TE TUPU NGĀTAHI
SUPPORTING GROWTH

Pukekohe Transport Network
Assessment of Alternatives Report

September 2023

WAKA KOTAHI NZ TRANSPORT AGENCY

AT

New Zealand Government

Document Status

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Glossary

Acronym/Term	Description
AT	Auckland Transport
AUP:OP	Auckland Unitary Plan (Operative in Part)
CFAF	Corridor Form Assessment Framework
DBC	Detailed Business Case
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GPS	Government Policy Statement
IBC	Indicative Business Case
KiwiRail	KiwiRail Holdings Limited
MCA	Multi-Criteria Assessment
NES:FW	Resource Management (National Environmental Standards for Freshwater) Regulations 2020
NES:Soil	Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011
NPS:FM	National Policy Statement on Freshwater Management
NPS:UD	National Policy Statement on Urban Development
NIMT	North Island Main Trunk
NoR	Notice of Requirement
NZUP	New Zealand Upgrade Programme
ONF	Outstanding Natural Feature
P2B	SH1 Papakura to Bombay Project
Partner	Manawhenua, Auckland Council, Auckland Transport, and Waka Kotahi
PBC	Programme Business Case
RMA	Resource Management Act 1991
SEA	Significant Ecological Area
SH	State Highway
SME	Subject Matter Expert
Te Tupu Ngātahi	Te Tupu Ngātahi Supporting Growth Alliance

Acronym/Term	Description
TDM	AT's Transport Design Manual
TfUG	Transport for Future Urban Growth
VKT	Vehicle Kilometres Travelled
Waka Kotahi	Waka Kotahi New Zealand Transport Agency
Zero Carbon Act	Climate Change Response (Zero Carbon) Amendment Act 2018

1 Introduction

1.1 Purpose of this Report

The Te Tupu Ngātahi Supporting Growth Programme (Te Tupu Ngātahi) is identifying the preferred transport network to support growth in the Drury, Paerata and Pukekohe areas of Auckland. This assessment of alternatives report provides a summary of the options development, assessment process and recommendations for the Pukekohe Transport Network.

This report has been prepared to support the Notices of Requirement (NoRs) for the Pukekohe Transport Network lodged by Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi) as requiring authorities under the Resource Management Act 1991 (RMA). The Pukekohe Transport Network includes nine NoRs (outlined in Table 1-1 and Figure 1-1 below) which seek to protect land to enable the construction, operation and maintenance of transport infrastructure.

Table 1-1: Overview of NoRs for the Pukekohe Transport Network

Notice	Project	Description	Requiring Authority
NoR 1	Drury West Arterial	A new transport corridor with active mode facilities in Drury West, extending south from the intersection of State Highway 22 and Jesmond Road to the edge of the Future Urban Zone near Runciman Road, Drury.	AT
NoR 2	Drury to Pukekohe Link	A new state highway including a shared path from Great South Road, Drury in the north east, connecting State Highway 22 in the west, and the area in the vicinity of Sim Road/Cape Hill Road, Pukekohe in the south.	Waka Kotahi
NoR 3	Paerata Connections	Two new transport corridors including active mode facilities. One between the two extents of Sim Road, Paerata across the North Island Main Trunk Rail Line. The second between Paerata Rail Station and Sim Road, Paerata.	AT
NoR 4	Pukekohe North-East Arterial	A new transport corridor including active mode facilities between State Highway 22, Paerata on the north west and Pukekohe East Road, Pukekohe in the south east.	AT
NoR 5	Pukekohe South-East Arterial	Upgrade of part of Pukekohe East Road and Golding Road, and a new connection from Golding Road to Svendsen Road, Pukekohe across Station Road and the North Island Main Trunk Rail Line - including active mode facilities.	AT
NoR 6	Pukekohe South-West Arterial	The upgrade of specific intersections and the regrade of specific driveways on Nelson Street, Ward Street, West Street and Helvetia Road for active mode facilities.	AT
NoR 7	Pukekohe North-West Arterial	The upgrade of Helvetia Road, Pukekohe in the south-west and a new corridor from Helvetia Road to SH22 Paerata in the north-east including active mode facilities.	AT

Notice	Project	Description	Requiring Authority
NoR 8 (AC) and NoR 8 (WDC) (two separate NoRs)	Mill Road – Pukekohe East Road Upgrade	An upgrade of Mill Road (Bombay) in the east for additional vehicle lanes and a shared path and an upgrade of Pukekohe East Road, Pukekohe in the west for a shared path.	Waka Kotahi

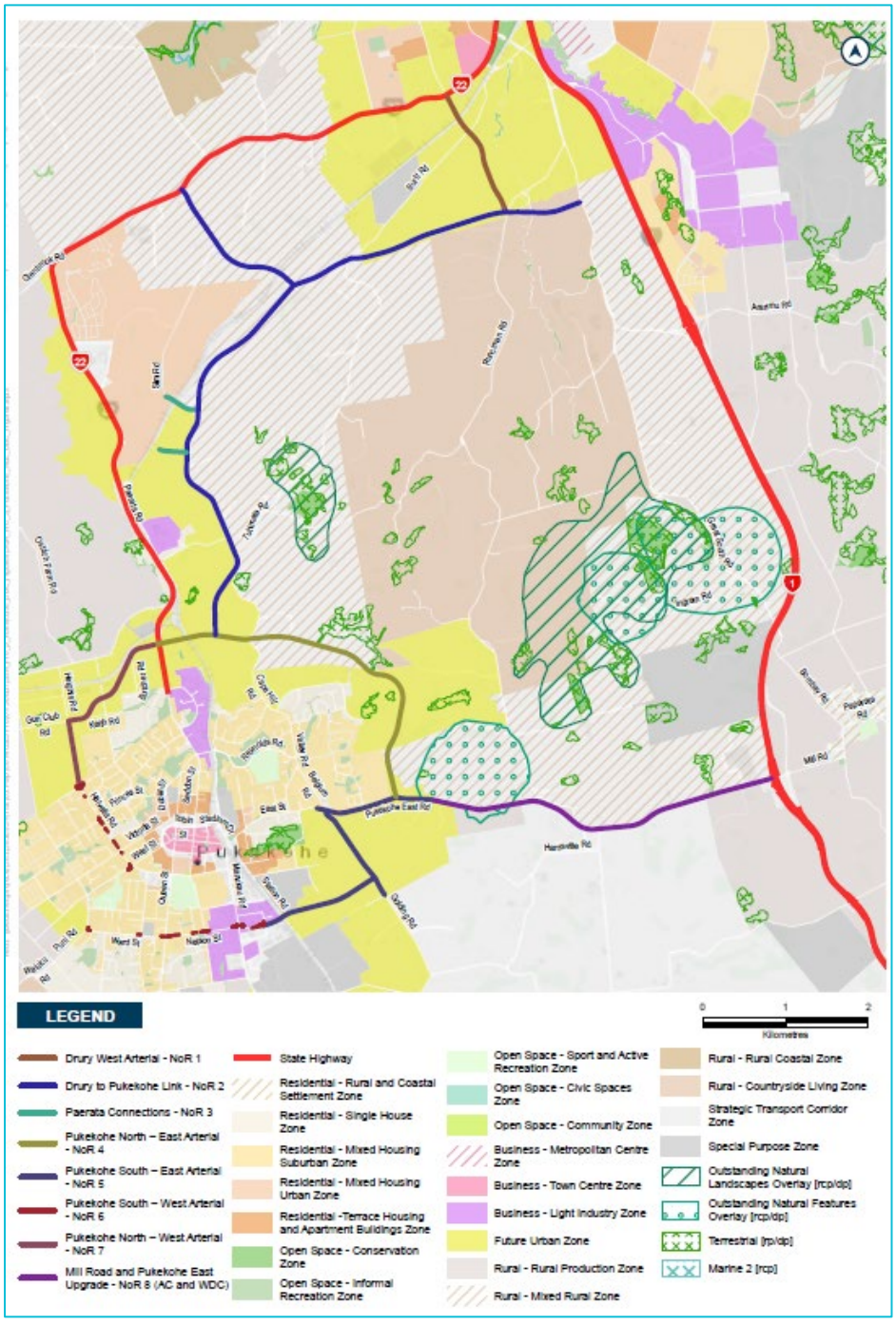


Figure 1-1: Pukekohe Transport Network

Section 171(1)(b) of the RMA requires that when making a recommendation on a NoR, a territorial authority shall have regard to whether adequate consideration has been given to alternative sites, routes or methods of undertaking the work in circumstances where 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 significant adverse effects on the environment.

There are several principles and key considerations for a requiring authority to apply and adhere to when undertaking an assessment of alternatives and identifying a preferred option. Of note are the following:

a) The process should be adequately transparent and robust, and clearly recorded so that it can be understood by others;

b) An appropriate range of alternatives should be considered; and

c) The extent of options considered, and the assessment of these options, should be proportional to the potential effects on the options being considered.

AT and Waka Kotahi do not have sufficient interest in the land required for the Project and as such are required to give adequate consideration to alternatives. 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 the options.

1.2 Structure of this Report

The report is structured as shown in Table 1-2.

Table 1-2: Structure of this report

Section	Heading	Description
1	Introduction	Sets out the purpose and structure of this report.
2	Background	Background to this Assessment of Alternatives report, context around the Pukekohe growth area and previous project phases.
3	Assessment of Alternatives Methodology	The alternatives development and assessment process: including gap analysis, alternatives development and assessment, engagement, form and function and approach to intersections and stormwater infrastructure.
4	Corridor Assessment	Sets out the corridor assessments for the Pukekohe Transport Network components – grouped into the following packages: • Drury West Local – relates to NoR 1 and NoR 2; • Paerata Local – relates to NoR 2 and NoR 3; • North-South – relates to NoR 2 and NoR 8; • Network Package Assessment (for Drury West Local, Paerata Local and North-South) – relates to NoRs 1, 2, 3 and 8; and • Pukekohe Local – relates to NoRs 4, 5, 6 and 7.
4	Route Refinement Assessment	Sets out the route refinement assessments for the Pukekohe Transport Network components – grouped into the following packages: • Drury West – NoR 1;

Section	Heading	Description
		• Drury to Pukekohe Link – NoR 2; • Paerata Connections – NoR 3; • Pukekohe North-East Arterial – NoR 4; • Pukekohe South-East Arterial – NoR 5; • Pukekohe South-West Arterial – NoR 6; • Pukekohe North-West Arterial – NoR 7; and • Mill Road – Pukekohe East Road – NoR 8.
6	The Emerging Preferred Network	Summarises the Emerging Preferred Network for the Pukekohe Transport Network.
7	Alternative Statutory Methods	Sets out consideration of alternative statutory methods for route protecting the Pukekohe Transport Network for future implementation.

2 Background

Auckland is New Zealand's largest city, home to approximately 1.7 million people. The city is growing rapidly; driven by both natural growth and migration from overseas and other parts of New Zealand.

The Auckland Plan anticipates that this growth would 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 (ha) of predominantly rural land for future urbanisation.

To enable urban development on this land, appropriate bulk infrastructure needs to be planned and enabled. To provide clarity and certainty about when the land identified in the AUP:OP would be 'development ready', Auckland Council developed the Future Urban Land Supply Strategy (FULSS) in 2015, which 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; and
- 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 15,000ha of land allocated for future urbanisation.

In response to the FULSS, AT and Waka Kotahi formed the Te Tupu Ngātahi Programme to plan transport investment in Auckland's future urban zone (FUZ) areas over the next 10 to 30 years to support the envisioned urban growth. 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.

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. It would also likely have impacts on and require improvements to the existing arterial, public transport, and state highway network, and to planning frameworks and/or policy.

2.1 Pukekohe-Paerata and Drury West – Overview and Issues

Pukekohe-Paerata and Drury are within the Southern growth area, as identified in Figure 2-1. The Southern growth area is approximately 20km south of Auckland's central city and covers an area of approximately 30km. This area makes up the largest proportion of future urban areas in Auckland (45%). It includes the large future urban areas of Takaanini, Ōpāheke, Drury, Drury West, and Pukekohe-Paerata.

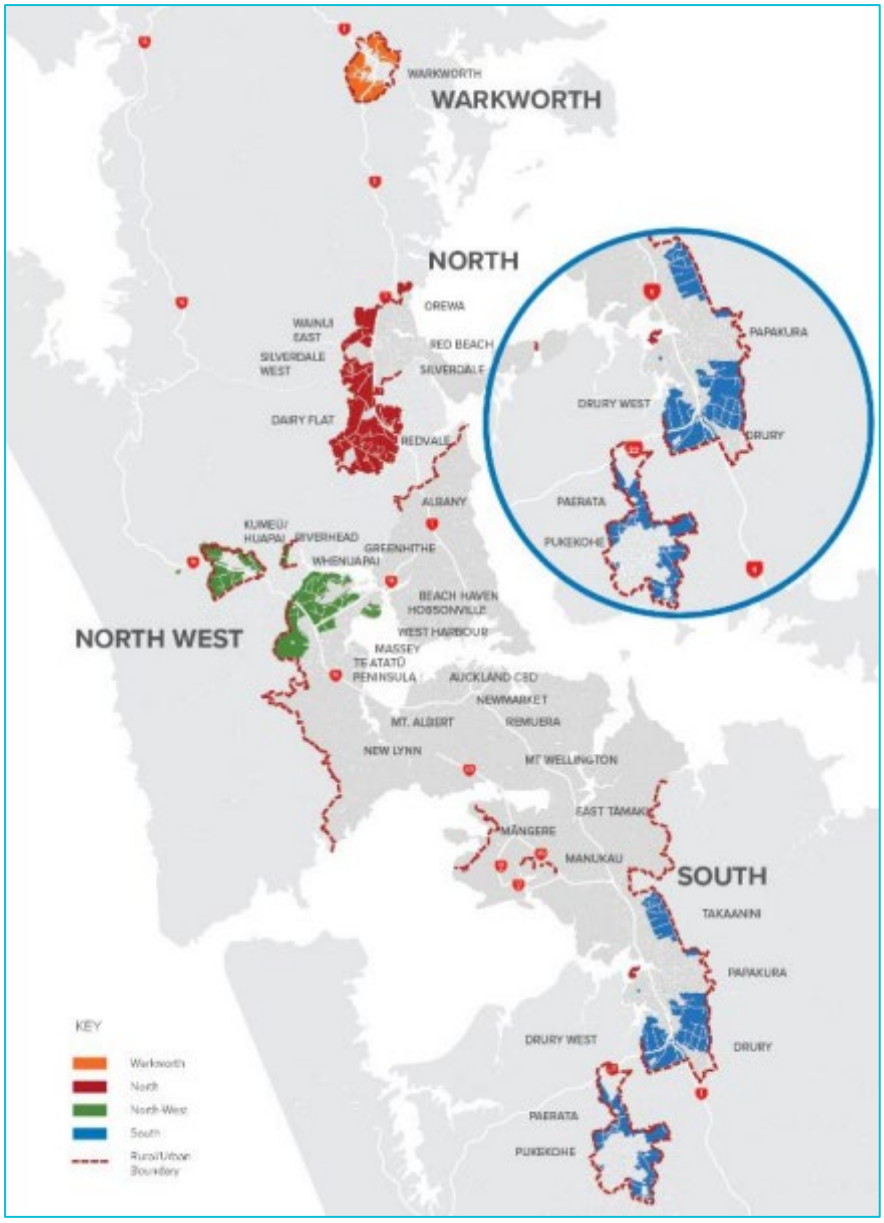


Figure 2-1: Southern growth area

The FULSS identifies the FUZ areas of Pukekohe-Paerata amounting to 1,704ha of former (primarily) rural land rezoned for future business and residential growth. This growth over the next 25 years towards 2048 is anticipated to result in a total of over 14,000 new dwellings. The subsequent Pukekohe-Paerata Structure Plan 2019 provides indicative statistics of 1,262ha developable land area (529ha net available for building) anticipated to result in 12,520 additional dwellings for an additional population of 33,809 people and 5,020 jobs once fully developed by 2050. With the addition of Drury West, growth across the area amounts to 21,000 additional households, 9,000 additional jobs and 55,000 more people at full build out post-2048.

The ratio of people to jobs indicates many people living in the area will need to travel elsewhere for employment, consolidating an existing pattern of transport demand out of the Pukekohe area for employment trips, typically made in morning and evening peak periods.

In August 2019, Auckland Council formally adopted the structure plan for the Pukekohe-Paerata and Drury-Ōpāheke areas which sets out the anticipated land uses and supporting infrastructure network

for the future growth of the area, as shown in Figure 2-2 and Figure 2-3. This has formed the basis of a number of subsequent plan changes.

The Waikato District is also experiencing significant growth and the pressure of development. As discussed within the Waikato District Growth Strategy, the Waikato District population is expected to double by 2061 with a consequent increase in the demand for land, infrastructure, services and amenities. Of importance to the Pukekohe Transport Network is Tuakau and Pōkeno, which are located approximately 10km and 8km from Pukekohe East and Mill Road respectively. Specifically, Mill Road and Pukekohe East Road are key transport routes for those travelling between Pukekohe and North Waikato. Mill Road (Bombay) and Pukekohe East Road provide an important connection between Auckland and Waikato.

The urgency for route protection in the Pukekohe-Paerata and Drury West area is driven by the rate and scale of committed developments, the release of land planned by the Council, and pressure from developers who have already submitted private plan changes. 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 in ability to influence good urban form.

Furthermore, over-reliance on the existing strategic transport corridors combined with rapid population growth in and around the Southern growth area will reduce the ability of the transport system to move people and goods efficiently. 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.

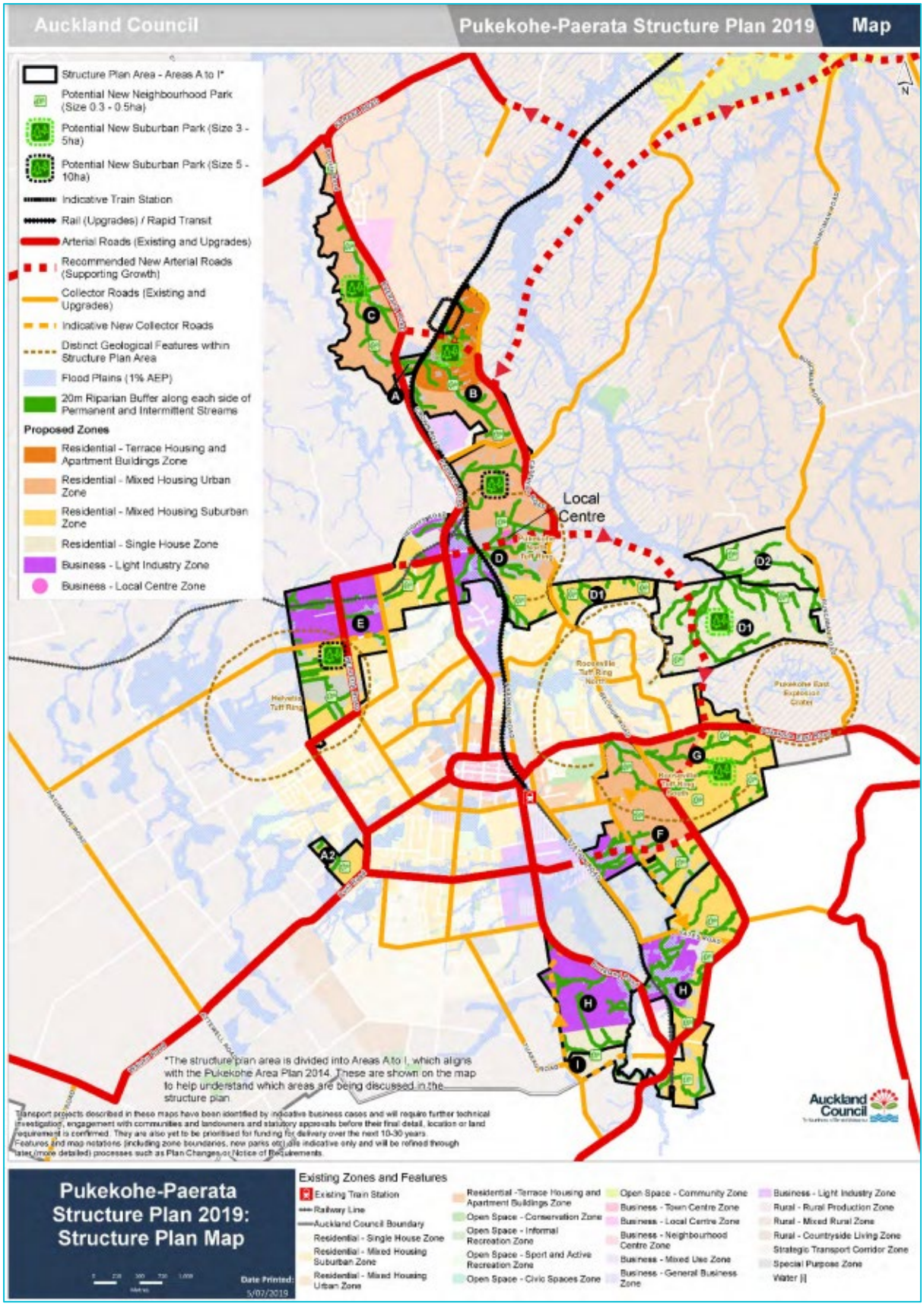


Figure 2-2: Auckland Council Pukekohe-Paerata Structure Plan (2019)

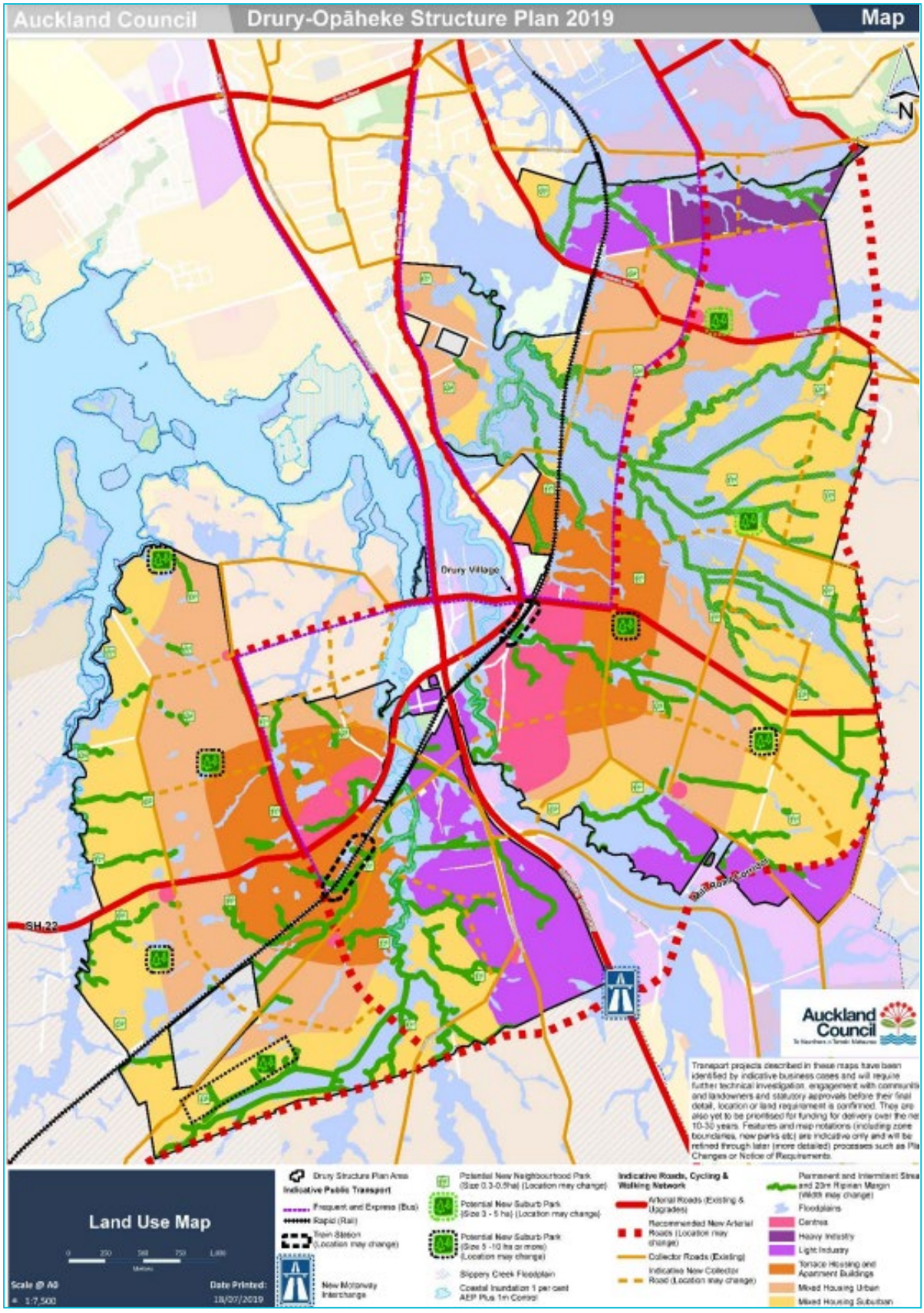


Figure 2-3: Auckland Council Drury-Ōpāheke Structure Plan (2019)

2.2 Strategic Response – Previous Project Phases

To determine the most appropriate transport solution to respond to the scale and pace of growth in Auckland, AT and Waka Kotahi worked in partnership to develop businesses cases for each of Auckland's identified growth areas. The below summarises the optioneering processes which have occurred to date.

In 2015, AT, Waka Kotahi and Auckland Council formed the Transport for Future Urban Growth (TfUG) Programme to investigate, plan and deliver the transport networks needed to connect the urban growth areas across North, North West and South Auckland over the next 30 years. A TfUG Programme Business Case (PBC) was completed in 2016, which identified the indicative network for all FUZ growth areas across the region. The TfUG Programme is now known as the Te Tupu Ngātahi Supporting Growth Programme.

