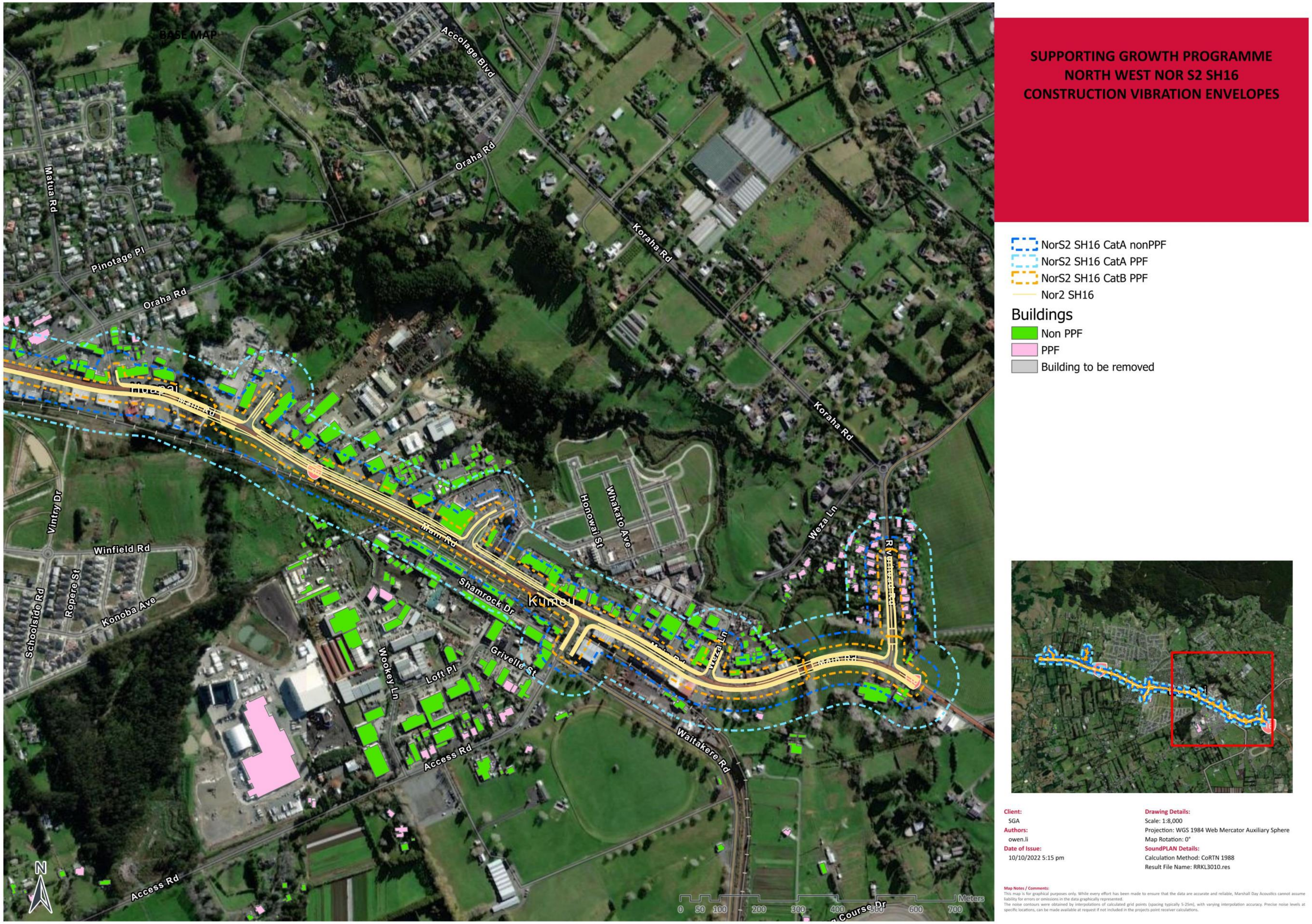
2.2 NoR S2


BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION VIBRATION ENVELOPES
NorS2 SH16 CatA nonPPF
NorS2 SH16 CatA PPF
NorS2 SH16 CatB PPF
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
Matua Rd
Tapu Rd
Burns Ln
Browns Rd
Old North Rd
Koraha Rd
Foster Rd
Oraha Rd
Main Rd
Trigg Rd
Station Rd
Nobilo Rd
Access Rd
Access Rd
Waitakere Rd
Smith Rd
16
N
0 125 250 500 750 1,000 1,250 1,500 1,750
Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:20,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

