TE TUPU NGĀTAHI
SUPPORTING GROWTH

North West Strategic Appendix A – Assessment of Alternatives

December 2022

Version 1

WAKA KOTAHI NZ TRANSPORT AGENCY

New Zealand Government

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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

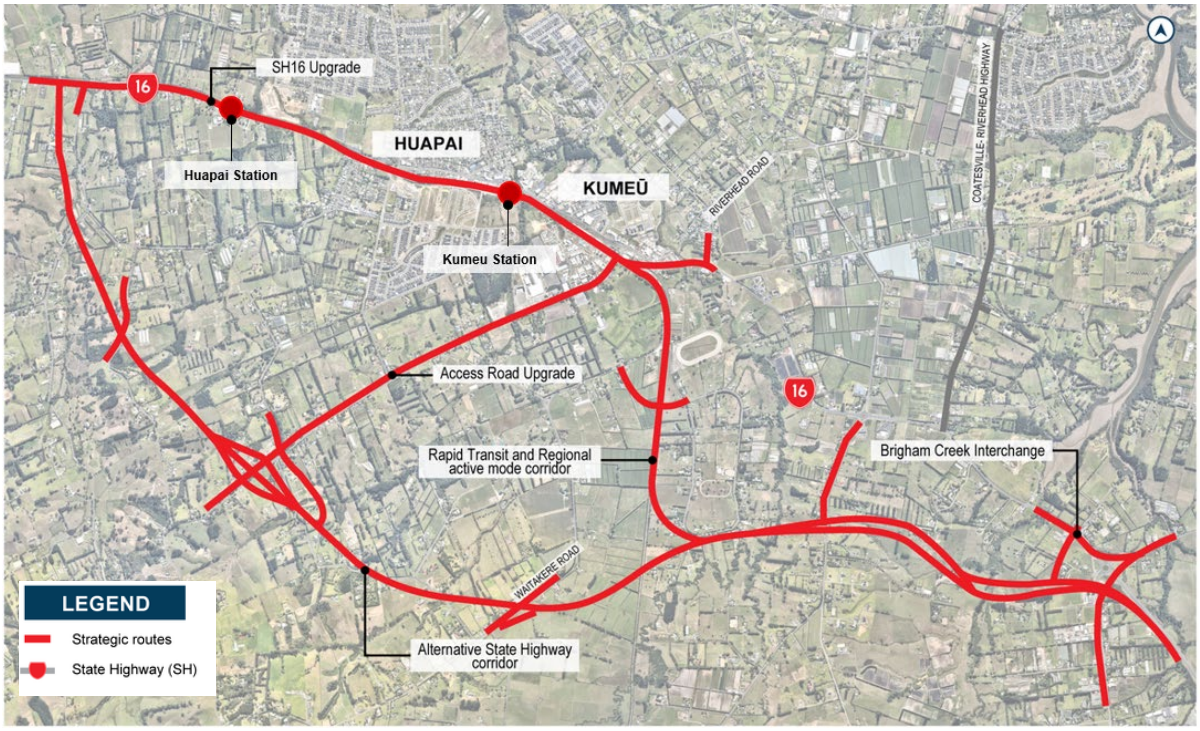


Figure 1-1: NW Strategic Package Overview

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.

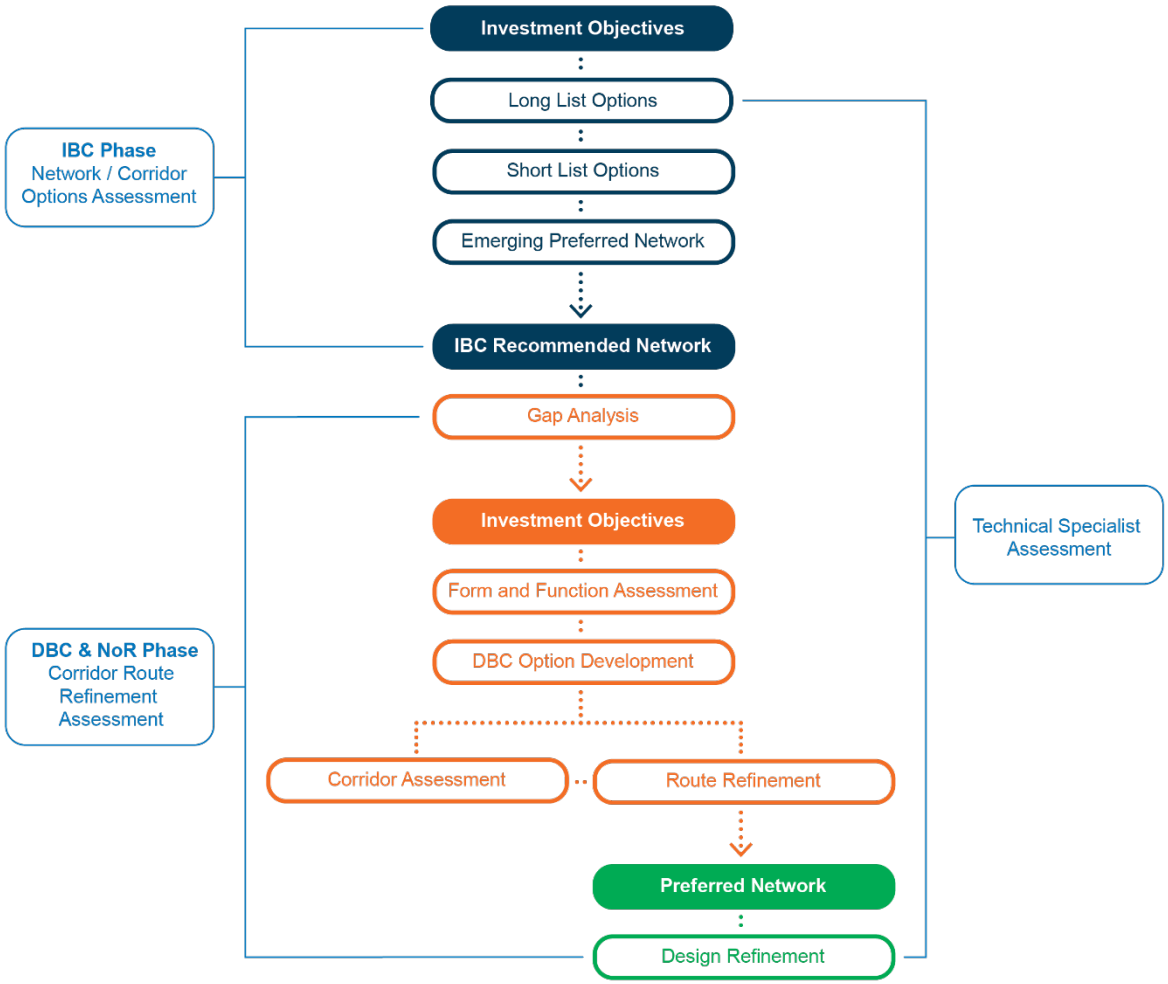


Figure 1-2: Summary of Assessment of Alternatives Process

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.

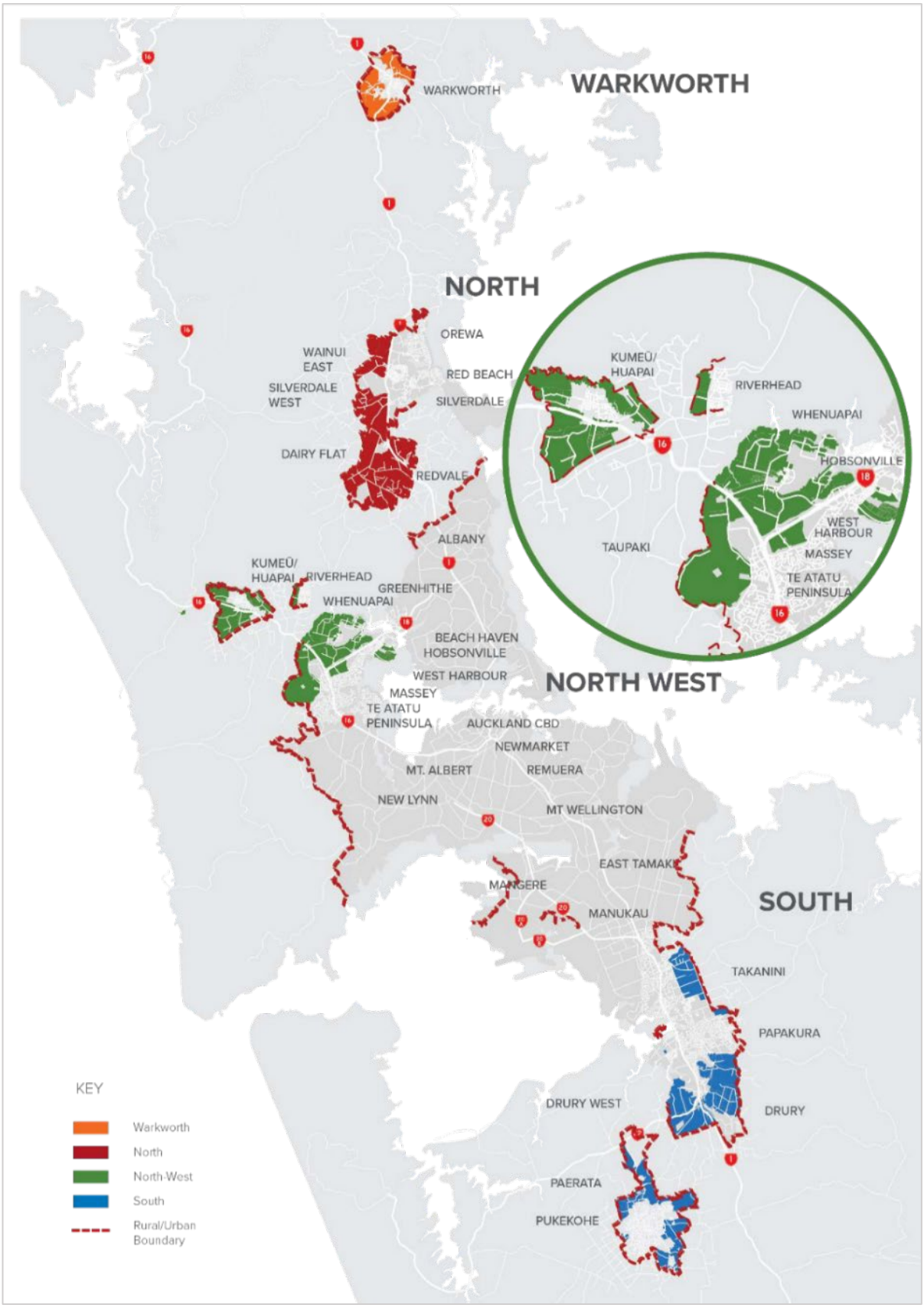


Figure 1-3: Future Urban Areas of Auckland, Highlighting the North West Growth Area

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.

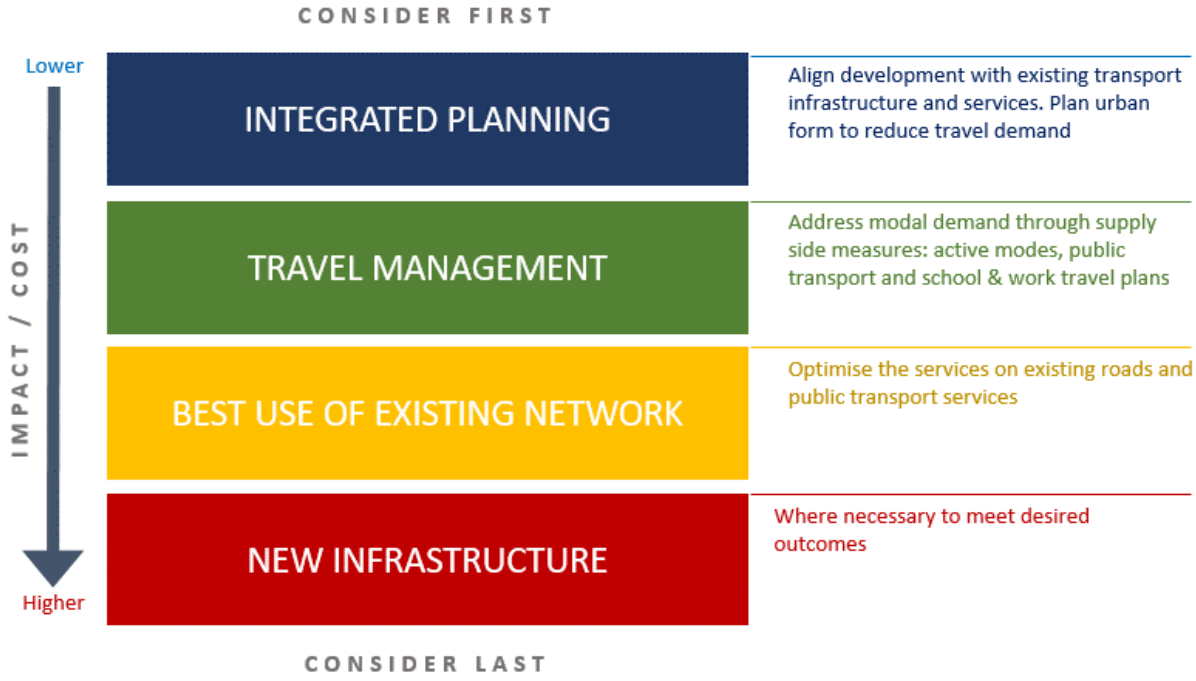


Figure 2-1: Options development – intervention hierarchy approach

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’.

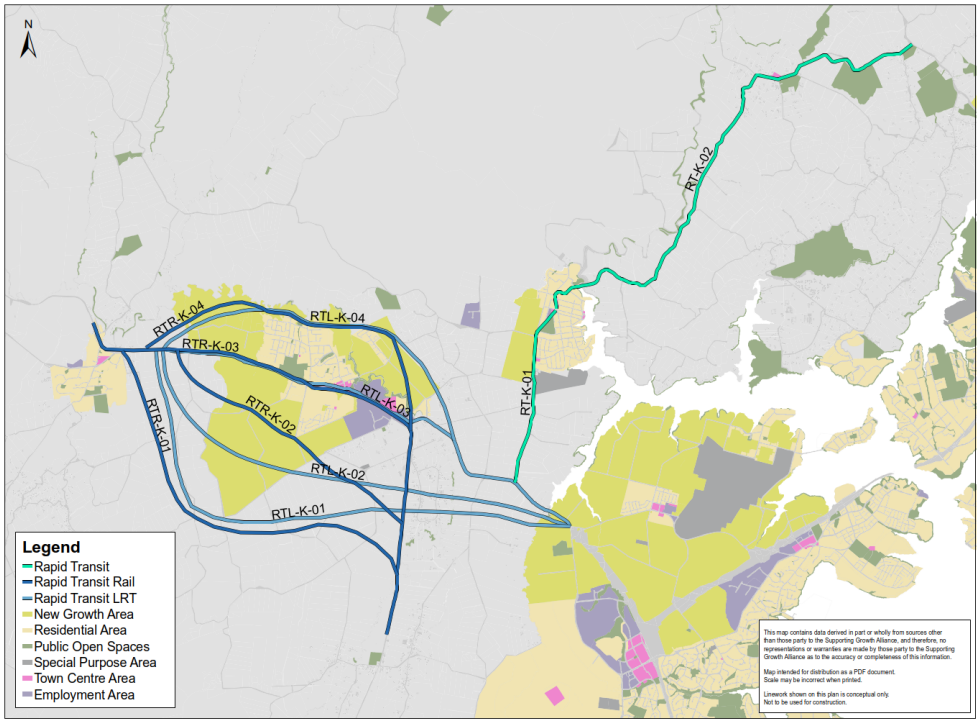
Each of the long list options were assessed using the distilled MCA framework. Key steps in the options assessment included:

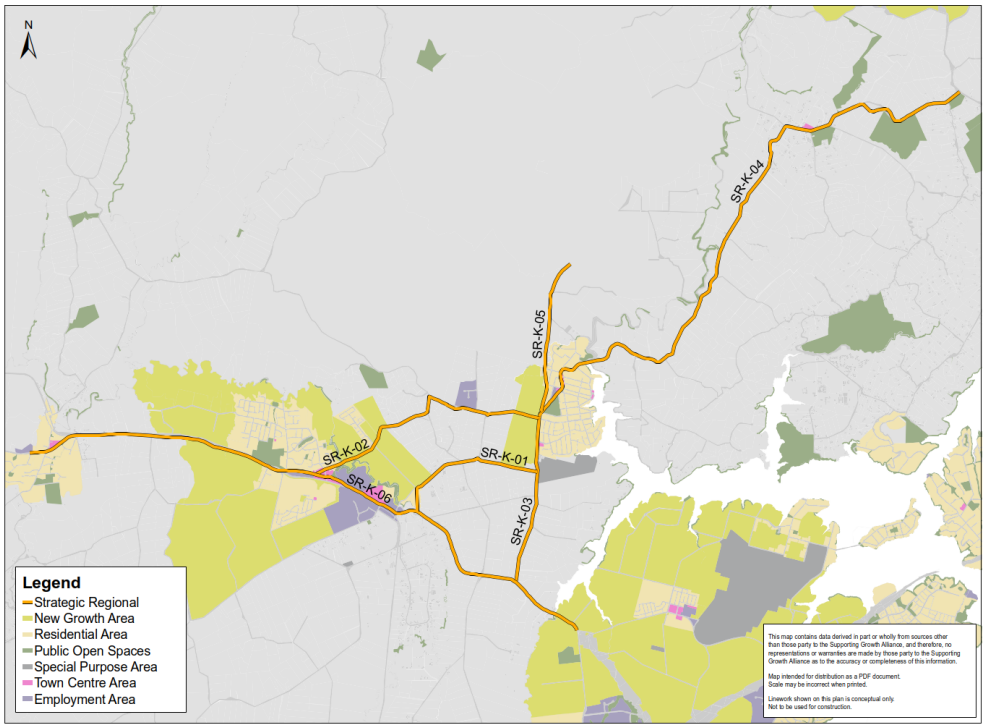
1. Initial long list scoring and assessment of non-scored criteria by subject experts
2. Manawhenua hui and discussion
3. Workshops – collaborative evaluation of options and feedback from Partners
4. Scores refined
5. Long list refinement
6. Identification of the short list.

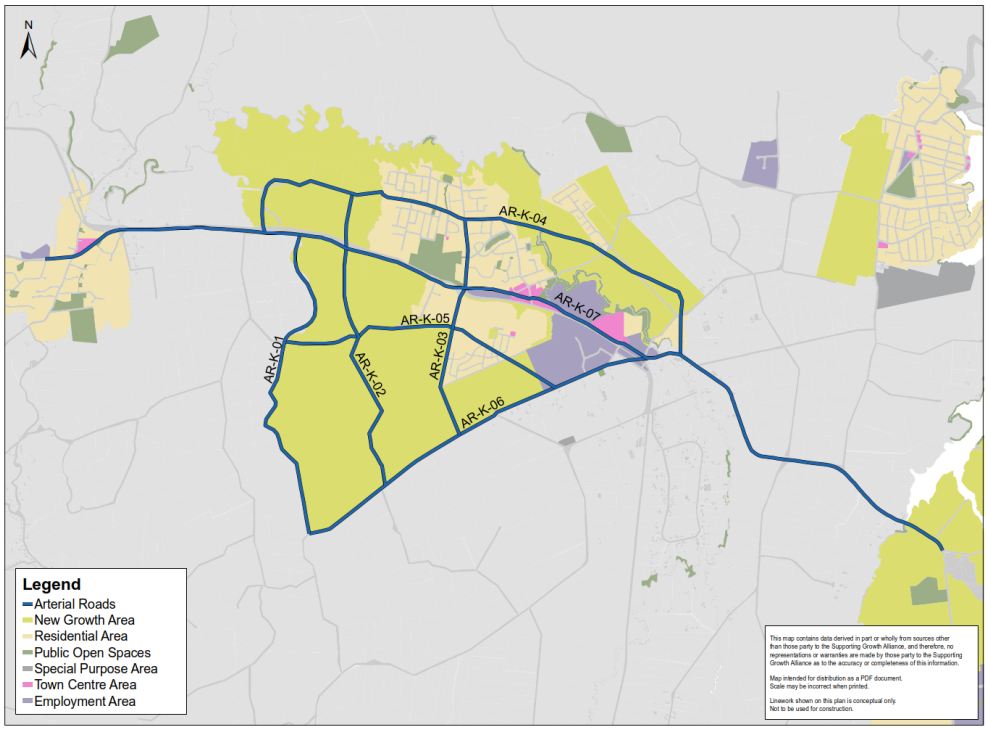
3.1.3 Recommendations

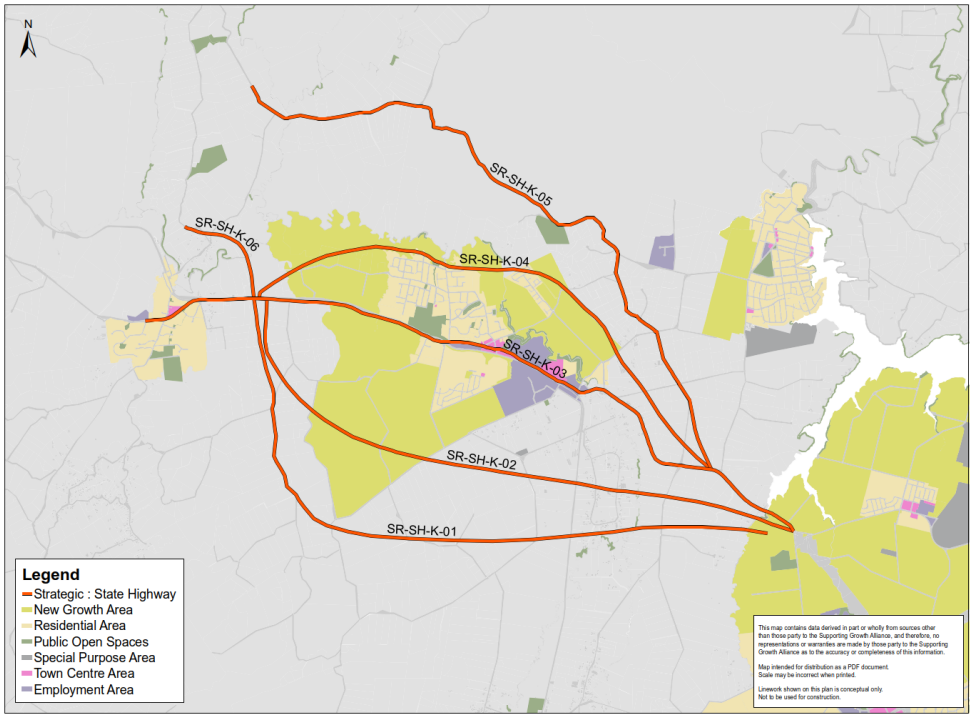
Table 3-1 provides an overview of the options assessed, recommendations and reasoning for progressing options to the short list.