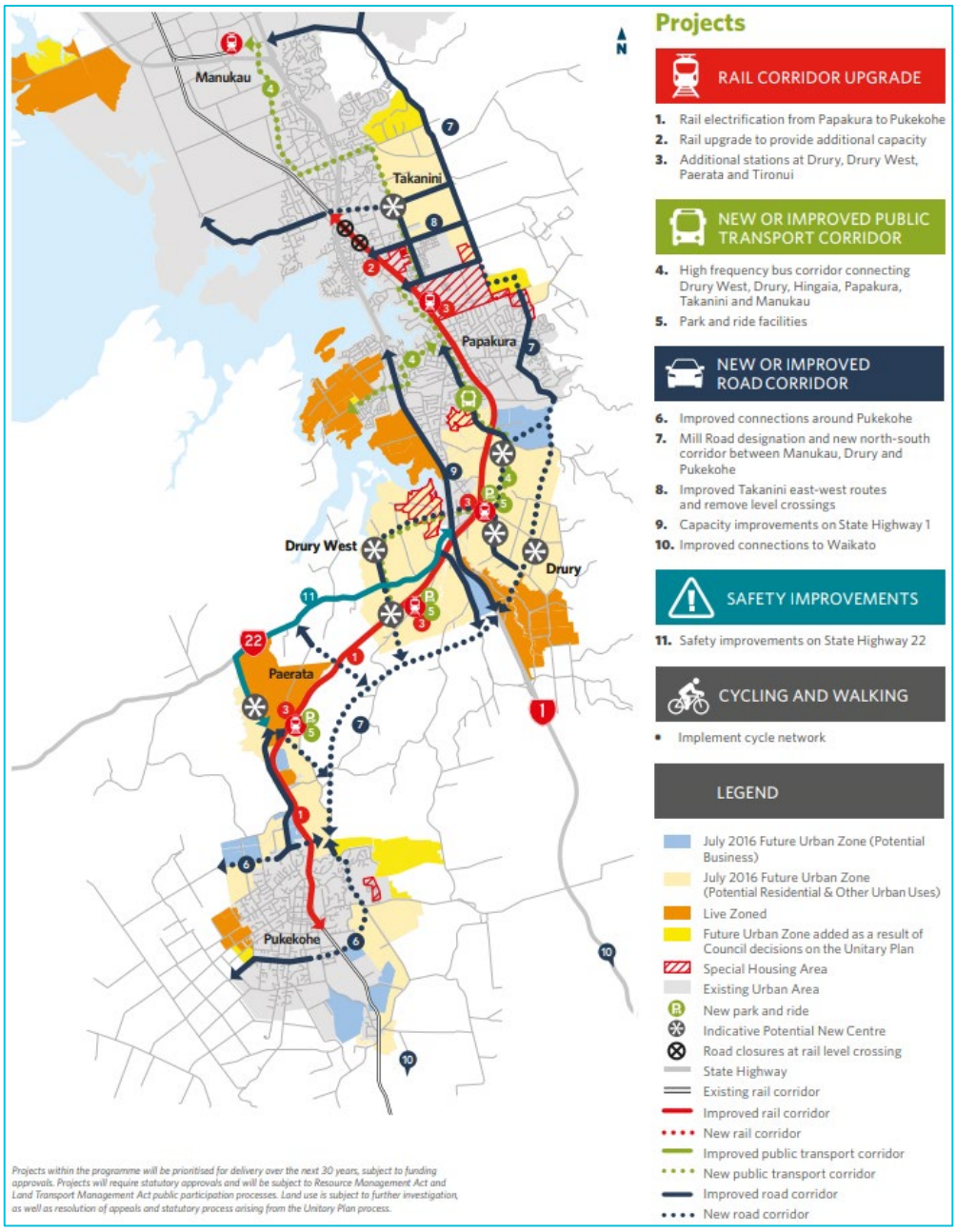


Figure 2-4: TFUG PBC Preferred South Transport Network

In May 2019, AT and Waka Kotahi Boards approved Indicative Business Cases (IBC) for each growth area (Warkworth, North, North West and South) to further test and develop the recommendations of the PBC. The IBC's identified an indicative strategic transport network, which includes indicative locations for new or upgraded public transport connections, walking and cycling links and roads or state highways.

The South IBC recommended the Indicative Strategic Transport Network for Drury, Paerata and Pukekohe is shown in Figure 2-5.

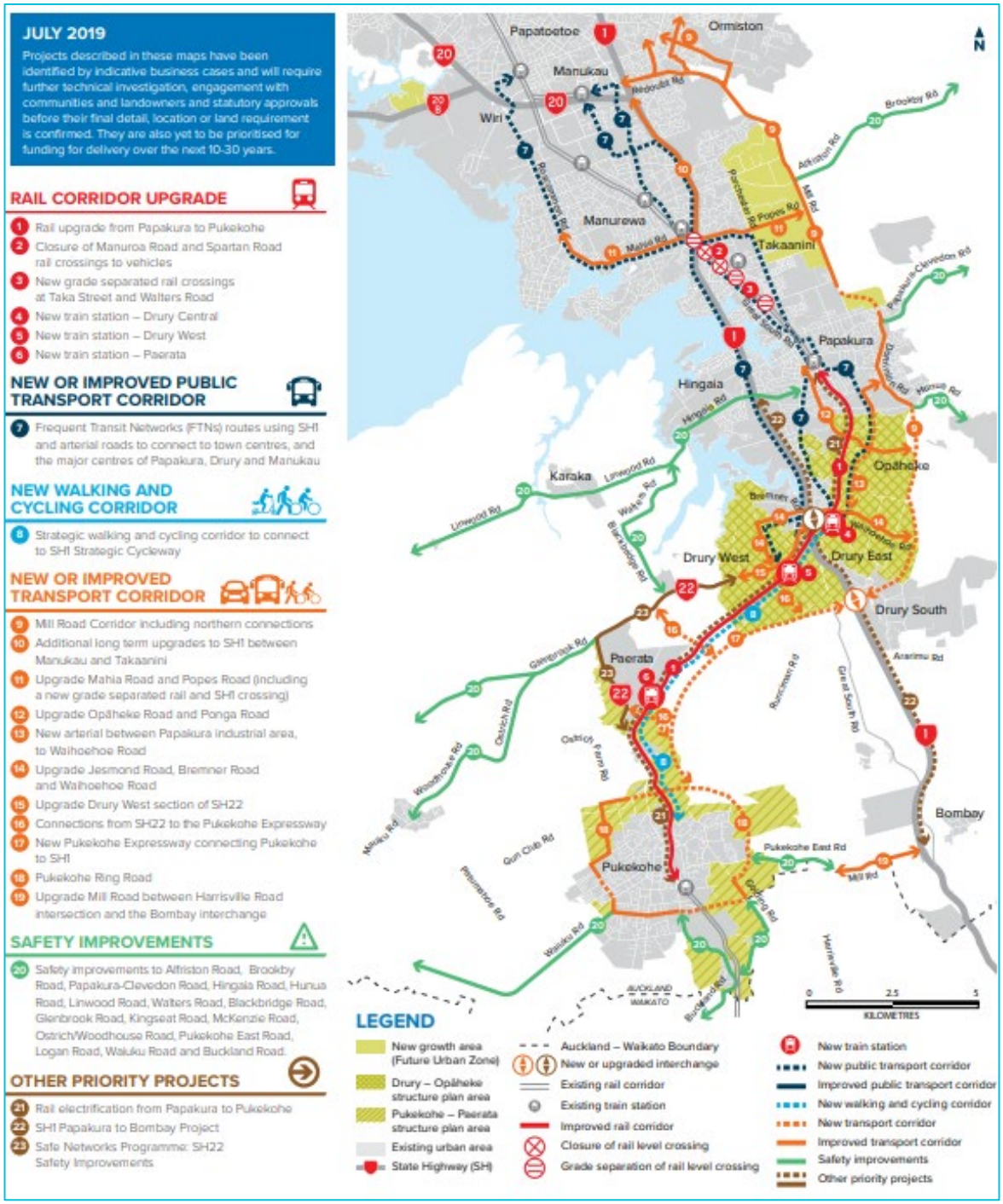


Figure 2-5: Southern growth area – Indicative Strategic Transport Network

Following this, the Strategic South Detailed Business Case (DBC) was commenced which included the “strategic” components of the Pukekohe area: the Pukekohe Expressway and the Pukekohe Urban Arterial (north-east section of the Pukekohe arterials) that connected with the southern extent of the Pukekohe Expressway. The Strategic South DBC undertook alternatives assessment on these components and recommended preferred options that were presented public engagement in 2020.

Later in 2020, the New Zealand Upgrade Programme (NZUP) announced funding for implementation of the Mill Road components of the Strategic South DBC. The remaining Strategic South DBC projects were reallocated to the Pukekohe Local DBC within the Te Tupu Ngātahi Programme. These projects form the basis of this alternatives assessment to determine the recommended Pukekohe Transport Network.

3 Assessment of Alternatives Methodology

3.1 Overview

This section provides an overview of the alternatives assessment process.

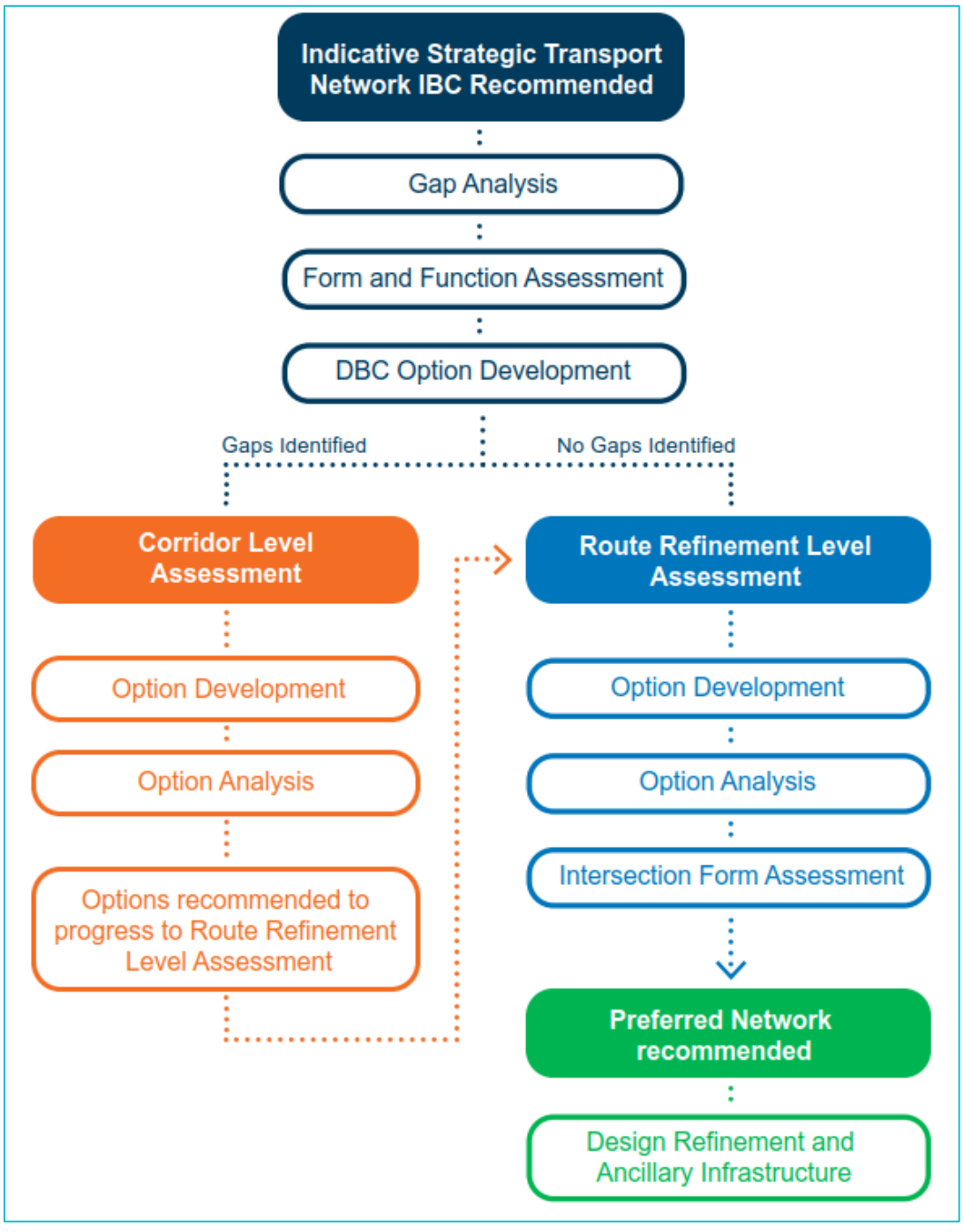


Figure 3-1: Overview of alternatives assessment process

For the Pukekohe Transport Network assessment of alternatives, two primary sets of assessments were undertaken: at the corridor level and at the route refinement level. Corridor level assessments involved wider corridor options which are developed with more extensive geographical areas and

assessed at a higher network level. Route refinement assessments follow the corridor assessment and include a greater level of detail, and assessed option refinements based on the effects, constraints and opportunities related to the identified preferred corridors.

The assessment of alternatives (for both corridor and route refinement assessments) included the following processes:

- **Development of a multi-criteria assessment framework**
  To guide the evaluation of comparison of options across the Te Tupu Ngātahi Programme, a Multi-Criteria Analysis (MCA) framework was developed. The MCA is a common tool that is often used to assist in the decision-making process and provide an opportunity to understand how different options compare against a set of standard and grouped criteria. This interdisciplinary framework was tailored for the Te Tupu Ngātahi Programme and developed in consultation with Manawhenua, AT, and Waka Kotahi. The MCA framework is set out in Section 3.4.

- **Options development**
  Informed by the previous stage of assessment (i.e. the PBC informed the options for the IBC, which then informed the options for the DBC and for this assessment), an iterative process was undertaken when developing options with an increasing level of detail corresponding to the level of assessment. For example, options developed for a “corridor assessment” were developed as wide corridors across more extensive geographical areas, whereas “route refinement” options were more developed options following the corridor assessment.

- **Briefing packs**
  Briefing packs were provided to technical experts with an outline of the options to be assessed, the criteria to be used in undertaking the assessment (including the MCA framework), and a pre-scoring spreadsheet. The pack provided details on the planning and land use context for the various study areas, as well as the programme-wide approach to considering the existing and future environment in the MCA. A briefing session was also held to explain all options and answer any questions from specialists.

- **Te Tupu Ngātahi GIS options assessment viewer**
  Once developed, all options were uploaded onto the Te Tupu Ngātahi GIS Options Assessment viewer, which was an online, interactive tool created specifically to allow all technical experts to view known constraints (including AUP:OP constraints) within the vicinity of the option subject to evaluation.

- **Site visits**
  The constraints analysis was undertaken via desktop analysis along with site visits.

- **Pre-assessment**
  In advance of the interdisciplinary workshops, experts were asked to assess options using the MCA tool so that they could be compiled and discussed during the workshop.

- **Interdisciplinary workshops**
  MCA assessments were presented and challenged in an interdisciplinary workshop. Experts were given the opportunity to amend their assessments in light of discussions at the

workshop, where appropriate. The presence of the design team at the workshop provided a valuable opportunity for experts to clarity or confirm the nature of all the options before confirming or assigning their final scores. While the MCA tool was typically used when assessing alternatives, it was not the sole means of assessing options and was complementary to the decision-making process.

- **Analysis and testing of results**
  Upon completion of the workshops, the Project Team met to review and test the results. This included consideration of how option segments interacted with each other, and how they best fit together. Where necessary, technical experts reviewed the scores and provided additional information and further options were developed and assessed where required.

  During the route refinement options assessment process, specialists identified several areas where further design considerations could be considered, or refinements should be made to deliver a better outcome. Once a preferred option was selected the Project Team, designers and specialists worked together to identify and make design refinements with the purpose of further minimising impacts of the preferred option through the route refinement assessment.

  This process was particularly useful where each option assessed had both positive and negative impacts, allowing a more balanced approached that adopted positive, and avoided negative, impacts where possible. Where design refinements were made, they are outlined in the discussion of the Project's preferred options.

- **Engagement with Partners**
  Workshops were held with AT, Waka Kotahi and KiwiRail subject matter experts to inform and seek feedback on the options developed and the MCA scoring. Their input was sought, and refinements were made where appropriate.

  Regular Manawhenua hui were held to explain the alternatives assessment process and seek feedback on the options throughout. It is noted that it is the preference of Manawhenua to provide feedback rather than providing a quantitative analysis of options through the MCA process.

- **Identification of technical preferred option(s)**
  Once assessment of the findings from the technical workshops was complete, the Project Team identified emerging technical preferred option(s).

- **Engagement with the stakeholders and the community**
  Following identification of the preferred options after the route refinement assessment, an engagement period took place with the stakeholders and the wider community. This was an opportunity for the public to provide feedback on the preferred options.

- **Analysis and testing of results**
  Upon completion of the engagement period, the Project Team met to review the technical preferred option(s) in light of the feedback received through engagement and refine the options or develop new options as necessary.

- **Recommendation by the Project Team**

Once the emerging preferred options were confirmed and the recommended network was identified the preferred options were grouped into projects for individual Notices of Requirement. The overall recommendation was presented to seek endorsement from the AT and Waka Kotahi Boards.

3.2 Gap Analysis

Due to the length of time between the IBC (approved in 2019), the Strategic South DBC (2020), and commencement of the Pukekohe Transport Network alternatives assessment (2022), a gap analysis was undertaken to test the following:

- That alternative options proportional to the scale of potential effects were considered (in accordance with Section 171(1)(b) of the RMA); and
- Whether new information has emerged that would alter the Project.

Specifically, the gap analysis included an assessment of the following:

- Review of Te Tupu Ngātahi PBC (formerly TFUG) recommendations;
- Review the South 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;
- Review of the draft Strategic South DBC options assessment and public feedback received;
- Background research, including previous project phases where this assisted understanding of previously identified issues;
- The alignment of the previously recommended options with relevant policy documents (for example, Government Policy Statement on Land Transport, AUP:OP);
- Alignment with strategic plans, other statutory documents and developer aspirations that may have progressed from the previous recommendations. For example, structure plans, plan changes (or appeals), recent NoRs and developer plans; and
- Interaction with other projects in the area.

In summary, the gap analysis recommended corridor re-assessment of all components of the Pukekohe Transport Network. This was reflective of:

- Government policy changes in climate change and response – in particular the Government Policy Statement for Land Transport 2021 and the Climate Change Response (Zero Carbon) Amendment Act (2019);
- Funding of new rail stations in Paerata and Drury;
- Numerous private plan changes being lodged or approved; and
- Pukekohe Local corridors (apart from the North-East Arterial) had not been assessed since 2019 at IBC level.

In response to the above considerations, the gap analysis recommended the following:

- Further alternatives should be considered for the corridor assessment, which may provide more of a contribution to decarbonisation objectives as set out in government direction. This could include the investigation of upgrading existing roads and maximising connectivity to the rail stations, integration with future urban development and increasing mode shift.
- The form and function of the Pukekohe Expressway should be re-assessed and the need for the expressway confirmed.

- As a number of connections including the SH22 connection, Drury West connection and north east quadrant of the Pukekohe arterials interact with the Pukekohe Expressway, these also need to be re-assessed based on any movement of the expressway.
- Form and function of the Pukekohe Arterial routes need to be confirmed to inform options assessment (e.g. 2 vs. 4 lane) and if a two lane arterial, consideration needs to be given to upgrading existing roads rather than the offline options recommended in the IBC.

As a result of these recommendations, four groups of options were developed for corridor assessment:

- **Drury West Local** – local connectivity in the FUZ to the station and strategic corridors;
- **Paerata Local** – local connectivity in the FUZ to the station and strategic corridors;
- **North-South** – strategic or local connections between Drury, Paerata and Pukekohe; and
- **Pukekohe Local** – local connections around Pukekohe as alternatives to the current main connection through the Pukekohe centre.

Further details from the gap analysis are contained within each of the options assessment sections in this report in Section 4.

3.3 Options Development

A long list of preliminary options was developed for each group, considering the indicative transport network identified in the IBC, the gap analysis and a high-level assessment of key engineering/design constraints including:

- Geology;
- Contours and potential earthworks requirements;
- Floodplains and flood sensitive areas;
- Live zoning, plan changes and structure plans; and
- Sensitive areas such as AUP:OP overlays, critical services and special purpose zones.

The initial options were loaded into the Te Tupu Ngātahi GIS viewer as corridor centrelines with 50m route buffers either side of the centreline for new corridors and 30m from the centreline for upgrades to existing corridors. Each option segment had a unique code.

The viewer included constraints and management layers that can be viewed in conjunction with the options. Those included constraints/opportunities tagged during the IBC phase, all AUP:OP management layers and zonings, the public Cultural Heritage Inventory register, Auckland Council GeoMaps landbase, and Cultural Heritage Environmental Assets.

Initial constraints/opportunities assessments were carried out and recommendations were made for the long list of options to modify, discount or add new options.

3.4 Options Assessment Framework

3.4.1 Multi Criteria Assessment

An MCA framework was used to evaluate and compare the options. The framework was applied throughout the alternatives assessment process and included transport outcomes as well as criteria around the four well-beings: Cultural, Social, Environmental and Economic. The MCA framework and scoring scale are set out in Table 3-1 and Table 3-2.

Criteria were developed for consideration by Manawhenua under the cultural wellbeing grouping. On review, Manawhenua stated a preference to rank options where possible (rather than score) and to provide a collective Manawhenua response, rather than each iwi individually. Accordingly, Manawhenua representatives expressed their views and provided specialist cultural advice on key issues through the optioneering and assessment of alternatives process.

Table 3-1: MCA Framework

Transport Outcomes			Measure
Transport Outcomes			• Safety – Provide a transport network that is safe for all users within and between Pukekohe, Paerata and Drury West; • Integration – Provide a transport network that minimises conflict between movement and place, and contributes towards well-functioning future urban environment; • Access – Enable access to economic and social opportunities by providing multi-modal corridor; • Resilience – Enable resilient freight and people movement to, from and within Pukekohe, Paerata and Drury West; and • Travel choice – Enable travel choice in Pukekohe, Paerata and Drury West by enhancing access to the existing rail network and providing a safe and attractive walking and cycling network.
Well-being	**Topic**	**Criteria**	**Measure**
Cultural	**Heritage**	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; and • Sites and places of European cultural heritage value.
Social	**Socio-economic impacts**	Land use futures / integration with planned land use	To what extent would the option impact on the future development of land (within the corridor, adjacent to it and impacted by it – i.e., consider all three scales), in relation to: • Integration with the future land use scenario (including any Structure Plans or Plan Changes); and • Size and shape of potential development parcels to enable appropriate building typologies.
		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; and • Scale of long-term impact on the amenity and character of the surrounding environment.

Transport Outcomes			Measure
		Land requirement / property	• Extent of property effects, including: • Scale of public / private land (m^2 / number of properties / special status of impacted property) required to deliver the option; • Ability to consolidate residual land; and • Access.
		Social cohesion	Extent of impact on the use of, and connectivity / accessibility to, existing urban areas, including: • 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; and • Public access to the coast, rivers and lakes.
		Human health and wellbeing	Would 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; and • Noise and vibration.
Environment	**Natural Environment**	Landscape / visual	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 and zoning; • Natural character and outstanding natural features / landscapes including geological features (mapped and protected features); and • Visual effects.
		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; and • Consideration of future climate change scenarios.
		Ecology	Extent of effects on: • Significant indigenous flora; • Significant habitats of indigenous fauna; • Indigenous biodiversity; • Stream / waterway ecology • Marine ecology
		Natural Hazards	Extent of effect on adverse geology, steep slopes, seismic impacts, and other resilience risks (e.g. low level infrastructure near coastlines, inundation areas)

Transport Outcomes			Measure
	Construction impacts	Embodied carbon emissions	• Consideration of the following design requirements: • Length (in km); • Area of impervious surface/ volume of earthworks; and • Specific infrastructure requirements (e.g. bridges, viaducts, tunnels etc.).
		Construction impacts on utilities / infrastructure	Requirements for relocation / design of existing infrastructure, including: • Consideration of safety impacts; • Risk of continuity of service over construction; and • Opportunities for integration with other bulk infrastructure.
		Construction disruption	Construction impacts on people and businesses regarding: • Traffic and noise; • Earthworks related effects including dust; • Quality of life and amenity; and • Economic impacts on businesses / community / town centres.
	Cost & Construction Risk	Construction costs / risk / value capture	Assessed cost for construction of options including: • Complexity and risk in construction (including consideration of constructability, earthworks cut / fill balance and material reuse); • Complexity in programme; • Cost and complexity of safely undertaking works (including works on contaminated land); and • Extent to which the option can use a value capture mechanism to offset construction costs.

3.4.2 Scoring Methodology

Scoring was completed by technical experts and the Project Team using the scale in Table 3-2, and was presented and challenged in an interdisciplinary workshop setting.

Table 3-2: 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

When considering the options and assigning scores, experts considered options and potential effects in the context of a likely future environment within which the transport corridor would likely be operating. It is considered that there are broadly two likely future environments that could apply:

a) Environments that are likely to experience material change as a result of urbanisation; and

b) Environments that are not likely to materially change in the future.

When considering the future environment, there are four scenarios that are likely to eventuate through the Te Tupu Ngātahi Programme, two of which have a high probability of change as a result of a signal of land use change by way of operative planning provisions. These are outlined in Table 3-3.

Table 3-3: Overview of likely scenarios eventuating through the Te Tupu Ngātahi Programme

Environment today	Zoning	Likelihood of change	Likely future state environment
Rural	Rural	Low	Rural
Rural	Future Urban	High	Urban
Rural	Urban	High	Urban
Urban	Urban	Low	Urban

Unless circumstances suggested otherwise, when considering effects in areas highly likely to change, the approach that was adopted was that construction effects were to be considered in the context of an un-urbanised (or transitioning) environment and operational effects were to be considered within the context of an urbanised environment.

In addition to the MCA framework, other inputs within the assessment framework included the matters set out in Table 3-4.

Table 3-4: Other inputs into the MCA framework

Project partner and landowner feedback	Feedback from project partners, landowners, stakeholders and the community (engagement process detailed in Section 3.5).
Policy analysis	Options alignment with the strategic policy framework including the AUP:OP, and the Pukekohe-Paerata Structure Plan 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.

3.5 Engagement

As set out above, feedback from partners, stakeholders and the community were an important part of the options assessment process. This section details the engagement undertaken through the alternatives assessment process.

3.5.1 Partners

Partners includes representatives from AT and Waka Kotahi (subject matter experts), KiwiRail, Auckland Council and Manawhenua. Partners were given the opportunity to provide feedback throughout the development and the options assessment of both corridor and route refinement assessments.

Eight workshops were undertaken with Partners at the beginning of options assessment process to gain feedback on the options development and corridor assessment of the North-South, Drury West and Paerata packages:

Table 3-5: Initial partner workshops undertaken during the alternatives assessment process

Workshop #	Date	Purpose
Workshop 1	8 April 2022	Introduction to workshop series to collectively test Pukekohe Expressway's role in the network, considering whether alternative options could achieve outcomes sought, and how changing policy direction could impact timing and sequencing.
Workshop 2	22 April 2022	Provide an overview of the project area history, site context, features and constraints.
Workshop 3	6 May 2022	Obtain Waka Kotahi, AT, KiwiRail and Manawhenua perspectives on the project area.
Workshop 4	20 May 2022	Obtain Auckland Council's perspectives on the project area. The Project Team also presented outcomes sought for the Pukekohe Transport Network.
Workshop 5	3 June 2022	Provide an overview of network outcomes with and without Pukekohe Expressway.

Workshop #	Date	Purpose
Workshop 6	17 June 2022	Present and discuss options assessment process and provide an overview of the approach to packaging corridor options into Drury West, Paerata and North-South options.
Workshop 7	30 June 2022	Present the outcomes of corridor assessments for each package and seek feedback.
Workshop 8	29 July 2022	Present the recommended corridor options as a network and next steps (approach to route refinement and public engagement).

During the partner workshops, there was discussion around Pukekohe's role as a satellite town – to be as self-sufficient as possible, i.e., providing employment opportunities, not just housing. It was suggested that environmental and cultural landscape outcomes should be prioritised with a target of enhancing environment and landscape rather than just preserving it as it is.

KiwiRail shared the following perspectives:

- Electrification of railways expected to be complete by 2025, which would result in higher frequencies of services. Need to consider how development would occur across the railway, including permeability.
- Ensure railway operation continues during the construction of new transport infrastructure across the rail.
- Considerations of connections to the three new rail stations in the project area.

Auckland Council shared the following perspectives:

- Two Private plan changes have been lodged along Golding Road.
- Developer activity around Helvetia Road and west of SH22.
- Difficult to anticipate developer pressures resulting from NPS:UD.
- Less constrained sites are likely to have more developer interest (example Wesley, Paerata Heights).

Manawhenua raised the following matters:

- Concern that the proposed strategic network has the potential to induce more growth areas currently zoned rural.
- Two Pā sites within the study area.
- Preference for Waiohua to lead the conversations - Te Ākitai Waiohua, Ngaati Te Ata Waiohua and Ngāti Tamaoho.
- Protection and preservation of Waahi Tapu.
- Iwi governance should be considered.
- Significant cultural landscape locations within the study area noted:
    - Tuhimata Pā.
    - Raventhorpe reserve SEA.
    - Pukewhau bowl.
    - Pukekura / Red Hill.
    - Ngaakoroa stream.
    - Oira Creek.
    - Whangapouri Stream.

- Manawhenua do not support further growth outside of the FUZ land. Difficult to justify two-lane arterial through greenfield rural zoned areas as this could induce further development on both sides. Advocates for four lanes as this is future proofing given predicted growth. But this does depend on potential impacts on bat movement and stream crossings.
- Any tolling roads should be done with consideration for road users who do not have viable alternatives.