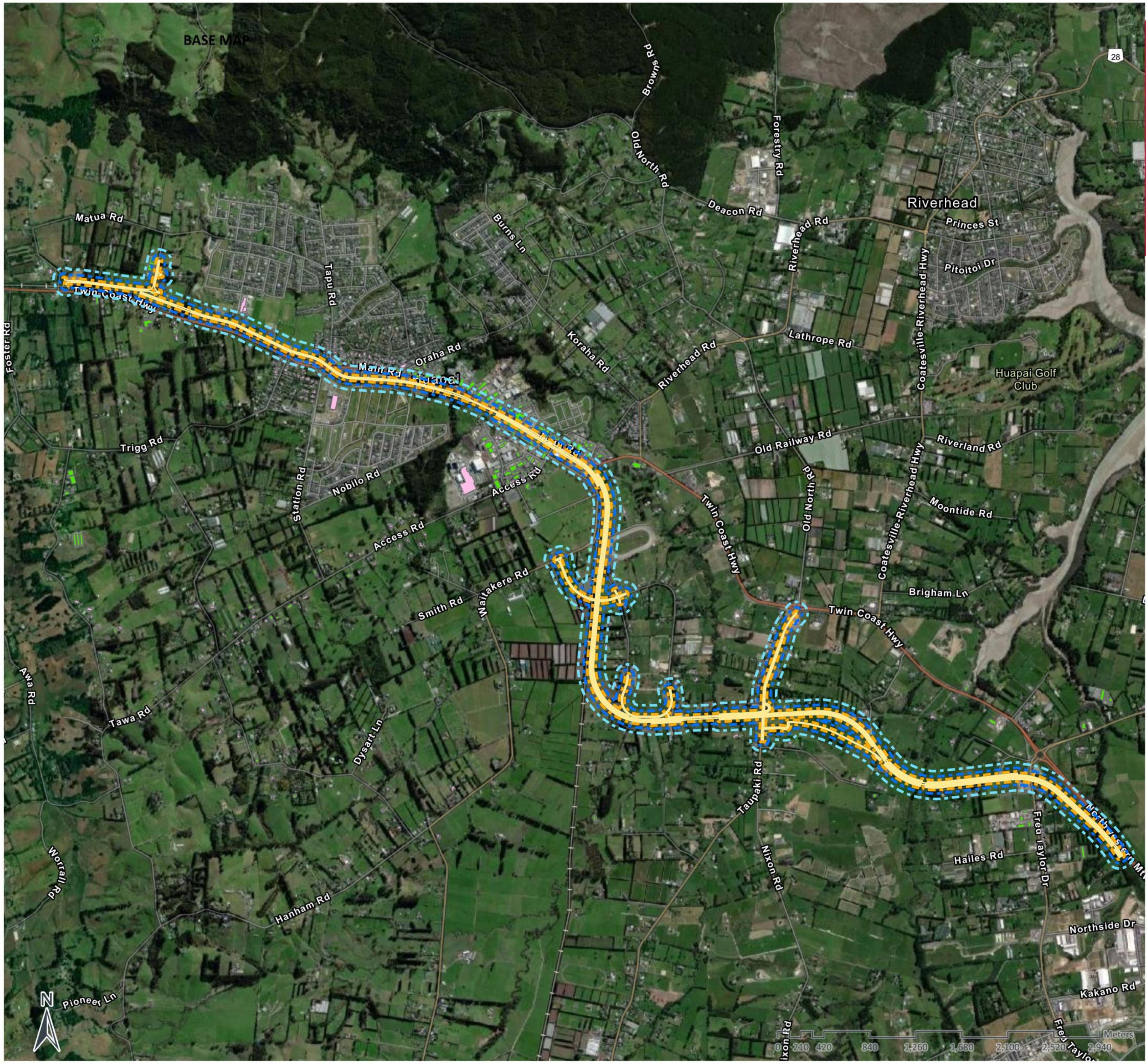

BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION VIBRATION ENVELOPES
NorS2 SH16 CatA nonPPF
NorS2 SH16 CatA PPF
NorS2 SH16 CatB PPF
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
Matua Rd
Fruitlands Rd
Robert Might Rd
Lewis Younie Rd
McIndoe Rd
Cutfield Ln
Gilbransen Rd
Korako Dr
Madden Ave
Lockyer Rd
Van Rixel Dr
Kuawa Dr
Aporo Dr
Meryl Ave
Matua Rd
Coast Hwy
Foster Rd
Trigg Rd
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION VIBRATION ENVELOPES
NorS2 SH16 CatA nonPPF
NorS2 SH16 CatA PPF
NorS2 SH16 CatB PPF
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Korako Dr
Matua Rd
Kuawa Dr
Aporo Dr
Eric Farley Dr
Hooton Dr
Van Rixel Dr
Maple Ln
Huarahi Pai Rd
Park Views Ln
Ara Kakara Ave
Malbec Pl
Tapu Rd
Sunny Cres
Pinotage Pl
Oraha Rd
Main Rd
Trigg Rd
Vintry Dr
Schoolside Rd
Winfield Rd
Station Rd
Vinistra Rd
Podgora Ave
Tarras Rd
Ropere St
Konoba Ave
Nobilo Rd
Noble Dr
Dida Park Dr
Wookey Ln
Loft Pl
Access Rd
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.



SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S2 SH16
CONSTRUCTION VIBRATION ENVELOPES
NorS2 SH16 CatA nonPPF
NorS2 SH16 CatA PPF
NorS2 SH16 CatB PPF
Nor2 SH16
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Accolage Blvd
Oraha Rd
Matua Rd
Pinotage Pl
Oraha Rd
Koraha Rd
Koraha Rd
Main Rd
Main Rd
Honowai St
Whakato Ave
Weza Ln
Vintry Dr
Winfield Rd
Ropere St
Schoolside Rd
Konoba Ave
Shamrock Dr
Kumeu
Wookey Ln
Loft Pl
Grivelle St
Access Rd
Waitakere Rd
Access Rd
N
0 50 100 200 300 400 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
This map is for graphical purposes only. While every effort has been made to ensure that the data are accurate and reliable, Marshall Day Acoustics cannot assume liability for errors or omissions in the data graphically represented.
The noise contours were obtained by interpolations of calculated grid points (spacing typically 5-25m), with varying interpolation accuracy. Precise noise levels at specific locations, can be made available at request if not included in the projects point receiver calculations.