Table 3-1: Long List Corridor Assessment Recommendations

Options	Assessment Recommendation
Rapid Transit **Kumeū-Huapai**	
10 Options	**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. *Riverhead Rapid Transit (RT-K)* • RT-K-01: Riverhead to SH16 • RT-K-02: Dairy flats via Coatesville-Riverhead Highway.
Options progressed	**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.
Options Discarded	**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.

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.

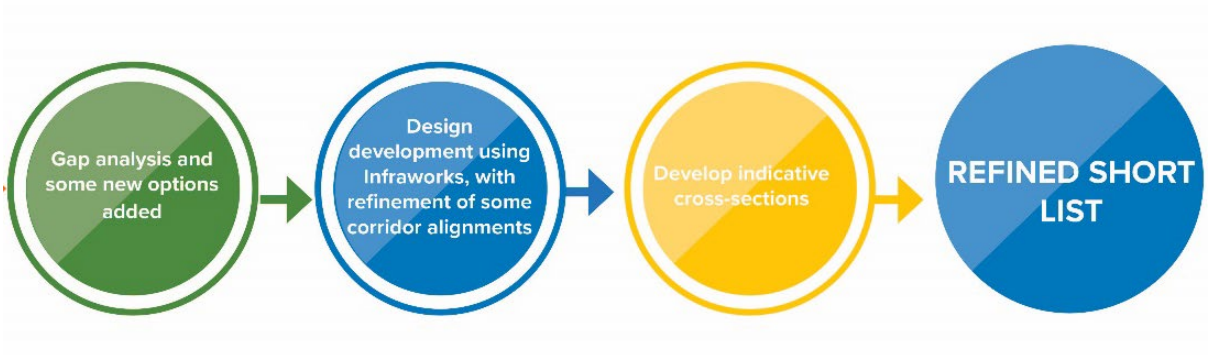


Figure 3-1: Short list development process

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:

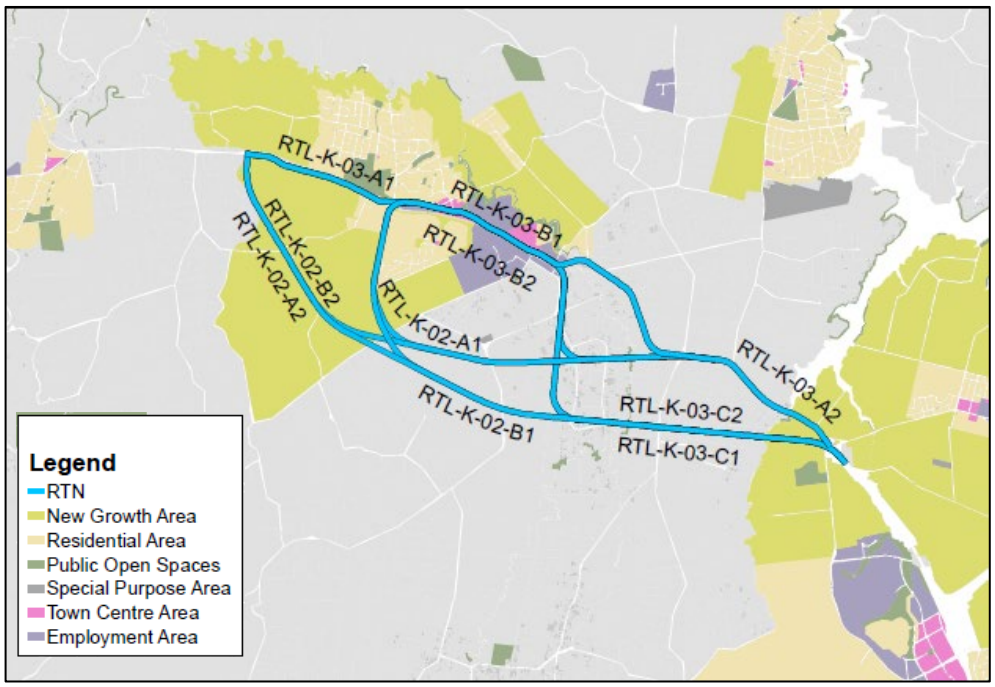
- Initial draft assessment of criteria by subject experts
- Pre-scoring workshop (challenge workshop) by subject experts
- Manawhenua hui to discuss experts scores and an opportunity to score Manawhenua criteria
- Project partner input, stakeholders and public feedback
- Recommendation on ISTN.

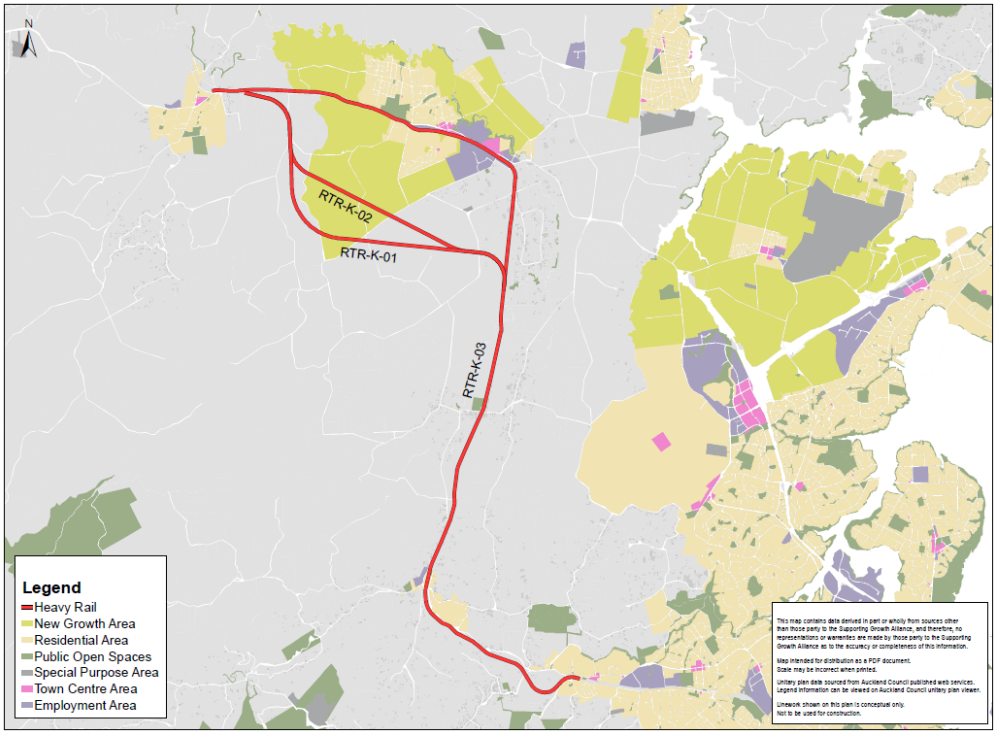
The MCA process was applied at the short list option assessment, however at a more detailed level. Transport outcomes were assessed by the Project Team transport planners using quantitative and qualitative evaluation against key performance indicators and measures. Technical specialists scoring the MCA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

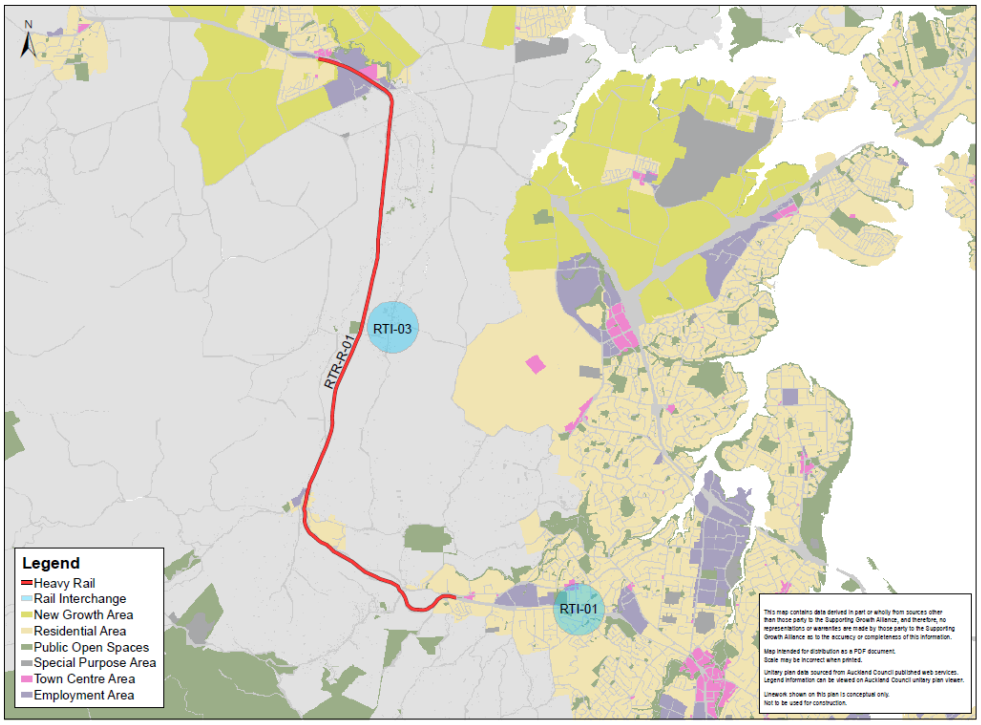
3.2.3 Recommendations

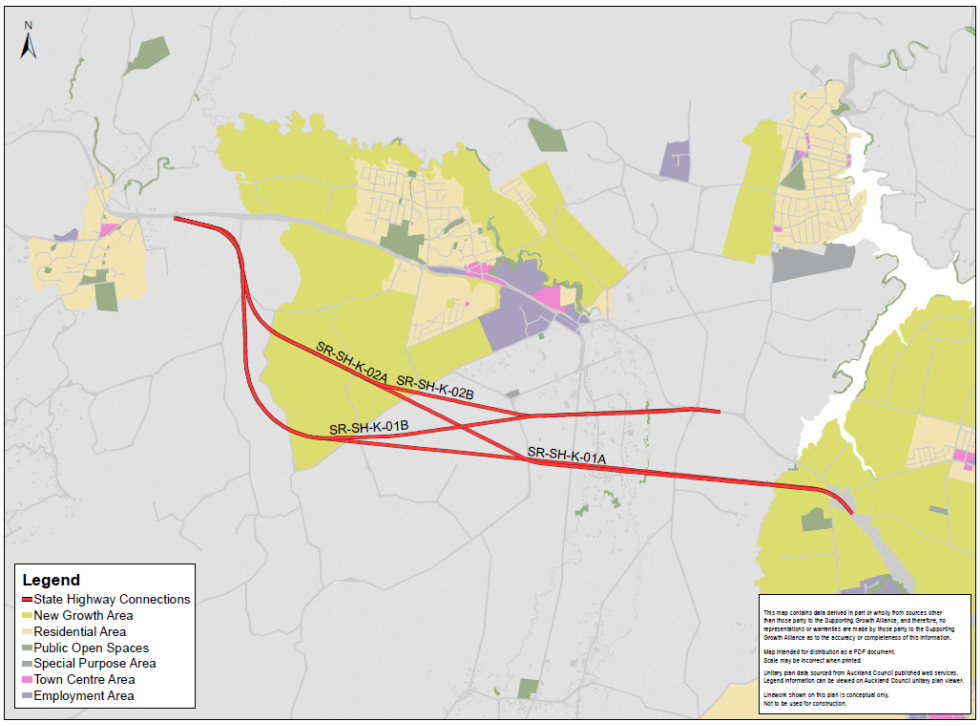
Table 3-3 provides an overview of the options assessed, recommendations and reasoning for identifying the preferred corridors and discarding options. The short list assessment resulted in options being taken forward in the ISTN identified in Section 3.3.

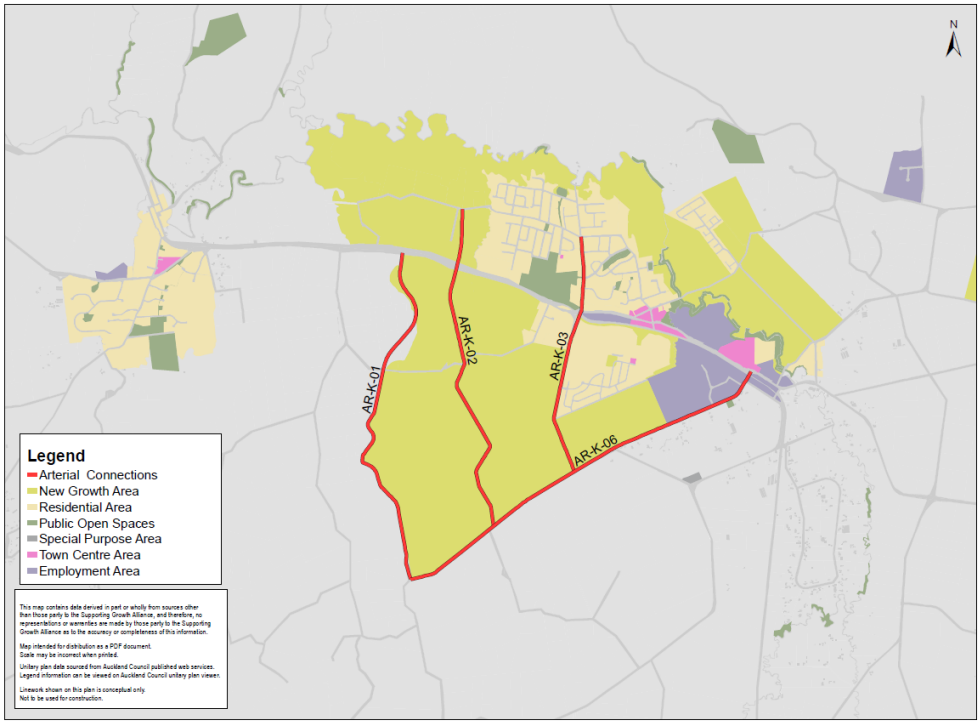
Table 3-3: Short list corridor assessment recommendations

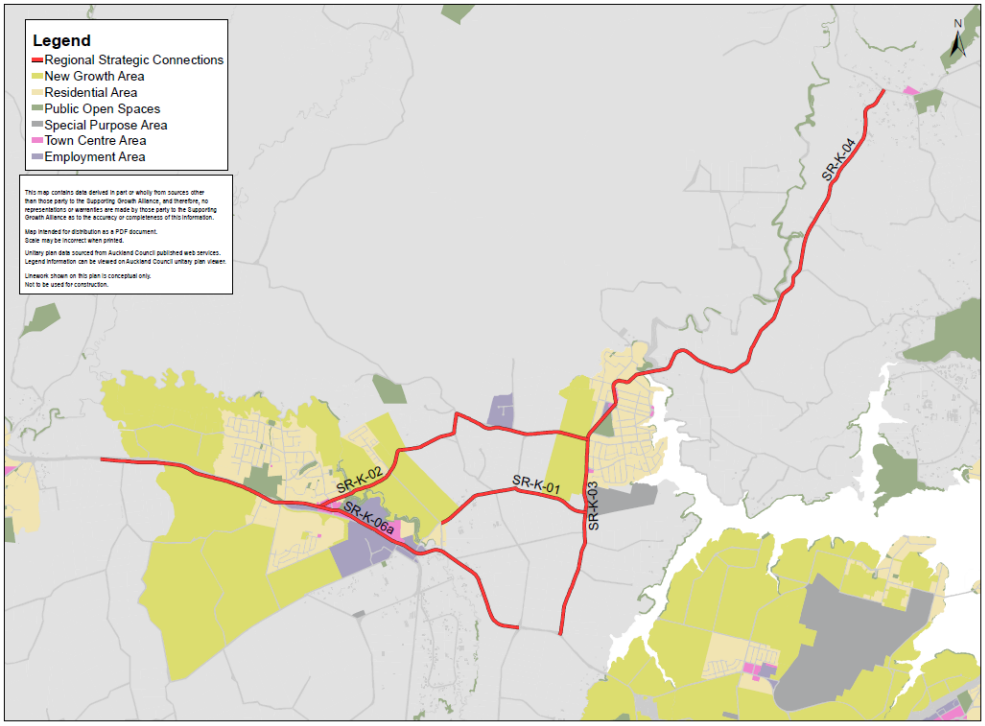
Options	Assessment Recommendation
Rapid Transit **Kumeū-Huapai**	
10 Options	**RTL-K-02: *RT through Kumeū-Huapai FUZ* variants, leave SH16 at** • RTL-K-02-A1: Taupaki Road to end at Kumeū-Huapai centre • RTL-K-02-A2: Taupaki Road to end west of Huapai RUB • RTL-K-02-B1: Brigham Creek to end centre of 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.

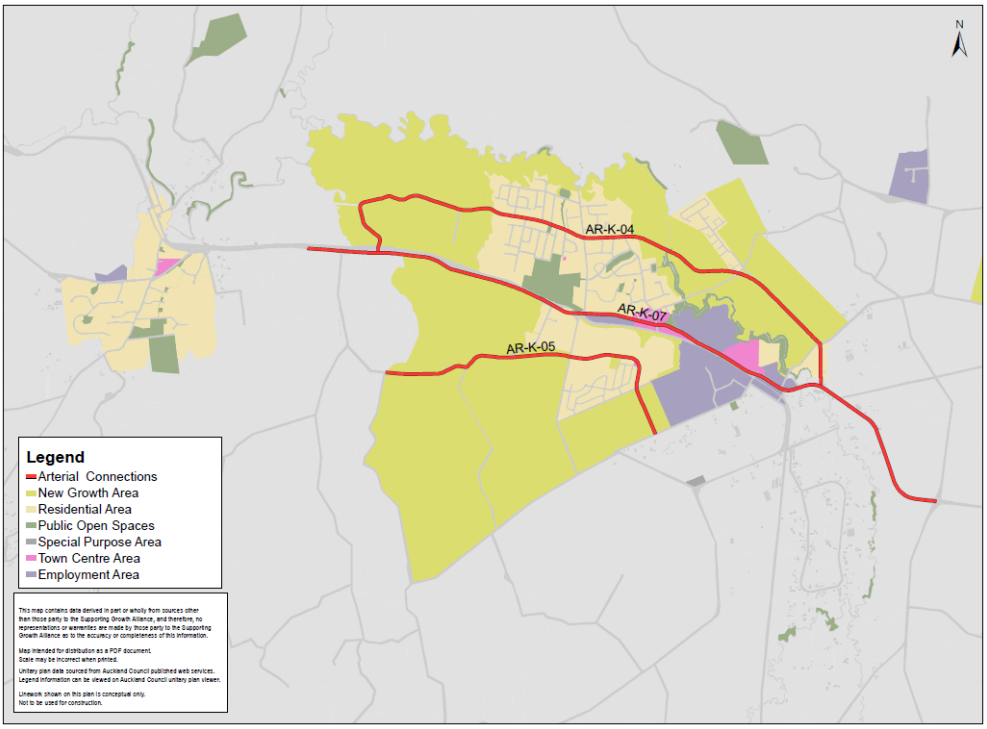
Options	Assessment Recommendation
Heavy Rail **Kumeū-Huapai** **(previously grouped under *Kumeū-Huapai Rapid Transit* split at short list)**	
3 Options	• RTR-K-01: RT heavy rail through southern bypass • RTR-K-02: RT heavy rail through the southern FUZ • RTR-K-03: RT heavy rail on the existing rail 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.