Summary of Subject Matter Expert (SME) Activities

SME workshops were held with AT, Waka Kotahi and KiwiRail as the project progressed through options assessment. These forums provided the subject matter experts an opportunity to provide feedback on the options development, assessment and recommendations. Specific feedback (where provided) is set out in each of the options assessment tables in this report (Sections 4 and 5).

Summary of Manawhenua engagement activities

Regular hui were held with Manawhenua of the southern Auckland area through the existing AT Southern Manawhenua Table. At hui, the Project Team presented and sought feedback on the development and assessment of options. Table 3-6: Iwi representative attendance by hui below identifies the iwi representative attendance at each hui. Specific feedback (where provided) is set out in each of the options assessment tables in this report (Sections 4 and 5).

Table 3-6: Iwi representative attendance by hui

Date of hui	Iwi representative in attendance
3 March 2022	Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Maru, Te Patu Kirikiri, Ngai Tai Ki Tamaki
7 April 2022	Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Maru, Ngāti Paoa Trust Board
26 April 2022	Ngāti Tamaoho, Te Ākitai Waiohua, Ngāi Tai ki Tāmaki, Ngāti Tamaoho, Ngāti Whanaunga, Ngāti Tamaterā
5 May 2022	Ngāi Tai ki Tāmaki, Ngāti Maru, Ngāti Tamoho, Ngāti Whanaunga, Te Ākitati Waiohua, Ngāti Tamaterā
2 June 2022	Ngāti Maru, Ngāti Tamaoho, Ngāti Whanaunga, Te Ākitai Waiohua, Ngāti Tamaterā, Ngāti Te Ata
21 June 2022	Ngāti Tamaoho, Te Ākitai Waiohua, Ngāti Whanaunga, Ngāti Maru
7 July 2022	Ngāti Tamaoho, Ngāti Paoa Trust Board, Ngāti Tamaterā, Te Ākitati Waiohua, Ngāti Te Ata Waiohua, Ngāti Whanaunga
8 July 2022	Ngāti Te Ata Waiohua, Ngāti Tamaoho
28 July 2022	Site visit with Ngāti Tamaoho and Ngāti Te Ata Waiohua
4 August 2022	Ngāti Tamaoho, Ngāti Tamaterā, Te Ākitai Waiohua, Ngāti Whanaunga
23 August 2022	Ngāti Tamaoho, Te Ākitati Waiohua, Ngāti Whanaunga, Ngāti Maru, Ngāi Tai ki Tāmaki
27 September 2022	Te Ākitai Waiohua, Ngāti Whanaunga, Ngāti Tamaterā, Ngāti Paoa Trust Board

Date of hui	Iwi representative in attendance
6 October 2022	Te Ākitai Waiohua, Ngāti Te Ata Waiohua, Ngāti Tamaoho, Ngāti Tamaterā
12 October 2022	Ngāti Te Ata Waiohua (including site visit)
25 October 2022	Te Ākitai Waiohua, Ngāti Tamaoho, Ngāti Tamaterā, Ngāti Whanaunga, Te Ahiwaru, Ngāti Maru, Ngā Tai Ki Tāmaki
1 December 2022	Te Ākitai Waiohua, Ngāti Tamaoho, Ngāti Whanaunga
15 December 2022	Te Ākitai Waiohua, Ngāti Tamaoho
19 December 2022	Ngāti Te Ata Waiohua

3.5.2 Stakeholders and Community

Between 1 November 2022 and 20 December 2022, Te Tupu Ngātahi asked the community and key stakeholders for feedback on the emerging preferred options for the future transport network for Drury West, Paerata and Pukekohe. The options presented focused on the route refinement options assessment. However, parts of the corridor assessment were also presented in some instances to show the range of options assessed. Feedback was collected using an interactive map and an online survey.

The Project Team also held two community open days on 12 November 2022 (Franklin: The Centre) and 3 December 2022 (Pukekohe Memorial Hall) and attended the Waka Kotahi Papakura ki Pukekura – Papakura to Bombay open day on 10 December 2022. All open days were well attended by the community.

Key stakeholders who provided feedback included:

- Franklin Local Board;
- Local developers;
- Bus and Coach Association New Zealand;
- Federated Farmers of New Zealand;
- Grace James (and surrounds) Residents Group;
- Karaka Residents and Ratepayers Association;
- Pukekohe Business Association;
- Waikato District Council – Mayor Jacqui Church; and
- Andrew Bayley – Port Waikato Minister of Parliament.

One on one meetings were held with landowners where this was requested.

Specific feedback received on specific options is set out in each of the options assessment tables in this report (Sections 4 and 5).

3.6 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 during the route assessment process.

The Corridor Form Assessment Framework (CFAF) has been designed by Te Tupu Ngātahi to provide a consistent methodology to define the desired corridor form and function requirements and ensure all modes are considered. The framework seeks to encourage well-rounded thinking about both the place and movement functions of corridors.

The CFAF output recommends traffic capacity, bus priority measures, walking and cycling facilities and other corridor elements which influence the corridor footprint. All modes are considered in the development of the cross-section, however facilities for all modes may not necessarily be provided. The resulting cross-section forms the basis for route protection for the corridor.

The form and function of a corridor is determined using a combination of 'place' and 'movement' significance on the individual setting:

- **Place factors** consider the existing land use, future land use plans and trip generators present in the catchment area. It also includes an assessment of the future density of residential, industrial or mixed land use and local / regional trip attraction areas e.g. metro stations, schools, hospitals.
- **Movement factors** consider the hierarchy of the corridor in the regional road network (public transport network, strategic freight network), modal priorities for the corridor and existing and future traffic volumes to determine the future typology and recommendations for a corridor function. Movement is considered at both local and network levels to ensure that duplication of facilities is avoided, and the corridors have targeted modal functions.

The form and function assessment undertaken for each Pukekohe corridor is summarised in the route refinement assessments in Section 5. Figure 3-2 provides an overview of the form and function for the Pukekohe projects, based on AT's Roads and Streets Framework.

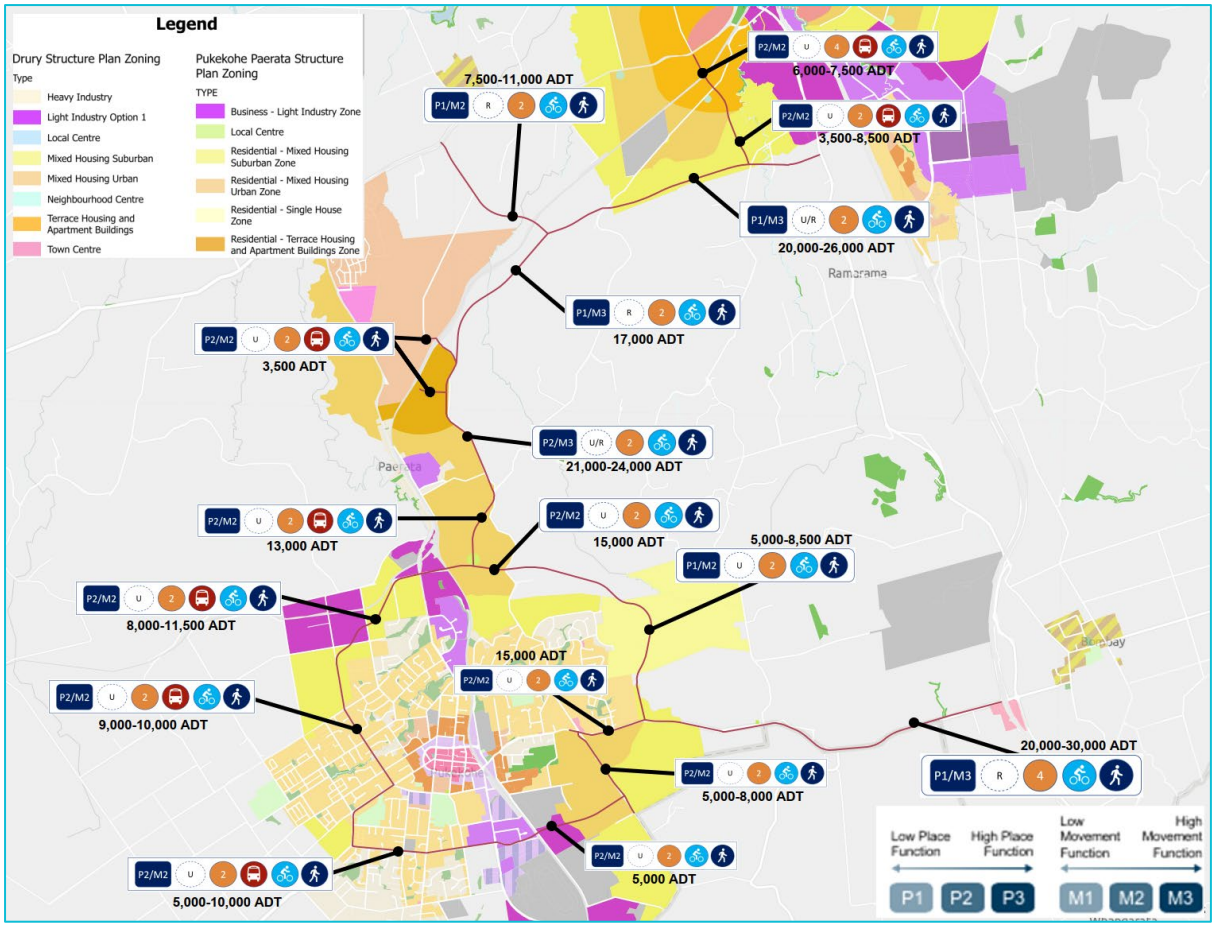


Figure 3-2: Pukekohe projects Form and Function

3.7 Intersection Form Assessment

As part of the route refinement process, an assessment was undertaken to determine preferred intersection forms across the Pukekohe Transport Network. The purpose of this process was to identify the indicative intersection controls and subsequent footprint implications. It is noted that the final decision of the form and control of the intersections could be modified when further land use certainties are known at the time of implementation.

Considerations for intersections in Pukekohe included:

- Maintaining 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 public transport and safe and efficient crossing opportunities for active modes;
- Intersection size (determined by SiDRA modelling), particularly in more constrained existing urban areas; and
- Ensuring each intersection had sufficient space for queuing length and the level of service is acceptable.

Where an intersection is required, Te Tupu Ngātahi Programme Wide guidance is used to determine whether this should be a roundabout or a signalised intersection. The guidance considers a number of factors including operational performance, safety, road environment and different road users.

The guidance adopts a 'Safe Systems' approach and recommends roundabouts as the first choice for at-grade intersections due to the safety benefits for vehicular traffic resulting from slowing down through traffic and reducing the number of conflict points. However, where roundabouts are not appropriate, signalised intersections are then analysed. This is illustrated in Figure 3-3.

For either intersection typology chosen, design features are also considered to ensure that the intersection meets the needs of different users safely and effectively and responds to the site-specific factors, including:

- Movement and place principles;
- Form and function;
- Future land use assumptions;
- Future modal priority;
- Future transport network (2048+);
- Design constraints;
- Roundabout vs signal guidance; and
- Route protecting and transport network staging.

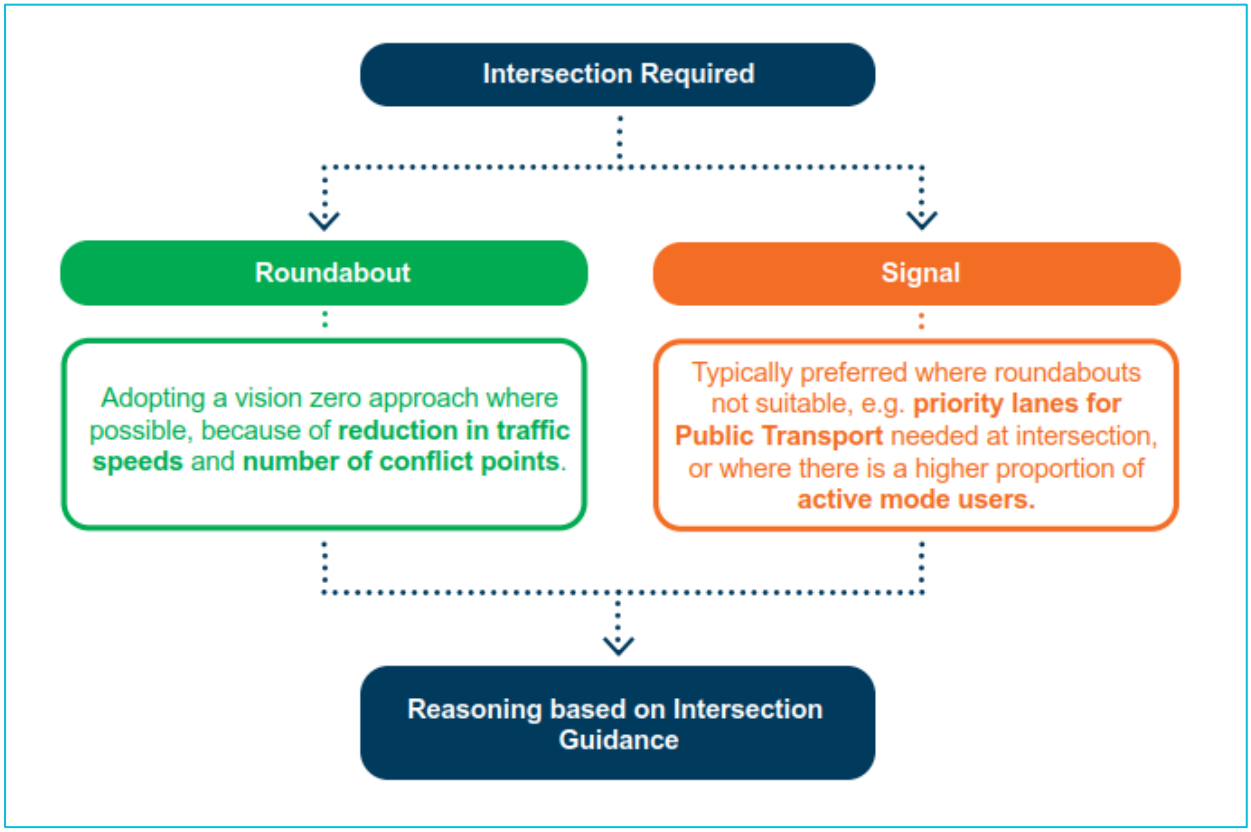


Figure 3-3: Intersection typology decision-making

3.8 Approach to Stormwater Infrastructure

As part of route protection, the Project is required to identify and appropriately protect the land necessary to enable the future construction, operation, and maintenance of the required transport infrastructure, including land required to mitigate the effects of the Project. The design has therefore

considered the appropriate stormwater management methods to meet likely catchment needs and achieve the future regulatory requirements.

The additional land required for stormwater infrastructure is dependent upon the type of stormwater management devices selected for each transport corridor. To determine the type and location of stormwater infrastructure, a design process was undertaken. This process is summarised below:

1. Identification of existing stormwater infrastructure and management devices;
2. Develop a shortlist of appropriate stormwater management devices for each corridor;
3. Assess the size for these devices depending on if treatment, retention, detention and/or attenuation is needed;
4. Identify stormwater management device locations and sizes; and
5. Include stormwater infrastructure within the proposed designation boundary.

The type of stormwater management devices identified for use was based on a number of factors including the surrounding land-use, form of the transport route, road hierarchy and how connectivity to any adjacent properties is to be provided. This approach is summarised in Table 3-7.

Table 3-7: Stormwater System Design Approach Summary

Stormwater Design Environment	Treatment	Conveyance	Attenuation[2]	Diversion
Existing Urban	Proprietary treatment devices or treatment wetland	Pits and pipes	Above ground devices, attenuation wetland or underground tanks	N/A
Future Urban[1]	Proprietary treatment devices or treatment wetland	Pits and pipes	Above ground devices, attenuation wetland or underground tanks	Cut-off channels as required
Rural	Treatment swales or treatment wetland	Conveyance channels	Attenuation swale or wetland	Cut-off channels as required

Note: [1] Assuming direct driveway access from future residential to the main corridor is restricted. To align with the overall project objective, developable land adjacent to the corridors within this environment should be maximised.

[2] Attenuation is typically only required in the upper half of the larger catchment where the wetland is located.

The following approach was generally taken to determine the need for, and location of attenuation devices such as stormwater wetlands, noting that stormwater attenuation devices tend to be most efficient where sited at a centralised location to capture larger catchments:

- Assess the catchment between two geometric high points in the road alignment;
- Calculate the wetland area as a percentage of this catchment (10% was used for catchments that require 1% AEP attenuation and 6% for catchments that do not require attenuation);
- The lowest point of the road is then located, and a wetland is placed in the best suited position to:

– Reduce impacts on sensitive ecological areas;

- Reduce impacts on waterways and floodplains;
- Where possible, avoid steep land where excessive earthworks would be required;
- Provide clearance from proposed road design cut batters; and
- Maximise use of orphaned land parcels where possible.

- Model the earthworks for the wetlands to ascertain the footprint required within the proposed designation; and
- Indicatively design the pipe or swale network required to convey all flows to the wetland location.

If it was determined that a stormwater wetland was required, the location of the wetland was identified by placing the wetland at a low point along the transport corridor alignment and close to the corridor for easy access and maintenance. Also required is an outlet structure to discharge to a nearby natural stream. Where environmental constraints had been identified by technical specialists through constraint mapping and the options assessment process, these were also considered.

Bridges have been designed at all watercourse crossings where the upstream catchment is larger than 80 hectares. Culverts are included on flowpaths where the catchment is less than 80 hectares. The width of each bridge is approximately three-quarters of the floodplain as defined by Auckland Council's floodplain layer. Bridges and culvert structures are subject to a future resource consent process. The details and sizing of those structures will be determined at a later date to meet the council requirements and other legislation at the time of design and implementation.

3.9 Interdependencies in the Network

The Pukekohe Transport Network area interacts with a number of other projects in the wider South Auckland area, which was taken into consideration during the alternatives assessment process. Table 3-8 provides an overview of the interdependencies and relationships in the network between the Pukekohe package study area and other projects in the wider South Auckland Area.

Table 3-8: Interrelated transport projects with the Pukekohe Transport Network

Package	Project(s)	Inter-relationships with the Pukekohe Transport Network
Drury Arterial Networks (Te Tupu Ngātahi)	Frequent transit network (FTN) and arterial upgrades to Jesmond Rd, Bremner Rd and Waihoehoe Rd West (all designations confirmed in the AUP:OP)	The functional intent of the FTN route in Drury is to provide north-south, and east west connectivity across the Drury area, and to form part of the Southern FTN connecting to the rail network and proposed Mill Rd improving multimodal connection. These projects interact with the Drury West Arterial (part of the Pukekohe Transport Network) that connects from SH22/Jesmond Road intersection and the Drury West rail station to the south of the Drury FUZ.
	Upgrade of SH22 between Oira Road and the SH1 Drury interchange (alteration to SH22 designation confirmed in the AUP:OP)	This upgrade provides walking and cycling connections and better accommodates freight and general traffic to support current and future residents. This section of SH22 is important in the context of the urbanisation of the surrounding area, and the proposed rail upgrades and new rail stations. To support the urban growth in Drury, the upgrade to SH22 proposes a change in the form and function from a state highway to an urban arterial. The Drury West Arterial (part of the Pukekohe Transport Network) interacts with this project at the SH22/Jesmond Road intersection.

Package	Project(s)	Inter-relationships with the Pukekohe Transport Network
Rail DBC / Stations NoR (Te Tupu Ngātahi)	Rail capacity improvements between Pukekohe and Papakura (and associated grade separations at rail crossings)	Additional and more reliable rail capacity is anticipated to improve mode shift in the southern growth area. This would result in alleviating traffic pressures off the network, improving capacity along strategic routes. The Pukekohe Transport Network provides a number of new bridge crossings across the North Island Main Trunk (NIMT).
	New rail stations at Drury Central, Drury West and Paerata	Two new stations are proposed in Drury and one in Paerata. Drury Central and Paerata rail stations have been confirmed, the Drury West rail station NoR (and resource consents) has been lodged. The Pukekohe Transport Network provides new connections to the Drury West and Paerata rail stations.
	Proposed Regional Active Mode Corridor between SH 1 and NIMT	The Regional Active Mode Corridor provides a direct connection to stations/ centres along the NIMT. The Pukekohe Transport Network interacts with the proposed Active Mode Corridor where projects propose new crossings of the NIMT.
Mill Road DBC (Te Tupu Ngātahi)	Proposed Mill Road Corridor	A proposed new and upgraded strategic transport corridor from Manukau to Drury, including upgrades to Redoubt Road, Mill Road and Dominion Road and a new section connecting to SH1 in Drury South. The corridor links into the proposed Drury South Interchange. Funding was announced for implementation of Mill Road through NZUP. The status of the Mill Road corridor is uncertain at this stage. The Pukekohe Transport Network interacts with the proposed alignment of the Mill Road at the proposed Drury South Interchange.
SH1 Papakura-to-Bombay (P2B) (NZUP)		The P2B project is being delivered by Waka Kotahi as a mixture of implementation works and route protection (for future implementation). This project includes upgrading the alignment to six lanes, providing wide shoulders to future-proof for bus services along the SH1 corridor; interchange improvements; and a shared path. The Pukekohe Transport Network interact with the P2B corridor at the proposed Drury South Interchange.
Safe Roads SH22 Karaka Road (Safe Network Programme)		The Waka Kotahi Safe Network Programme includes SH22 improvements. The Pukekohe Transport Network interacts with SH22 in a number of places.
Papakura to Pukekohe rail electrification		Funding has been allocated for an additional 15 electric trains to enable electric rail services to be extended to Pukekohe and to provide additional capacity on the rail network. Rail electrification removes the need for passengers to change trains at Papakura, increasing the attractiveness of public transport in the South. Construction works are already underway for this project. The Pukekohe Transport Network interacts with this as new crossings of the NIMT will be provided in a number of places.

3.10 Concept Design Refinements

Following identification of the preferred route, initial concept designs were developed. Based on this, technical specialists (including SMEs) provided recommendations on design refinements through multidisciplinary workshops. The recommendations then informed the iterative development of later revisions of the concept design. Engagement with affected landowners also informed design refinements where appropriate. Concept design refinements for each transport corridor are summarised in Section 5.

4 Corridor Assessment

As set out in Section 3.2, the gap analysis identified four groups of options for corridor assessment as part of the Pukekohe Transport Network alternatives assessment:

- **Drury West Local** – local connectivity in the FUZ to the station and strategic corridors;
- **Paerata Local** – local connectivity in the FUZ to the station and strategic corridors;
- **North-South** – strategic connections between Drury, Paerata and Pukekohe; and
- **Pukekohe Local** – local connections around Pukekohe as alternatives to the current main connection through the Pukekohe centre.

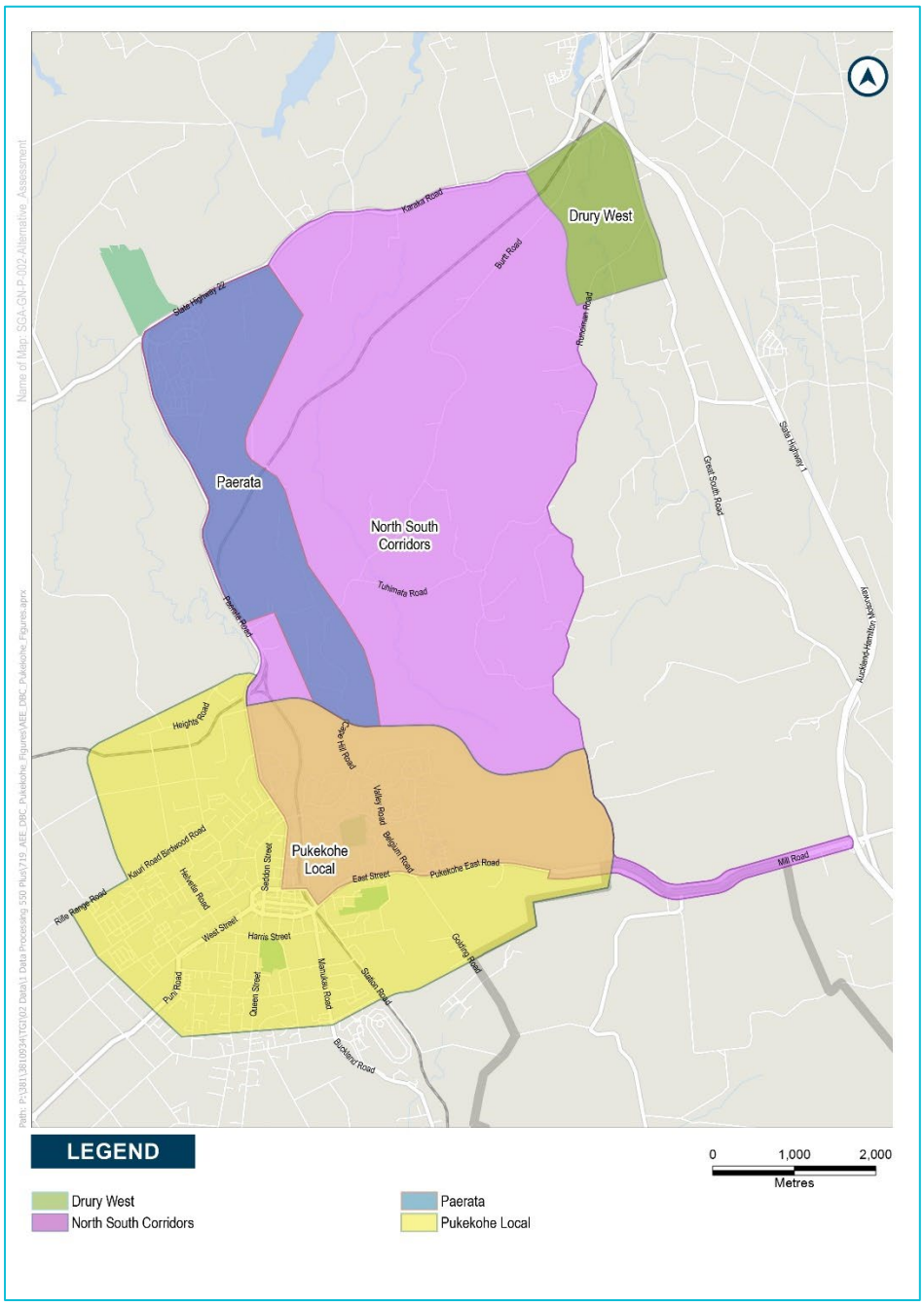


Figure 4-1: Four assessment areas for the corridor assessment

The Drury West Local, Paerata Local and North-South options were assessed individually. Following this, the recommended corridors from Drury West Local and Paerata Local assessments were tested with a short list of the North-South options as network packages. This was to test the individual recommendations from each area to make an overall recommendation as an integrated transport network.

The Drury West Local and Paerata Local corridor assessments focused on maximising access to the proposed Drury West and Paerata rail stations, mode shift, and connectivity to existing strategic corridors (SH22 and SH1) and within the FUZ. The North-South options investigated the need for the strategic North-South connections when coupled with the Drury West Local and Paerata Local recommended corridors.

Pukekohe Local corridor options were assessed individually.

4.1 Drury West Corridor Assessment (relevant for NoRs 1 and 2)

4.1.1 Background: South IBC / Strategic South DBC assessment summary

As set out in Section 2.2, the IBC and draft Strategic South DBC provide important background to the previous rounds of optioneering for the Drury West area, which inform the alternatives assessment for the Pukekohe Transport Network. The alternatives assessed at these phases are summarised below.

A number of new and upgraded arterials in Drury West were investigated at the IBC phase. Figure 4-2 shows the short list options considered in the IBC. The alignment of AR20 was recommended forming a connection between the IBC recommended Pukekohe Expressway, Drury west rail station and SH22 and Jesmond Road.