2.3 NoR S3

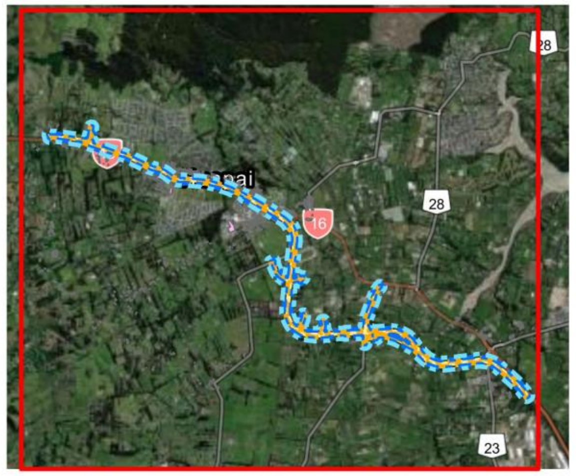


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION VIBRATION ENVELOPES

NorS3 RTC CatA PPF
NorS3 RTC CatA nonPPF
NorS3 RTC CatB PPF
Nor3 RTC

Buildings

Non PPF
PPF
Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:33,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
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SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION VIBRATION ENVELOPES
BASE MAP
NorS3 RTC CatA PPF
NorS3 RTC CatA nonPPF
NorS3 RTC CatB PPF
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
Matua Rd
Fruitlands Rd
Robert Might Rd
Larmer Dr
Pititi Ln
Lewis Younie Rd
Gilbransen Rd
Koroko Dr
McIndoe Rd
Cutfield Ln
Meryl Ave
Madden Ave
Lockyer Rd
Kuawa Dr
Aporo Dr
Eric Farley Dr
Van Rixel Dr
Twin Coast Hwy
Trigg Rd
16
28
23
0 50 100 200 300 400 500 600 700 Meters
N