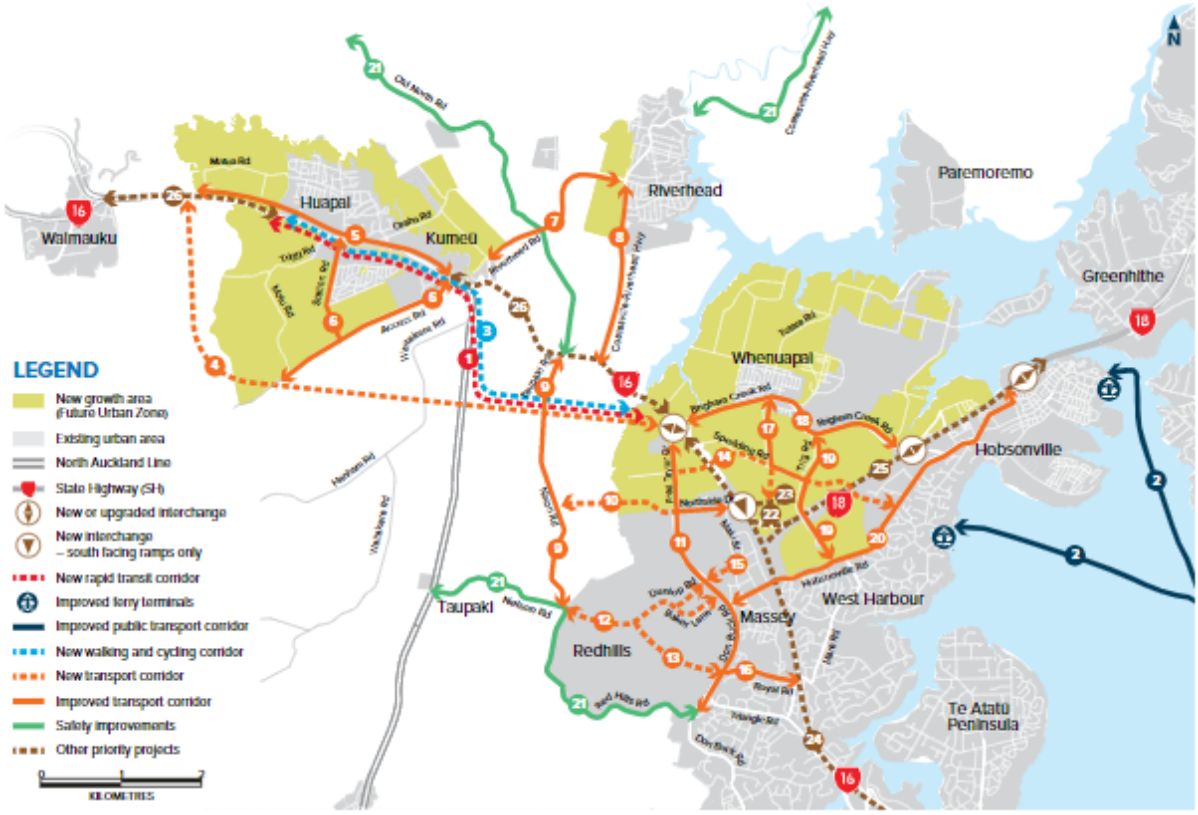
Options	Assessment Recommendation
North South Arterial Routes **Kumeū-Huapai**	
4 Options	• AR-K-01: Upgrade Puke Road • AR-K-02: Upgrade Motu Road to the northern Huapai catchment • AR-K-03: Upgrade of Station Road and Tapu Road • AR-K-06: Upgrade of Access Road.
Options Progressed	**2 Options: AR-K-03** 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.



NEW RAPID TRANSIT CORRIDOR

1. Rapid Transit corridor extending to Kumeu-Huapai*

IMPROVED PUBLIC TRANSPORT CORRIDOR

2. Improved ferry interchange facilities and services at existing terminals

NEW WALKING AND CYCLING CORRIDOR

3. Strategic walking and cycling corridor connecting Whenuapai to Kumeu and Huapai

NEW OR IMPROVED TRANSPORT CORRIDOR

4. Alternative State Highway corridor
5. Upgrade SH16 within Kumeu and Huapai
6. Upgrade Access Road and Station Road**
7. Upgrade Riverhead Road
8. Upgrade Coatesville-Riverhead Highway between SH16 and Riverhead
9. Upgrade Taupaki Road and Nixon Road
10. Upgrade and extension of Northside Drive extension from Nixon Road to SH16
11. Upgrade Fred Taylor Drive and Don Buck Road to Red Hills Road
12. New east west connections from Nelson Road to Fred Taylor Drive
13. New north south connection from the east-west connection (12) to Royal Road
14. Upgrade and extension of Spedding Road from Fred Taylor Drive to Hobsonville Road, including SH16 and SH18 crossings
15. Dunlop Road extension from Fred Taylor Drive to Maki Street
16. Upgrade Royal Road from Don Buck Road to SH16
17. Upgrade and extension of Mamari Road from Northside Drive to Brigham Creek Road
18. Upgrade Brigham Creek Road
19. Upgrade Trig Road from Brigham Creek Road to Hobsonville Road
20. Upgrade Hobsonville Road and Fred Taylor Drive between SH18 and Don Buck Road

SAFETY IMPROVEMENTS

21. Safety improvements on Old North Road, Coatesville-Riverhead Highway north of Riverhead township, Nelson Road and Red Hills Road

OTHER PRIORITY PROJECTS

22. Direct State Highway connection between SH16-SH18, new shared paths and interchange upgrades
23. Northside Drive East
24. City Centre to Northwest Rapid Transit*
25. Upper Harbour Rapid Transit (Westgate-Hobsonville)
26. Safe Network Programme – SH16 Brigham Creek to Waimauku

Final decision subject to City Centre to Northwest Rapid Transit business case

**Intersection improvements at Access Road/SH16 and Station Road/SH16 to facilitate Huapai Triangle – Special Housing Area development*

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.

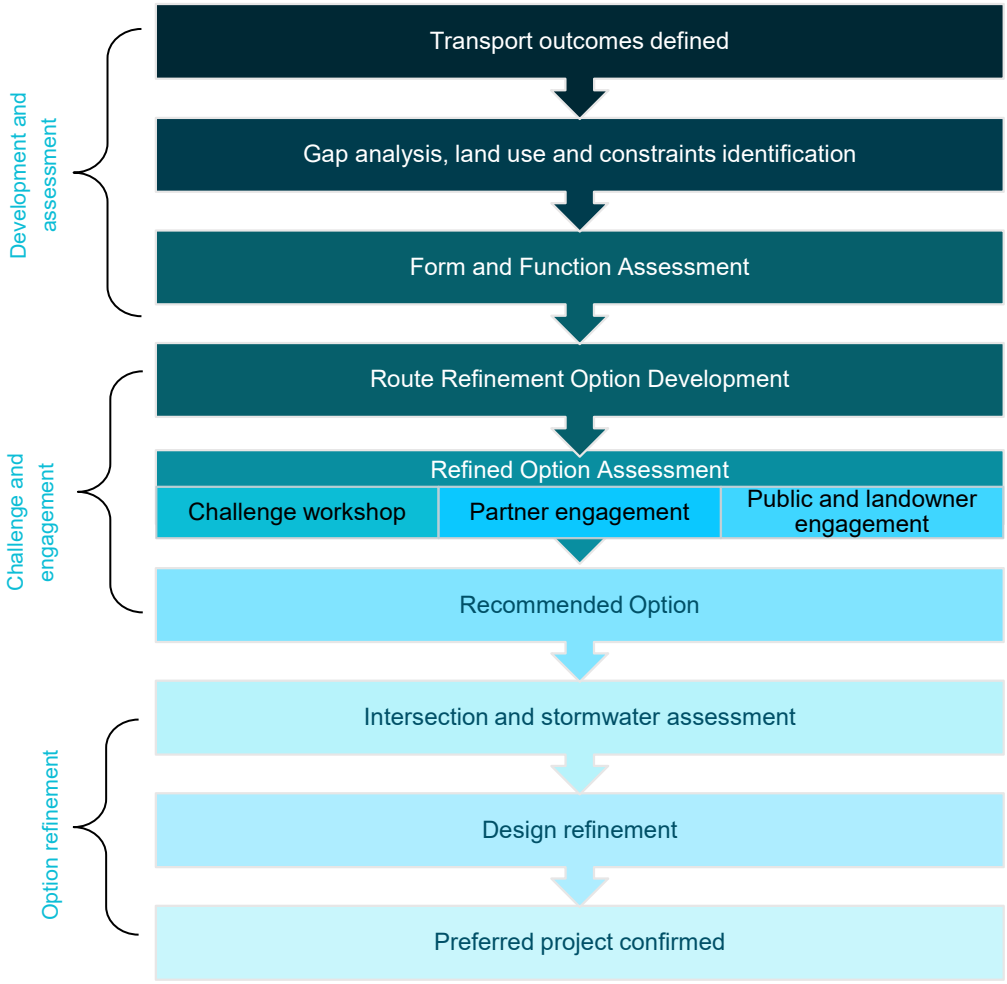


Figure 4-1: Route refinement process following corridor identification

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.

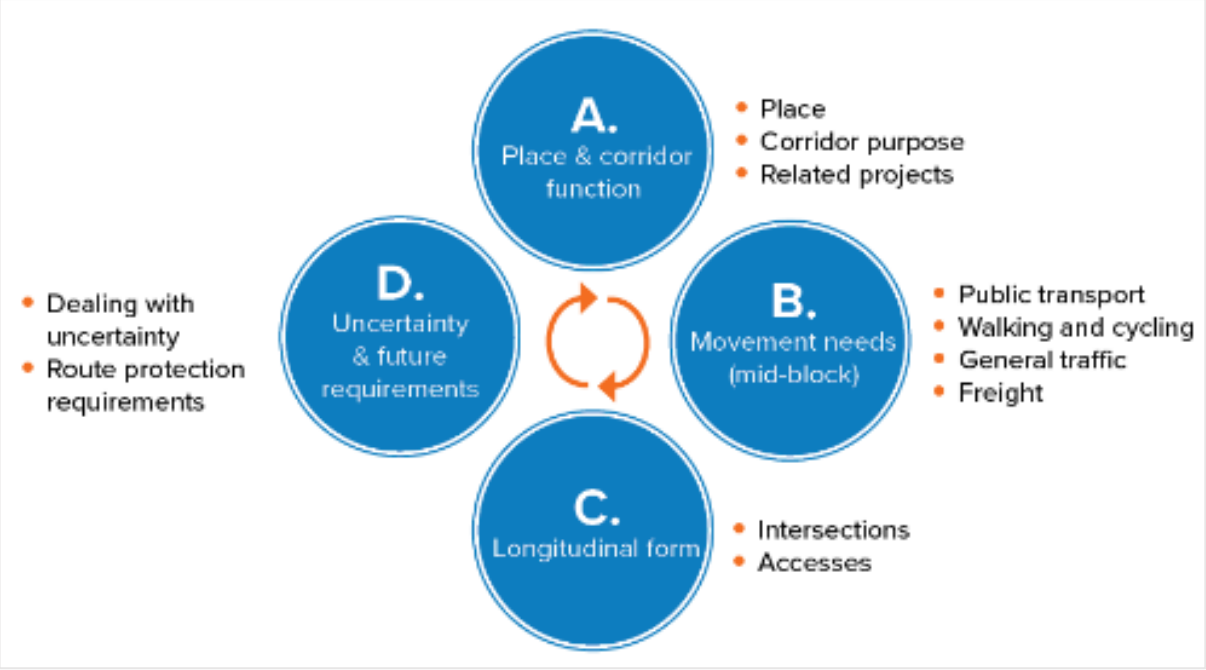


Figure 4-2: Corridor Assessment Principles, from A to D.

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.

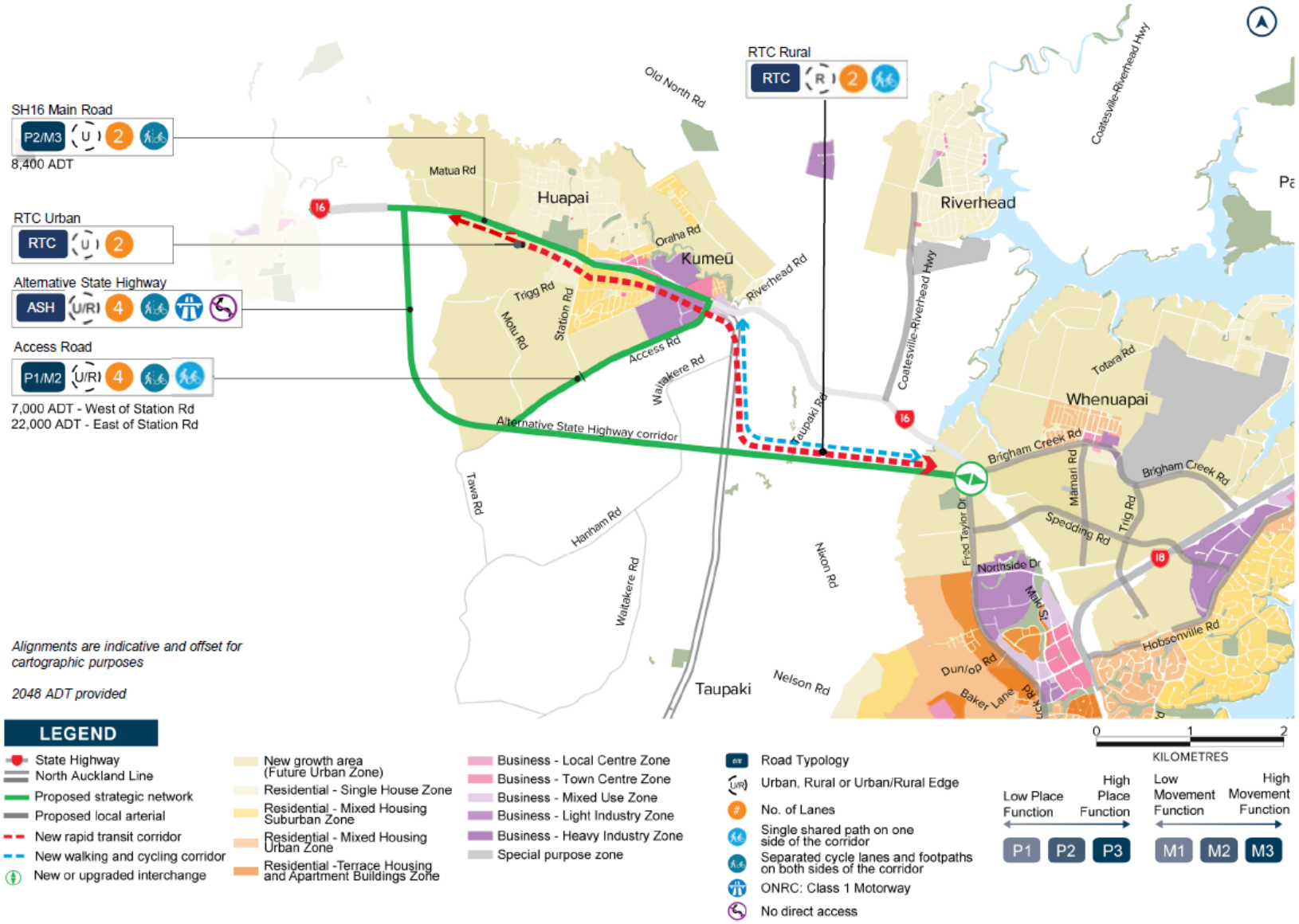


Figure 4-3: NW Strategic Package projects – Form and Function

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.

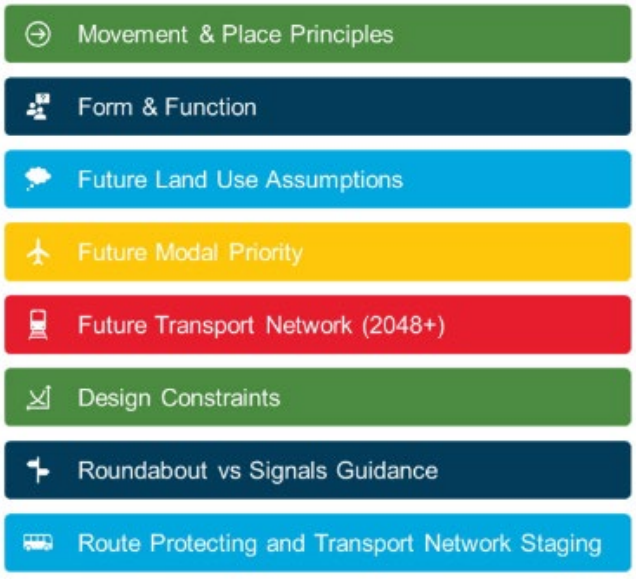


Figure 4-4: Intersection design considerations

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.

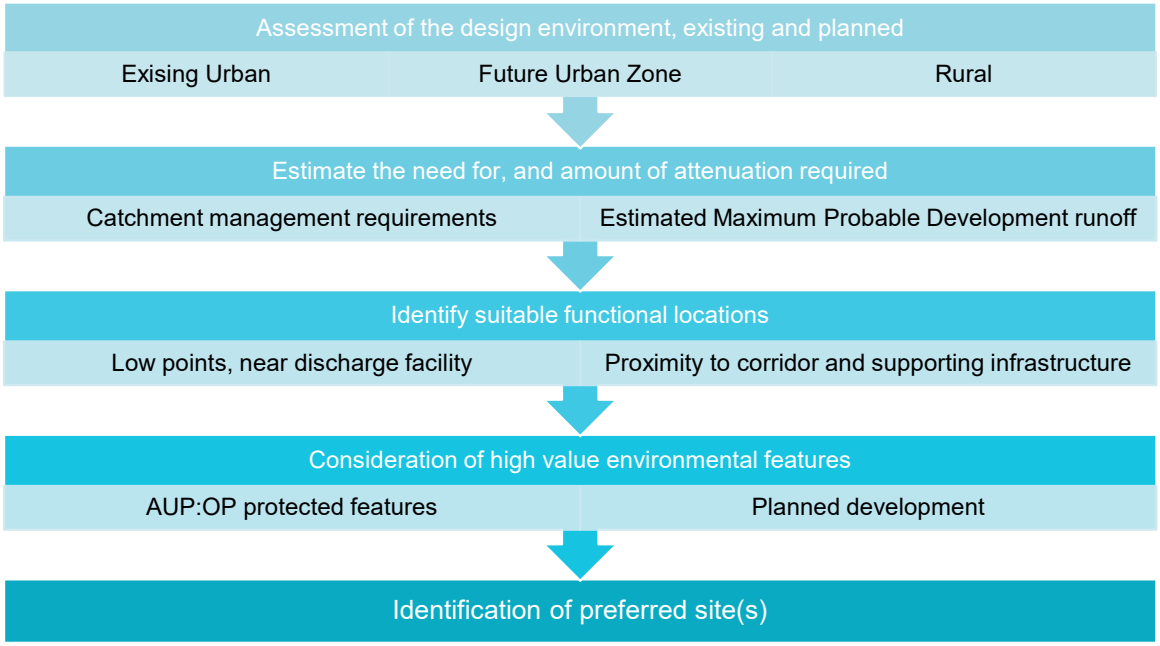


Figure 4-5: Stormwater infrastructure design and location approach

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.

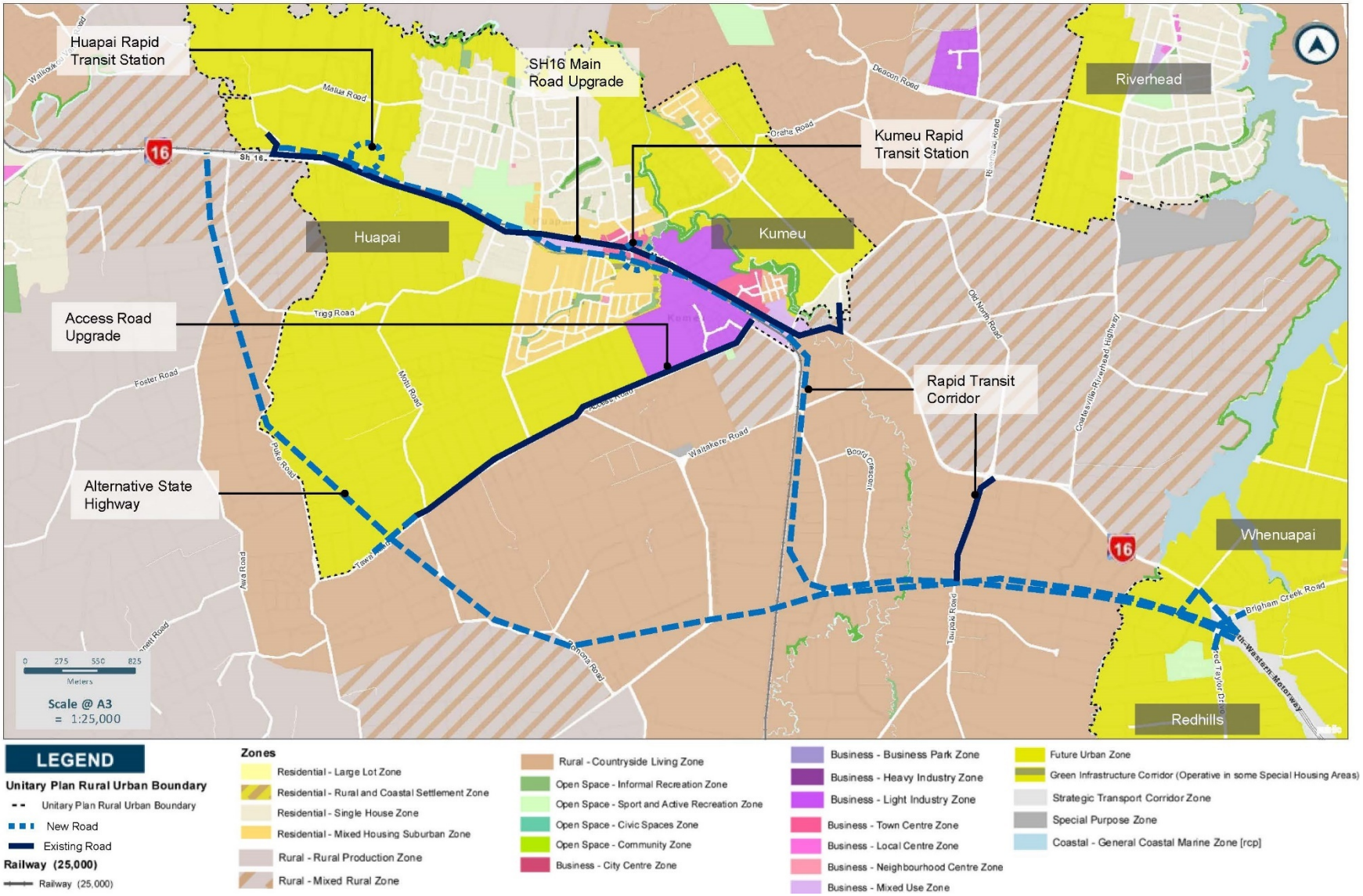


Figure 5-1: Indicative Transport Network – North West Strategic

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.