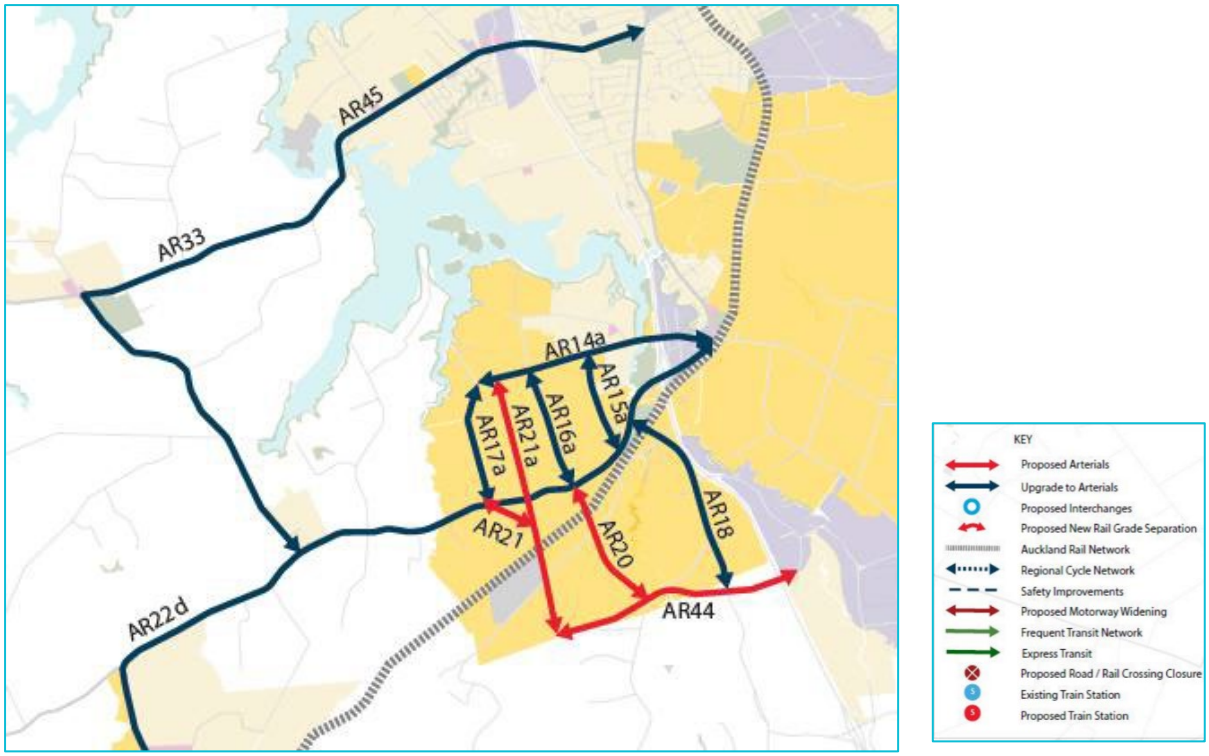


Figure 4-2: IBC Drury West Short List Options (Source: South IBC Options Assessment Report 2018)

Through the IBC, the AR20 alignment was recommended as a 2 lane, 24m wide cross section. This was developed further through the Strategic South DBC to 4 lane, 30m wide cross section. Two options (Option A and Option B) were developed for the SH22 North Connection for the Strategic South DBC:

- Option A – South alignment connecting Jesmond Rd and the Pukekohe Expressway to the west of Runciman Road; and
- Option B – North alignment connecting Jesmond Rd and Pukekohe Expressway.

Both options scored similarly. A hybrid of both options, which generally follows the Option B alignment in the north section, and Option A alignment in the southern section was recommended. The tie-in point at Pukekohe Expressway is largely constrained by the Transpower electricity transmission lines and spacing of pylons.

Figure 4-3: Draft Strategic South DDBC Northern Connector Options (Source: Draft Strategic South DBC, July 2020)

4.1.2 Gap analysis

Table 4-1 provides a summary of previous optioneering for Drury West components of the Pukekohe Transport Network, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC, and recommendations for the Pukekohe Transport Network alternatives assessment.

Table 4-1: Summary of gap analysis and recommendations

Intention and previous options assessment	Key changes since IBC and Draft Strategic South DBC	Recommendation(s)
Provides access to Drury West station from SH22, crosses the rail line and connects to the Pukekohe Expressway. Two options were investigated at the Strategic South DBC phase. Interacts with the location of the Pukekohe Expressway. The access to the Drury West station needs consideration based on any revisit to the Pukekohe Expressway.	Drury West Plan changes within close proximity, which may influence the number of trips that may use the Drury West connector. GPS 2021/Zero Carbon Act – Climate change lens. Consider implications of NPS:FM and NES:FW – adopt avoidance of wetlands where possible as principle in first instance.	Corridor assessment considering the following: • Interaction with Pukekohe Expressway; • East-west connectivity through FUZ – maximise access to proposed Drury West Station; • Consideration of natural wetlands under NPS:FM; and • Connections to existing strategic network (SH22 and SH1).

4.1.3 Alternatives Development

For the Pukekohe Transport Network alternatives assessment, options were developed within the Drury West area. The options connect Drury to the proposed Drury South interchange, from

SH22/Jesmond Road to Great South Road, providing connectivity to the wider strategic network (SH1, SH22, FTN Network and North Island Main Trunk), future town centre, new Drury West Rail Station and future Drury West communities. The options developed are described below (Figure 4-4):

- **DW Option 1:** new corridor extending south from SH22 to the edge of the Drury West FUZ then east to the proposed Drury South interchange;
- **DW Option 2:** a new corridor extending south connecting to and including an upgrade of Runciman Road and Great South Road;
- **DW Option 3:** a new corridor extending south to and including an upgrade of a portion of Burtt Road. Includes a new section of road between Burtt Road and Great South Road through FUZ in the north and an upgrade of Great South Road;
- **DW Option 4:** corridor utilising existing roads (Burtt Road, Pitt Road, Great South Road);
- **DW Option 5:** new corridor extending south from SH22 with a direct alignment to Great South Road; and
- **DW Option 6:** a new corridor extending south to and including an upgrade of a small portion of Burtt Road. Includes a new section of road between Burtt Road and Great South Road through FUZ in the north and an upgrade of Great South Road.

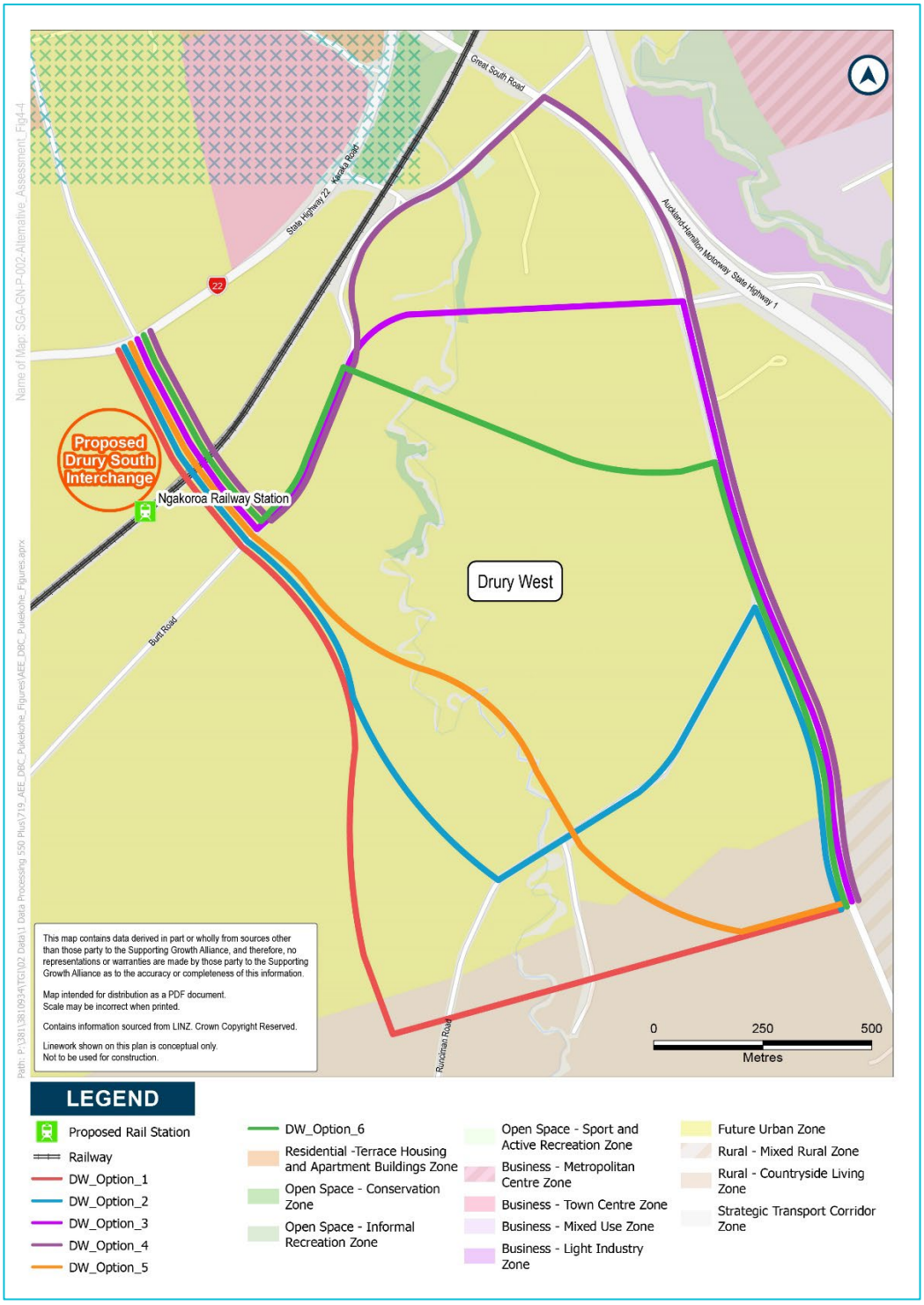


Figure 4-4: Drury West corridor options

There are two related proposed transport projects that all options provide a connection between, these are:

- Proposed Drury West Rail Station – a NoR for a new designation has been lodged by KiwiRail; and
- Proposed Drury South Interchange (SH1) – a NoR for a new designation (or an alteration to the existing designation) is being sought by Waka Kotahi as part of the Papakura to Bombay SH1 Upgrade.

For both of these projects, the project team had regular liaison meetings to integrate and discuss options for the proposed transport projects, keep up to date on timing and engagement with public and landowners and share findings from technical assessments.

All options extend south from the accessway proposed by the Drury West Rail Station at the intersection of SH22 and Jesmond Road and connect to the proposed at Great South Road proximate to the proposed Drury South Interchange (SH1). The Drury West options also interface with the following transport projects:

- SH22 Upgrade (Waka Kotahi) and Jesmond to Waihoehoe West FTN Upgrade (AT) – NoRs by Waka Kotahi and AT lodged in 2021 and recently confirmed (part of the Te Tupu Ngātahi Programme). The upgrade of part of SH22 (Drury interchange to Jesmond Road) is being progressed by Waka Kotahi under NZUP. The upgrade of part of SH22 (Drury interchange to Jesmond Road) is being progressed by Waka Kotahi under NZUP;
- SH1 Papakura to Bombay Project (Waka Kotahi) – Stage 1 of this project which is between Papakura and Drury is under construction. This includes the upgrade of the existing Drury / SH22 / SH1 interchange. Waka Kotahi will soon be lodging a NoR for the Drury South to Bombay section, which includes the proposed new Drury South Interchange as noted above; and
- The future collector roads indicated in the Drury – Ōpāheke Structure Plan are expected to be developed through developer contributions (or delivered by developers) as areas are urbanised.

4.1.4 Alternatives Assessment

Six alternatives were assessed for the Drury West corridor assessment against the MCA framework by each technical specialist. Six alternatives were assessed for the Drury West corridor assessment against the MCA framework by each technical specialist. Table 4-2 provides a summary of the assessment undertaken.

Table 4-2: Drury West corridor MCA scoring

MCA Criteria	Scores					
	DW1	DW2	DW3	DW4	DW5	DW6
Transport outcomes						
Safety	1	1	2	3	1	2
Integration	2	2	1	1	2	2
Access	3	2	2	1	3	2
Resilience	3	2	1	0	3	1
Travel Choice	1	1	2	1	1	2
Cultural						
Heritage	0	-3	-3	-3	0	-3
Social						

Land use futures / integration with planned landuse	1	3	2	2	1	2
Urban design	2	-2	-1	-2	1	1
Land requirement / property	-3	-2	-2	-2	-3	-2
Social cohesion	2	2	2	1	1	1
Human health and wellbeing	-1	-1	-1	0	-1	-1
Environment						
Landscape / visual	-2	-1	-2	0	-2	-2
Stormwater	-2	-2	-3	-1	-2	-1
Ecology	-4	-3	-4	-2	-4	-3
Natural hazards	-3	-2	-3	-1	-4	-2
Construction impacts						
Embodied carbon emissions	-3	-3	-3	-3	-3	-3
Construction impacts on utilities / infrastructure	-1	-2	-2	-2	-1	-2
Construction Disruption	-1	-2	-2	-2	-1	-2
Construction costs / risk / value capture	-2	-2	-2	-2	-2	-2

Table 4-3: Drury West corridor assessment findings summary

Criteria	Summary of performance
Transport Outcomes	DW1 and DW5 were preferred providing a high degree of connectivity and access to support the growth. DW3 and DW6 improve E-W connectivity for active modes and buses but would need additional local connections to support growth. DW4 was least preferred as it would provide less network resilience.
Heritage	Options DW1 and DW5 have no recorded heritage. DW4 is the least preferred given it has the largest number of features being potentially impacted. This includes the Clarke homestead, villas, Herkt's petrol station, Runciman Tennis club, and Māori huts close to Ngakoroa Stream.
Social	**Land use** DW2 was preferred as it connects to the proposed Drury West rail station, directly to two business centres and traverse multiple future residential areas as well as future light industry. DW1 was least preferred given it is the longest stretch of new corridor and would take up a greater amount of developable land. DW5 was also less preferred due to impacts on developable land albeit partly located within a stream/floodplain.

Criteria	Summary of performance
	Urban design DW1 was preferred for taking a direct route to the proposed Drury South interchange over those options that deviate through the industrial area. DW2 is least preferred as it is not a direct connection, adding distance and reducing legibility. **Land requirement** DW4 was preferred as it requires partial acquisitions of large plots. DW1 and DW 5 were least preferred as these options would require full acquisitions of residential areas. **Social cohesion** DW2 is preferred as it provides the best connectivity between areas and crosses the Ngakoroa Stream at an existing crossing point. **Health and wellbeing** DW4 predominantly traverses light industrial area, which is not a sensitive land use and uses existing roads, where air quality, noise and vibration effects are existing and expected.
Environmental	**Landscape and visual** DW4 was preferred due to its use of existing road alignment and the proximity to FUZ. Effects would likely be limited to rural residential properties within the localised setting of the western part of the route. However, seen in the context of the anticipated future urban zoning. The area of new roading would likely result in the loss of a limited area of established planting. **Stormwater** DW4 was preferred as it contains the least new impervious area compared to the other options, however, it also has several small culverts that would be difficult to upgrade and crosses several flood plains. DW3 was the least preferred as the alignment follows the same path as a large stream and would require stream modification / realignment to accommodate the road, nearly all of this alignment is the 1% AEP floodplain and would require significant earthworks to mitigate displacement effects of the road embankment. **Ecology** While DW4 impacts a similar number of streams and wetlands as other options there are pre-existing impacts hence the magnitude of effects is likely to be lower and, in some cases, upgrading undersized bridges / culverts would improve ecological integrity. DW3 and DW5 were least preferred due to significant impacts on streams, requiring realignment. DW1 is also least preferred due to potentially high impact on bat movement. **Natural Hazards** The alignment is entirely within alluvium with a risk of soft soil/liquefaction. DW4 was preferred as it requires mostly widening on existing alignments and only crosses one floodplain, where the other options cross three. DW2 and DW6 also use the existing alignment but still crossed three flood plains making them potentially less attractive from a hazards point of view. DW3 and DW5 were least preferred.
Construction impacts	**Embodied carbon emissions**

Criteria	Summary of performance
	DW1 is preferred as it has low lane kilometres (likely lower materials and construction emissions) and no addition features which might adversely differentiate option based on earthworks or major structures. DW3 is least preferred as one of the longest (implies greater materials and construction fuel/energy). The corridor crosses a floodplain and would require a longer bridge and significant earthworks (greater materials emissions related to bridge, and construction emissions for earthworks). **Construction impacts on infrastructure/utilities** The alignment would require protection of the First Gas transmission pipe, overhead powerlines and transmission lines. DW2, DW3 and DW6 are also likely to require undergrounding of overhead powerlines and relocation or protection of the water distribution pipe making them less preferred. **Construction disruption** Majority of route is greenfield. DW2, DW3, DW4 and DW6 are likely to require temporary traffic control making them less preferred. **Construction costs** All options require a number of bridges and there was limited differentiation between them.
Partner feedback	Key feedback from KiwiRail during workshops included: • Support a direct, multi modal, connections to the Drury West Station. Relating to the option to upgrade Burtt Road to an arterial, an upgrade is required regardless due to the that due to the future development around the station and also noting the catholic school. Key points from AT and Waka Kotahi SMEs during workshops were: • Consideration of accessibility to the proposed Drury West options through FUZ areas currently in floodplain (that likely cannot be developed). • Access across the NIMT is crucial to reduce severance. Manawhenua during hui expressed preference for reducing impacts on the Ngakoroa Stream Manawhenua also advised that there are two Pā sites within the study area and are keen to work with Te Tupu Ngātahi to understand other features and constraints in the area.

4.1.5 Discarded Alternatives

Table 4-4: Options to be discarded

Option	Reason
DW1 (southern portion)	The southern part of the option was discounted because it is located outside the FUZ and this part of the corridor does not integrate or serve the FUZ well. A higher amount of land is required for this option. The southern portion of DW1 option also has a potentially high impact on bat movement.
DW3	Option DW3 was discounted as it follows a significant portion of the Ngakoroa Stream requiring significant stream diversion/realignment. Has higher construction costs and environmental impacts through the assessment.

Option	Reason
DW4 and DW6	These options were discounted as they do not travel effectively through the growth area. Great South Road has the corridor width to be upgraded in a separate future project as this route is more focussed through industrial / business areas.

4.1.6 Recommended Corridor Option

It was recommended that a corridor between **DW1** (new corridor extending south from SH22 to the edge of the Drury West FUZ then east to the proposed Drury South interchange) and **DW2** (a new corridor extending south connecting to and including an upgrade of Runciman Road and Great South Road) be taken forward to test with the Paerata Local and North-South recommended corridor options at a network level (see Section 4.4). This corridor provides good connectivity and access to support the growth and is a direct connection. At route refinement assessment, options will look to reduce impacts on the Ngakoroa Stream.

4.2 Paerata Local Corridor Assessment (relevant for NoRs 2 and 3)

4.2.1 Background: South IBC / Strategic South DBC assessment summary

The Paerata Local component was considered as part of the North-South Connection in the South IBC. See Section 4.3.1 for more details.

For the Draft Strategic South DBC, three options were developed for the Southern Connector at Paerata to connect SH22 at Paerata with the Pukekohe Expressway. The options were:

- Option A – partially online, utilises Sim Road
- Option B – Offline, connection further south from the Pukekohe Expressway
- Option C – Offline, direct east west connection

Option A was selected as the recommended option. This option was chosen because it integrates with planned land use (i.e. Paerata Rise Development) in the northern section of the alignment and also integrates well with the proposed Paerata Rail Station.

Options B and C were discounted for potential impacts on live-zoned areas to the north, highest associated costs and land instability concerns.

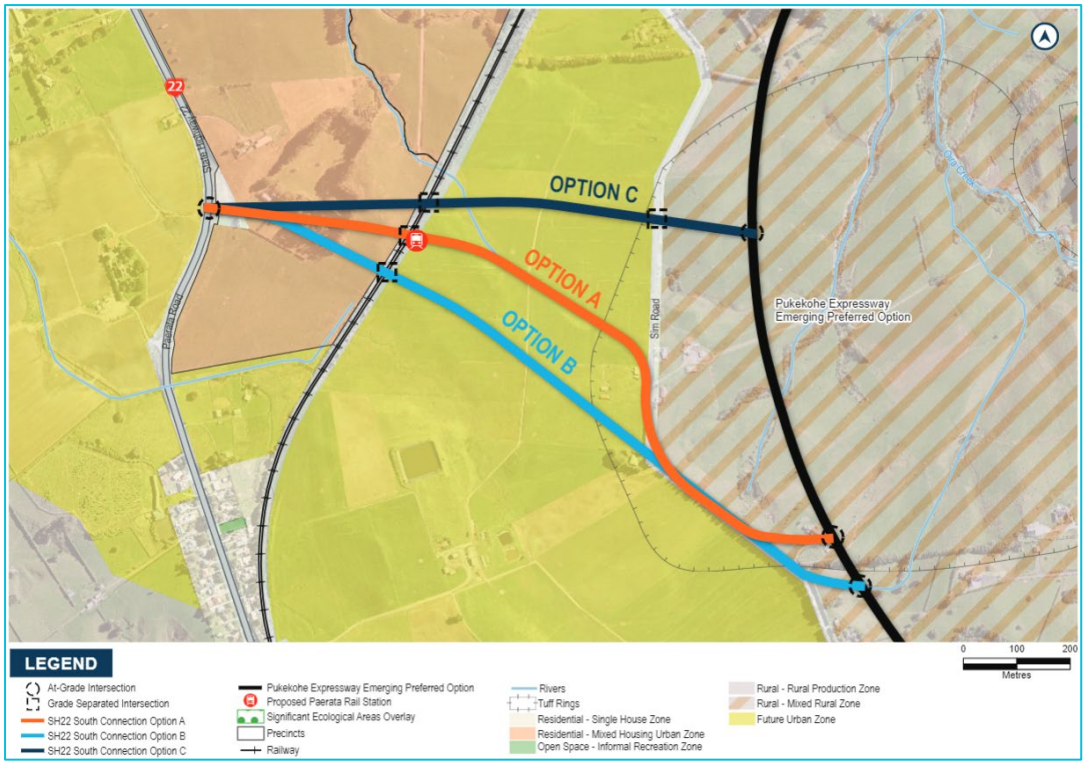


Figure 4-5 Draft Strategic South DBC Southern Connector Options (Source: Draft Strategic South DBC, July 2020)

4.2.2 Gap analysis

Table 4-5 provides a summary for previous optioneering for Paerata Local transport components of the Pukekohe Transport Network, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC, and a recommendation for the Pukekohe Transport Network alternatives assessment.

Table 4-5: Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)

Provides access to Paerata station, crosses the rail line and connects to the Pukekohe Expressway – known as the Southern Connector.	• A focus on climate change in government policy and future direction (impending with RMA reform):
	  • The Government Policy Statement on Land Transport (2021) requires investment decisions to be consistent with transformation to a low carbon transport network.
	  • Auckland Council's declaration of climate change emergency.
	  • Increased scrutiny on the impacts on climate change from transport corridors,
		Corridor assessment considering the following:
		• The form and function of the Pukekohe Expressway is re-assessed and the need confirmed which influence the connections in Paerata;
		• Further alternatives are considered (via a corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads;

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
	affordability, socio-political pressure. • Funding of Paerata Rail Station through NZUP. • Active development in Paerata Rise.	• Maximise connectivity to the proposed rail stations (NZUP) and associated mode shift through strategic connections; and • Through any optioneering processes new information such as impacts on wetlands (under the NPS FW) and opportunities to integrate with urban development are identified.

4.2.3 Alternatives Development

The options developed within the Paerata area investigate local connectivity to the proposed Paerata Station and to SH22 and within the Paerata and north Pukekohe future urban areas. Five options were developed:

- **PS Option 1**: new connection in the Rural Zone;
- **PS Option 2**: new eastern connection linking to the Paerata industrial area and upgrading part of Crown Road, Tuhimata Road and Sim Road;
- **PS Option 3**: new connection upgrading Sim Road;
- **PS Option 4**: north-south connection connecting the two extents of Sim Road over the NIMT, connecting to the Paerata Rise Development and to SH22; and
- **PS Option 5**: new eastern connection linking to the Paerata industrial area, upgrading part of Crown Road, Tuhimata Road and a new connection extending south in the centre of the FUZ.

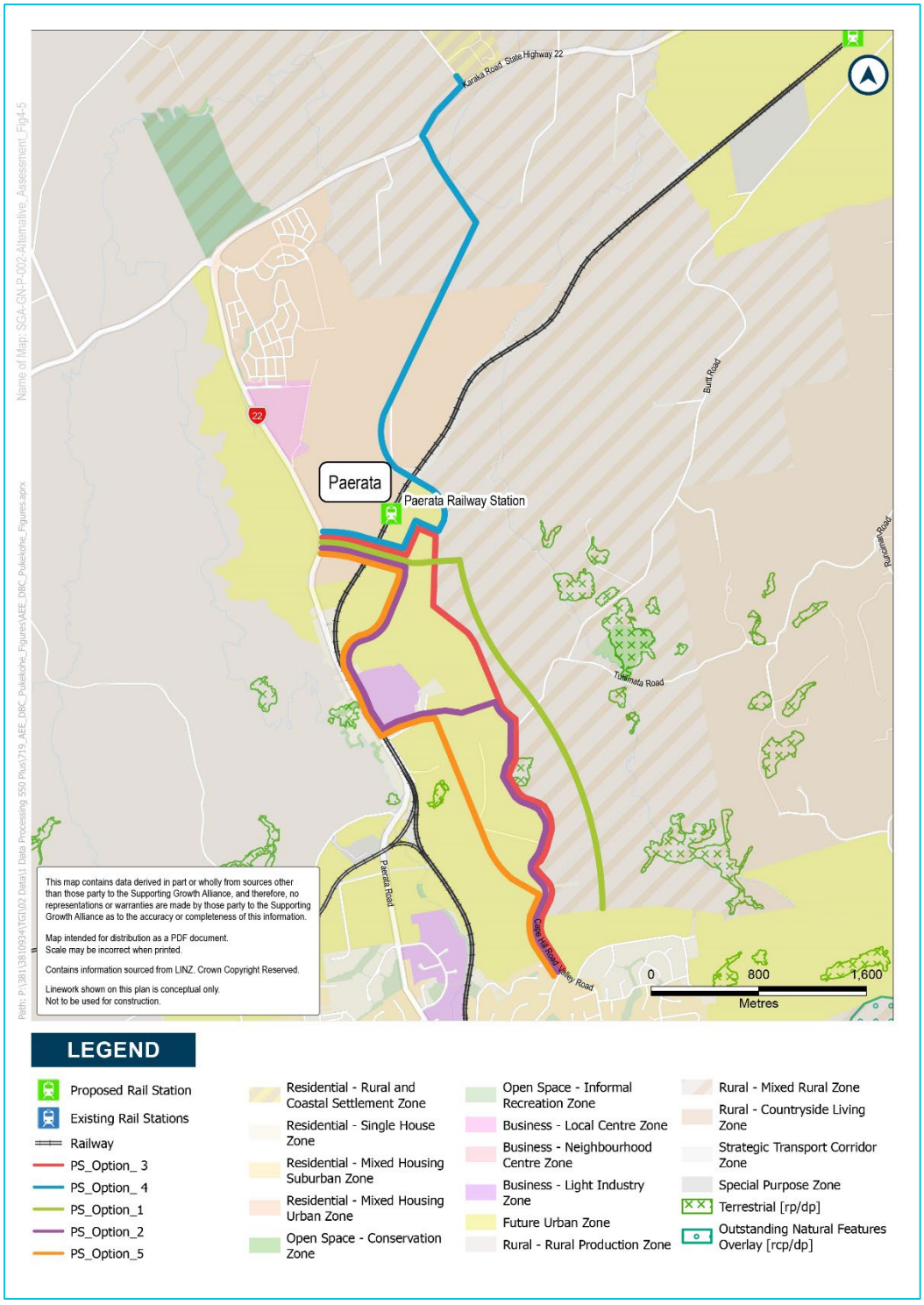


Figure 4-6: Paerata Local corridor options

The Paerata options at the southern extent interact with the Pukekohe Local options – with the north-east section of the Pukekohe arterials. They also interact with the North-South options.