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
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SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION VIBRATION ENVELOPES
NorS3 RTC CatA PPF
NorS3 RTC CatA nonPPF
NorS3 RTC CatB PPF
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
Client:
SGA
Authors:
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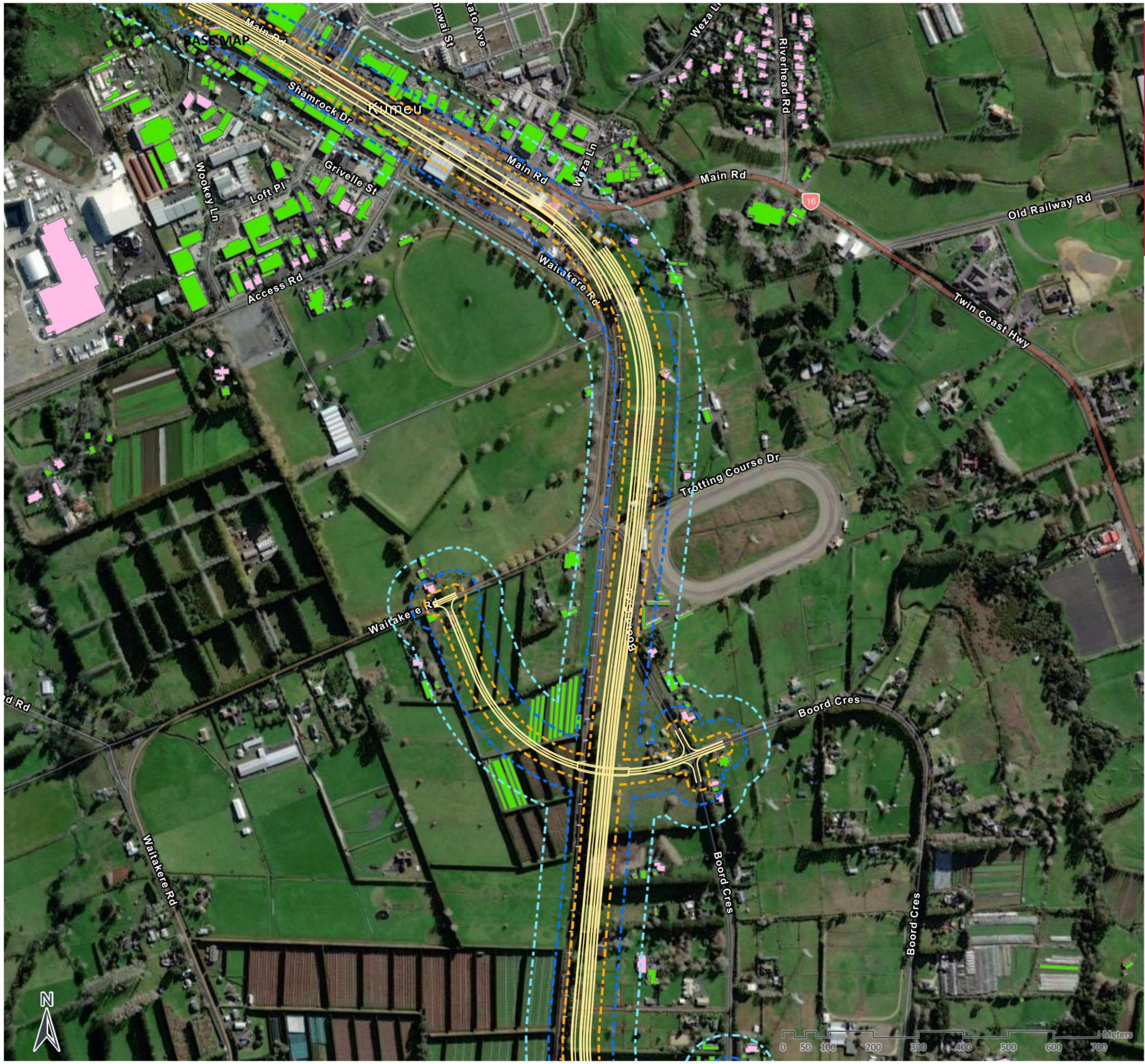
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
BASE MAP
Huapai
Kumeu
Main Rd
Vintry Dr
Station Rd
Schoolside Rd
Winfield Rd
Podgora Ave
Vinistra Rd
Nobilo Rd
Access Rd
Shamrock Dr
Grivelle St
Loft Pl
Wookey Ln
Konoba Ave
Tarras Rd
Ropere St
Oraha Rd
Pinotage Pl
Sunny Cres
Matua Rd
Malbec Pl
Ara Kakara Ave
Huarahi Pai Rd
Maple Ln
Park Views Ln
Tapu Rd
Hooton Dr
Accolage Blvd
Honowai St
Whakato Ave
Nellie Dr
Dida Park Dr
Meters
0 50 100 200 300 400 500 600 700
N