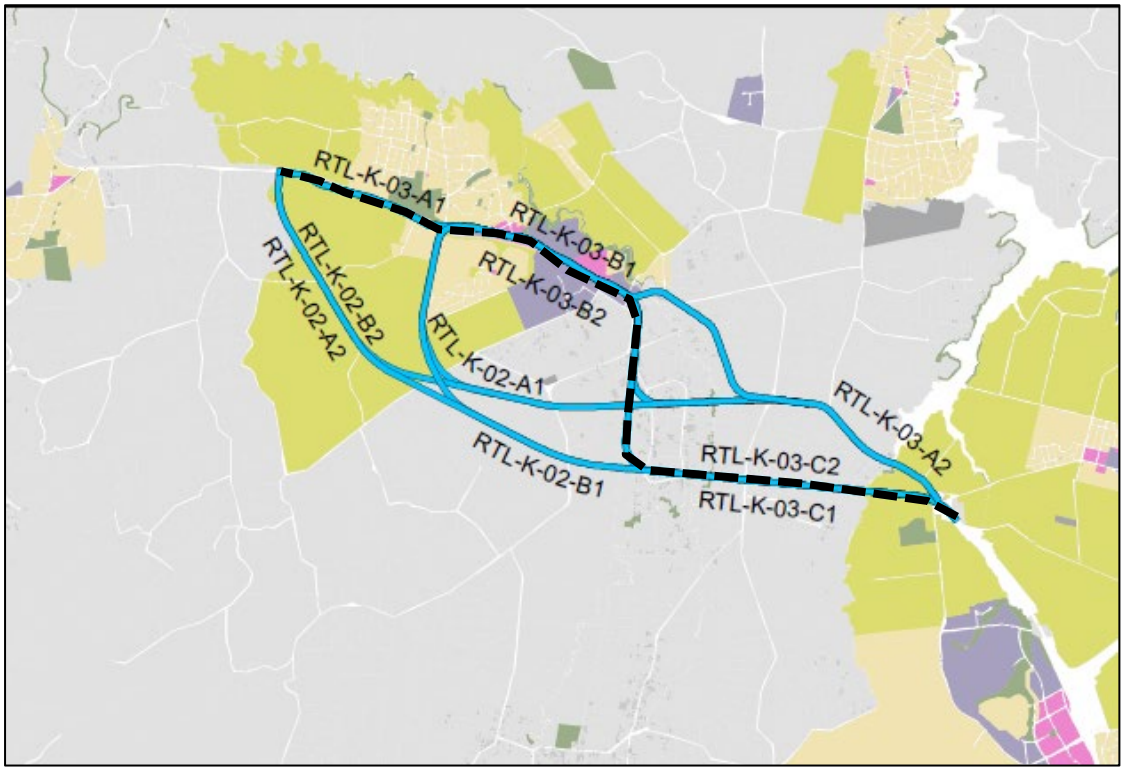


Figure 6-1: Rapid Transit Corridor IBC Option RTL-K-03-C1

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

RTC and SH16 interface

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.

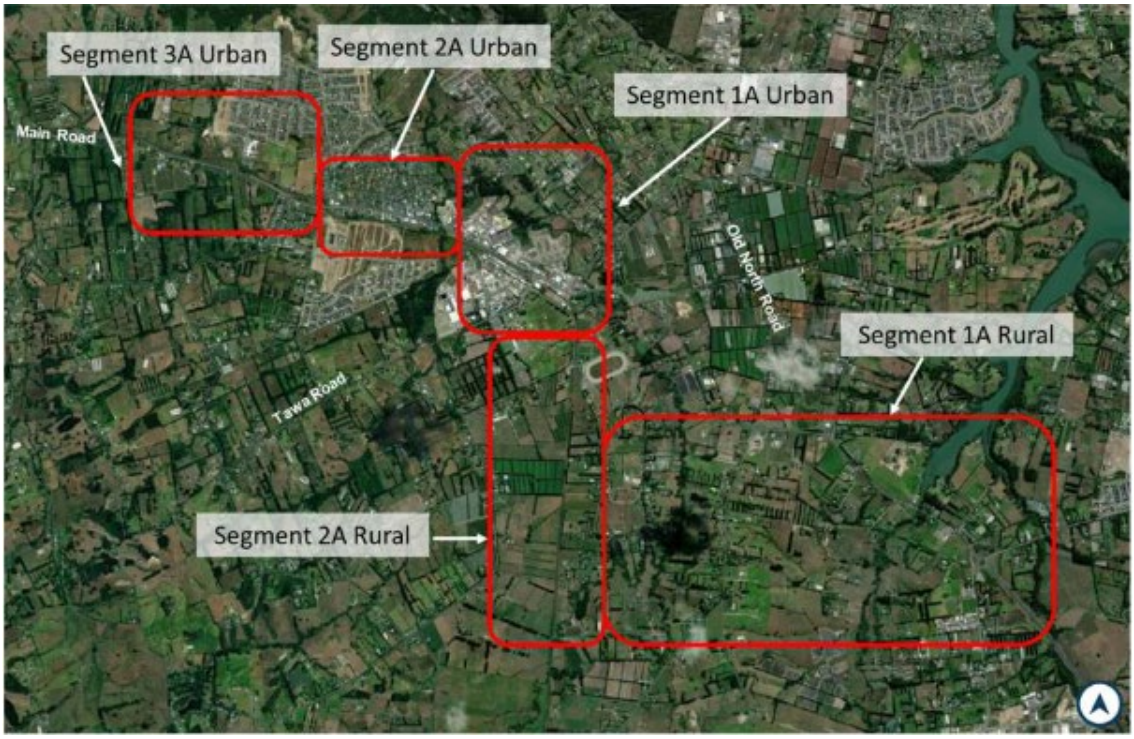


Figure 6-4: Rapid Transit Corridor segments for route refinement

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

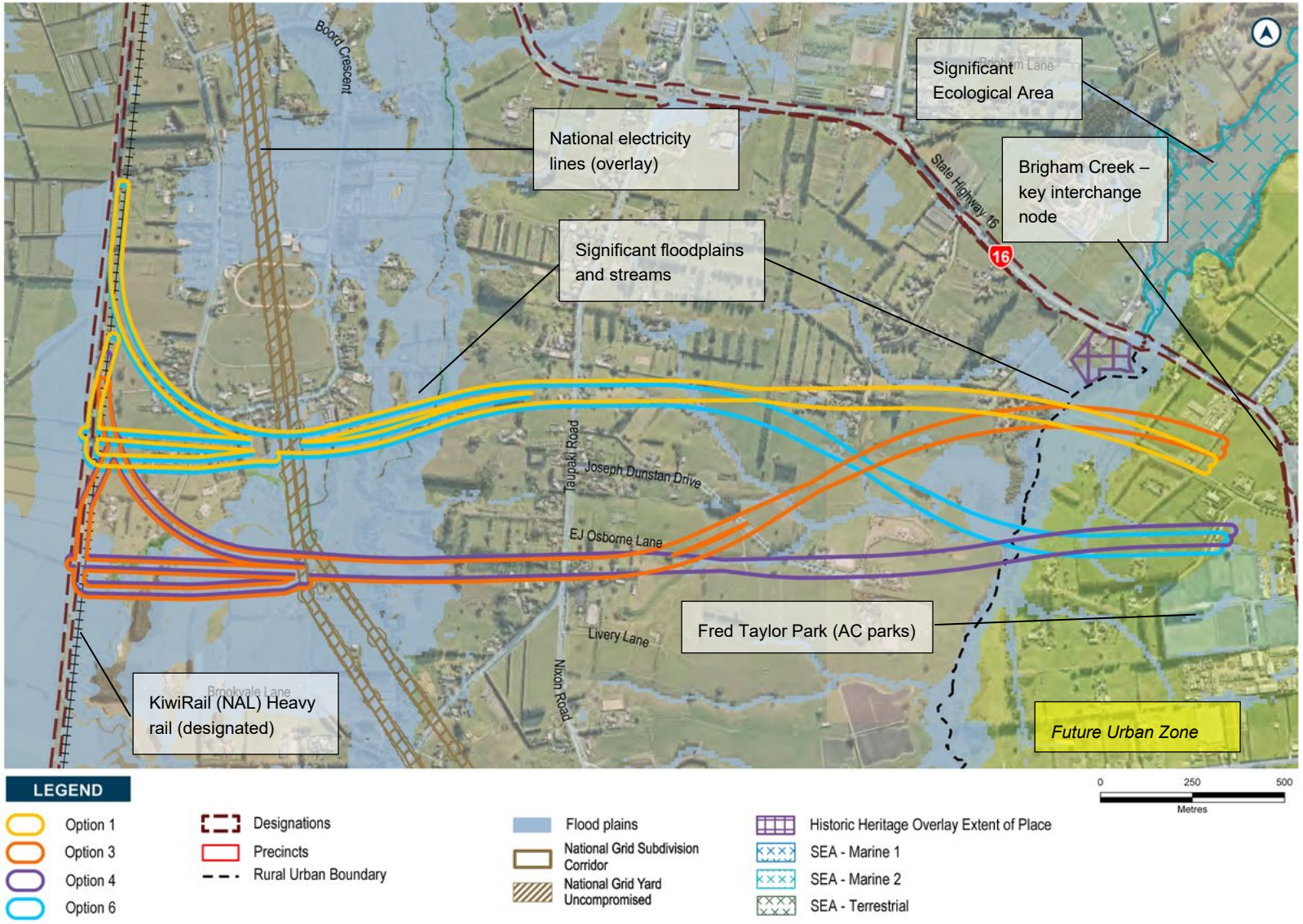


Figure 6-5: RTC Rural 1A Options and identified constraints

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

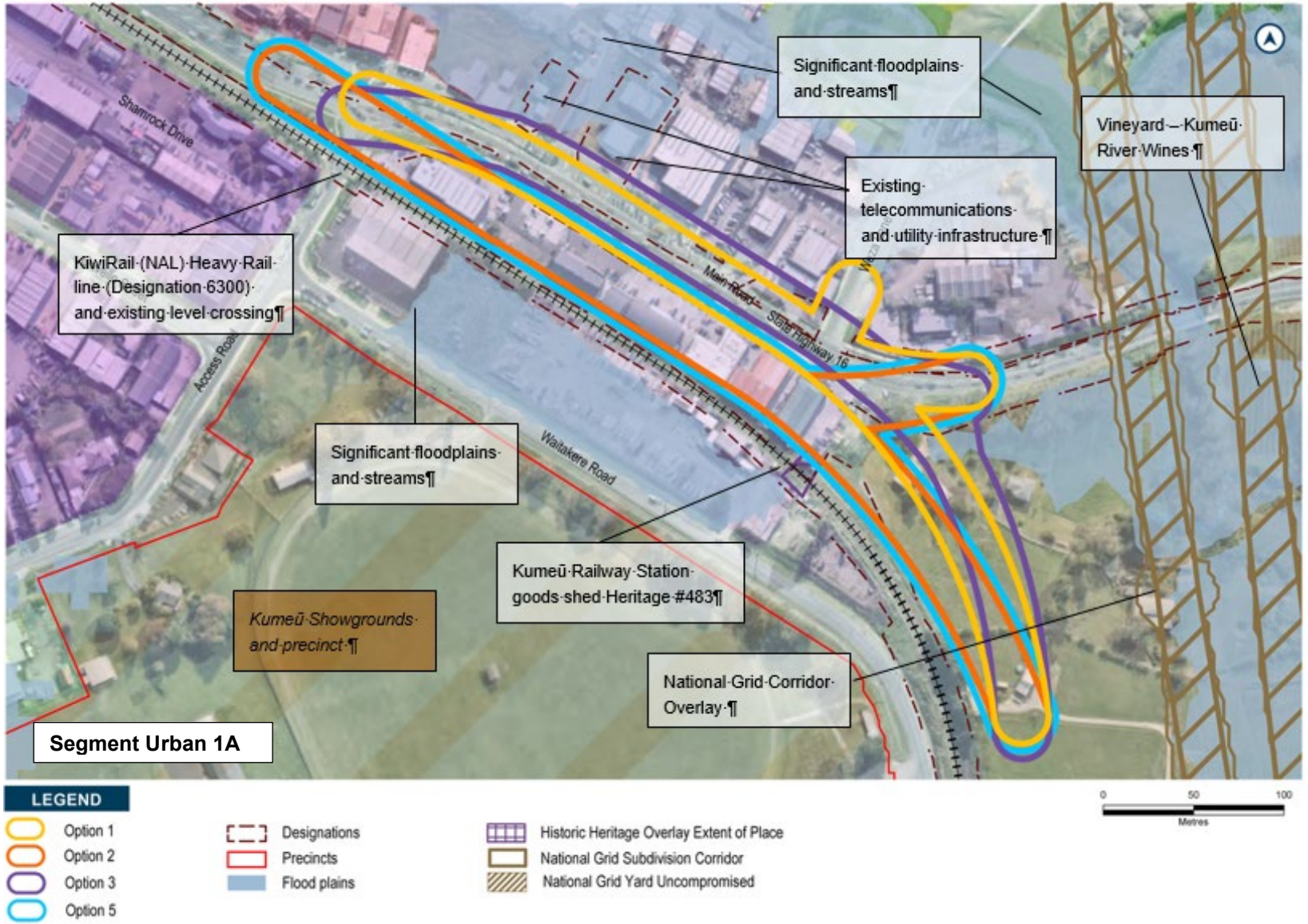


Figure 6-6: RTC Segment Urban 1A Options and identified constraints

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

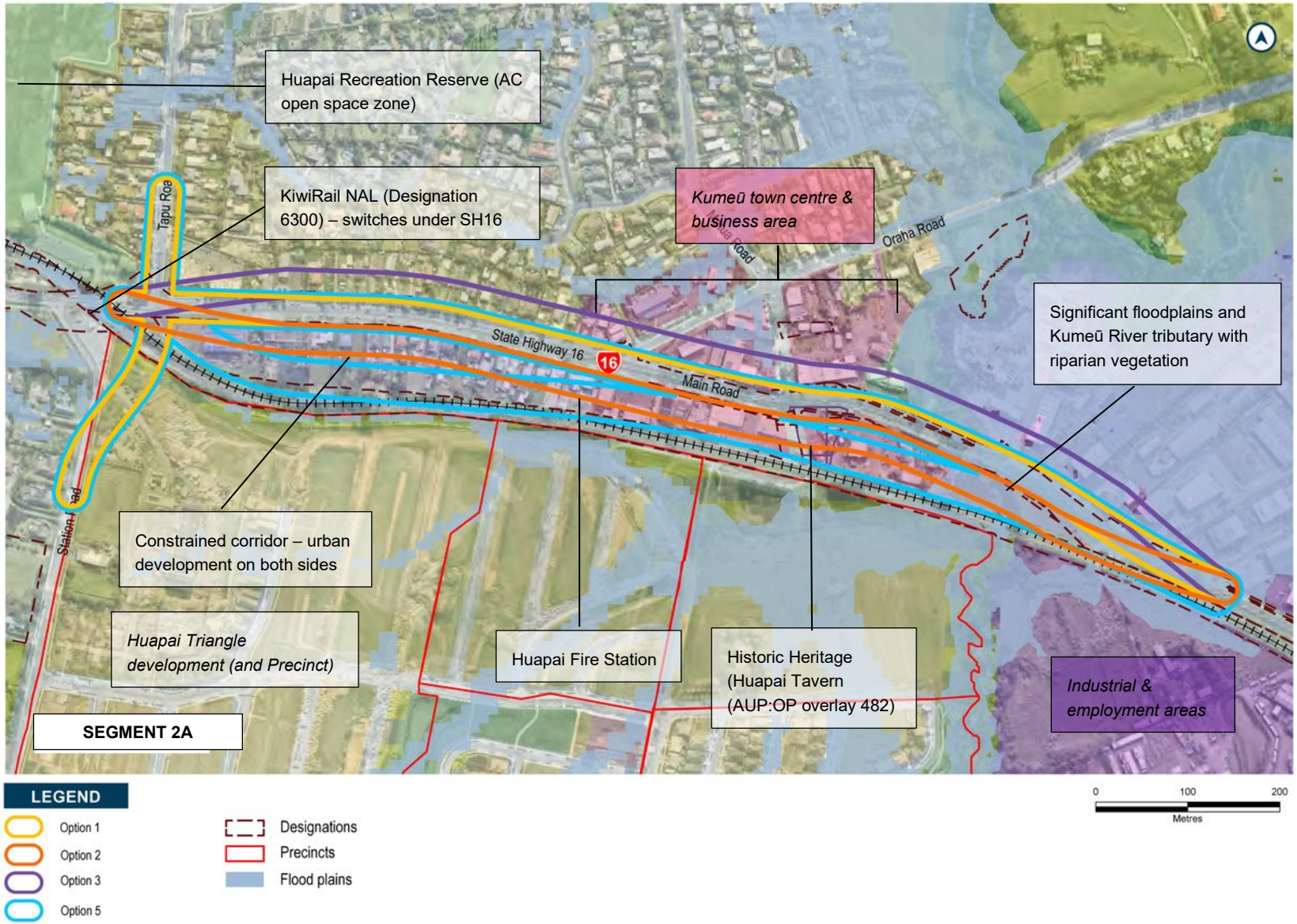


Figure 6-7: RTC Urban 2A Options and identified constraints

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.

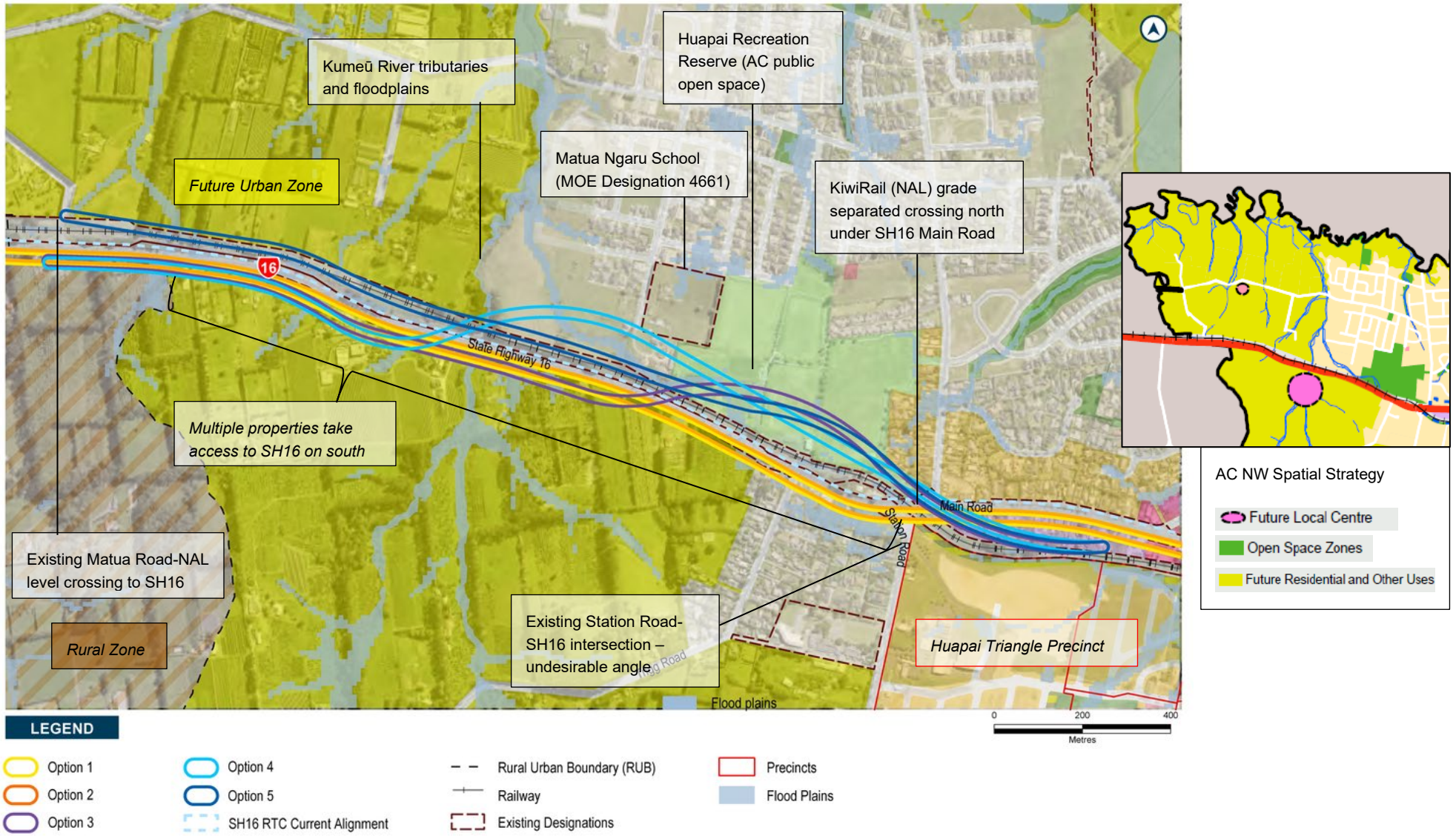


Figure 6-8: Segment 3A Urban Options and identified constraints

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.