At the time of assessment, KiwiRail had lodged a NoR for the Paerata Station confirmed through the COVID fast track process. Construction of the station is expected to commence in 2023.

4.2.4 Alternatives Assessment

Five alternatives were assessed against the MCA framework by each technical specialist. Table 4-6 provides a summary of the assessment:

Table 4-6: Paerata Local MCA scoring

MCA Criteria	Scores				
Options	**PS1**	**PS2**	**PS3**	**PS4**	**PS5**
Transport Outcomes					
Safety	2	3	3	3	2
Integration	0	3	2	3	3
Access	1	3	2	3	3
Resilience	3	2	1	3	3
Travel Choice	-1	2	2	2	3
Cultural					
Heritage	0	-2	0	-1	-2
Social					
Land use futures	1	2	2	1	3
Urban design	-3	-1	1	-1	-1
Land requirement / property	-2	-2	-2	-1	-2
Social cohesion	0	2	1	2	2
Human health and wellbeing	-1	-1	0	-1	-1
Environment					
Landscape / visual	-2	-2	-2	-1	-2
Stormwater	-2	-2	-1	-1	-2
Ecology	-4	-3	-3	-2	-3
Natural hazards	-2	-1	-1	-1	-3
Construction impacts					
Embodied carbon emissions	-3	-3	-3	-3	-3
Construction impacts	-2	-2	-2	-2	-2
Construction Disruption	-1	-2	-2	-2	-2

Construction costs / risk	-2	-2	-2	-2	-3

Table 4-7: Paerata Local corridor assessment findings summary

Criteria	Summary of performance
Transport Outcomes	PS2 and PS5 are preferred as these options increase connectivity between FUZ areas across the rail corridor. Consideration of a more direct option for PS5 was recommended (for route refinement). PS4 also scored favourably but was likely to have a different function to the other options and would need to be combined with other options. PS1 was least preferred due to lack of integration with FUZ and limited benefits for mode choice.
Heritage	PS1 and PS3 have no recorded heritage and were the preferred options. PS2 and PS5 had the potential to impact early mid-20th century heritage: railway workers cottages, Paerata dairy factory, dairy factory workers cottages and Paerata bowling club. PS4 had the potential to impact 2 heritage barns close to Sim Road.
Social	**Land use** PS5 was preferred as it connects the proposed rail station to future urban areas and provides good integration. This option would create large, viable areas of developable land. In addition, the route provides for large volumes of vehicles to travel around the future residential areas providing best integration for these future land uses. PS2 and PS3 were less preferred as the corridor is partly outside the FUZ/planned residential areas, reducing the amount of developable land being impacted and potentially creating a future conflict between those residential land uses and high-volume road corridor reducing integration. PS1 was the least preferred as it was within the rural zone and too far from the FUZ and did not provide good integration with current and future land uses. It also was considered to encourage development outside the FUZ. **Urban design** PS3 is preferred as it runs along the edge of the FUZ on an existing corridor, defining the rural/urban boundary, and would separate traffic from future residential development. PS2, PS4, PS5 traverse an area identified as THAB in the Structure Plan which may create challenges around future development creating a positive interface with the road corridor. The topography has potential to negatively affect character and amenity and create poor interface outcomes, particularly in the southern area. PS1 was the least preferred as it is outside the FUZ and there are no place making opportunities. This option was considered likely to create pressure to extend FUZ and create a Rural Urban Boundary. Due to running through Rural area this option would have an adverse effect on the amenity and character of the area. **Land requirement** PS4 was the preferred option as it required the acquisition of the least number of properties. PS1, PS2, and PS5 had greater impacts on properties.

Criteria	Summary of performance
	PS3 was also less preferred but it was noted that by following the southern side of Sim Road this could be mitigated and would be similar to PS4. **Social cohesion** PS2, PS4 and PS5 create a link through rural land and past an existing industrial area to an existing residential. PS3 creates a link to the existing residential area. PS1 is least preferred as it does not provide a direct connection to existing urban areas. **Health and wellbeing** PS1, PS2, PS4, PS5 were similar. The options would have a negative impact introducing a new corridor near existing and future residential areas and Country Village Preschool. PS3 was the preferred option as while it is in proximity to residential land use it is not close to any other sensitive receivers.
Environmental	**Landscape and visual** PS4 was the preferred option. While there were likely to be effects on rural character, there was an opportunity to provide planting along the new road corridor to integrate the road into the landscape. PS1, PS2, PS3 and PS5 were less preferred as the proposed route would result in the road being located upon steep topography and potentially impacting a stand of vegetation on Cape Hill Road identified as an SEA. **Stormwater** PS3 and PS4 are the preferred options. PS1 would require water quality detention and attenuation via wetlands. PS2 and PS5 cross a number of small tributaries and run alongside / over a flood prone area near the NIMT rail. Mitigation would be required to balance flood effects on the railway line and upstream properties. **Ecology** PS4 was preferred as reduces potential impacts on wetlands PS1 and PS5 were the least preferred due to potential impacts on nationally critical long-tailed bats recorded in Paerata Scenic Reserve (1km West) and Coulthards Scenic reserve (1km East). Fragmentation of numerous stream corridors and bush fragments likely to provide key habitat corridors for bats. PS2 and PS3 were also not preferred due to potential impacts along the east side of Cape Hill Road, where indigenous vegetation occurs in the SEA_T_4380. **Natural Hazards** PS2, PS3 and PS4 manages to avoid most of the problematic terrain. PS1 was not preferred as it mostly crosses undulating terrain associated with volcanic deposits (mostly tuff and basalt) with numerous flood plains in gullies. PS5 was the least preferred as involves new construction on swamp in southern section, adjacent to Whangapouri Creek.
Construction impacts	**Embodied carbon emissions** There was limited differentiation between options. PS3 was the preferred option as it is mostly the widening of existing roads and may benefit from reusable materials and previous works, from a construction emissions perspective. **Construction impacts on infrastructure/utilities**

Criteria	Summary of performance
	There was limited differentiation between options as a number of services would need to be protected or relocated including first gas, overhead transmission lines and power lines. **Construction disruption** PS1 was the preferred option. All other options would require lane narrowing or temporary traffic control needs to be implemented during construction on the existing roads. **Construction costs** All options have challenging terrain, and some require a bridge to cross the railway.
Partner feedback	During workshops KiwiRail shared insights on railway electrification (by 2025) and construction of railway / Paerata and Drury Rail Stations. During the workshop AT and Waka Kotahi SMEs raised following matters: • AT shared existing and potential plan changes within the study area. • AT raised that due to the narrow extent of Paerata FUZ, an arterial through the middle of it may have some integration issues. Benefits were acknowledged for the option on the edge of the FUZ supported by a local road within the FUZ as development progresses. • Consideration of the efficiency of the freight network in terms of journey time and emissions. A number of intersections may delay movement. • Acknowledgement of topographical constraints on Cape Hill Road. • Discussion on a network that reduces VKT whilst supporting development. Manawhenua shared at hui: • Ngāti Tamaoho highlighted development in the Paerata area and suggested liaison with developers to reduce any potential overlap. • Ngāti Te Ata Waiohua queried the weighting of cultural and environmental impacts in options assessment and the project confirmed these will be critically considered while developing and assessing options.

4.2.5 Discarded Alternatives

Table 4-8: Options to be discarded

Option	Reason
PS1	Almost completely outside of the FUZ, within existing and future rural land. Provides the least connection to employment, communities, and facilities. Does not meet the transport outcomes (-1 for mode choice). Highest ecological potential impact on bats and waterways. However, this option may be revisited if the Pukekohe Expressway option is chosen.
PS2	Discounted due to potential impacts on heritage items and potential flooding effects.
PS4	Discounted as Paerata Rise Development is providing collector roads that have a similar function.

4.2.6 Recommended Corridor Option(s)

It is recommended that **PS3** (new connection upgrading Sim Road) and **PS5** (new eastern connection linking to the Paerata industrial area, upgrading part of Crown Road, Tuhimata Road and a new connection extending south in the centre of the FUZ) be taken forward to be tested with the Drury West Local and North-South recommended corridor options at a network level (see Package Assessment in Section 4.4). PS3 and PS5 provide good connectivity and access to support the growth.

Recommendations for route refinement include a more direct route for PS5 and consideration of topographical constraints of upgrading Sim Road/Cape Hill Road for PS3. The connection to the Paerata Station (formerly known as the Southern Connector at Draft Strategic South DBC) is also to be considered.

4.3 North-South Corridor Assessment (relevant for NoRs 2 and 8)

4.3.1 Background: South IBC / Draft Strategic South assessment summary

4.3.1.1 South IBC

At the IBC phase, several options were investigated to test a Pukekohe Expressway which would provide a direct link to SH1 from Pukekohe. This would take traffic off SH22, which traverses both Pukekohe and Drury West growth areas. The options were mutually exclusive from each other but relating to other strategic routes such as Mill Road, or the arterial routes in Pukekohe.

The longlist of options is as follows (and shown in Figure 4-7):

- SR4A – central alignment: Drury South Interchange to Pukekohe East Road;
- SR4B – alignment on edge of FUZ connecting to Drury South Interchange;
- SR4C – eastern alignment: Drury South Interchange to Pukekohe East Road;
- SR4D – Ramarama interchange connecting to SH22 south of Paerata;
- SR4E – Upgrade Pukekohe East Road and widen Mill Road connecting to Bombay Interchange;
- SR4F – northern alignment: Drury South Interchange along edge of Drury west FUZ connecting to SH22 south of Paerata;
- SR19 – central alignment: Drury South interchange along the edge of Drury west FUZ to Pukekohe East Road (amalgamation of options); and
- MT10 – provides a bus rapid transit option between Pukekohe and Drury at SH1. This was not given a specific alignment as it would be located on SR options.

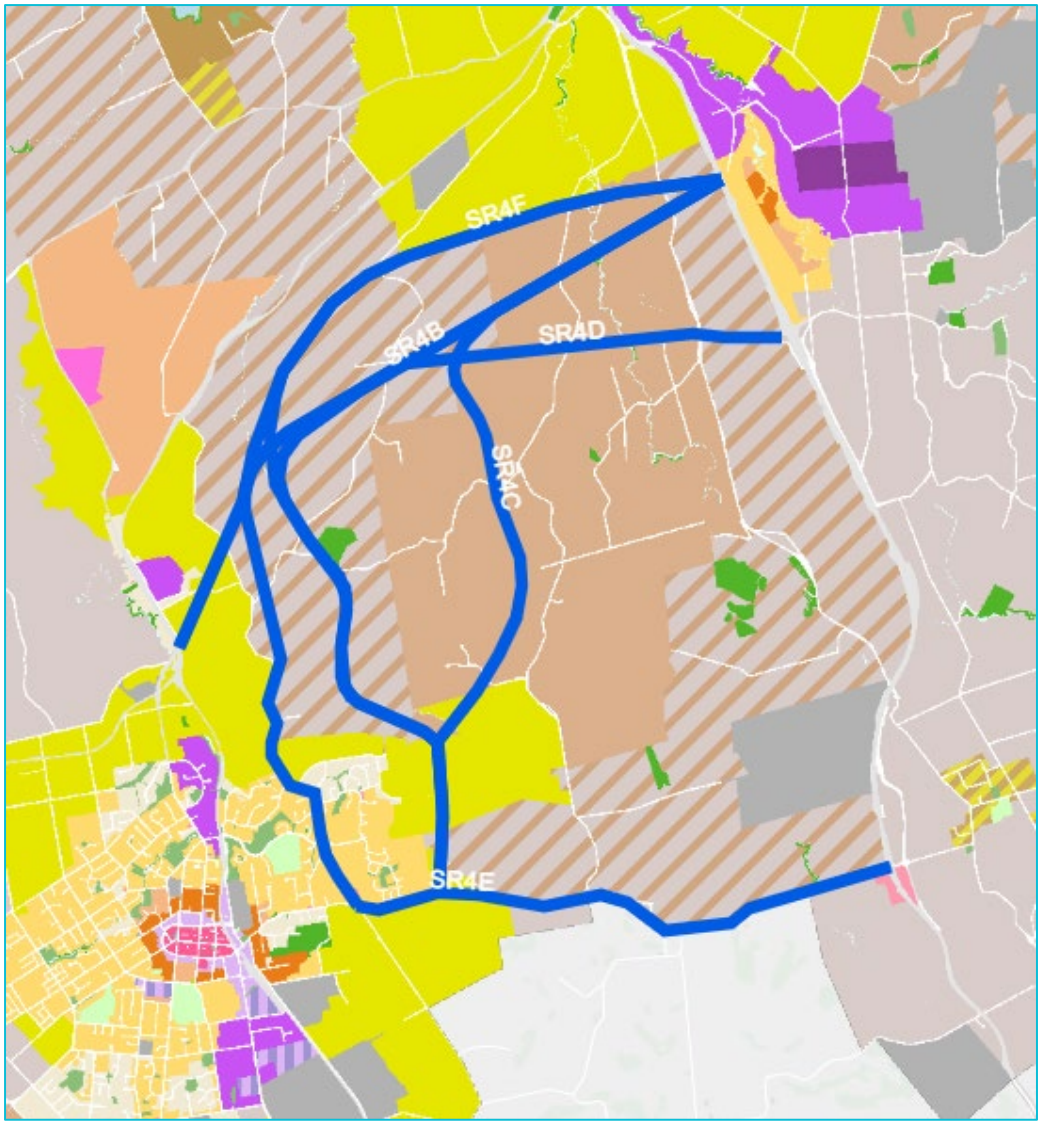


Figure 4-7: South IBC long list options

Options SR4E, SR4F and SR19 were recommended for the short list as they all scored positively against all three transport outcomes. Option MT10 was also recommended for the short list for further investigation.

Options SR4A, 4B, 4C and 4D were discarded due to the potential moderate to high adverse environmental effects, inability to achieve all the transport outcomes, and lack of integration with future or existing communities.

Following this, SR4E was packaged separately from the other two Pukekohe Expressway options, where it was taken forward as an option under ‘Strategic Connections’. Option SR4F (including the main trunk of SR19) was the recommended option for the Pukekohe Expressway as it aligns best with future land use at north-east Pukekohe, avoids proximity to the Outstanding Natural Landscape – Coulthards Scenic Reserve and provides a more direct route compared with SR19.

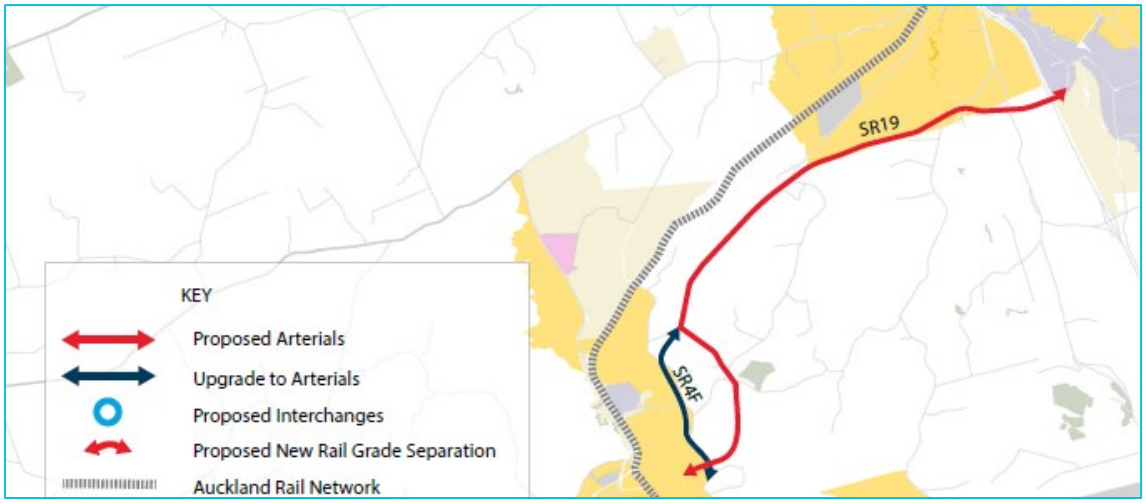


Figure 4-8: South IBC short list options (the southern section of SR19 and SR4F are mutually exclusive)

4.3.1.2 Draft Strategic South DBC

The Strategic South DBC divided the north south extent of the Pukekohe Expressway into two sections – Pukekohe Expressway (A) and (B). Section B was progressed to a corridor assessment to investigate if impacts could be reduced.

Three options were developed for the Pukekohe Expressway (B) section during the Strategic South DBC (see Figure 4-9 below). Option A was the IBC recommended option. Options B and C track further to the west of Option A, before connecting to the Pukekohe Urban Arterial (North-East).

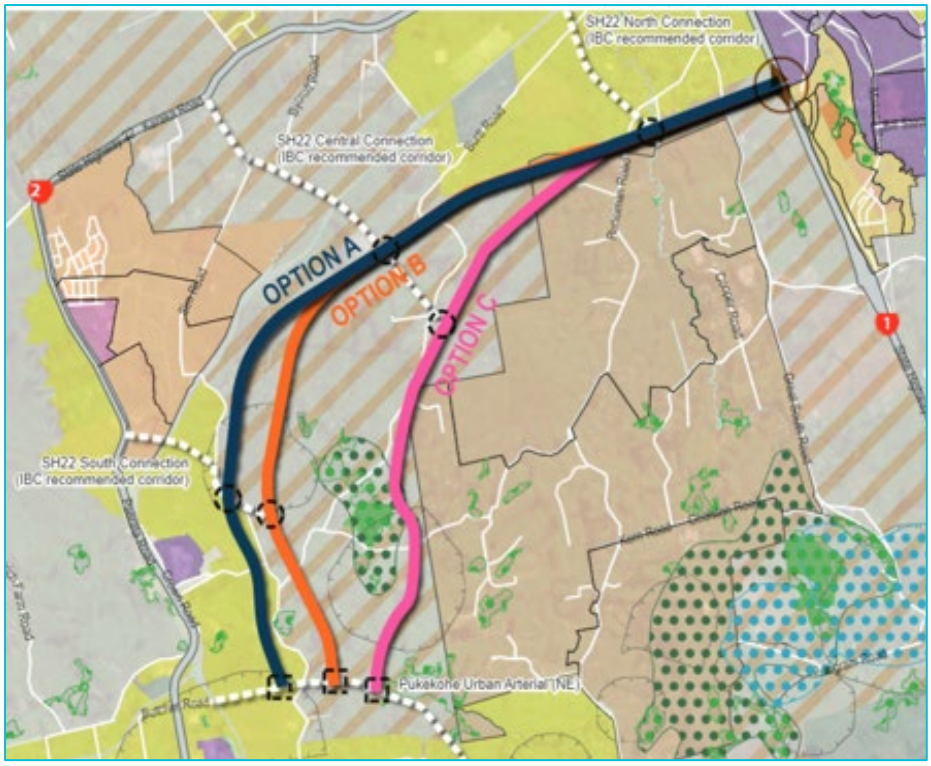


Figure 4-9: Pukekohe Expressway (B) options (Source: Strategic South Detailed Business Case, July 2020).

Following the option development at the route refinement level, the Pukekohe Expressway was divided into four segments, identified by constraints in the area and interaction with other options.

Two options were developed for segment 3, and three options were developed for Segments 1,2 and 4.

It was recommended that Option A and Option B be progressed to route refinement in the form of a hybrid option, broken down into the following segments:

- Segment 1: Option B – Offline, south of Transpower line;
- Segment 2: Option B – Offline, south of Transpower line;
- Segment 3: Option A – Offline, south of NIMT line, west of Oira Stream; and
- Segment 4: Option C – Offline, east of Cape Hill Road.

The hybrid option would broadly follow the Option A alignment between SH22 Central Connection and the SH22 Southern Connection, and the Option B alignment from the SH22 South Connection to the Pukekohe Urban Arterial. The form and function recommended in the Strategic South DBC was for a 4-lane arterial.

This preferred option was selected as it would be far west of the identified pā site/volcanic feature as practicable and is better aligned with the FUZ.

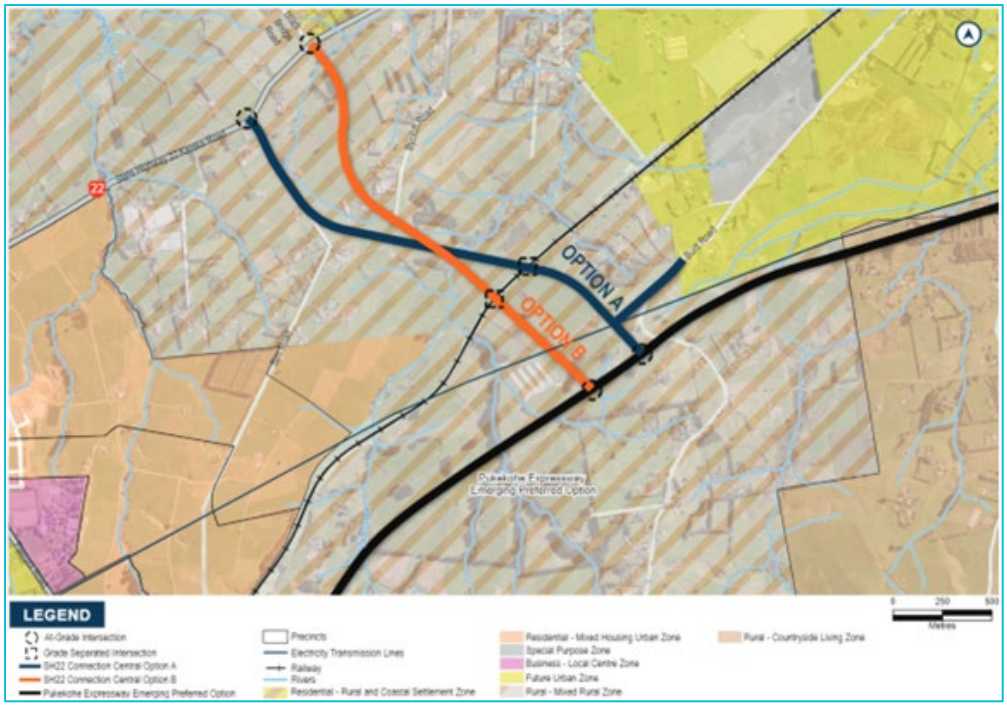


Figure 4-10 Draft Strategic South DBC SH22 Central Connector Options (Source: Draft Strategic South DBC, July 2020)

The Draft Strategic South DBC SH22 Central Connection was divided into two segments based on key constraints. Segment 1: from SH22 to the west of Bycroft Road and Segment 2: from west of Bycroft Road to the proposed Pukekohe Expressway.

Segment 1 (Option A – Online, utilising Sim Rd) and Segment 1 (Option B - SH22 and Blackridge Rd, ending north of Bycroft Rd were both assessed.

Segment 1 (Option A utilising Sim Road) was selected as the recommended option as it has less impacts on streams and provides better sightlines onto and from Pukekohe Expressway compared to Option B.

Segment 2 (Option A – offline, closer to Burtt Road) and Segment 2 (Option B – offline, crosses rail line perpendicularly). Options A (closer to Burtt Road) was selected as the recommended option. This was due to a more direct connection to the Pukekohe Expressway, less cut and fill impacts and less risks of geotechnical instability than Option B.

4.3.2 Gap analysis

Key transport and environmental policy direction have changed since the recommendations made by the South IBC and Draft Strategic South DBC on the Pukekohe Expressway. This includes:

- A focus on climate change in government policy and future direction (with RMA reform coming);
- The Government Policy Statement on Land Transport (2021) requires investment decisions to be consistent with transformation to a low carbon transport network;
- Auckland Council's declaration of climate change emergency; and
- Increased scrutiny on the impacts on climate change from transport corridors, affordability, socio-political pressure.

In considering the above changes, the following carbon emissions assessment methodology was formed to further test the alignment of the preferred network with this new policy direction:

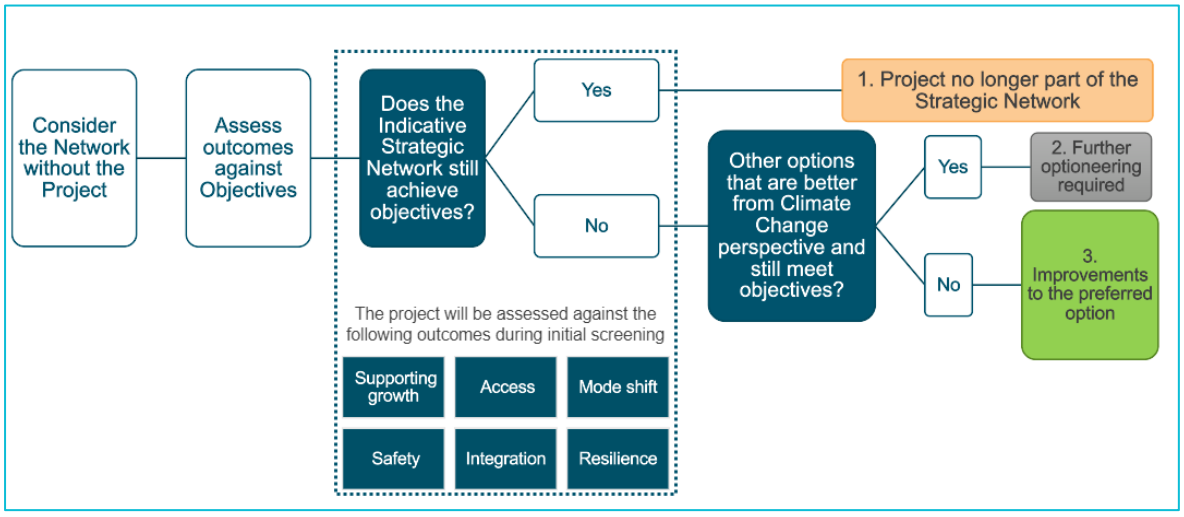


Figure 4-11: Carbon emissions assessment methodology

Table 4-9 provides a summary of the previous optioneering for the Pukekohe Expressway transport components of the Pukekohe Transport Network, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC, and a recommendation for the Pukekohe Transport Network.

Table 4-9: Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
The Draft Strategic South DBC took the recommended option from	GPS 2021/Zero Carbon Act – Climate change lens – implications	Corridor assessment considering the following:

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
the IBC and investigated another two options (three in total) – and then undertook a route refinement assessment. SH22 Central Connector investigated two options to connect the Pukekohe Expressway to SH22 between Drury and Paerata.	on the need for a four lane "expressway" that will induce light vehicle travel. Risk that road projects are challenged due to their contribution to greenhouse gasses – contrary to legislative direction to reduce emissions. Consider implications of NPS:FM and NES:FW – adopt avoidance of wetlands where possible as principle in first instance. Engagement undertaken as part of the Strategic South DBC included opposition to the Pukekohe Expressway. Concerns around potential loss of rural lifestyle/outlooks and property values. Three new rail stations were confirmed through NZUP (funding confirmed).	• The form and function of the Pukekohe Expressway is re-assessed and the need confirmed; • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads; • Maximise connectivity to the proposed rail stations (NZUP) and associated mode shift through strategic connections; and • Through any optioneering processes new information such as impacts on wetlands (under the NPS:FW) and opportunities to integrate with urban development are identified.

Through the gap analysis it was concluded that the changes in the policy direction of the Government and Auckland Council and the need for the Project warranted further investigation of alternative corridors.

4.3.3 Alternatives Development

The primary purpose of the North-South options is to provide a direct route from Drury West to Pukekohe, to reduce pressure on the SH22 corridor and existing surrounding rural roads and to provide for the urbanisation of the Drury West, Paerata and Pukekohe areas.