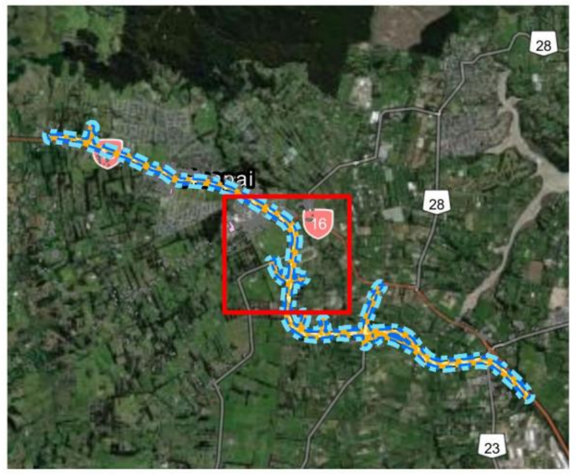


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION VIBRATION ENVELOPES

- NorS3 RTC CatA PPF
- NorS3 RTC CatA nonPPF
- NorS3 RTC CatB PPF
- Nor3 RTC

Buildings

- Non PPF
- PPF
- Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
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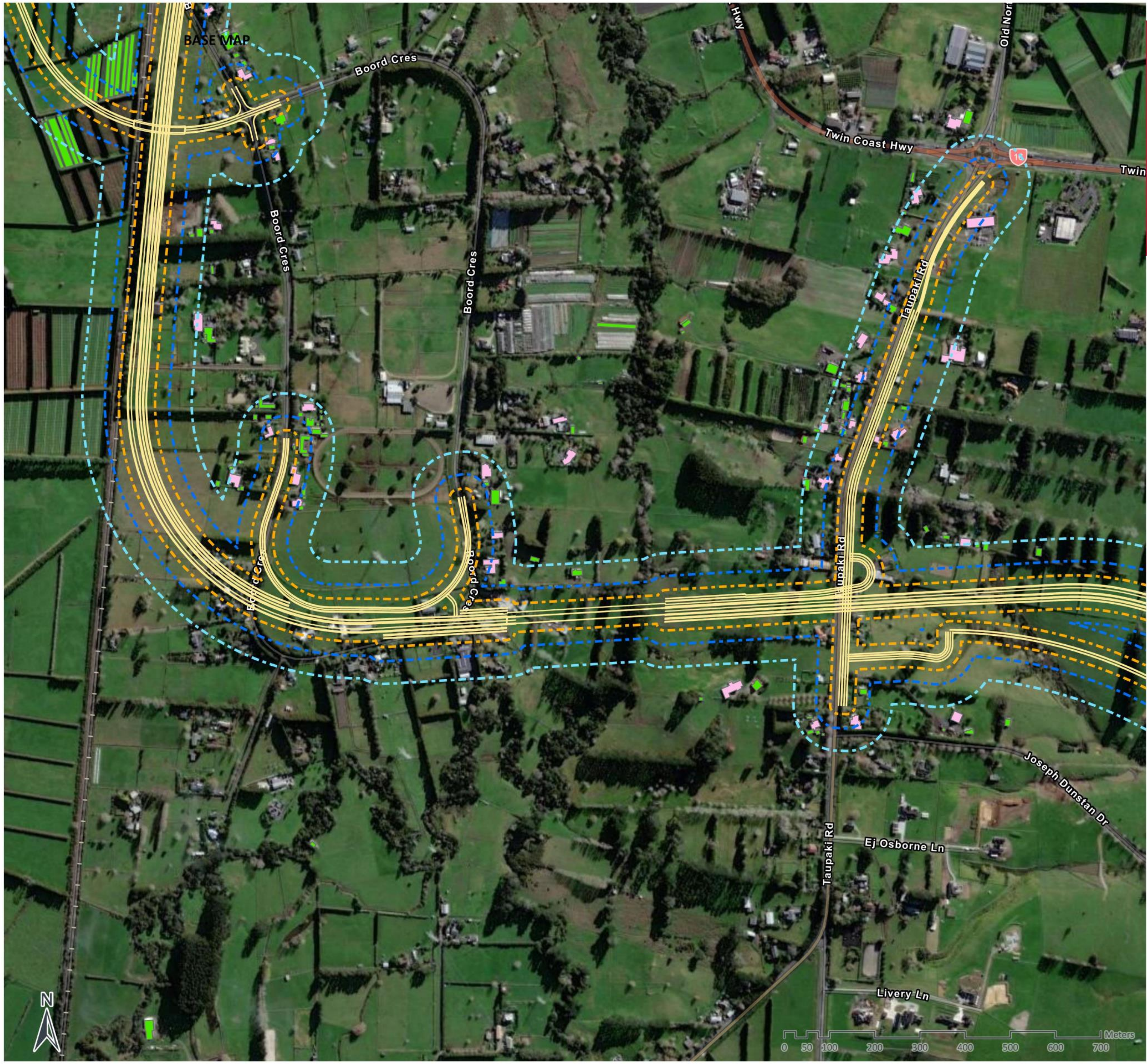
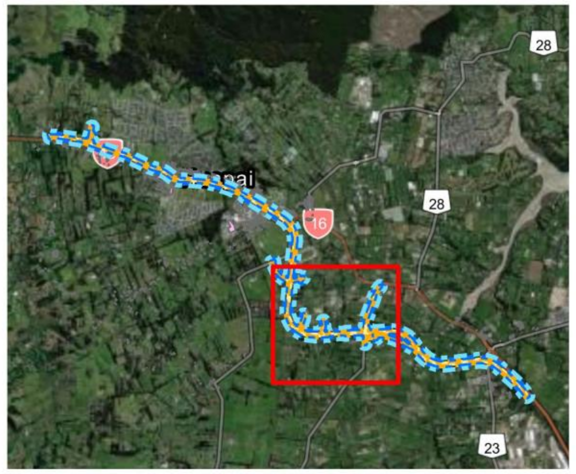


SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION VIBRATION ENVELOPES

NorS3 RTC CatA PPF
NorS3 RTC CatA nonPPF
NorS3 RTC CatB PPF
Nor3 RTC

Buildings

Non PPF
PPF
Building to be removed



Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
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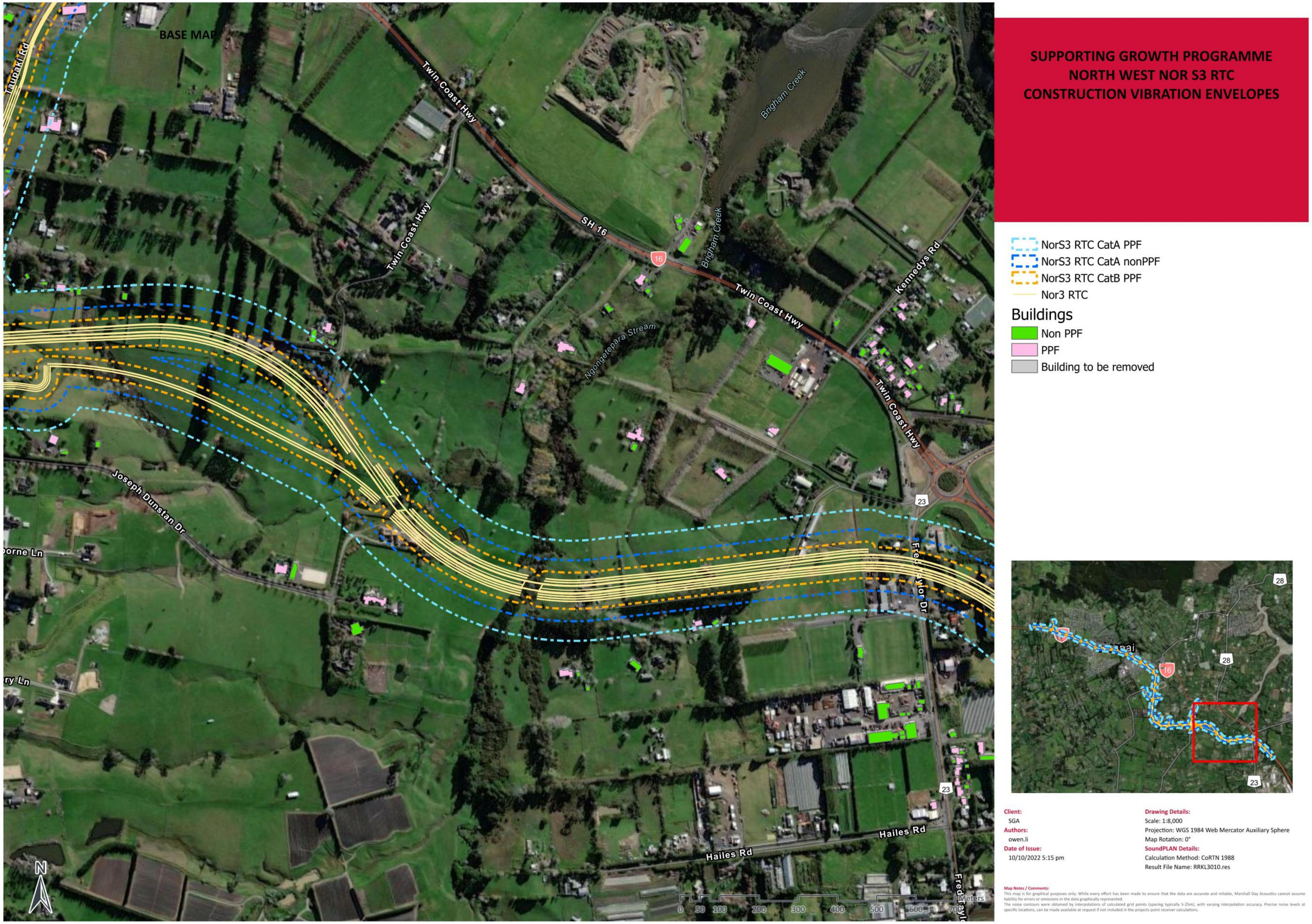
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION VIBRATION ENVELOPES
NorS3 RTC CatA PPF
NorS3 RTC CatA nonPPF
NorS3 RTC CatB PPF
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
BASE MAP
Twin Coast Hwy
SH 16
Brigham Creek
Kennedys Rd
Ngongetepara Stream
Joseph Dunstan Dr
Fred Taylor Dr
Hailes Rd
Meters
0 50 100 200 300 400 500 600 700
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
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BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S3 RTC
CONSTRUCTION VIBRATION ENVELOPES
NorS3 RTC CatA PPF
NorS3 RTC CatA nonPPF
NorS3 RTC CatB PPF
Nor3 RTC
Buildings
Non PPF
PPF
Building to be removed
SH 16
Twin Coast Hwy
Brigham Creek
Kennedys Rd
Ngongetepara Stream
Brigham Creek Rd
Fred Taylor Dr
Northwestern Mtwy
Hailes Rd
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
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0 50 100 200 300 400 500 600 700 Meters