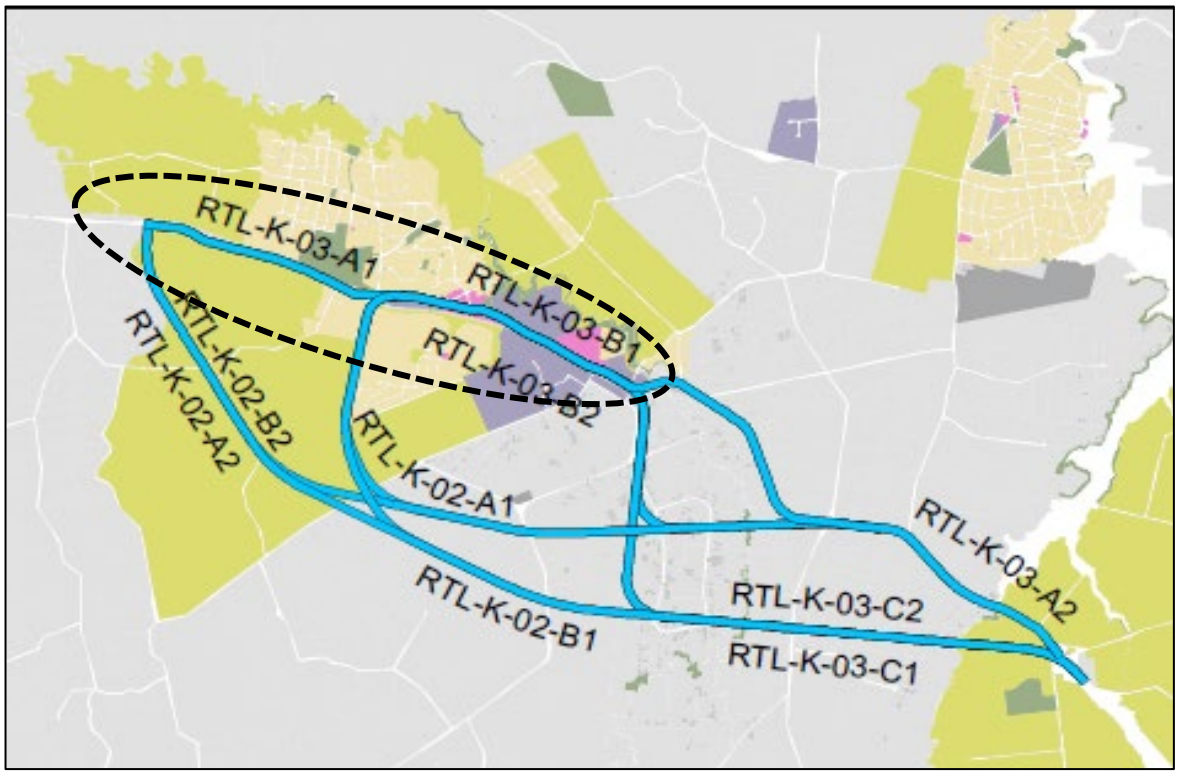


Figure 7-1: Rapid transit stations study area, alongside preferred RTC alignment

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.

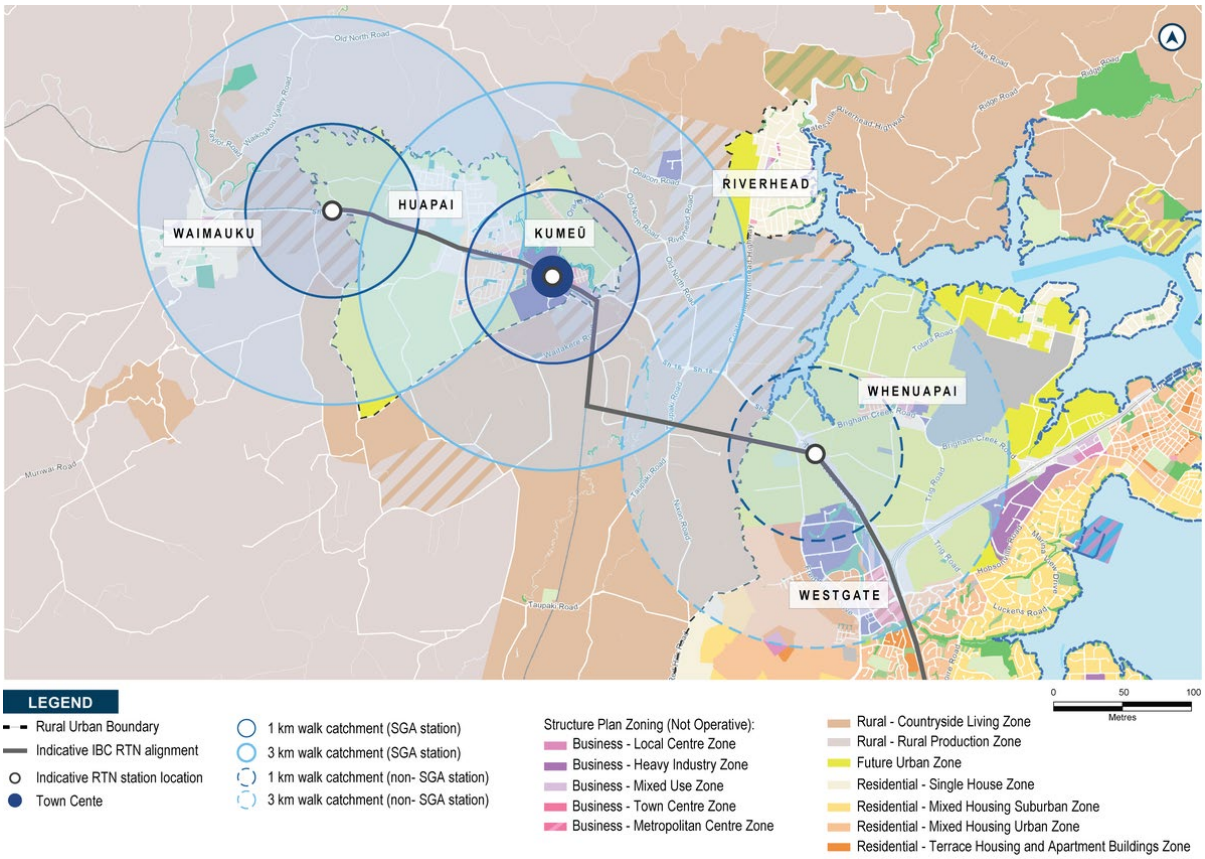


Figure 7-2: Indicative active modes and walk catchment (Two Station Scenario)

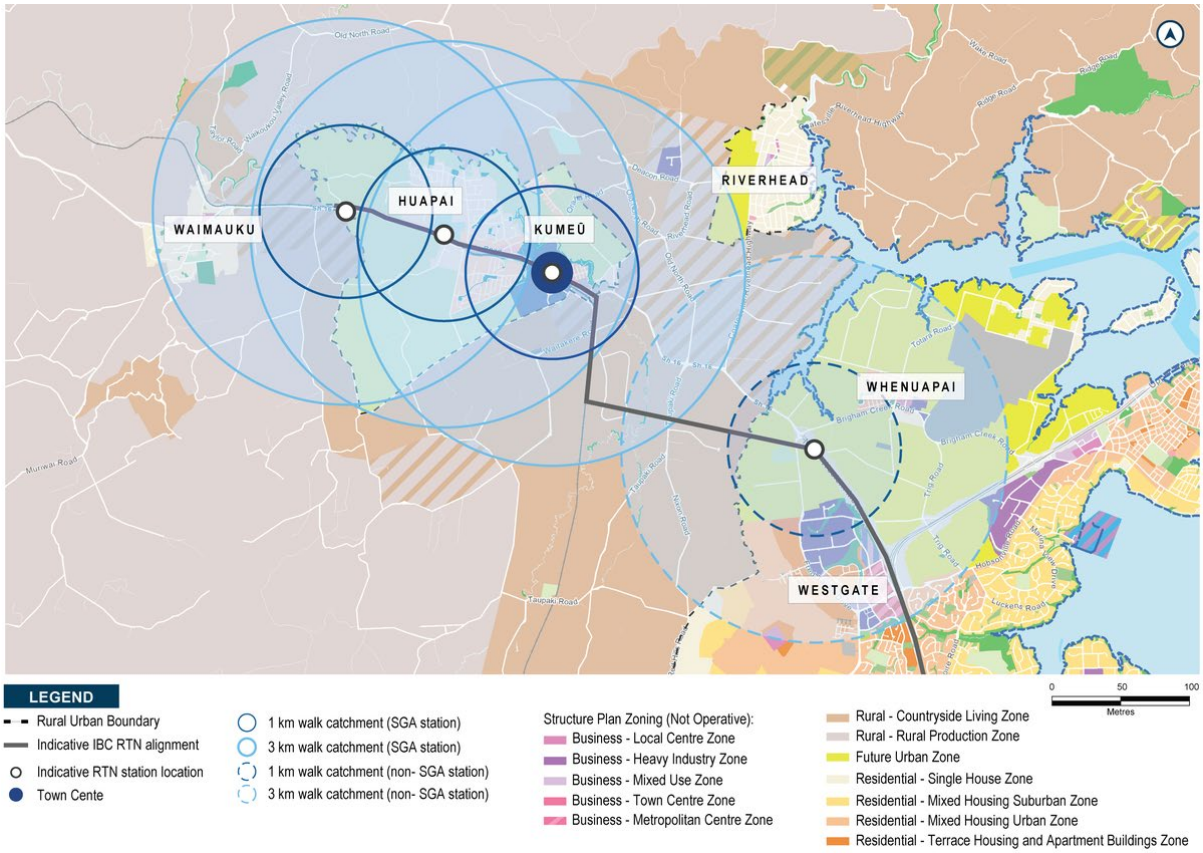


Figure 7-3: Indicative active mode and walk catchment (Three Station Scenario)

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.

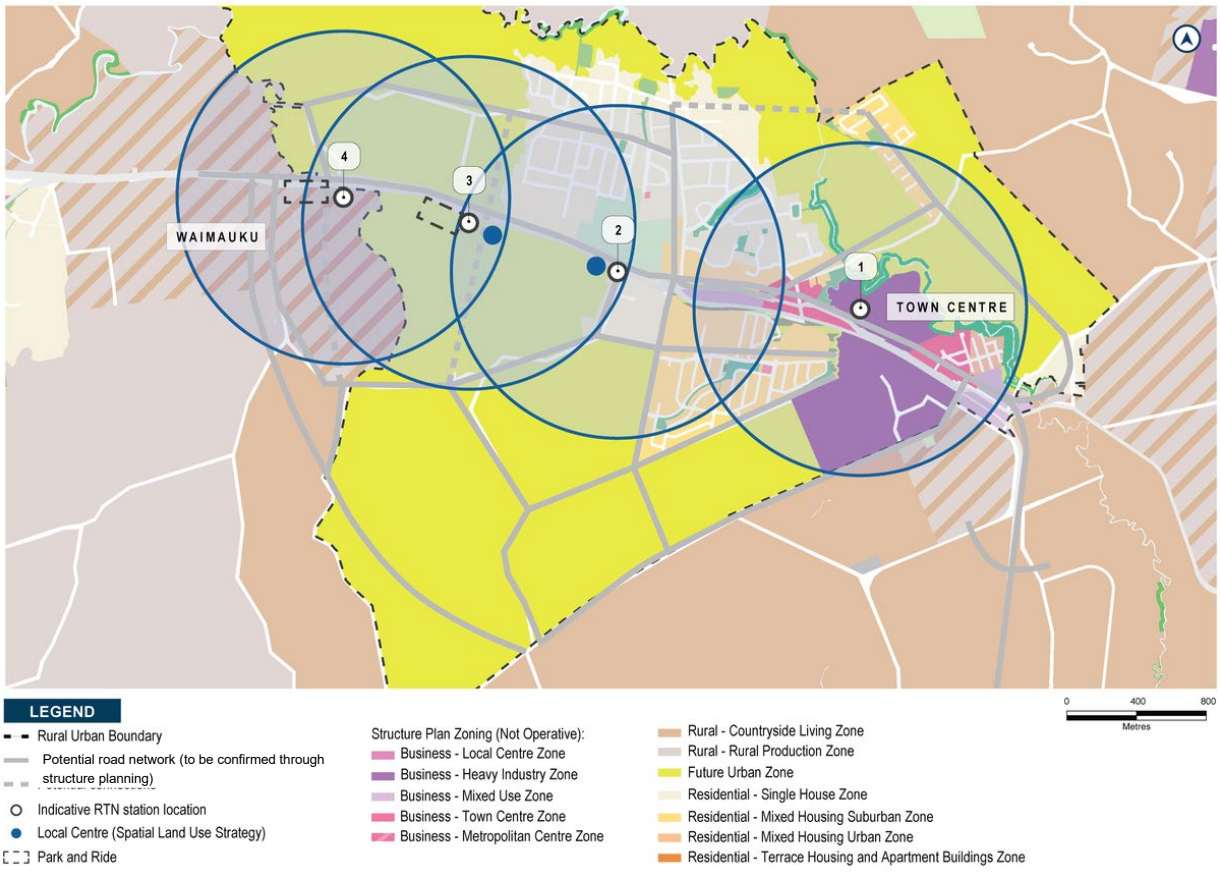


Figure 7-4: Potential station location options

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:

Town Centre (Kumeū) Station

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.

End of line (Huapai) Station

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

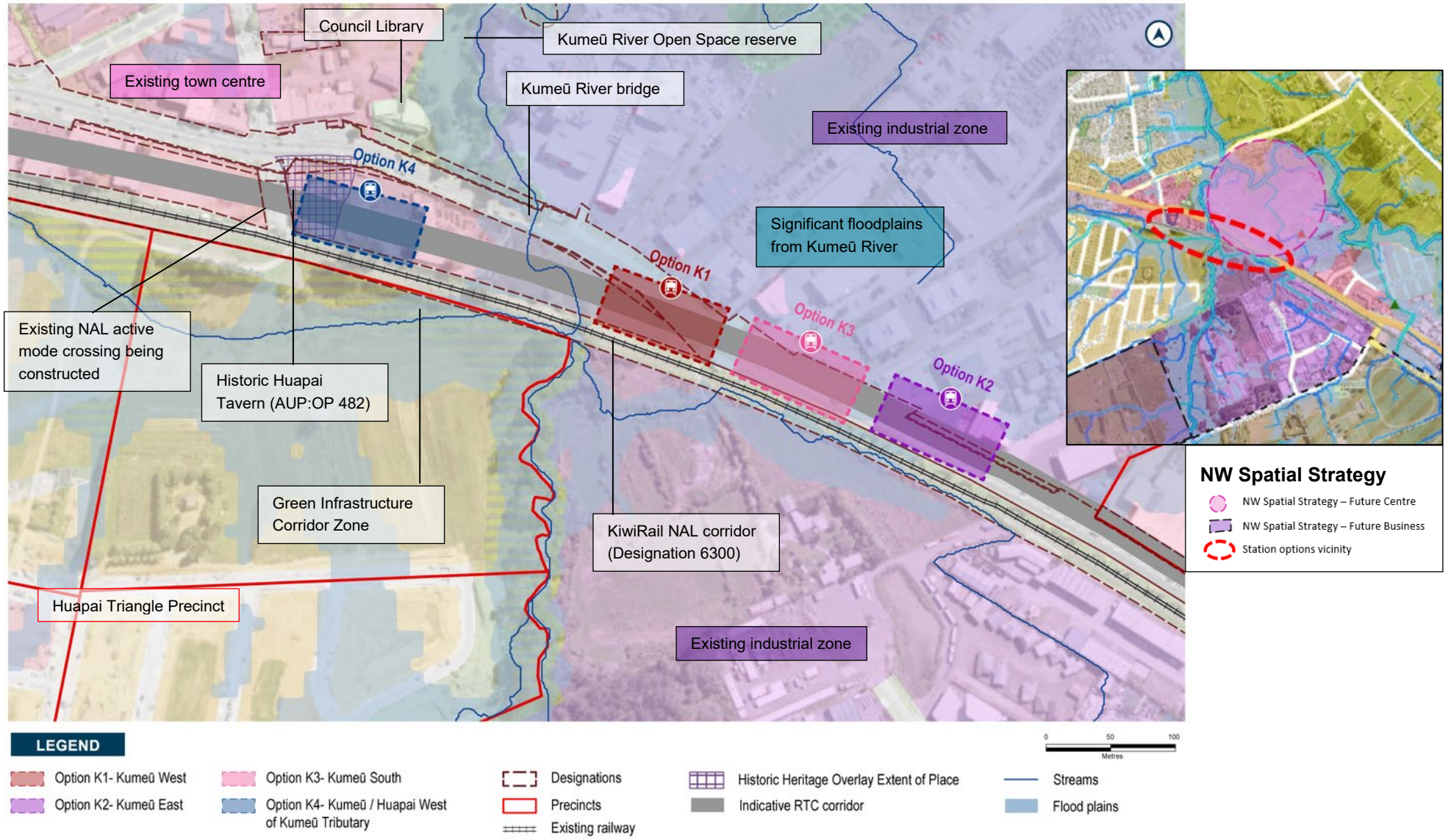


Figure 7-5: Town Centre (Kumeū) Station Location Options against landuse and constraints

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

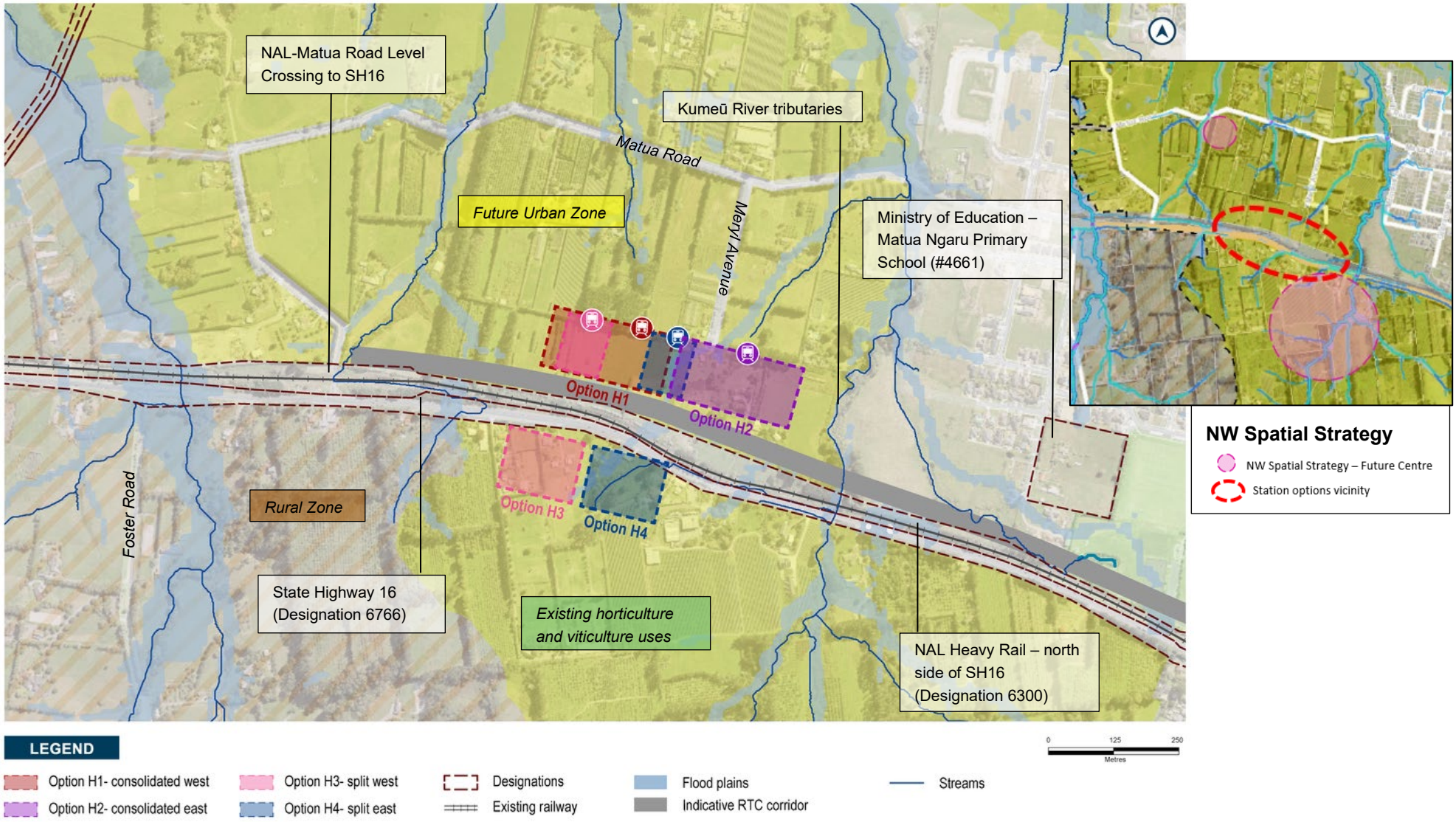


Figure 7-6: Huapai (End of Line) Station options and identified constraints

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.

Community Feedback

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)

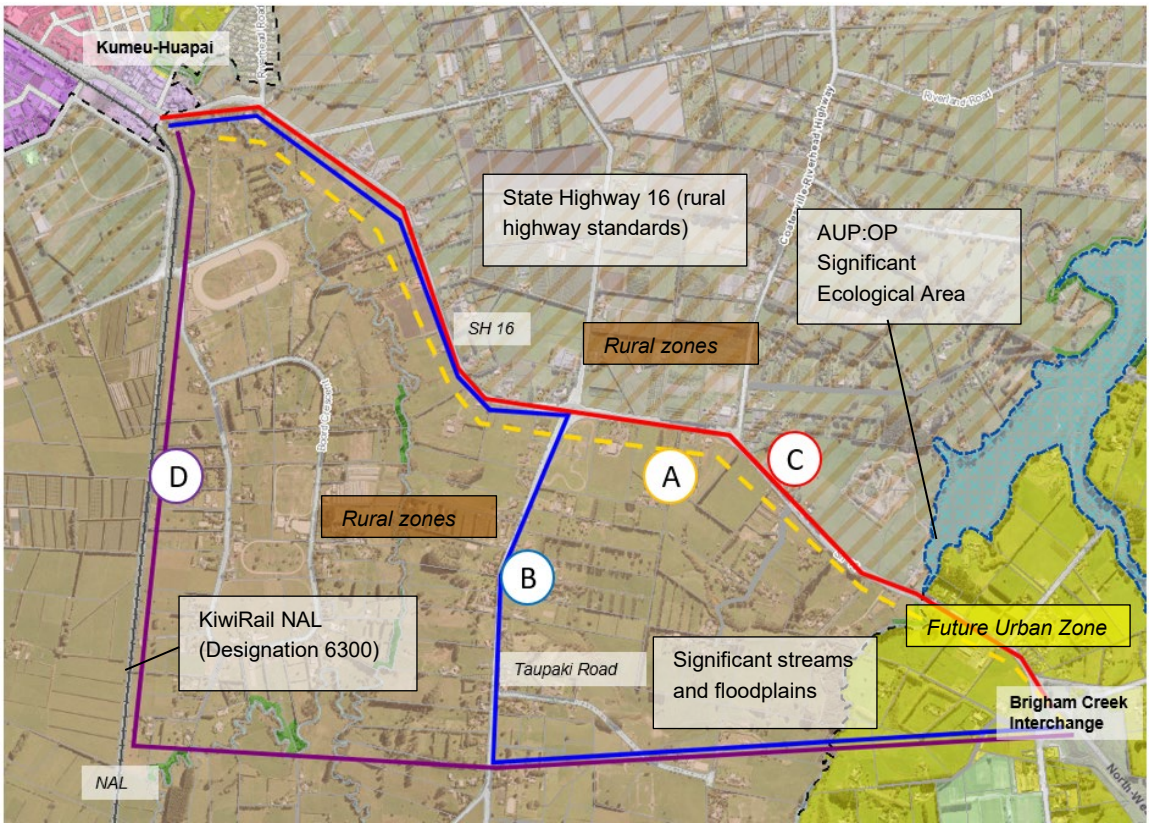


Figure 8-1: RAMC option alignments (indicative only) against constraints and landuse

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	Conditions – 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. Dimensions – 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). Conflicts – 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).