The project aims to increase accessibility to a range of transport choices and increased people movement within the area to provide connections to employment, industrial areas, existing and future residential areas, and rail stations, within the study area.

The options include the recommendations from the Draft Strategic South DBC (a 4-lane high speed state highway) as well as new options that investigate upgrading existing rural roads, upgrading existing strategic roads, new corridors and a combination of these.

Nine options were initially developed for the North-South package (set out in Table 4-10) and two additional options were added (set out in Table 4-11).

Table 4-10: Initial North-South corridor options

Option	Route	Form & Function
NS1	New corridor from the proposed Drury South interchange connection at Great South Road to the edge of the Pukekohe FUZ area.	• Rural four-lane • New corridor: 8.7 km • 30 m cross-section • 80 kph
NS1A		• Urban two-lane • New corridor: 8.7 km • 24 m cross-section • 50 kph
NS2	New corridor between the proposed Drury South interchange at Great South Road and Paerata, where it then uses the existing Cape Hill Rd to Pukekohe.	• Urban two-lane / rural • New corridor: 5.6 km • Upgrade roads: 3.7 km • 24 m • Urban – 50 kph / rural – 60 kph to 80 kph
NS3	Between the Drury West station and Pukekohe. Uses Burtt Road, with a new connection between Burtt Road and Paerata Station. Uses Cape Hill Road to Pukekohe.	• Rural two-lane high speed / urban two-lane • New corridor: 2.4 km • Upgrade roads: 6.2 km • 24 m cross-section • Urban – 50 kph / rural – 60 kph to 80 kph
NS4	Between Drury West station and Pukekohe. Uses Burtt Rd, Tuhimata Road and Cape Hill Road.	• Rural two-lane • Upgrade roads: 8.7 km • 24 m cross-section • Urban – 50 kph / rural – 60 kph to 80 kph
NS5	Follows Runciman Road between the Great South Road / Runciman Rd south of Drury West station and Pukekohe East Rd west, through to East Street / Valley Road.	• Rural two-lane high speed / urban two lane • Upgrade roads: 10.3 km • 24 m cross-section • Urban – 50 kph, rural – 60 kph to 80 kph
NS6	A new corridor from the proposed Drury Interchange at Great South Road to SH22. Then uses the existing SH22 until it reaches Pukekohe centre	• Rural two-lane high speed / urban four lane arterial • New corridor: 5.5 km • Upgrade roads: 6.9 km • 24 m cross-section from Great South Rd to SH22 / Sim Rd and 30 m cross-section from Sim Rd / SH22 to Butcher Rd / SH22. • Urban – 50 kph, rural – 60 kph and 80 kph
NS7	Upgrades the existing SH22 to four-lanes between Oira Creek and Butcher Rd / SH22.	• Rural four-lane high speed rural / urban four lane arterial • Upgrade roads: 8.8 km • 30 m cross-section • Urban – 50 kph, rural - 60 kph and 80 kph

Option	Route	Form & Function
NS8	A new connection from the proposed Drury South interchange at Great South Road to Paerata Station.	• Rural two-lane high speed / urban two-lane arterial • New corridor: 6.8 km • 24m cross-section • Rural – 60 kph to 80 kph, urban – 50 kph
East	Upgrade to the existing Mill Road and Pukekohe East Road from Bombay / interchange to Golding Rd / Belgium Rd.	• Four-lane arterials (Urban-Rural Edge) • Upgrade roads: 6 km • 30 m cross-section • 60 to 80 kph
SH22 Central	New corridor connecting Karaka Rd / SH22 to Runciman Road.	• Rural two-lane high speed • Upgrade roads: 750 m • New corridor: 4.8 km • 24 m cross-section • 50 kph

Two new options were added after the first round of assessment, as shown in Table 4-11 below.

Table 4-11: Additional North-South corridor options

Option	Description / Reason	Form & Function
NS9	An upgrade of SH22 along with a new section of transport corridor to Drury.	• Rural four-lane high speed rural / urban four lane arterial • Upgrade roads: 8.8 km • 30 m cross-section • Urban – 50 kph, rural - 60 kph and 80 kph
NS10	Refinement of the NS3 and SH22 Central Options – including an upgrade of Burtt Road along with a new section of road across the NIMT then utilising Sim Road within the Paerata Rise development as well as an upgrade of Sim Road (south) and Cape Hill Road.	• Rural 60-80km, urban 50kph • Total length: 10.32 km • Upgrade of existing roads: 8.578km • New corridor: 1.742 km • 24m cross-section

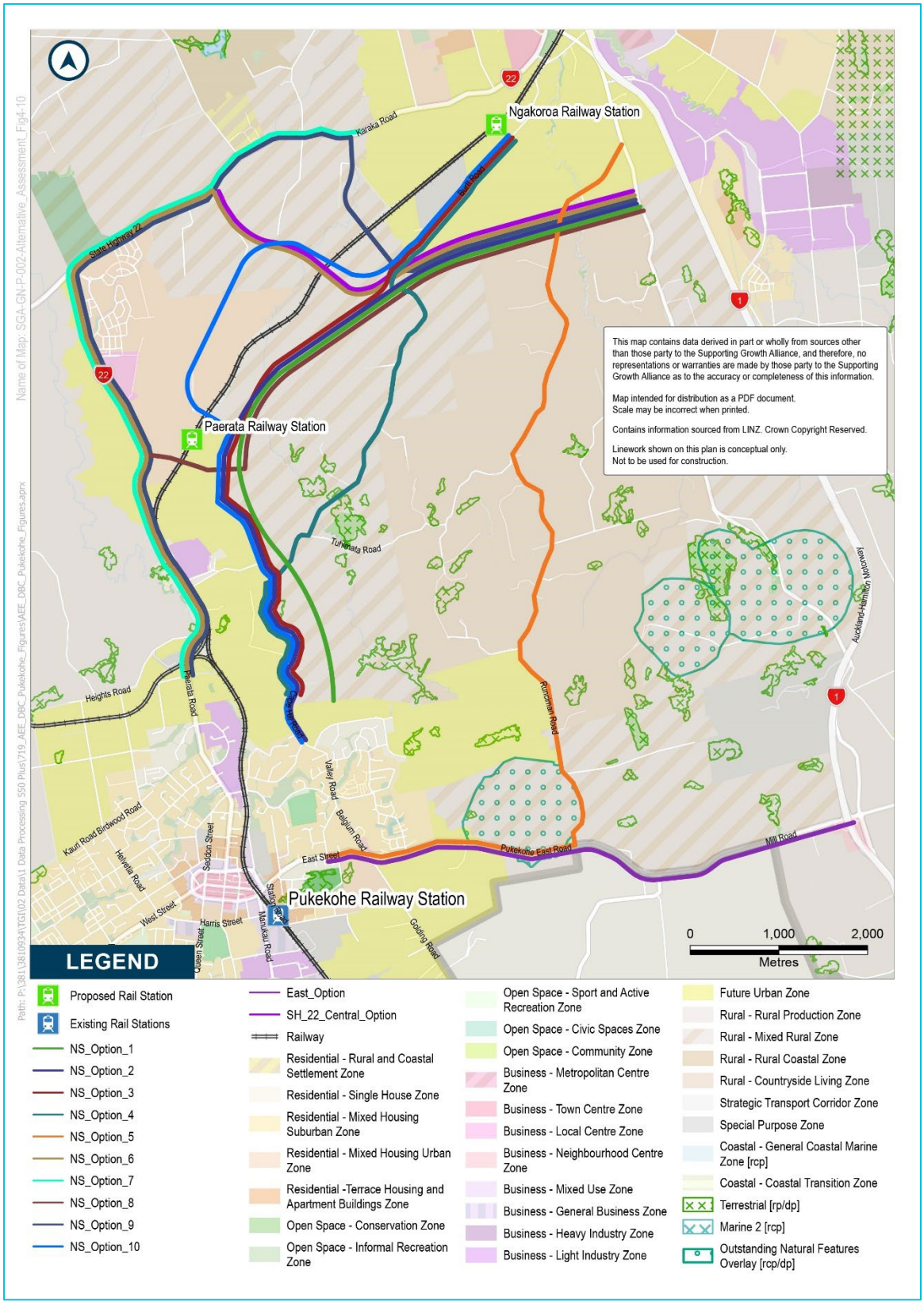


Figure 4-12: North-South corridor options

4.3.4 Alternatives Assessment

Eleven options were assessed against the MCA framework by each subject matter expert. Table 4-12 provides a summary of the assessment undertaken by technical specialists against the MCA framework.

As set out earlier, the North-South corridor assessment options were assessed separately. However, a short list of the options was tested with the Drury West and Paerata options from a network perspective. This network assessment is set out in Section 4.4.

Table 4-12: North-South corridor assessment MCA scoring

MCA Criteria	Scores												
Options	**NS 1**	**NS1 A**	**NS2**	**NS3**	**NS4**	**NS5**	**NS6**	**NS7**	**NS8**	**NS9**	**NS10**	**East**	**SH22**
Transport Outcomes													
Safety	4	4	3	3	2	1	2	3	2	2	3	2	2
Integration	3	3	3	3	1	1	2	2	1	2	3	2	1
Access	2	2	3	3	1	0	2	1	1	2	3	1	1
Resilience	4	4	3	3	1	1	1	1	2	1	2	2	1
Travel Choice	-2	-1	1	1	1	0	1	1	1	1	2	1	1
Heritage													
Heritage	0	0	0	-2	-2	-5	-2	-2	0	-2	-2	-1	0
Social													
Land use futures	3	1	2	3	2	1	2	3	1	2	2	1	1
Urban design	-4	-4	-2	-1	-2	-1	-3	-2	-2	-2	-2	-1	-1
Land requirement	-3	-3	-2	-1	-1	-2	-3	-3	-2	-2	-3	-1	-2
Social cohesion	2	2	2	2	2	2	2	2	2	2	2	1	1
Human health	-1	-1	-1	-1	-1	-1	-2	-2	-1	-2	-1	-1	-1
Environment													
Landscape / visual	-2	-2	-2	-2	-3	-4	-2	-2	-2	-2	-2	-3	-2
Stormwater	-2	-2	-2	-1	-1	-1	-2	-1	-2	-2	-2	-1	-2

Ecology	-4	-4	-4	-4	-4	-4	-4	-3	-4	-4	-3	-3	-4
Natural hazards	-3	-3	-2	-2	-1	-3	-3	-1	-3	-3	-2	-2	-3
Construction impacts													
Embodied carbon	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3	-3
Construction impacts	-2	-2	-2	-2	-2	-3	-2	-2	-2	-2	-2	-2	-1
Construction Disruption	-1	-1	-2	-2	-2	-2	-2	-2	-1	-2	-2	-2	-1
Construction costs / risk	-4	-3	-3	-3	-3	-3	-3	-2	-2	-3	-3	-2	-3

Table 4-13: North-South corridor assessment findings summary

Criteria	Summary of performance
Transport Outcomes	**Safety** NS1 and NS1a scored the highest for safety as they will significantly reduce the likely future traffic using unsafe rural roads (Burt Road and Runciman) and also reduce traffic growth on SH22 which will result in further safety benefits. Options NS7, NS 9 and NS10 provide some safety improvements but do not address all safety concerns. NS5 scored the lowest for safety concerns as it doesn't resolve existing and future safety issues and would need major improvements to SH22, Sim Road, Cape Hill Road and local connections in Paerata and Drury West. **Integration** NS1, 1a, 2, 3 and 10 all scored the highest for integration, with good network-wide integration with Pukekohe, Paerata and Drury West. These options also provide significant movement integration with general traffic and limited amount with PT and active modes. Option NS 4, 5 8 are scored the lowest for integration. Option NS 4 and 5 scored lower due to the options being outside of the FUZ (less integrated). This is less preferred and has limited network-wide benefits to reduce the conflict between movement and place in Pukekohe, Paerata and Drury West. NS 8 provides good integration between Drury West and Paerata but limited integration between Paerata and Pukekohe. **Access** NS1, 1a, 2, 3 and 10 provide significant improvement in access to key destinations. They provide significant improvement to general traffic and PT and modest improvement for active modes. NS2 and 3 scored the highest. The East option does not provide the same connection as the other options and alone will not provide the same strategic benefits as the other north-south options. However, it is beneficial in combination with the north-south options and should be progressed in conjunction with a north-south option(s).

Criteria	Summary of performance
	NS 5 scored the lowest with very limited improvement in access to key destinations and limited access improvement by all modes. **Resilience** NS1 and 1a scored the highest with high network-wide improvement in resilience, but over supplying of resilience may result in auto-dependency. NS 2 and 3 provide for medium to high network-wide improvements in resilience. NS 4 – 9 and the central and east options scored the lowest for access with limited network-wide improvement in resilience. **Travel Choice** NS 10 scored the highest regarding travel choice with medium to high improvements in general traffic, modest benefit to public transport and active modes. This option will increase car mode share slightly and significantly reduce VKT. NS1 and NS1a scored the lowest regarding travel choice with significant improvement in general traffic, but disbenefits to public transport and limited improvement to active modes. These options have a significant amount of enabled carbon, will increase car mode share significantly and reduce VKT. Other options either had medium to high improvement in general traffic, but little benefit to public transport and modest improvement to active modes or else had little improvement to general traffic and to public transport but modest to high improvement to active modes. **Overall** Options NS2 and NS3 were preferred as these would best enable network-wide benefit to support growth. NS4 and NS5 are least preferred as they have a limited ability to address the network wide transport outcomes.
Heritage	Options NS1, NS1a, NS2, NS8 and SH22 Central have no recorded heritage. NS5 and East have the potential to impact on heritage due to the number of features along the corridor, including the Pukekohe East Presbyterian Church, which was the site of an 1863 battle at the beginning of the Waikato Invasion, which makes it a highly significant site. NS5 scored the lowest. Both NS9 and NS10 the potential to impact on heritage items in the CHI including the Paerata Community Hall, Paerata Station Water Tower and early 20th century Villa. The remaining options have minor impacts on heritage features and can be mitigated.
Social	**Land use** Options NS1, NS3 and NS7 were preferred due to the greatest integration with the FUZ catchment/planned development in the Drury West, Paerata and Pukekohe areas. NS3 provides the most direct connection between the two stations and multiple future residential areas. NS1 was preferred over NS1a, as a four-lane, high-speed arterial, located outside the FUZ avoids severance effects and does not reduce developable land. A two-lane low-speed arterial located outside the existing and future urban area was not considered to integrate with the land use. Options NS1a, NS5, NS8, NS9, NS10, East Option and SH22 Central were least preferred due to reduced integration with the FUZ catchment and/or the creation

Criteria	Summary of performance
	of small residual pockets of rural land between the FUZ and the option, which may encourage development beyond the FUZ/structure plan area. The East Option in particular, provided the least connection between FUZ areas. **Urban design** All options had challenges creating a positive interface with the road corridor and topography. The East Option is preferred as it follows an existing corridor into Pukekohe, avoiding the steep topography of Pukekohe north. Options NS1 and NS1a are least preferred as they cut through the rural area, which would adversely impact the existing amenity and character and provide minimal interface opportunities. **Land requirement** NS3, NS4 and the East option have the least property impacts, being existing routes. Of these, NS4 is preferred as the impact on dwellings can be mitigated if the alignment follows one side of the existing road. Options NS1 and 1A are least preferred given the significant property acquisitions required. **Social cohesion** NS7 is the preferred option as it provides a new connection to existing facilities, including the Paerata Rise development. The East Option provides the least connected to employment, communities, and facilities, being more isolated than the other options. **Health and wellbeing** NS4 is preferred as it predominantly traverses existing roads, where air quality, noise and vibration effects are existing and expected. NS5 was considered slightly less preferable as it is closer to a school which is considered a sensitive receiver. Options NS6 and NS7 were least preferred as they would create a new corridor close to existing residential areas and several schools, which introduces new air quality, noise and vibration effects to these receivers. Although this option scores the same as NS7, NS7 is predominantly within existing road, therefore effects here are generally anticipated.
Environmental	**Landscape and visual** NS7 is preferred given it traverses an existing roading alignment, where only limited amounts of vegetation would be required to be removed. Potential visual amenity effects would be limited to residences within existing and future developed areas. NS5 is least preferred (-4) due to the nearby Outstanding Natural Feature (ONF) and potential effects on rural character, visual amenity and notable trees. **Stormwater** There is limited differentiation between options. All options impact upon overland flow paths but would have manageable stormwater impacts. In general, new roads have more impact on stormwater (Options NS1, NS1a, NS2, NS6, NS8 and SH22 Central) and options that involve upgrading existing assets have less impact on stormwater (Options NS3, NS4, NS5, NS7, NS9 and NS10 and East Option). **Ecology**

Criteria	Summary of performance
	All options would either impact nationally critical bats, bird species, SEAs, streams, wetlands or a combination of these features, earning high negative scores. NS7 and the East Option are entirely upgrades of existing infrastructure and therefore are more preferred as the impacts are already present. Options NS1 and NS1A are new corridors that run entirely outside the FUZ, potentially impacting a large number of streams, wetlands and identified habitat for species of significance including bats and birds. These are less preferred. **Natural Hazards** Existing roads score slightly better, as they are already stabilised. Options NS4 and NS7 are preferred as these are mainly existing corridors. The East Option, while also an existing road is adjacent to the tuff crater. NS1 and NS1A were least preferred as involved new construction over undulating alluvium with potentially liquefiable soils at the eastern end.
Construction impacts	**Embodied carbon emissions** While NS8 is a new corridor, with more involved earthworks, it is a short two-lane corridor, which is likely to indicate lower construction emissions overall. Therefore, this option is preferred. NS9 and NS6 are least preferred given its length, the need for two bridges, likely significant earthworks, four-lane cross section and greenfield development for half the corridor. **Construction impacts on infrastructures and utilities** The SH22 Central option is preferred as it requires a smaller amount of earthworks given its short corridor. NS5 is least preferred given the number of impacts to existing infrastructure, such as two First Gas Transmission pipes, a water distribution pipe and the Transpower electricity transmission lines. **Construction disruption** In general, options passing through greenfield areas (Options NS1, NS1A, NS8 and SH22 Central) encounter less disruption than options passing through existing and future urban areas. **Construction costs** NS7 is preferred as it has less earthworks as it upgrades an existing corridor. NS1 is least preferred due to the length of new corridor through rural greenfield and steep topography, as well as the construction of five bridges.
Partner feedback	The following matters were raised by partners during workshops: • Auckland Council provided an update on the existing and potential private plan changes in the study area highlighting the growth planned in the near future. • Waka Kotahi highlighted inter-related projects around Pukekohe and Drury such as safety improvements on SH22, SH1 Upgrade (Papakura to Bombay). • North Waikato perspectives highlight the significant growth pressure on existing local connections if Waikato Growth Strategy is followed through. Investment needed in active mode infrastructure and public transport networks to make these modes competitive to private vehicle use.

Criteria	Summary of performance
	• Waka Kotahi emphasised the importance of climate change / VKT reduction being considered in the options assessment and supported the alternatives being considered. • Auckland Council confirmed that no additional Council initiated rezoning of rural zoned land is currently being considered. Manawhenua representatives raised the following key matters at hui: • A representative from Ngāti Tamaoho advocated for future proofing for four lanes given predicted growth (dependent on ecology matters). • Ngāti Tamaoho highlighted that careful consideration will be required for corridors outside FUZ and expressed concerns of inducing further development Ngāti Te Ata Waiohua stated that all options have an impact on cultural values/integrity and taonga.

4.3.5 Discarded Alternatives

Table 4-14 summarises the reasons for discounting the options individually.

Table 4-14: Options to be discarded

Option	Reason
NS4	Too far east and does not achieve the transport outcomes.
NS5	Too far east and does not achieve the transport outcomes.
SH22 Central Option and NS6	Duplicate NS7 and do not offer significant additional connection.
NS8	Duplicates NS2 and the Paerata options.
NS9	Provides limited network wide resilience, greater potential carbon emissions and potential heritage impacts
NS10	Higher property impacts and construction costs and potential heritage impacts

4.3.6 Recommended Corridor Option(s)

The north-south corridor options investigated new corridors, upgrading existing strategic corridors (SH22 and Mill Road Bombay), upgrading existing rural roads and a combination of these.

It was recommended that the following North-South corridors are progressed to the Package Assessment (short list) to be tested with the Drury West Local and Paerata Local recommended corridor options:

- **NS7** – Upgrade of the existing SH22 to four lanes (Drury to Pukekohe): this corridor improves safety, upgrades an existing strategic corridor and scored marginally better through the assessment because of this. However, upgrading the existing corridor does not improve network resilience.

- **East option** – Upgrade of the existing Mill Road Bombay and Pukekohe East Road: The East option does not provide a similar north-south connection as the other options and alone will not provide the same strategic benefits as the other north-south options. However, this corridor does provide benefits for movements between Pukekohe and the strategic transport network (SH1) and was progressed to the Package Assessment to further understand it's benefits in the network.
- **NS3** – Upgraded and new section of corridor between the Drury West station and Paerata. Upgrades Burtt Road, with a new connection between Burtt Road and Paerata Station and connects to the Paerata Arterial at Cape Hill Road: This option was one of the preferred options through the transport outcomes assessment as it would best enable network-wide benefits to support growth.
- **NS2** – A new two-lane connection from the proposed Drury South interchange at Great South Road to Paerata Station. This was one of the preferred options from a transport perspective as it would best enable network-wide benefit to support growth.
- **NS1** – A new four-lane, high speed corridor from the proposed Drury South interchange at Great South Road to the edge of the Pukekohe FUZ area (formerly known as the Pukekohe Expressway). While this option has high network resilience scoring, it does not score favourably in terms of the transport outcome of travel choice. While this option induces light vehicle movements significantly and provides reduced benefits in terms of public transport, it was progressed to the Package Assessment to compare against the other packages.

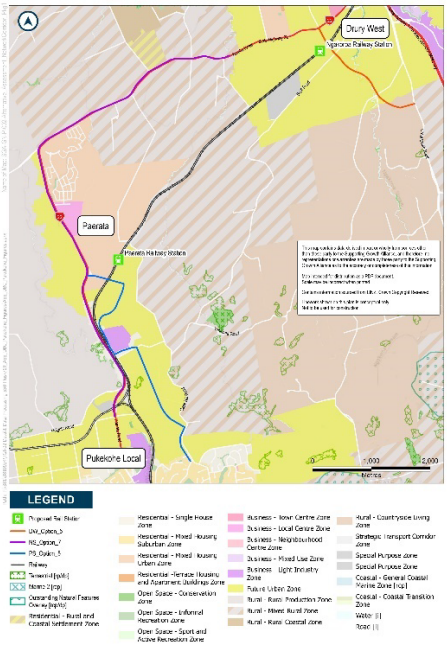
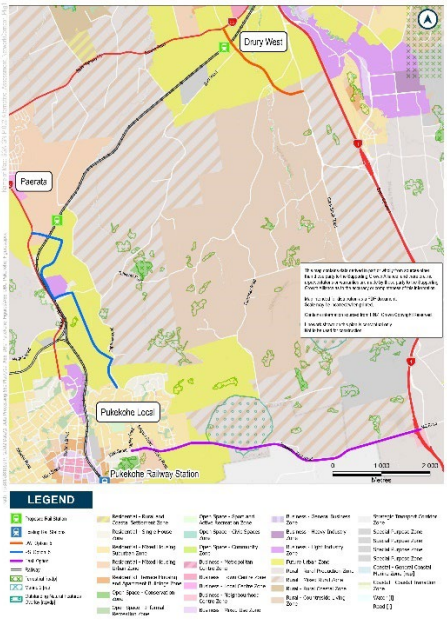
4.4 Network Package Assessment (Drury West, Paerata and North-South) (relevant for NoRs 1, 2, 3 and 8)

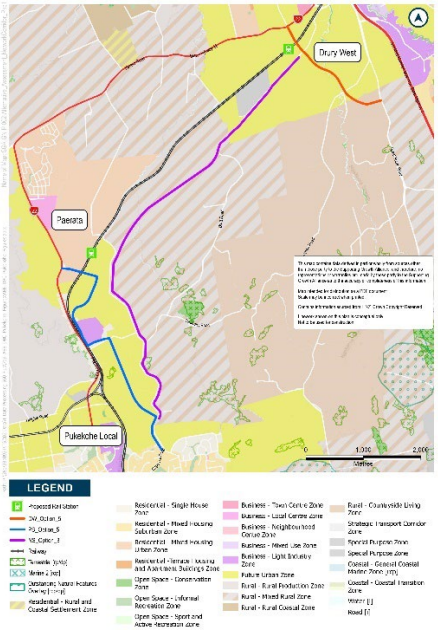
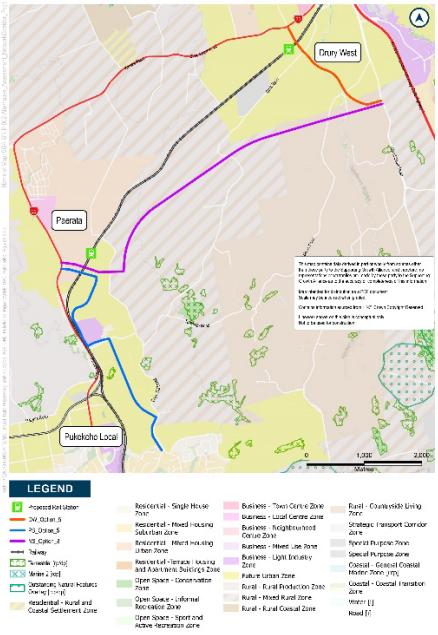
To determine the preferred network solution, the recommended corridor options from the Drury West Local and Paerata Local were considered with a short list of North-South options.

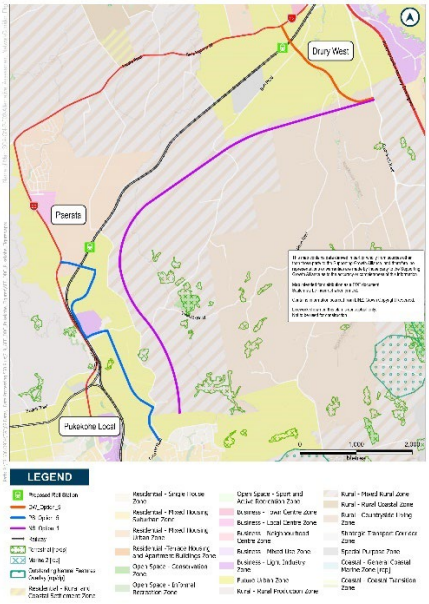
4.4.1 Package Alternatives Development

The package assessment options were grouped into five packages as shown in Table 4-15.

Table 4-15: Network Package description summary

Option	Routes	Overview Image
Package 1	SH22 Connection, comprising: • Drury West Arterial (DW5); • Paerata Arterial (PS5); and • Upgrade of existing SH22, adding an additional lane each way to four lanes (NS7).	
Package 2	South connection, comprising: • Drury West Arterial (DW5); • Paerata Arterial (PS5); and • Upgrading Mill Road and Pukekohe East Road, adding an additional lane each way to four lanes (East Option).	

Option	Routes	Overview Image
Package 3a	Drury Paerata connection, comprising: • Drury West Arterial (DW5); • Paerata Arterial (PS5); and • New and upgraded two-lane connection between Drury and Paerata (NS3) – NS3 modified to stop at Paerata Station.	
Package 3b	Drury Paerata connection, comprising: • Drury West Arterial (DW5); • Paerata Arterial (PS5); and • New two-lane connection between Drury and Paerata (NS8).	

Option	Routes	Overview Image
Package 4	Pukekohe Expressway, comprising: • Drury West Arterial (DW5); • Paerata Arterial (PS5); and • New four-lane connection between Drury and Paerata (NS1).	

4.4.2 Package Assessment

Five options were assessed against the MCA framework by each technical specialist. The transport outcomes and each wellbeing were assessed qualitatively. Table 4-16 provides a summary of the assessment undertaken.