2.4 NoR S4

SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S4 AR
CONSTRUCTION VIBRATION ENVELOPES

- NorS4 AR CatA nonPPF
- NorS4 AR CatA PPF
- NorS4 AR CatB PPF
- Nor4 AR

Buildings

- Non PPF
- PPF
- Building to be removed

Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm

Drawing Details:
Scale: 1:13,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res

Map Notes / Comments:
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BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S4 AR
CONSTRUCTION VIBRATION ENVELOPES
NorS4 AR CatA nonPPF
NorS4 AR CatA PPF
NorS4 AR CatB PPF
Nor4 AR
Buildings
Non PPF
PPF
Building to be removed
Kumeu
Main Rd
Shamrock Dr
Honowai St
Whakato Ave
Schoolside Rd
Winfield Rd
Vintry Dr
Podgora Ave
Konoba Ave
Station Rd
Vinistra Rd
Tarras Rd
Ropere St
Nobilo Rd
Nellie Dr
Dida Park Dr
Wookey Ln
Loft Pl
Access Rd
Waitakere Rd
Farrand Rd
Smith Rd
Huapai
Meters
0 50 100 200 300 400 500 600 700
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
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BASE MAP
SUPPORTING GROWTH PROGRAMME
NORTH WEST NOR S4 AR
CONSTRUCTION VIBRATION ENVELOPES
NorS4 AR CatA nonPPF
NorS4 AR CatA PPF
NorS4 AR CatB PPF
Nor4 AR
Buildings
Non PPF
PPF
Building to be removed
Motu Rd
Station Rd
Nobilo Rd
Vinistra Rd
Podgora Ave
Nellie Dr
Dida Park Dr
Access Rd
Tawa Rd
Smith Rd
Huapai
N
0 50 100 200 300 400 500 600 700 Meters
Client:
SGA
Authors:
owen.li
Date of Issue:
10/10/2022 5:15 pm
Drawing Details:
Scale: 1:8,000
Projection: WGS 1984 Web Mercator Auxiliary Sphere
Map Rotation: 0°
SoundPLAN Details:
Calculation Method: CoRTN 1988
Result File Name: RRKL3010.res
Map Notes / Comments:
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