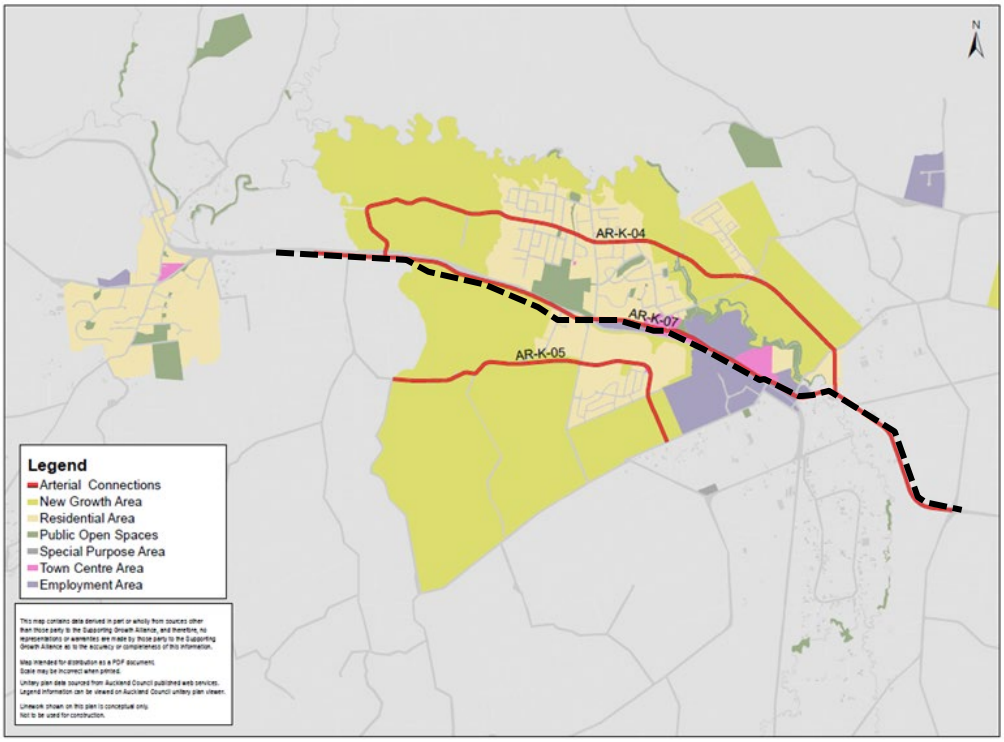


Figure 9-1: SH16 Main Road IBC Option SR-K-06A / AR-K-07

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.

RTC and SH16 interface

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.

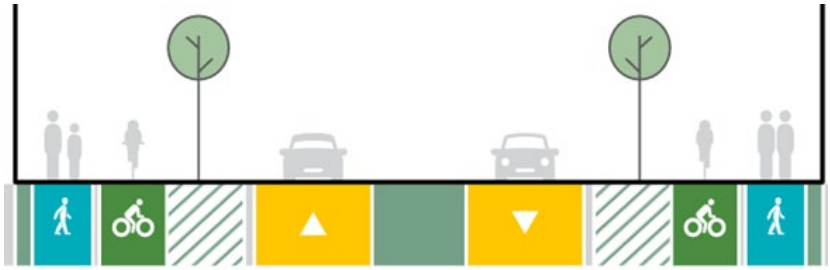


Figure 9-3: CFAF outcome SH16 Main Road only 24m (decoupled from RTC cross section)

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

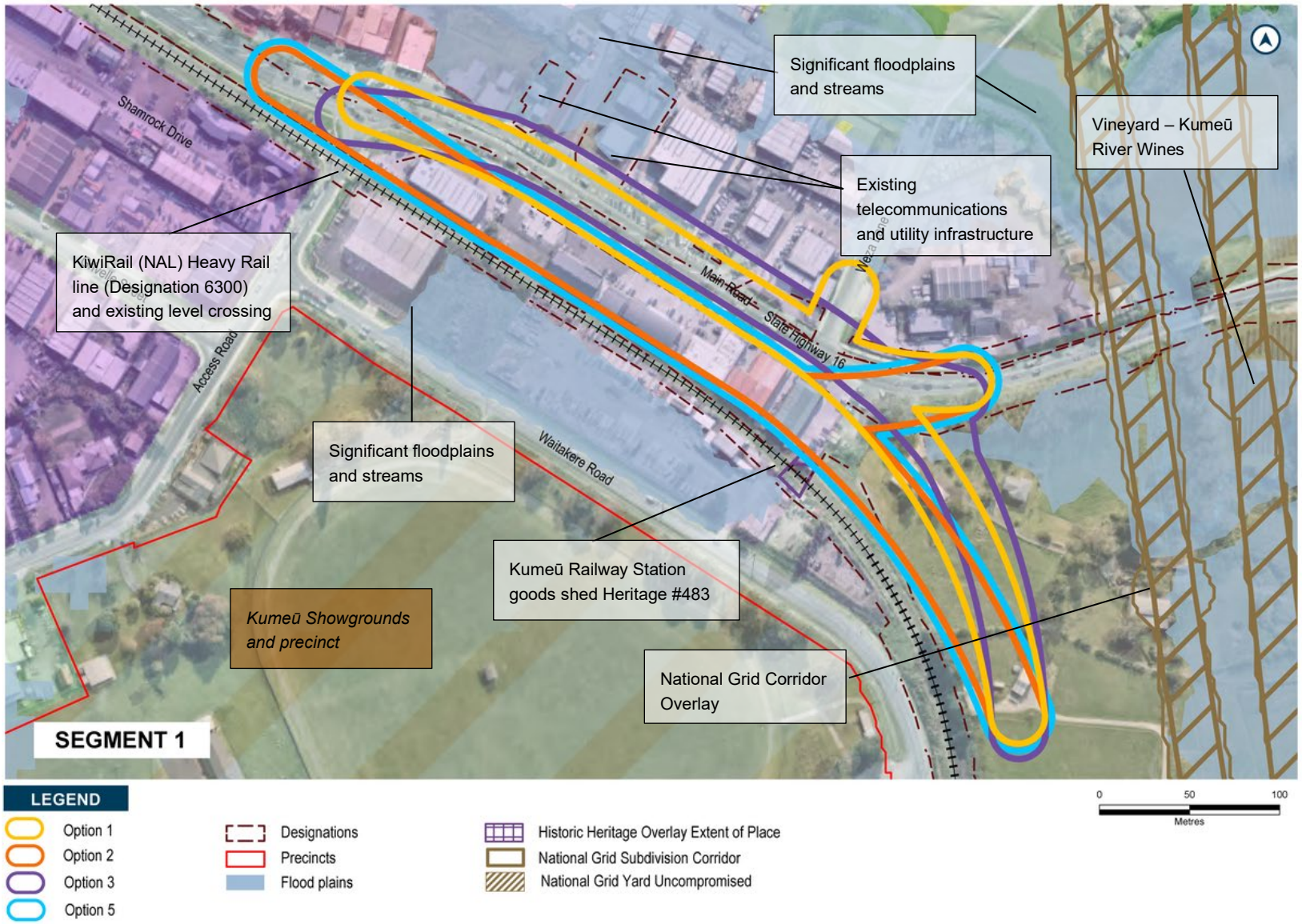


Figure 9-5 : SH16 Main Road Segment 1 Options and identified constraints (note Option 5 -decoupled is 38m vs Option 2 (30m wide)

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

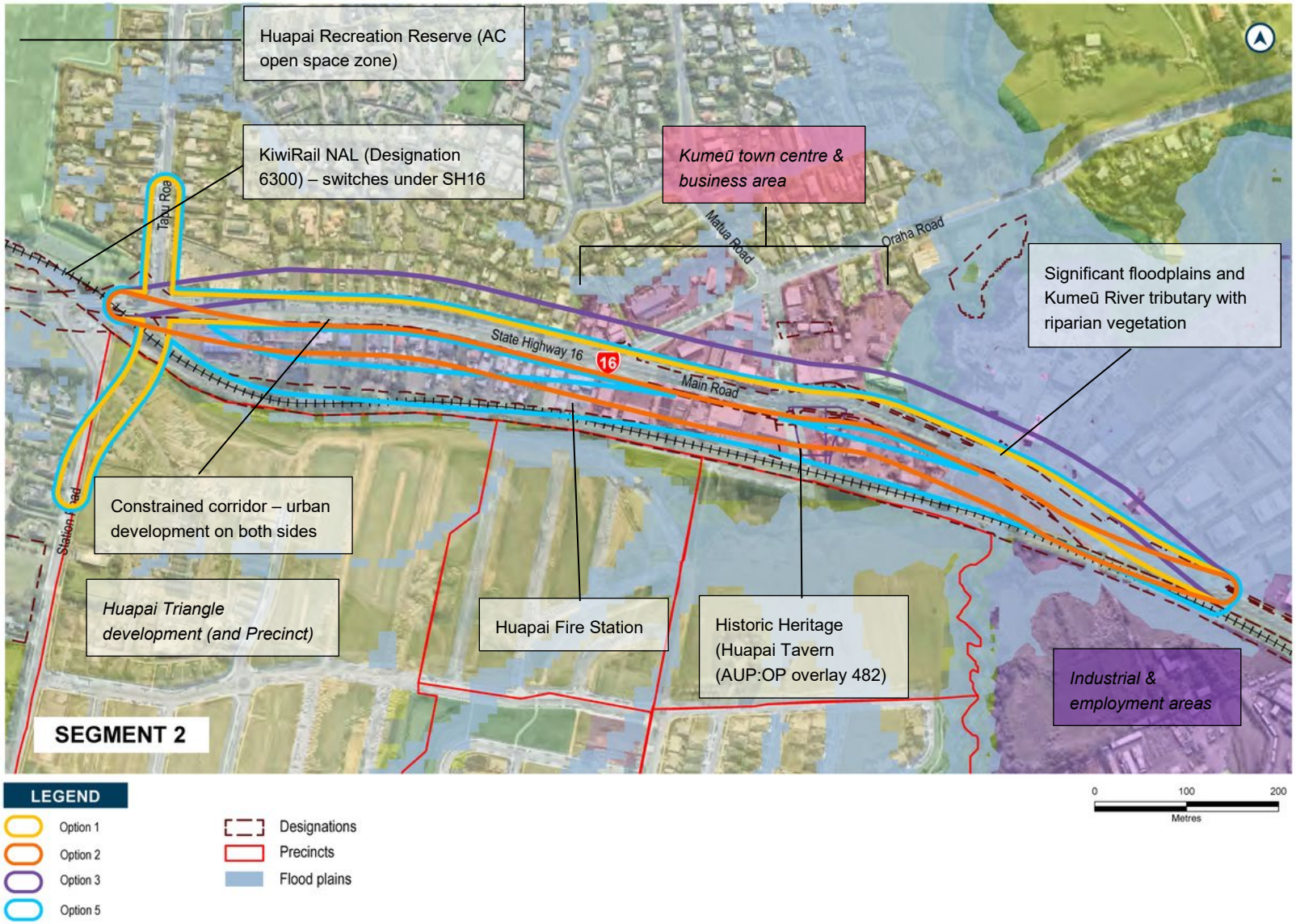


Figure 9-6 Segment 2 SH16 Main Road Options and constraints

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.
	Urban Design: 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.
	Land Requirement: 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.
	Human Health and Wellbeing: 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	Landscape and Visual: 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

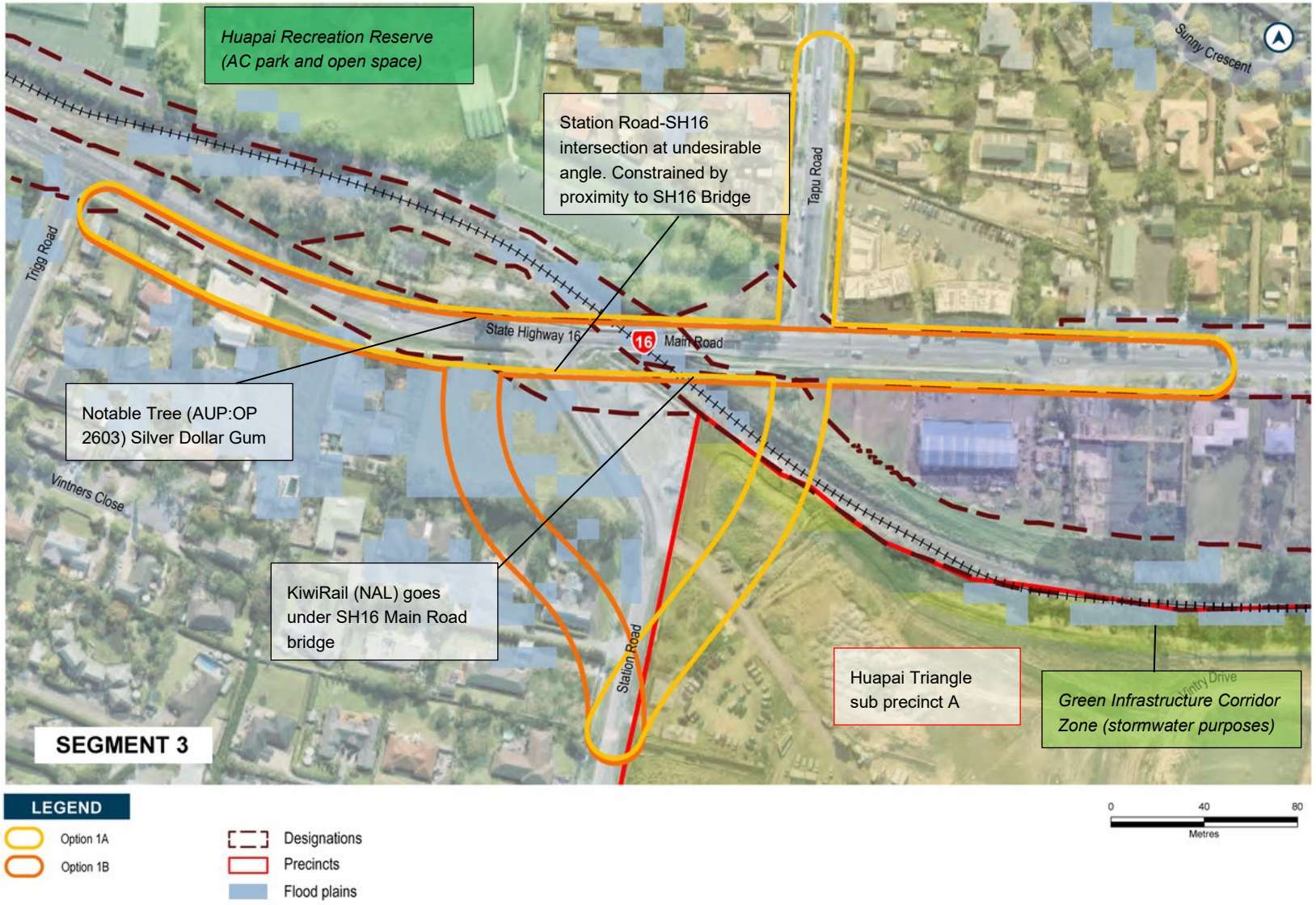


Figure 9-7: Segment 3 SH16 Main Road Options and constraints

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.

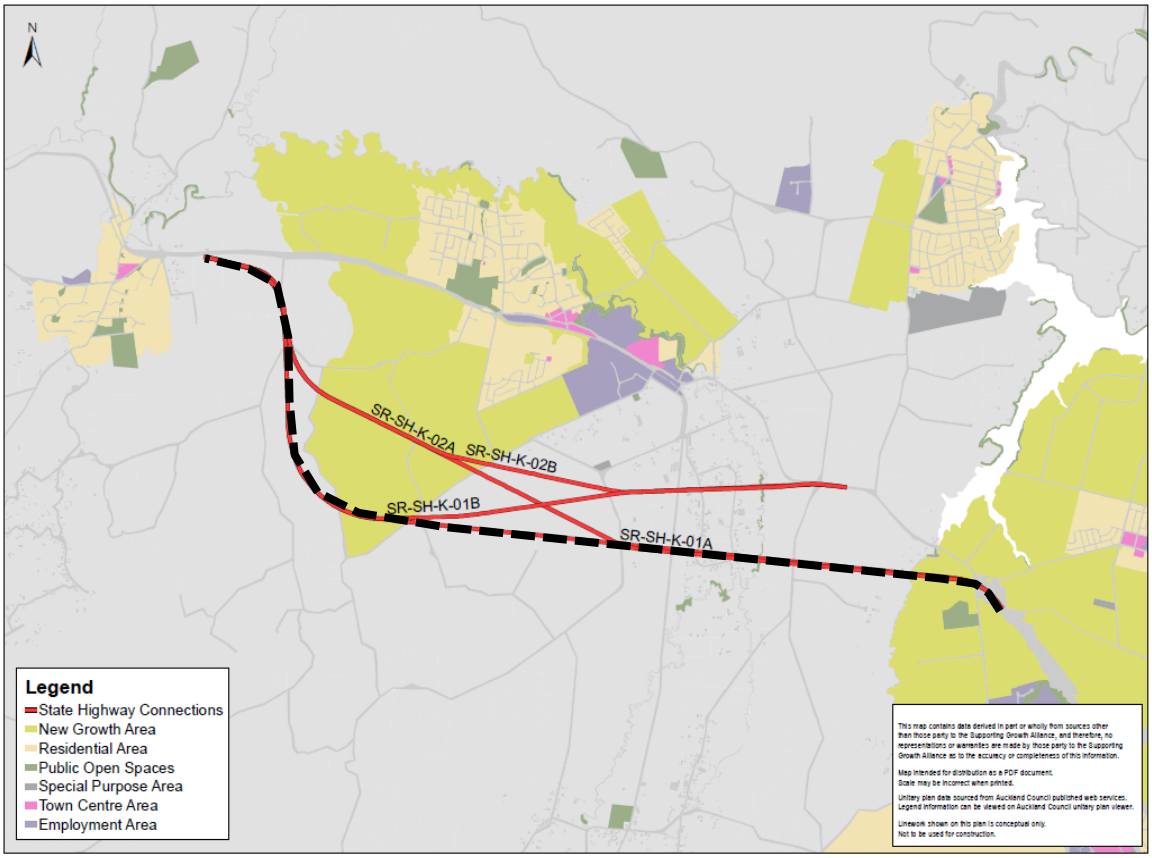


Figure 10-1: Alternative State Highway IBC Option SR-SH-K-01A

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.

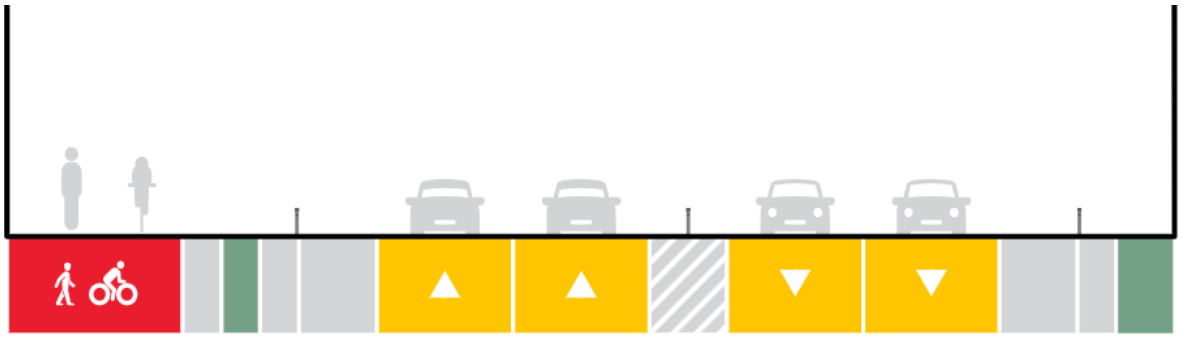


Figure 10-2: ASH CFAF Outcome – 50m cross section

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.