Table 4-16: Network package assessment MCA scoring

MCA Criteria	Scores				
Package options	**Package 1**	**Package 2**	**Package 3a**	**Package 3b**	**Package 4**
Transport Outcomes					
Safety	2	2	3	3	4
Integration	1	1	3	3	3
Access	1	1	3	3	2
Resilience	1	2	3	3	4
Travel Choice	1	1	1	1	-2

Table 4-17: Package assessment findings summary

Criteria	Summary of performance
Transport Outcomes	Package 1 improves safety on SH22 for all users but has limited network-wide safety benefits. It does not resolve future safety issues on rural roads and compromises urban corridor function of SH22 at Drury West and Paerata. Package 2 Improves safety for local connectivity including active modes but provides limited network-wide safety benefits. Does not resolve future safety issues on rural roads. It will also require other north-south projects to better serve Pukekohe, Paerata and Drury West. It does provide an important strategic upgrade and should be progressed together with another package. Package 3a reduces future traffic using rural roads, reduces traffic growth on SH22, improves safety and integration in Drury West, provides an improvement to general traffic, PT and active modes. It is however likely to put pressure on Drury West collector network and interacts with a future school on Burtt Rd. Speeds will need to be reduced for safety which will influence the strategic function of the corridor. Package 3b has the same benefits as Package 3a, except that it does not interact with a school and adds resilience to the network, reduces the pressure on existing local roads more than 3a. Like 3a, it provides improvements for all modes - general traffic, PT and active modes being located within/adjacent to the FUZ. Package 4 Reduces traffic growth on SH22: significantly improves safety and integration in DW, reduces future traffic using rural roads, and significantly increases network resilience and safety. However, mode shift scores poorly (-2). This package induces light fleet travel which undermines mode shift. It is has less desirable route or benefit for PT or active modes.
Heritage	Limited differentiation between the DW and PS options here and in other packages. Package 1 would potentially impact on a villa, probably early 20th century (CHI item 22338), Paerata community hall, date unknown, now demolished (CHI item 14979), Paerata train station water tower, date unknown, now demolished (CHI item 22218), World War II memorial plaque (CHI item 14978), Karaka Methodist Church, date unknown (CHI item 15106). Package 2 potentially impacts on Pukekohe East Community Hall, built 1959 (CHI item 19320) and Tennis courts (CHI item 22321). Package 3a potentially impacts on a late 19th / early 20th century villa (CHI item 22279). There was no recorded heritage for Packages 3a, 4 or 5.
Social	**Land use** Package 3a was the most preferred as it provides good integration and a more direct connection including direct connections to the proposed Drury and Paerata arterials. Package 1 was second most preferred as it connects both train stations and the Pukekohe town centre, which provides for good integration. Provides an alternate, parallel route at Paerata to increase access to residential catchment. Packages 3b and 4 also had positive effects for integration as they connect both train stations and the Pukekohe town centre, which provides for good integration Package 2 was the least preferred due to limited integration with town centre, other FUZ areas, proposed arterials and train stations. **Urban design**

Criteria	Summary of performance
	Package 1 and Package 3a uses existing corridors which reduces the visual impact but the rural areas to the north will not be able to respond to the alignment. Topography has potential to negatively affect character and amenity. Package 3b provides a direct connection but impacts on amenity and character in the rural area and traverses an area identified as THAB in the Paerata-Pukekohe Structure Plan. Package 4 cuts through the rural area, which will adversely impact the existing amenity and character. Its alignment away from the FUZ in the southern section may create pressure to extend the FUZ to the east. **Land requirement** Package 1 has fewer full acquisitions than Package 3b and Package 4. Package 3a requires only partial acquisitions. **Social cohesion** Package 1 was the most preferred as it connects the Drury community through Paerata to Pukekohe through rural land to existing residential. Connects Treetops Learning - Early Childhood Pukekohe Hill, new Paerata development, Paerata School, Wesley College, and existing light industrial and business areas. Packages 3a, 3b and 4 connect the Drury community through Paerata to Pukekohe through rural land to existing residential and provide an additional connection to SH22 provides greater indirect connection to Paerata Rise development and alternative route through existing communities. While Package 2 provides a link to shops in the precinct area it does not provide a connection to or directly between proposed Drury and Paerata arterials. **Health and wellbeing** Package 4 was the preferred option as there are no nearby sensitive land uses. Packages 2, 3a and 3b are in proximity to existing residential land use. While Package 1 is mostly an upgrade to existing road it is in proximity to residential land uses and is adjacent Wesley College, Paerata School, Country Village Preschool and is therefore the least preferred.
Environmental	**Landscape and visual** Package 1 includes potential effects on notable trees proximate to Paerata Road and effects on rural character. Package 2 includes potential effects on rural character and amenity and potential for impacts on the Pukekohe Tuff Ring Outstanding Natural Feature (ONF). Package 3a would result in the road being located upon steep topography and into adjacent catchments, including a stand of vegetation on Cape Hill Road identified as a Significant Ecology Area (SEA). Package 3b and 4 include the potential to impact on rural character and would require the removal of limited areas of mature vegetation. **Stormwater** Packages 1, 3a 3b has no new floodplain structures are needed and so impact of flooding is minimal. Package 2 will add minimal hardstand, however culverts and bridges will be required and WQ detention will be required via wetlands or raingardens. **Ecology**

Criteria	Summary of performance
	Nationally critical long-tailed bats recorded in Paerata Scenic Reserve (1km West) and Coulthards Scenic reserve and likely to occur in Oira Creek and Ngakoroa Stream. Bat effects likely for all packages. Package 1 would potentially have a direct impact on Paerata Scenic Reserve (SEA_T_4384), with known bat use. Package 2 avoids impacts on SEAs and significant areas of bush however likely to still be impacts to bats. Package 3a was preferred over Packages 1 and 2 as partially within FUZ, reducing overall impact on streams, wetlands and bat habitat. For Package 3b effects were similar to 3a, however, a two-lane highway easier to mitigate than four lanes. Package 4 was the least preferred as it is four lanes and more difficult to mitigate as well as being outside the FUZ. **Natural Hazards** Those routes which used existing roads (Packages 1, 2 and 3a) were more preferred. Packages 3b and 4 included potential liquefiable areas.
Construction impacts	**Embodied carbon emissions** Packages 2 and 3b were preferred option due to being a shorter route and only two lanes. Package 3a was slightly less preferred due to length. Packages 1and 4 were less preferred due to four lanes and their length. **Construction impacts on infrastructures and utilities** All packages required protection of a First Gas Transmission pipe. Packages 1 – 3b also required protection or relocation of local services. **Construction disruption** All packages required upgrading the existing rural corridor and the new corridors on the greenfield. Package 4 was preferred due to less disruption compared to other packages. **Construction costs** Package 4 was likely to be the most expensive due to steep topography and the number of bridges likely to be required. Packages 1, 2 and 3a were not likely to require any major engineering works and the associated cost is lower.
Partner feedback	Key feedback during workshops on the packages from partner SMEs included: • That the upgrade Mill Road (East Option) should be progressed with the preferred package. It is an important strategic connection between Pukekohe, State Highway 1 and south into Waikato (Package 2). • North Waikato is also experiencing significant growth (Package 2). • Consideration of development adjacent to SH22 in Drury and Paerata. Is going to put increasing pressure on SH22 (with reference to Package 1). • Safety on existing rural roads is a high priority to AT (all packages). • The preferred package needs to support transit-oriented development.

Criteria	Summary of performance
	• Grafton Downs (Paerata) are developing the next stages of their development. Engagement to take place shortly. • Support for Package 3b that provides more of a bypass rather than directing traffic through the centre of Drury West – Package 3a. • Support for investigating alternatives to Package 4 (which was recommended in 2018 through the South IBC) due to a number of central government changes in approach to climate change. In particular, decarbonising the transport network. The key feedback from Manawhenua representatives during hui were: • Planned schools in the area should be considered. Supported consideration of schools during options assessment (reference to Package 3a). • Support for future proofing for four lanes (for all packages), but consideration of impacts on ecological features is important. • All packages have an impact on cultural values, integrity and taonga. Package 4 has the greatest impact. • One representative raised concern towards the potential for arterials in rural areas which may encourage growth around the new roads rather than an 'expressway' (strategic connection between Drury and Pukekohe). This, in the representative's view, was a higher speed road with more limited access. • One representative noted that there are several water courses and cultural sites in the proposed network footprint, and that the project team needed to physically understand the environment rather than digitally.

4.4.3 Discarded Package Alternatives

Table 4-18: Options to be discarded

Option	Reasons for being discarded
Package 1	Does not resolve future safety issues on rural roads and compromises urban corridor function of SH22 at Drury West and Paerata.
Package 2	Does not resolve future safety issues on rural roads such as Runciman Road and Burtt Road. It will also require other north-south projects to better serve Pukekohe, Paerata and Drury West. SH22 integration outcomes with planned urban development are also poor with this package. It does however provide an important strategic upgrade and should be progressed together with the preferred North-South package.
Package 3a	Likely to put pressure on Drury West collector network and interacts with a future school on Burtt Rd. Speeds will need to be reduced for safety which will influence the strategic function of the corridor.
Package 4	Induces the most amount of light fleet travel and has limited benefits for PT and active modes. It scores poorly against mode shift investment objective (-2).

4.4.4 Recommended Package Option

Following the MCA assessment and consideration of feedback received from project partners, **Package 3b (Options DW5, PS5 and NS8)** is the preferred package. The reasons are as follows:

- Provides an alternative to SH22 and SH1 – significantly improving network resilience;
- Reduces future traffic using existing rural roads which reduces safety concerns;
- Improves safety and integration in Drury West urban development as well as providing improved access and resilience for general traffic, PT and active modes;
- Induces less light vehicle travel than Package 4;
- Is located close to FUZ to integrate with future urban development further supporting active modes;
- Has reduced potential impact on ecological features such as streams and wetland environment compared to other packages;
- Has reduced impact on potential bat habitat compared to other options; and
- Has reduced potential impact on archaeology and built heritage compared to other options.

Package 3b will be developed further through route refinement assessment. Recommendations for the report refinement options were to minimise impact on private properties where possible, the consideration of property access and reducing impacts on ecological features.

The East Option was also recommended to progress with Package 3b to route refinement. This option is an important strategic corridor between Pukekohe, SH1 and south to Waikato. Upgrading this corridor has significant benefits for freight movement and supports future urban growth in Pukekohe and north Waikato. Recommendations for route refinement for the East Option were to reduce impacts on the ONF Pukekohe Tuff Ring.

4.5 Pukekohe Local Corridor Assessment (relevant for NoRs 4, 5, 6 and 7)

4.5.1 Overview

4.5.1.1 Background: South IBC summary

At the IBC phase, several options were investigated to test multiple locations and alignments for a ‘ring route’ around the Pukekohe township. The ring route arterials provide an alternative route to going through the town centre and to support future urban growth. The other arterial options improve capacity for all modes of transport as well as support future urban growth and offer the opportunity for complete street solutions where all modes of transport can be sufficiently improved. The options (shown in Figure 4-13) included:

- Existing arterial upgrades (AR24, AR30, AR31, AR46);
- Western ring route options (AR25, AR29, AR35, AR40);
- Eastern ring route options (AR28, AR34, AR38, AR39, AR41, AR42, AR43); and
- South-eastern ring route options (AR26, AR27, AR36, AR37).

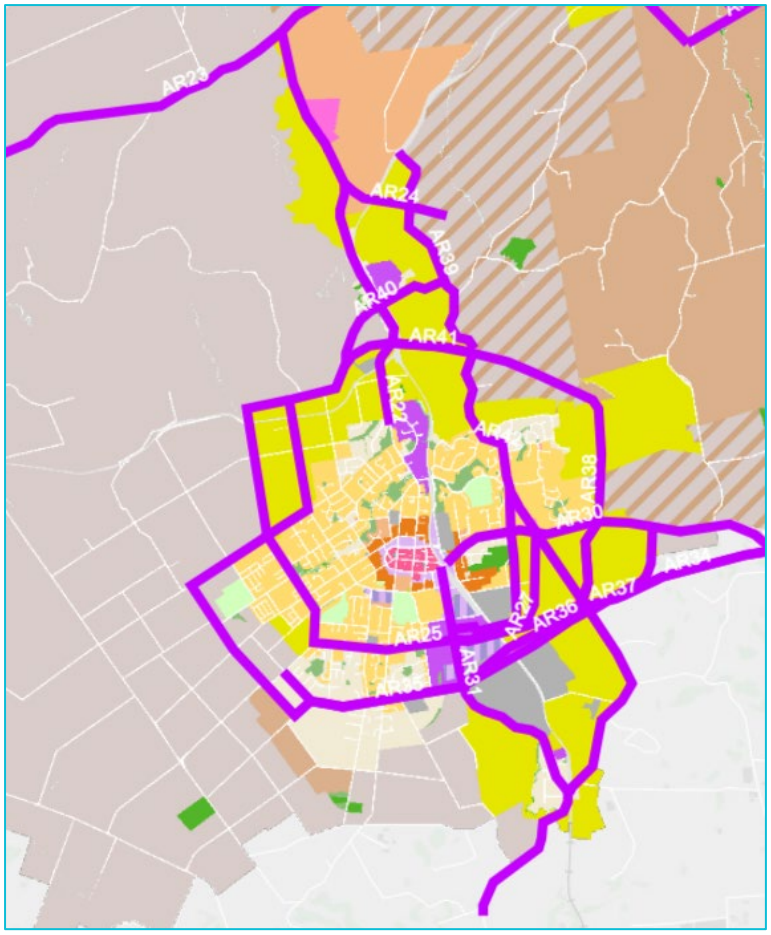


Figure 4-13: South IBC long list options

Many of the options were recommended for the IBC short list (Figure 4-14) as these were to be tested further in combinations with the strategic routes.

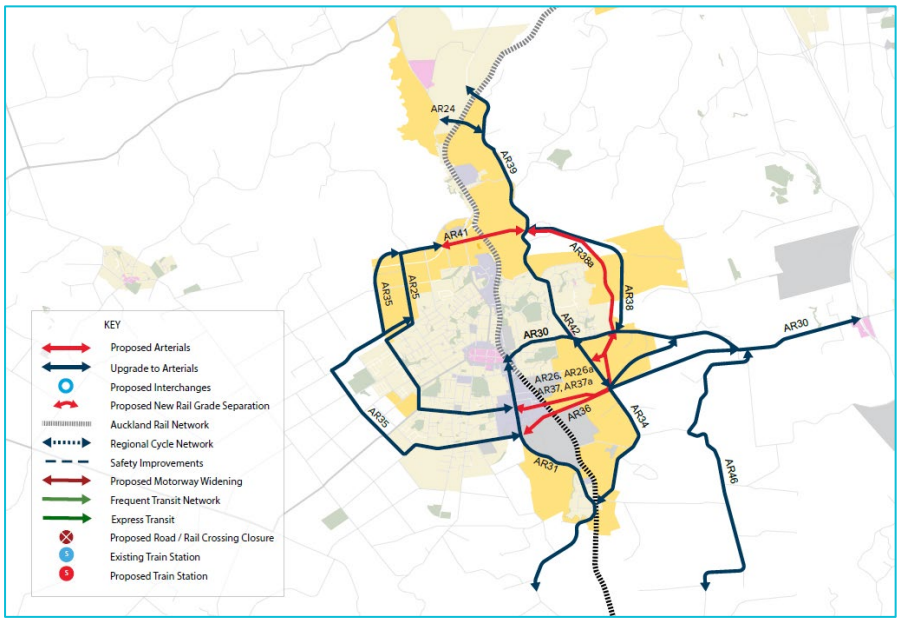


Figure 4-14: South IBC short list options

4.5.1.2 Pukekohe Local Corridor Assessment

For the purposes of corridor assessment, the Pukekohe Local Arterials component of the Pukekohe Transport Network were split into four quadrants (and further segments in some cases) as shown in the figure below.

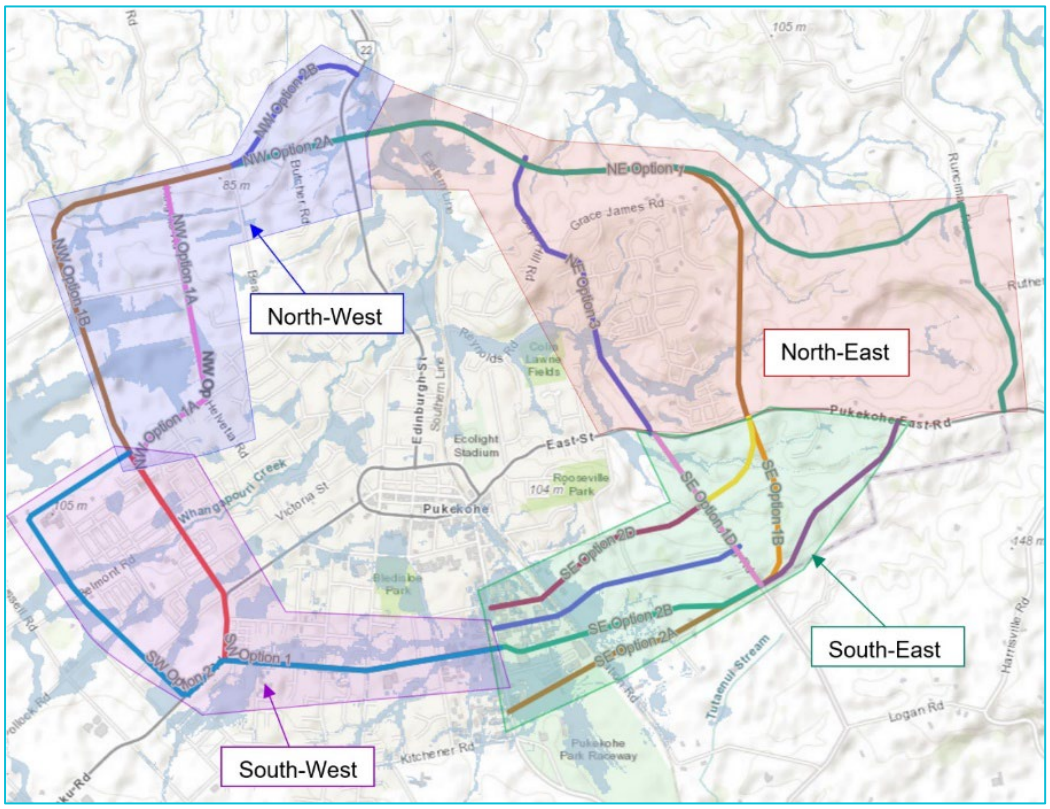


Figure 4-15: Pukekohe Local corridor options

The assessment of alternatives for each of the four quadrants are set out in the following sections.

4.5.2 Pukekohe North-East Corridor Assessment (NoR 4)

4.5.2.1 South IBC / Strategic South DBC assessment summary

- Seven options (referred to as AR28, AR34, AR38, AR39, AR41, AR42, AR43) were identified during the IBC long list options development and taken through to the IBC short list assessment.
- AR38a was added during the short list assessment by engineering refinement. This option involves safety upgrades with no widening of the corridor.
- Two options (AR41 and AR38a) were recommended in the IBC.
- AR41 has high benefits assuming that it connects to the Pukekohe Expressway, also acting as a supportive link to a wider network. Both options were selected for the following reasons:

– Enables quality access to Paerata rail station;
– Enables freight traffic to avoid town centre; and
– Allows through traffic to use strategic roads avoiding town centre.

The functional intent of these options is to facilitate an alternative north-south movement, linking the eastern growth areas. IBC recommended a 4-lane arterial with walking and cycling provided.

The draft Strategic South DBC developed the Pukekohe Urban Arterial (NE Arterial) to connect the former Pukekohe Expressway. Two options were developed with a preference for an alignment that followed the FUZ boundary and was located further away (in the southern section) from the Pukekohe Tuff Ring (ONF).

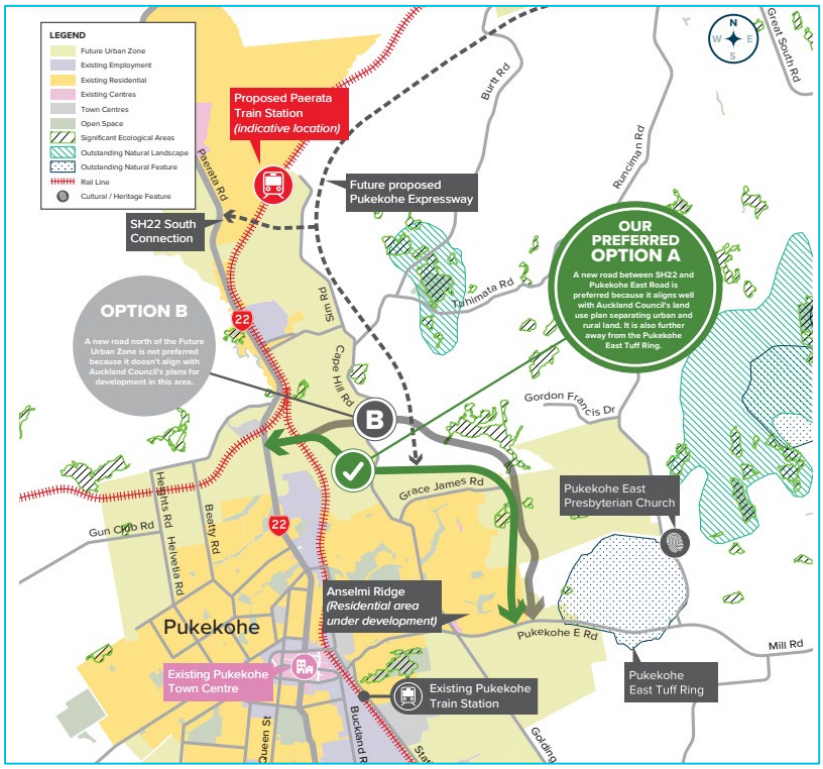


Figure 4-16: Pukekohe Urban Arterial (NE Arterial) from Draft Strategic South DBC

4.5.2.2 Gap analysis IBC – DBC

Table 4-19 provides a summary for Pukekohe North-East Arterial transport components of the Pukekohe Transport Network, key changes since the previous recommendations made by the South IBC and Draft Strategic South DBC and a recommendation for the Pukekohe Transport Network alternatives assessment.

Table 4-19: Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Arterial route connecting from SH22 west to Heights Road. Provides a strategic link to the Pukekohe Expressway and relieves the through-town traffic. The alignment was planned to be 4 lanes for vehicles with no planned PT lanes.	Developer interest / resource consents lodged. GPS 2021/Zero Carbon Act – Climate change lens, which may have implications on former Pukekohe Expressway alignment. Consider implications of NPS:FM and NES:FW – adopt avoidance of wetlands where	Corridor assessment considering the following: • Form and function of the Pukekohe Arterials to be confirmed. The options have not been assessed since the IBC (2019) which left the form and function to be confirmed in the DBC. The arterials are likely to be two lanes which may influence their placement over a four-lane corridor.

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
	possible as principle in first instance.	• The form and function of the Pukekohe Expressway is re-assessed and the need confirmed. This interacts and is likely to influence the NE Arterial. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • Through any optioneering processes new information such as impacts on wetlands (under the NPS:FM) and opportunities to integrate with urban development are identified.

4.5.2.3 Alternatives Development

Three options were developed for the Pukekohe North-East Arterial corridor assessment:

- **NE Option 1:** new corridor with a central alignment, passing through a recently rezoned urban area at the southern extent;
- **NE Option 2:** new corridor with an eastern alignment, connecting to and upgrading part of Runciman Road; and
- **NE Option 3:** corridor in the existing urban area upgrading Valley Road and Belgium Road.

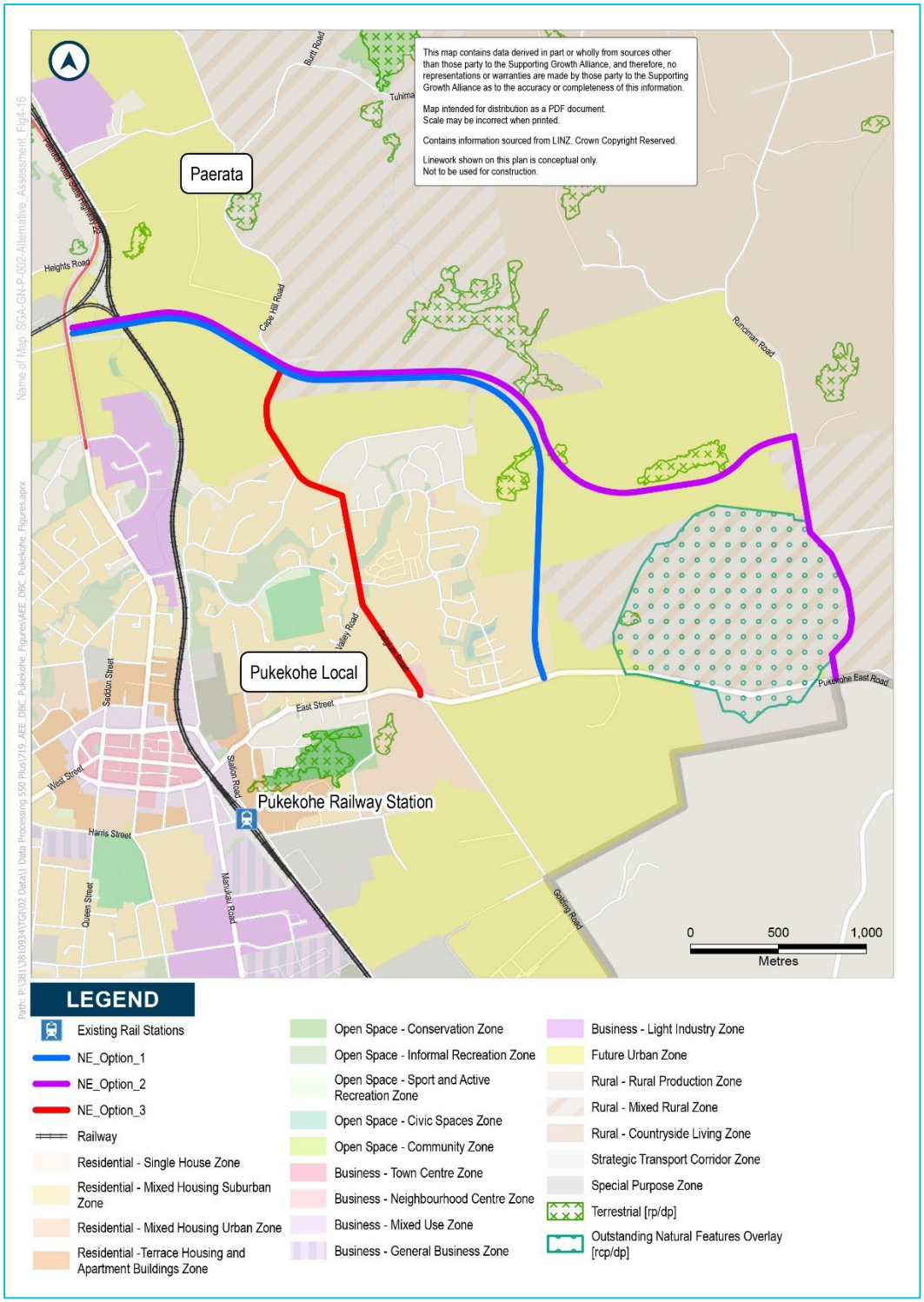


Figure 4-17: Pukekohe Local – North-East Arterial corridor options

4.5.2.4 Alternatives Assessment

Three options were assessed against the MCA framework by each subject matter expert in Table 4-20. Table 4-21 Table 4-20provides a summary of the assessment undertaken by technical specialists against the MCA framework.