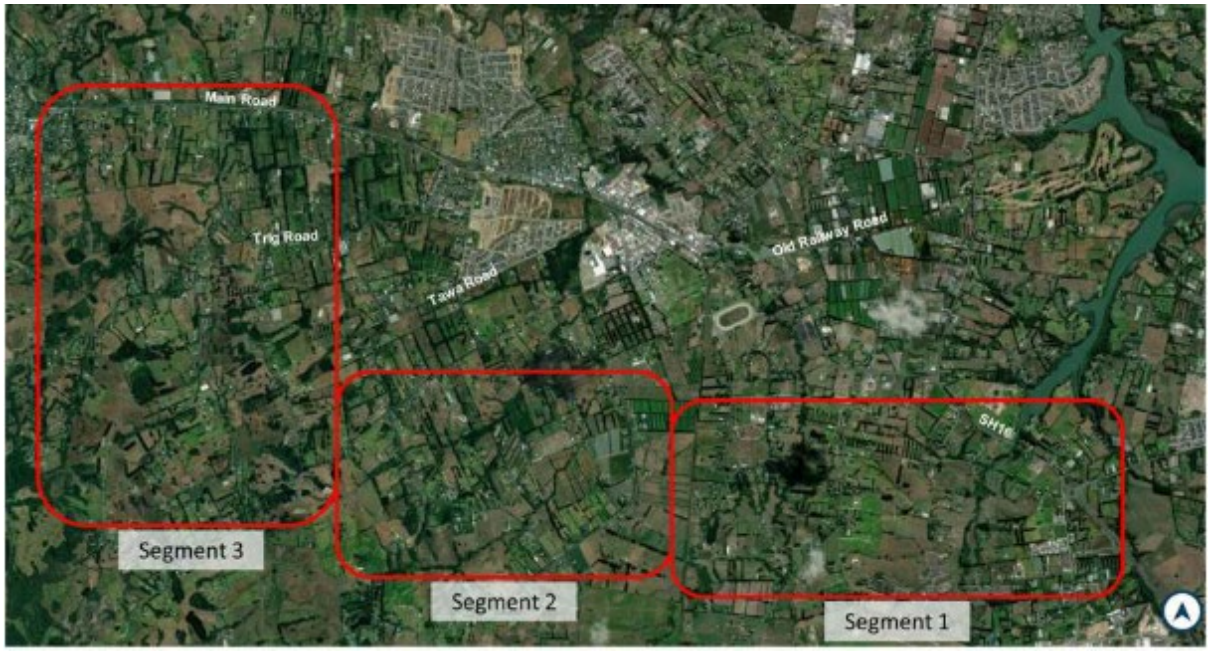


Figure 10-3: Alternative State Highway option development segments

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

Segment 1 Options

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

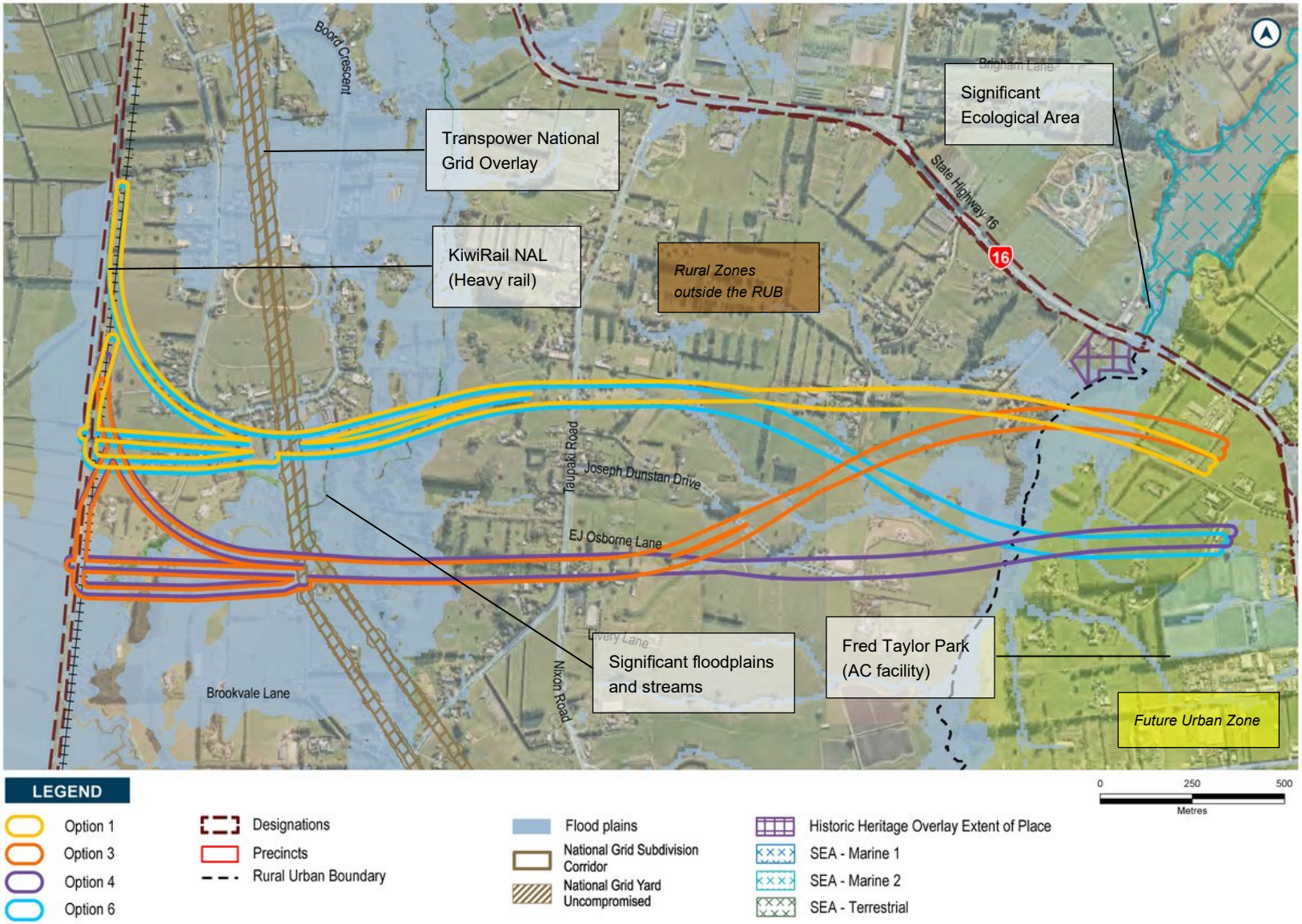


Figure 10-4: ASH Segment 1 Options and identified constraints

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

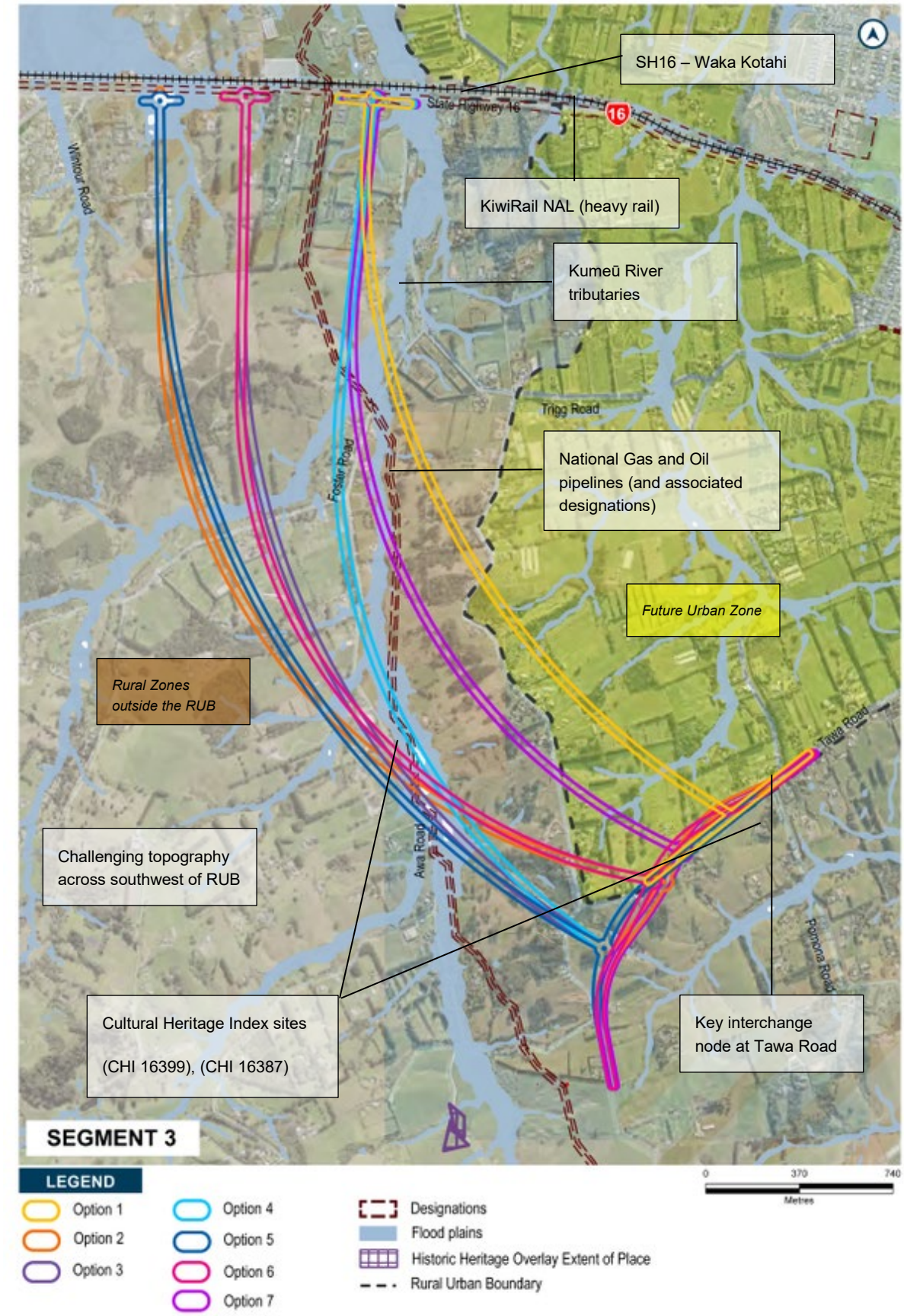


Figure 10-5: ASH Segment 3 Options and identified constraints

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.

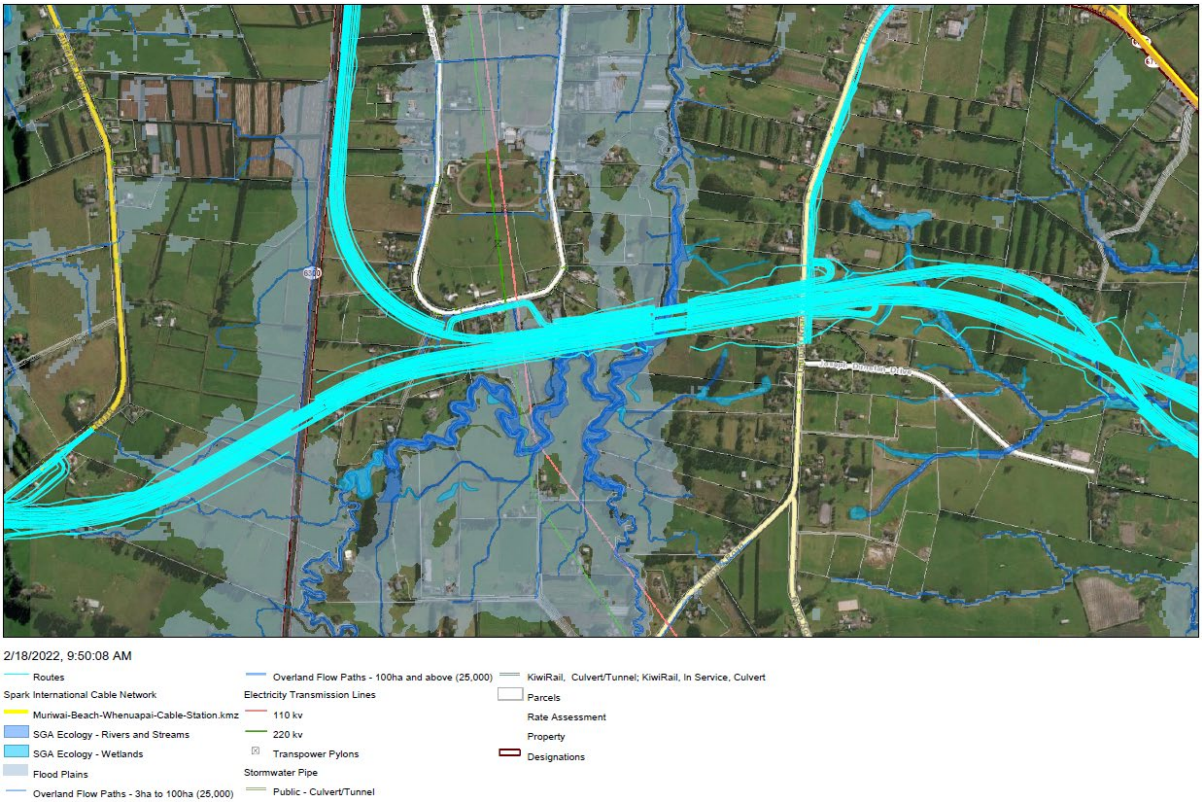


Figure 10-6: Alternative State Highway Kumeū River and Boord Crescent Alignment – pre refinement

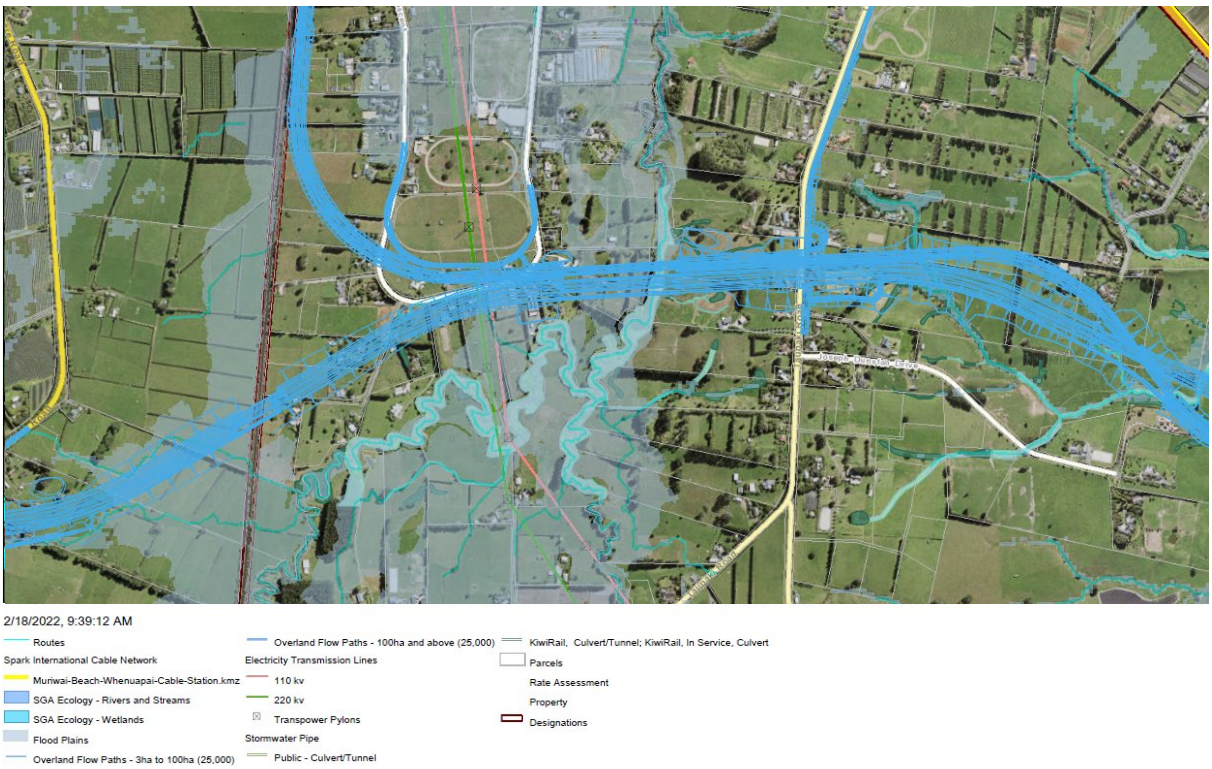


Figure 10-7: Alternative State Highway Kumeū River and Boord Crescent Alignment – post refinement

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.

Segment 2 Options (Post engagement)

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

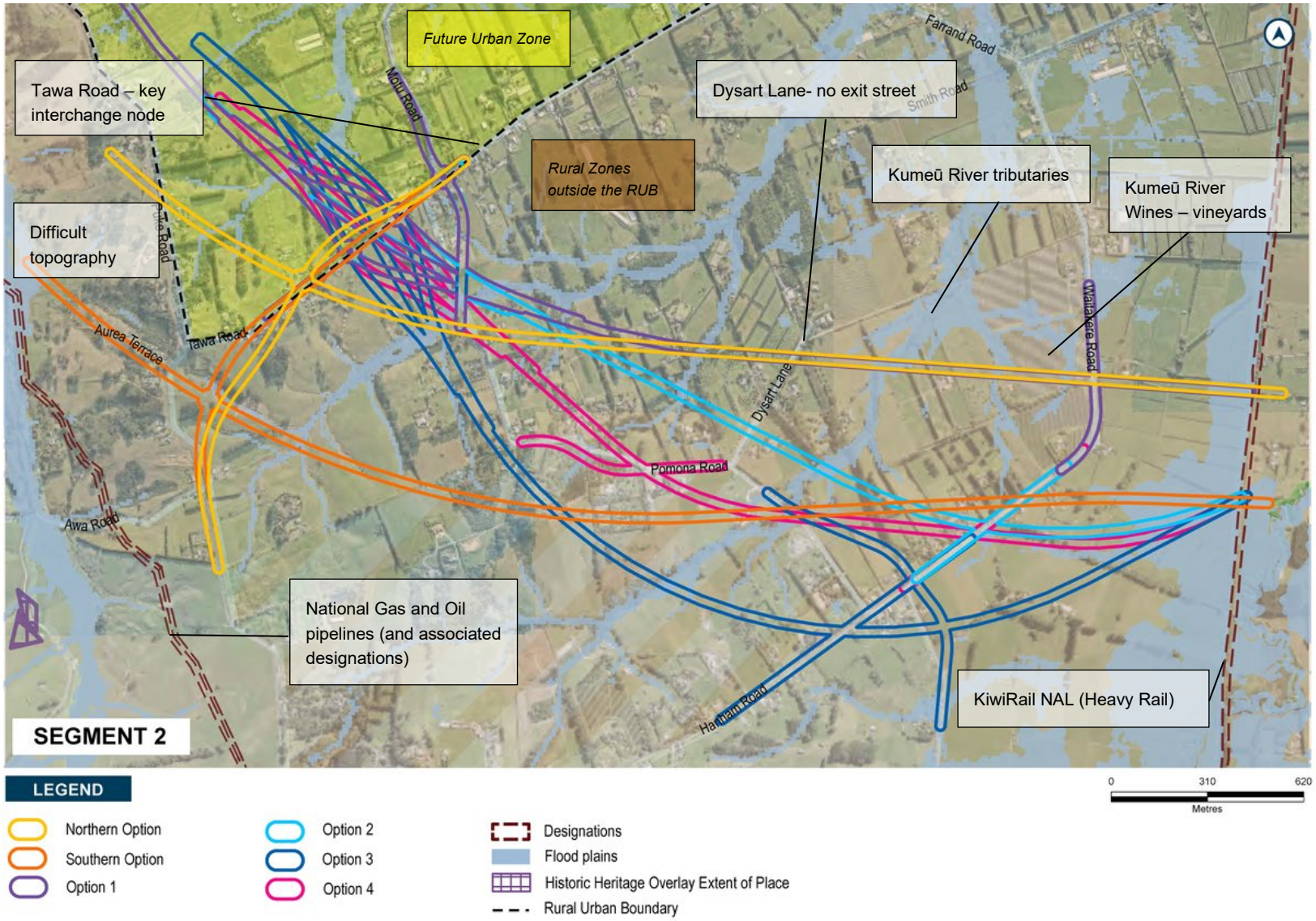


Figure 10-8: ASH Segment 2 Options and identified constraints

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

Wellbeing Assessment	
Transport Outcomes	Access: *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.
	Reliability: *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.
	Integration: *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.
	Safety: *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	Heritage: *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	Future land use integration: *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.
	Social: *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.

Segment 1 Preferred

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.

Segment 2 Preferred

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.

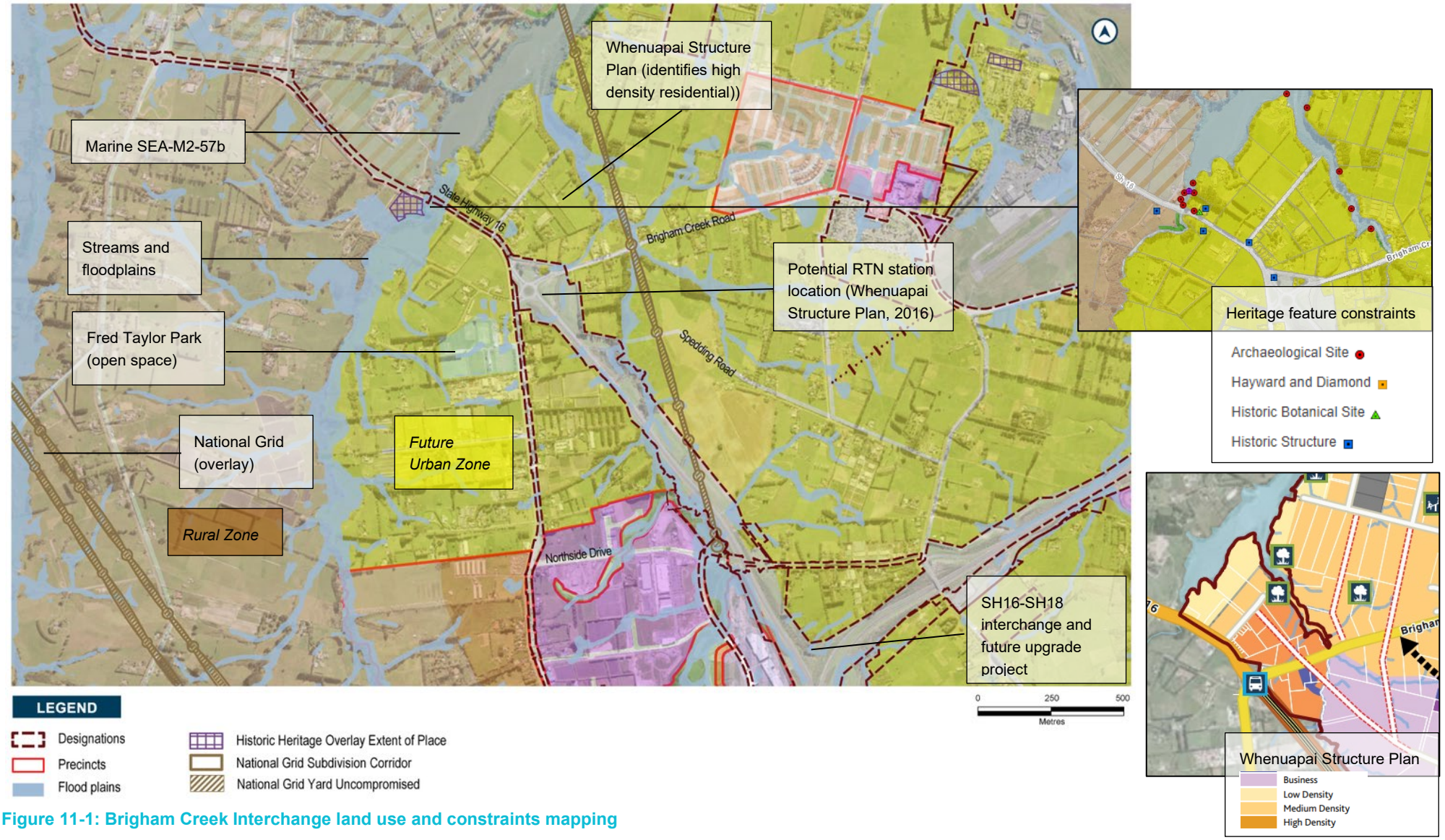


Figure 11-1: Brigham Creek Interchange land use and constraints mapping

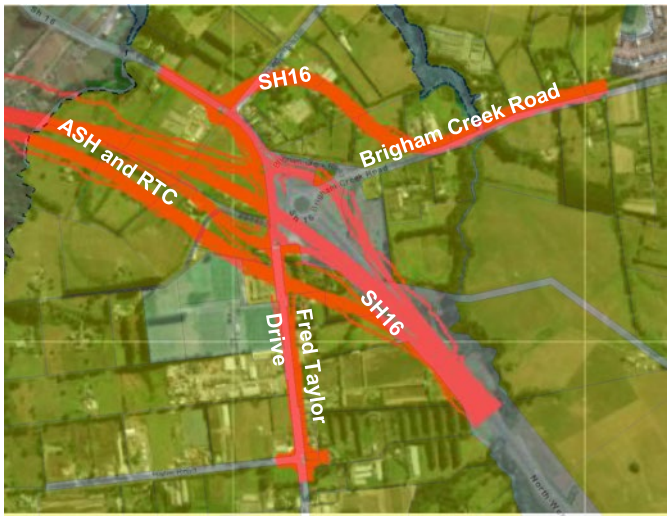
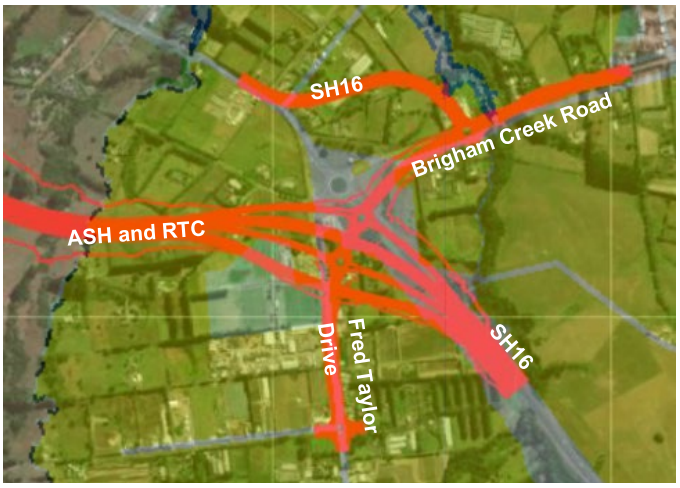
11.4 Corridor Option development

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.	

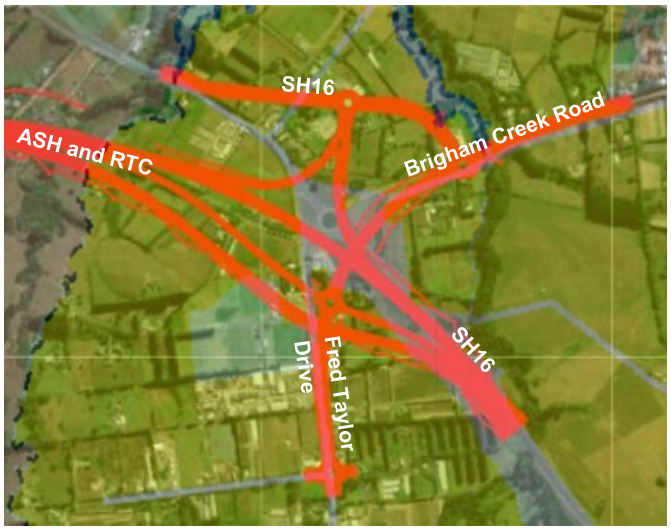
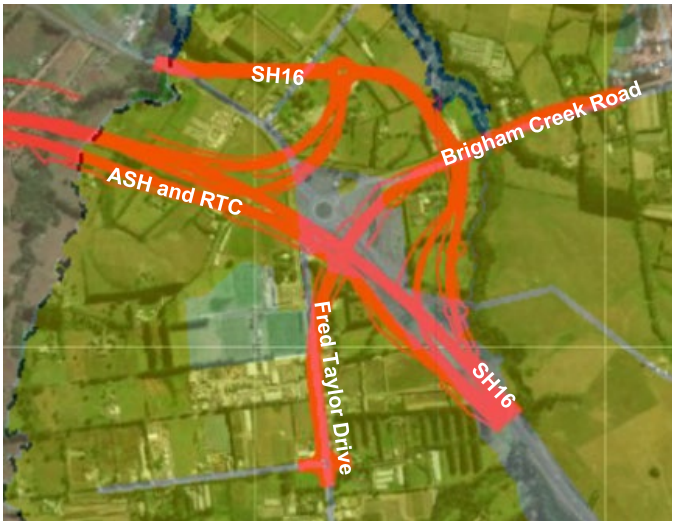
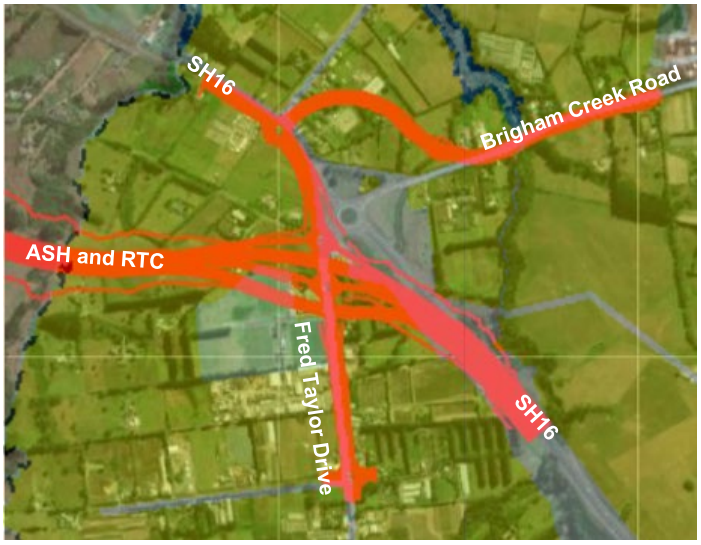
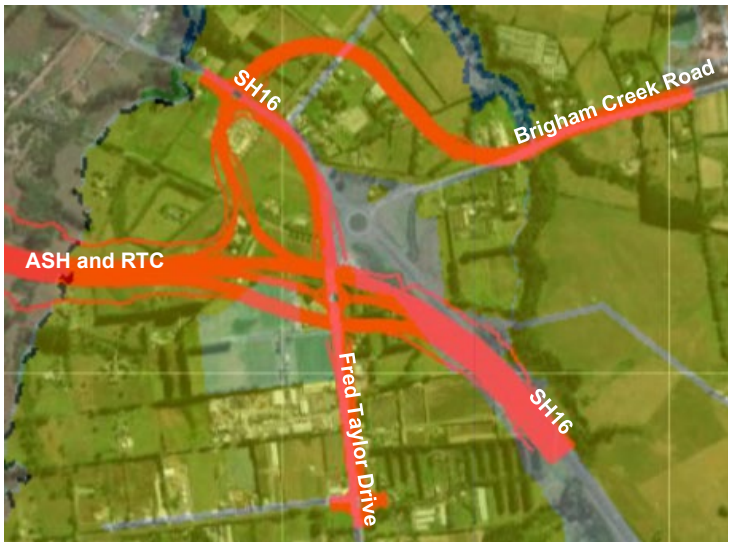
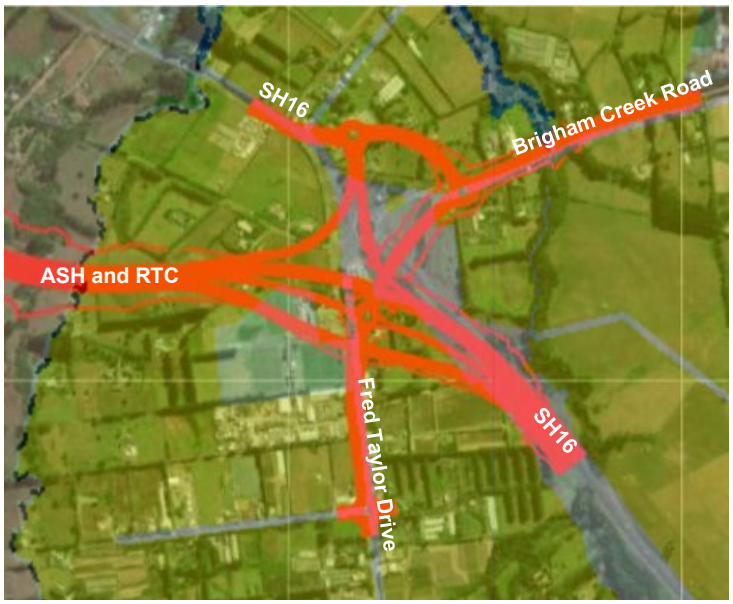
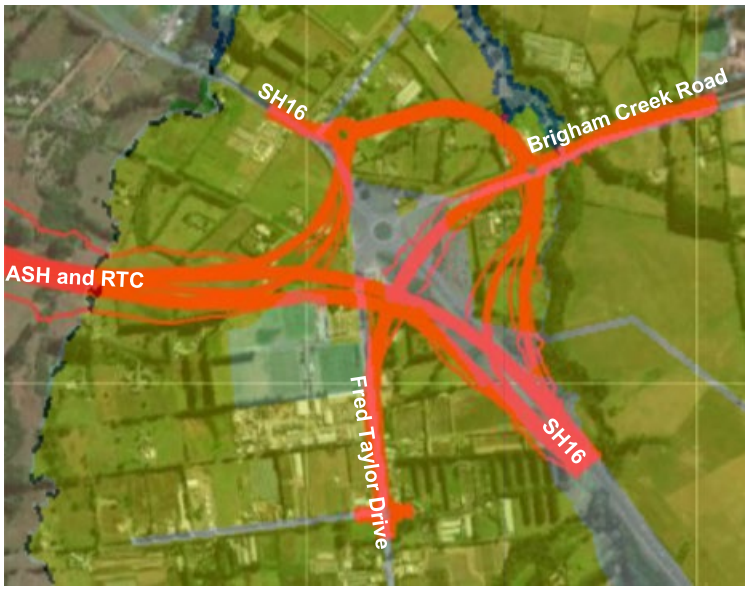
Option	Alignment
Option 5B ASH northern alignment with Fred Taylor Dr-Brigham Creek Rd Priority. Partial clover & diamond interchange.	
Option 5D ASH northern alignment with Fred Taylor Dr-Brigham Creek Rd Priority. Separated eastern and western "fork" ramps interchange.	

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	Access: 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. Reliability: • 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.

Auckland Council

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.

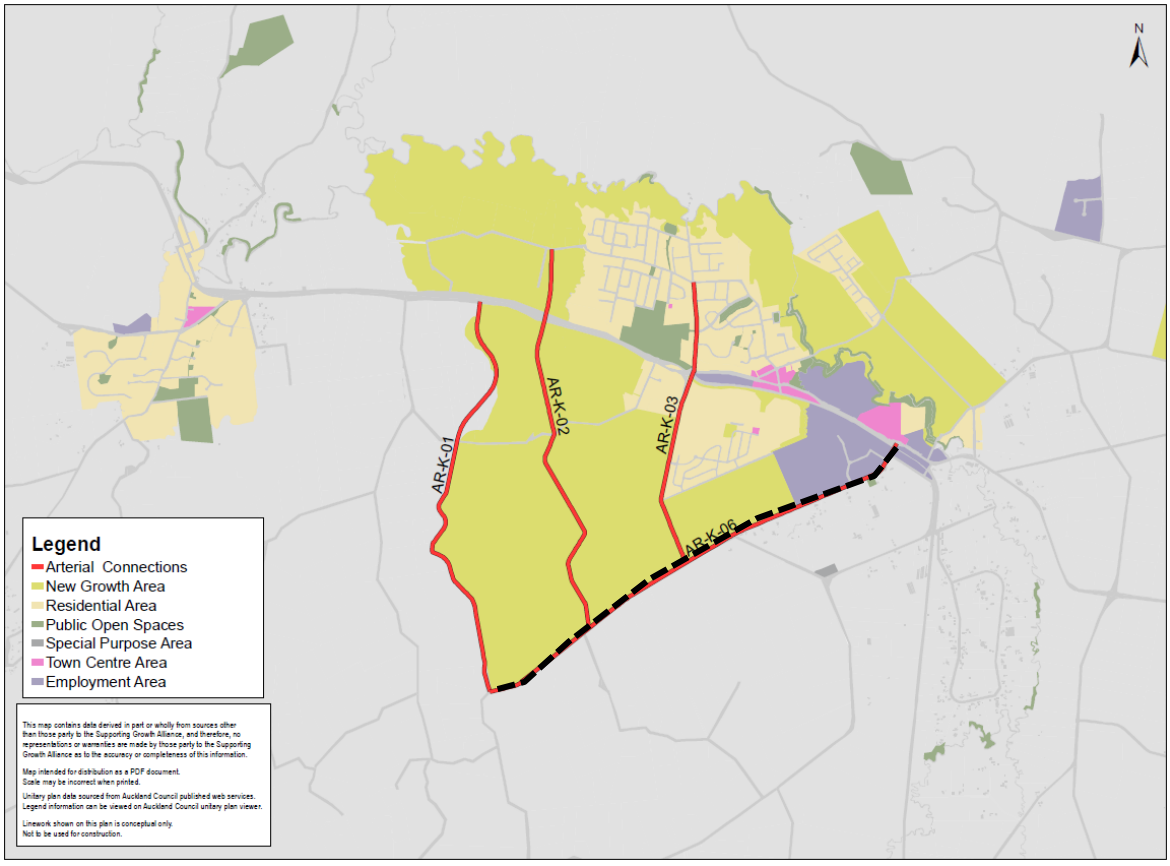


Figure 12-1: Access Road IBC Option AR-K-06 (in black dash)

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.

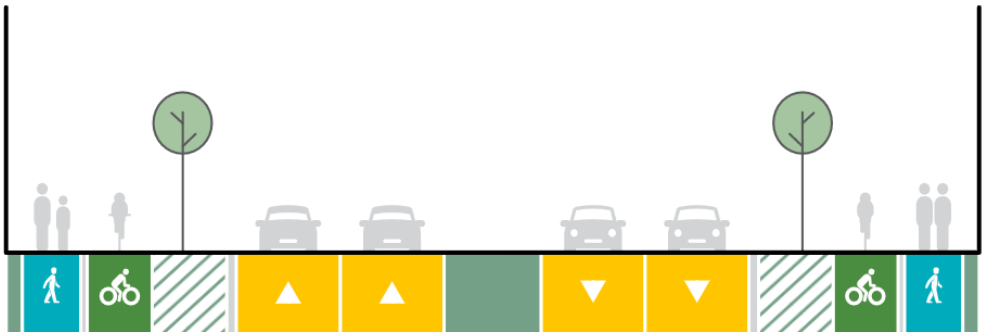


Figure 12-3: CFAF Outcome – Access Road indicative 30m cross section

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.

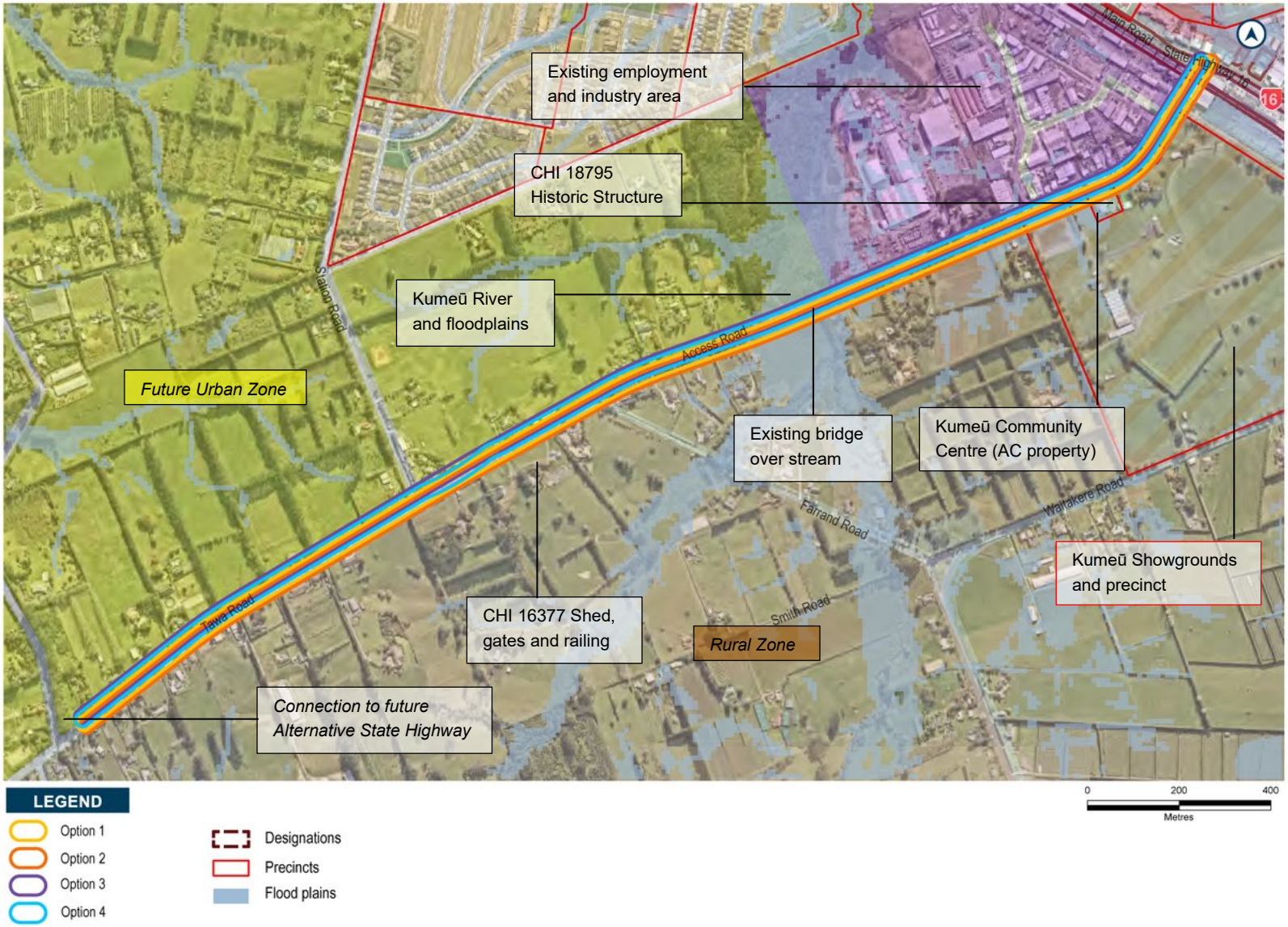


Figure 12-4: Access Road options and identified constraints

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.

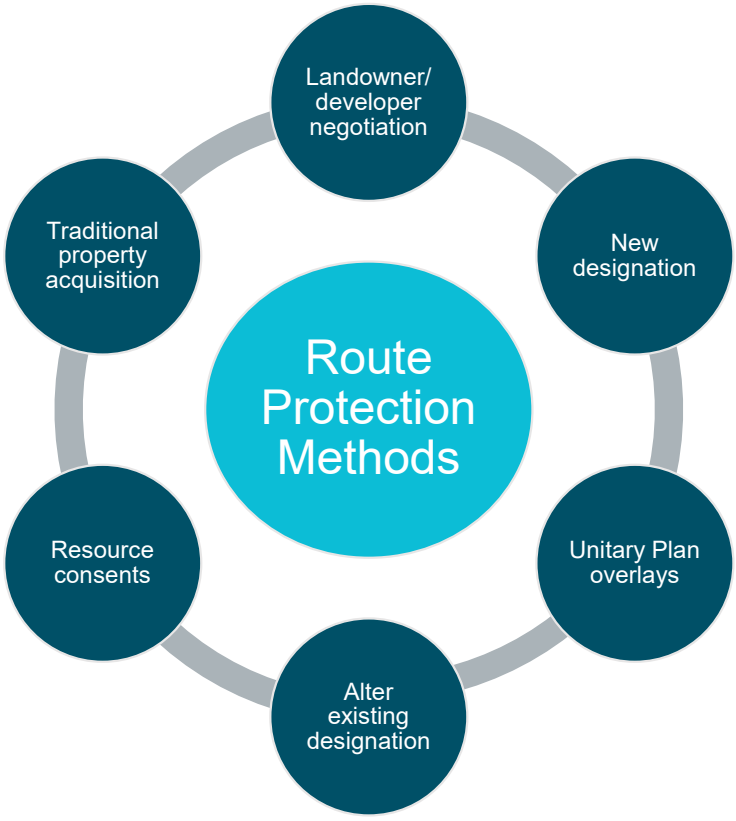


Figure 13-1: Route Protection Methods Considered

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.