Table 4-20: Pukekohe Local – North-East corridor option MCA scoring

MCA Criteria	Scores		
Options	**NE1**	**NE2**	**NE3**
Transport Outcomes			
Safety	2	1	0
Integration	2	1	0
Access	2	2	0
Resilience	3	1	-1
Travel Choice	1	1	1
Cultural			
Heritage	0	-5	0
Social			
Land use futures	-1	1	1
Urban design	-1	-1	-2
Land requirement / property	-2	-1	-3
Social cohesion	2	1	1
Human health and wellbeing	-1	-1	0
Environment			
Landscape / visual	-3	-4	-1
Stormwater	-3	-3	-1
Ecology	-4	-4	-2
Natural hazards	-3	-3	-2
Construction impacts			
Embodied carbon emissions	-3	-3	-3
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-1	-1	-2
Construction costs / risk / value capture	-3	-3	-2

Table 4-21: Pukekohe Local – North-East option assessment findings summary

Criteria	Summary of performance
Transport Outcomes	NE1 is preferred as it scored most favourably against the transport outcomes overall. NE3 is the least preferred as has limited benefits for active modes and the pressure on other modes would increase. Does not provide network resilience by upgrading a road in an existing urban area.
Heritage	NE1 and NE3 did not have any recorded heritage. NE2 potentially impacts the Sharp residence, a memorial plaque and flagpole, Pukekohe East Presbyterian Church, and the site of an 1863 battle at the beginning of the Waikato Invasion and a significant site. It therefore scores very poorly (-5).
Social	**Land use** NE3 was the preferred option as it would integrate the best with future development. While NE1 connects the most future land uses, it goes through a future subdivision which is advanced to a stage where the design cannot be adjusted to accommodate the new corridor. NE2 would reduce the amount of developable land and provides less direct connections between higher density residential areas. **Urban design** NE1 is preferred on the basis of future development having the opportunity to respond to the corridors. **Land requirement** NE2 was preferred as it involved mostly partial acquisition of mixed rural or FUZ land. NE3 would require the full acquisition of approximately a large number of homes, mostly new builds (<10 years old). **Social cohesion** NE1 provides the greater connection between areas and crosses existing residential areas, with indirect access to the Rugby Club and direct access to two reserves. NE2 has a lack of connection within the existing environment as it traverses the FUZ and rural areas. **Health and wellbeing** NE3 is predominantly an existing road, with less sensitive activities nearby. NE2 was the least preferred as it passes a school which was considered a sensitive receiver.
Environmental	**Landscape and visual** NE3 was preferred due to alignment relating to underlying landscape patterns (topography and vegetation), notable trees and the level of potential visual effects. NE2 was least preferred due potential impacts on the ONF (Tuff Crater), through SEA's and not following the underlying landscape patterns, and potential effects on rural character, visual amenity and notable trees. **Stormwater** NE3 was preferred as it involves upgrading existing roads and would cross less streams and floodplains than the other options. **Ecology**

Criteria	Summary of performance
	NE3 was preferred as it uses existing roads and avoids impacts on wetlands, indigenous vegetation and bats. NE1 and NE2 both impact the edge of several SEAs and are likely to impact smaller stands of indigenous vegetation and numerous streams and wetlands outside SEA areas. **Natural Hazards** NE3 is widening only, follows mostly existing roads. NE1 and NE2 cross peat swamp, NE1 has greater stability issues.
Construction impacts	**Embodied carbon emissions** NE3 is neutral overall as it is a short corridor with no major earthworks or structures. NE2 is the longest option and involves mostly new development through rural greenfield. Requires significant earthworks and two bridges. **Construction impacts on infrastructure/utilities** All options require relocation or protection of the first gas transmission pipe and scored the same. **Construction disruption** NE1 and NE2 were likely to have minimal impacts on the community as they are greenfield development. NE3 was least preferred as it would require lane narrowing and disruption for upgrades to the existing urban and rural corridor. **Construction costs** NE1 and NE2 were likely to have higher construction costs as they would include new corridor and bridge structures. NE3 was preferred as it involved upgrades to the existing road only.
Partner feedback	Key feedback from SMEs from workshops included: • Queries on option NE3 in terms of what improvements would be required of the existing roads. • Option NE3 currently carries a higher proportion of freight which will increase and needs consideration. • Feedback on the active urban development in the area and the interaction with a proposed development north of Pukekohe East Road (Nanjing) for NE1. During the site visit with Manawhenua (28 July 2022), the following matters were raised: • Ngaati Te Ata Waiohua noted that both the Tuff Ring and SEAs were in the area. • Next steps for route refinement were discussed in the context of developing options to avoid urban development and the reduce impacts on significant features. • Ngaati Te Ata Waiohua is not supportive of option 3 (NE3) due to the potential impact on existing residential areas. A preference for Option 1 (NE1) over the other two options. However, noted the dew urban development occurring in the area north of Pukekohe East Road.

4.5.2.5 Discarded Alternatives

Table 4-22: Options to be discarded

Option	Reason
NE2	Potential to impact a significant heritage site. Scores low positives against the transport outcomes, as a longer, less attractive route.
NE3	Upgrades existing road in an existing urban area. Does not integrate with FUZ. Scores poorly against resilience objective.

4.5.2.6 Recommended Corridor Option

Option **NE1** (new corridor with a central alignment, passing through a recently rezoned urban area at the southern extent) is the recommended corridor option as it provides increased resilience in the transport network and scores most favourably against the transport outcomes.

Recommendations for route refinement are to reduce impacts on active development around the Pukekohe East Road area.

4.5.3 Pukekohe South-East Corridor Assessment (NoR 5)

4.5.3.1 South IBC assessment summary

See IBC long list and short list figures in Section 4.5.1.

- Four south-eastern ring route options (AR26, AR27, AR36, AR37) were identified in IBC longlist assessment.
- Four options were taken through to the IBC short list assessment (AR26, AR26a, AR37 and AR37a).
- AR26a and AR37a were added during the shortlist development by engineering refinement.
- The IBC recommended AR26a – an inner bypass around south-eastern side of Pukekohe from Manuka Rd to Pukekohe East Rd via Svendsen Rd and Anselmi Ridge. This option was selected for the following reasons:

– To service further development south of Pukekohe town centre
– To enable freight traffic to avoid town centre
– To enable existing alignments to be more flexible
– Allows through traffic to use strategic roads avoiding town centre

Functional intent of these options was to link south-eastern growth areas providing improved access to SH1 via Mill Road and also supports access to Pokeno and Tuakau. IBC recommended 4-lane arterial with walking and cycling provided.

4.5.3.2 Gap analysis IBC to DBC

Table 4-23 provides a summary for Pukekohe South-East Arterial component of the Pukekohe Transport Network, key changes since the previous recommendations made by the South IBC and Strategic South DBC and a recommendation for the Pukekohe Transport Network assessment of alternatives.

Table 4-23: Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
From Svendsen Rd over the rail tracks to Golding Rd, heading north to Pukekohe East Rd. Enables freight to travel around Pukekohe for greater efficiency and a reduction in congestion within Pukekohe town centre.	Developer interest / resource consents lodged. GPS 2021/Zero Carbon Act – Climate change lens, which may have implications on the Pukekohe Expressway alignment. Consider implications of NPS:FM and NES:FW – adopt avoidance of wetlands where possible as principle in first instance.	Corridor assessment considering the following: • Form and function of the Pukekohe Arterials to be confirmed. The options have not been assessed since the IBC (2019) which left the form and function to be confirmed in the DBC. The arterials are likely to be two lanes which may influence their placement over a four-lane corridor. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • A number of plan changes have been lodged (or are planned) in proximity to this corridor – in particular along Golding Road. Opportunity to better integrate with these developments. • Through any optioneering processes new information such as impacts on wetlands (under the NPS:FM) and opportunities to integrate with urban development are identified.

4.5.3.3 Alternatives Development

The South-East Arterial was split into two segments for assessment purposes:

- Segment 1 – four options east of and including Golding Road; and
- Segment 2 – four options west of Golding Road connecting between Golding Road and Manukau Road.

The following options were developed for each segment:

Segment 1:

- **SE Option 1A:** new connection from Pukekohe East Road near the Pukekohe East Tuff ring on the outside of the FUZ connecting at Golding Road;
- **SE Option 1B:** new connection from Pukekohe East Road with a central connection through FUZ, connecting at Golding Road
- **SE Option 1C:** new connection from Pukekohe East Road through FUZ connecting at a more northern point at Golding Road and
- **SE Option 1D:** upgrade of Golding Road.

Segment 2:

- **SE Option 2A:** new connection from Golding Road upgrading Royal Doulton Drive through the FUZ, crossing the NIMT north of Pukekohe Park creating a new link to Manukau Road;
- **SE Option 2B:** new connection from Golding Road upgrading Royal Doulton Drive through the FUZ, crossing the NIMT and linking to Svendsen Road;
- **SE Option 2C:** new connection through the FUZ crossing the NIMT and linking to Crosbie Road; and
- **SE Option 2D:** new connection through FUZ crossing the NIMT and linking to Subway Road.

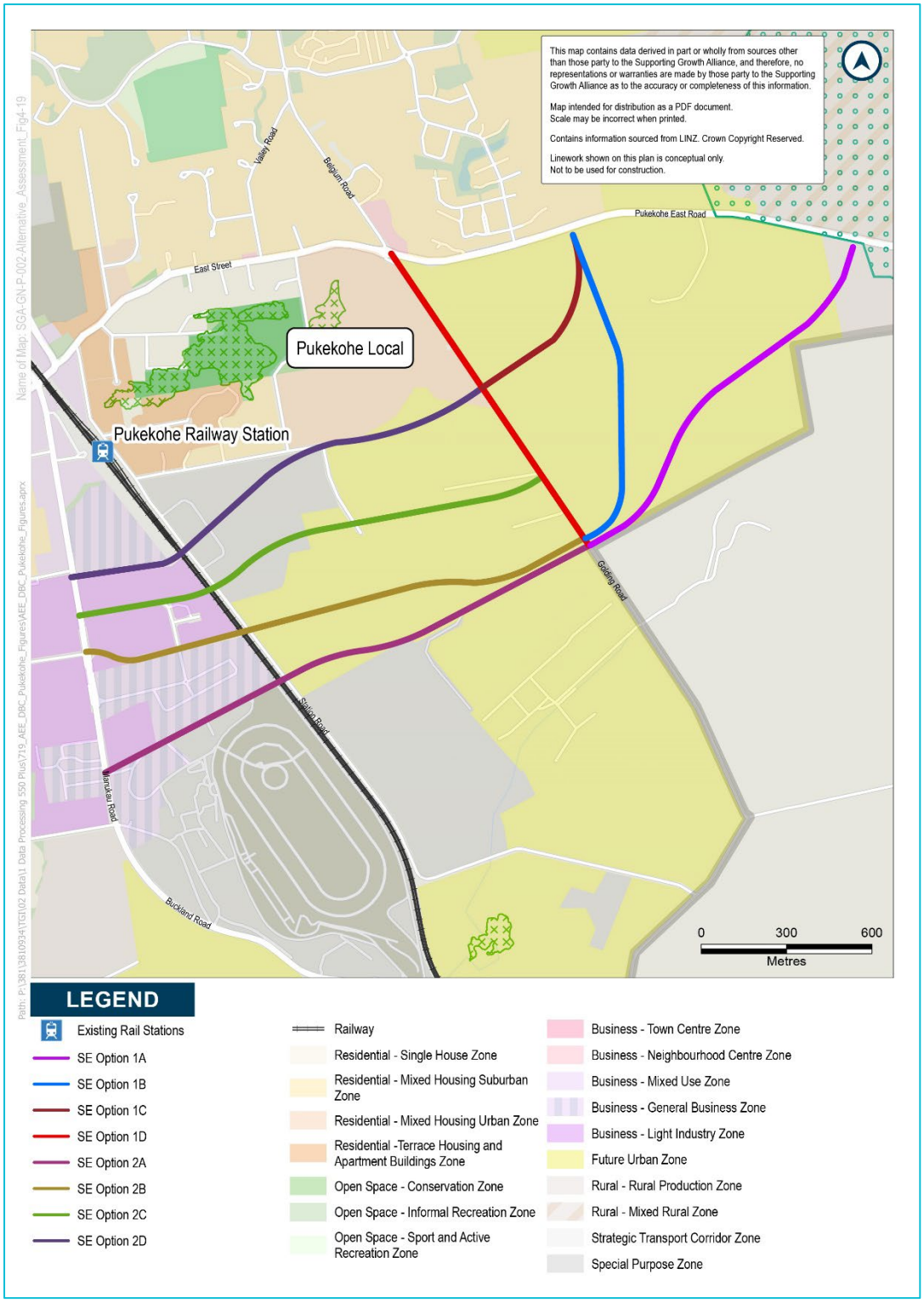


Figure 4-18: Pukekohe Local – South-East corridor options

4.5.3.4 Alternatives Assessment

Options were assessed against the MCA framework by each technical specialist. Table 4-24 provides a summary of the assessment undertaken.

Table 4-24: Pukekohe Local – South-East corridor option MCA scoring

MCA Criteria	Scores							
	Segment 1				Segment 2			
	SE1A	SE1B	SE1C	SE1D	SE2A	SE2B	SE2C	SE2D
Transport Outcomes								
Safety	1	1	1	2	1	2	2	2
Integration	1	2	2	1	2	2	2	2
Access	1	1	1	1	1	2	2	2
Resilience	2	2	2	0	3	3	3	3
Travel Choice	1	1	1	1	1	1	2	2
Cultural								
Heritage	0	0	0	0	0	0	-1	0
Social								
Land use futures	1	2	2	2	1	2	1	1
Urban design	-2	-2	-2	0	-2	-1	-2	-2
Land requirement / property	-1	-2	-1	-1	-2	-2	-2	-3
Social cohesion	0	0	1	1	-1	2	-2	-2
Human health and wellbeing	-1	-1	-1	0	-1	-1	-2	-2
Environment								
Landscape / visual	-3	-2	-1	-1	-1	-1	-2	-2
Stormwater	-1	-1	-1	-1	-2	-2	-2	-2
Ecology	-4	-3	-3	-1	-2	-2	-2	-2
Natural hazards	-3	-3	-2	-2	-3	-3	-2	-2
Construction impacts								
Embodied carbon emissions	-3	-3	-3	-3	-3	-3	-3	-3
Construction impacts	-1	-1	-1	-2	-2	-2	-2	-2
Construction Disruption	-1	-1	-1	-1	-2	-2	-2	-2
Construction costs / risk	-2	-2	-2	-2	-2	-2	-2	-2

Table 4-25: Pukekohe Local – South-East option assessment findings summary

Criteria	Summary of performance	
	Segment 1	**Segment 2**
Transport Outcomes	All options result in improved safety and provide balanced land-use and transport outcomes. SE1A, 1B and 1C provide an alternative connection to Golding Road and improve resilience and stronger freight connections. 1A scored slightly lower as it is located on FUZ fringe, has reduced integration and has a reduced catchment.	SE2C and SE2D were preferred as these options would significantly improve E-W access and were closer to Pukekohe Town Centre and rail station. These options also improved travel choice between the existing environment and likely future environment for all modes but also closer to jobs and schools.
Heritage	No recorded heritage.	SE2C had the potential to impact on early 20th century villa (CHI item 22335), 1920s railway workers cottages (CHI item 22373). No other recorded heritage.
Social	**Land use** SE1A is the least preferred as is it provides less integration with the FUZ. All other options provided good integration with FUZ areas. **Urban design** SE1D was preferred as uses an existing corridor alignment and topography appears to be less challenging in this location. By being outside of FUZ area the alignment increases development flexibility. **Land requirement** SE1B was the least preferred as it would have the largest property impact in terms of acquisitions and betterment. All other options were similar. **Social cohesion** SE1C and SE1D preferred as provides an upgraded existing direct route and includes walking cycling connections closer to existing residential. **Health and wellbeing** SE1D is preferred as involves only upgrades to existing roads, the remaining options were less preferred.	**Land use** SE2B was preferred as it avoids all precincts and the Franklin Showground a regionally important venue. **Urban design** SE2B was preferred as provides a connection to the SW options and uses an existing corridor and avoids community assets and is preferred on this basis. **Land requirement** SE2D was the least preferred due to negative impact to commercial properties along subway road, Saleyards and Franklin Agricultural Society land and a number of full and partial acquisitions. **Social cohesion** SE2B was preferred as provides a connection over the rail line between existing rural, business and light industrial indirectly to Pukekohe town centre. **Health and wellbeing** SE2A and SE2B were preferred as they do not impact the showgrounds.
Environmental	**Landscape and visual** SE1C and SE1D were preferred due to underlying landscape patterns (topography and vegetation), notable	**Landscape and visual** SE2A and SE2B were preferred due to underlying landscape patterns (topography and vegetation). SE2C and SE2D were

Criteria	Summary of performance	
	trees and the level of potential visual effects. SE1A presents new road infrastructure within the rural environment and within the productive landscape and has potential effects on notable trees and was the least preferred. **Stormwater** There was limited differentiation between options. SE1 crosses several streams in the headwaters of the Whangapouri Creek catchments which would require culverts sized for flow and fish passage. However, no significant flooding effects expected. **Ecology** SE1D was preferred as upgrading the existing 2 lane design would largely avoid impacts on streams and would upgrade existing infrastructure (upgrade undersized culverts). **Natural Hazards** The preferred options are primarily within tuff and basalt (SE1C and SE1D). The options were within alluvium, with likely soft and compressible conditions.	not preferred as these options would sever the Pukekohe Showgrounds which represents a publicly accessible facility and would result in adverse visual effects to its users. **Stormwater** There was limited differentiation between options. For SE2 new hardstand would require water quality, detention and attenuation via wetlands and options would pass through floodplain mostly on the western side of the railway line and would require mitigation to offset the displacement effects of the earthworks. **Ecology** Preferred SE2B as impacts would be minor, relating to individual scattered native / exotic trees. **Natural Hazards** The preferred options are primarily within tuff and basalt (SE2C and SE2D). The options were within alluvium, with likely soft and compressible conditions.
Construction impacts	**Embodied carbon emissions** SE1C was preferred as a short new development through rural greenfield. However, this option was likely to require two bridges. **Construction impacts on infrastructure/utilities** For SE1 services require protection where the new alignment intersects with existing roads. SE1D was least preferred as existing overhead powerlines are likely to require undergrounding on Golding Rd. **Construction disruption** For SE1 construction of a new corridor in a rural greenfield. Minimal impacts on the community. SE1D was the least preferred as would require lane narrowing / temporary traffic control. **Construction costs** Limited differentiation between options.	**Embodied carbon emissions** SE2C and SE2D were both preferred. **Construction impacts on infrastructure/utilities** For SE2 impacts on local network utilities only. Protection of services or relocation is likely required. **Construction disruption** For SE2 all options are likely to require lane narrowing / temporary traffic control, as well as direct access to businesses likely to be affected during construction. **Construction costs** Limited differentiation between options.

Criteria	Summary of performance	
Partner feedback	Key matters raised during partner SME workshops included: • Lots of active or planned plan changes in the immediate area that interact with the options. Provides opportunities to work with developers. • Consideration of how collector roads with the development will connect with the options. • Consideration of upgrading existing intersections such as Pukekohe East/Golding Road to make more efficient in the future. • Support for new crossing over the rail corridor and that this will be attractive for freight. • Consideration of gradient of transport corridors for active modes. Lots of active development Key matters raised by a Ngaati Te Ata Waiohua representative in hui were: • Plan change 76 discussed. Golding Road SE1D option allows for AT to work with developers either side of Golding Road through private plan changes. Additionally, terrain is more difficult on the east side of Golding Road, with numerous ecological features. Ngaati Te Ata Waiohua support the upgrade of Golding Road SE1D. • Ngaati Te Ata Waiohua supported not to affecting the AMP showgrounds and Trotting Club. • Ngaati Te Ata Waiohua supported keeping away from plan change areas that are advanced.	

4.5.3.5 Discarded Alternatives

Table 4-26: Options to be discarded

Option	Reason for being discarded
SE1A	Due to impacts on landscape features specifically the tuff ring and potential ecological impacts on wetlands and potential bat habitat.
SE1B	Requires the largest amount of land, traverses a number of gullies, wetlands, difficult topography.
SE1C	Traverses a number of gullies, wetlands, difficult topography.
SE2A	Significant property impacts including Auckland trotting club and Golding Road development.
SE2C	Impacts A&P showgrounds a significant regional facility.
SE2D	Impacts A&P showgrounds a significant regional facility.

4.5.3.6 Recommended Corridor Option

The emerging preferred options are:

- Segment 1: **SE Option 1D** (upgrade of Golding Road) – This is already a busy corridor and will have a significant public transport function in future. Has reduced potential impacts on

stormwater, landscape and visual, and ecology than other options. This option provides opportunities to work with developers to deliver the upgrade; and

- Segment 2: **SE Option 2B** (new connection from Golding Road upgrading Royal Doulton Drive through the FUZ, crossing the NIMT and linking to Svendsen Road) – Avoids the Auckland Trotting Club/Golding Road active development and Franklin A&P showgrounds and provides the most direct east-west connection for freight and general traffic.

Recommendations for route refinement are:

- SE1D: A section of Pukekohe East Road will also need to be upgraded to support this route.
- SE2B: Further investigation in the best place to cross the existing rail line and reduce property impacts.

4.5.4 Pukekohe South-West Corridor (NoR 6)

4.5.4.1 South IBC assessment summary

See IBC long list and short list figures in Section 4.5.1.

The IBC looked at the southwest and northwest together as “western arterials”. This included:

- Four western ring route options (AR25, AR29, AR35, AR40) were identified during the IBC long list assessment.
- A third option between AR25 and AR35 was considered during an internal alliance review, but due to a reserve, versatile soils and an irregular form of the urban edge this was not included in the longlist for assessment.
- Two western ring routes (AR25 and AR35) were taken through to the IBC shortlist assessment.
- The IBC recommended AR25 – an inner bypass around west of Pukekohe from Height Rd in the north to Manukau Rd in the south. This option was selected for the following reasons:

– To enable freight traffic to avoid town centre
– To enable existing alignments to be more flexible
– Allows through traffic to use strategic roads avoiding town centre

Functional intent is to facilitate movement of traffic north/south linking growth in the western areas.

4.5.4.2 Gap Analysis IBC – DBC

Table 4-27 provides a summary for Pukekohe South-East Arterial transport component of the Pukekohe Transport Network, key changes since the previous recommendations made by the South IBC and Strategic South DBC and a recommendation for the Pukekohe Transport Network assessment of alternatives.

Table 4-27: Summary of gap analysis and recommendations

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Facilitate movement of traffic north/south linking growth in the western area.	Developer interest / resource consents lodged. GPS 2021/Zero Carbon Act – Climate change lens, which may	Corridor assessment considering the following: • Form and function of the Pukekohe Arterials to be

Intention and Previous options assessment	Key changes since IBC and South DBC	Recommendation(s)
Enables movements around Pukekohe for greater efficiency and a reduction in congestion within Pukekohe town centre.	have implications on the Pukekohe Expressway alignment. Consider implications of NPS:FM and NES:FW – adopt avoidance of wetlands where possible as principle in first instance.	confirmed. The options have not been assessed since the IBC (2019) which left the form and function to be confirmed in the DBC. The arterials are likely to be two lanes which may influence their placement over a four-lane corridor. • Further alternatives are considered (corridor assessment) which may provide more of a contribution to decarbonisation as set out in government direction. This could include the investigation of upgrading existing roads. • A number of plan changes have been lodged (or are planned) in proximity to this corridor – in particular along Golding Road. Opportunity to better integrate with these developments. • Through any optioneering processes new information such as impacts on wetlands (under the NPS:FW) and opportunities to integrate with urban development are identified.

4.5.4.3 Alternatives Development

Three options were developed for the Pukekohe South-West Arterial as shown in Figure 4-19:

- **SW Option 1:** central alignment utilising Nelson St, Ward St, and Jutland Rd;
- **SW Option 2:** western alignment utilising Nelson St, Ward St, and a new corridor through Rural Zone to link to Rifle Range Road; and
- **SW Option 3:** eastern alignment utilising Nelson St, Ward St West St and Helvetia Road.

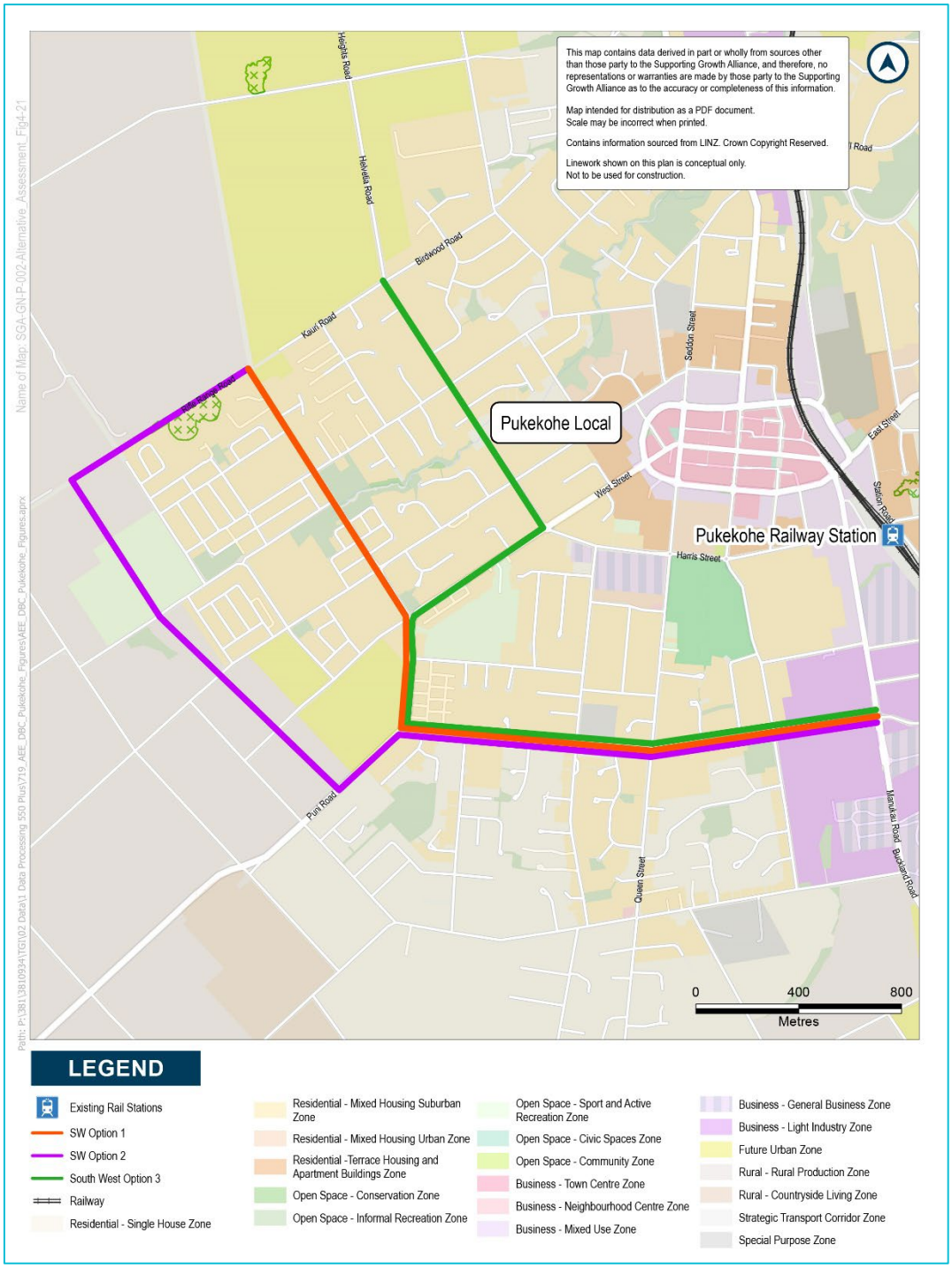


Figure 4-19: Pukekohe Local – South-West corridor options

4.5.4.4 Alternatives Assessment

Three options were assessed against the MCA framework by each technical specialist in Table 4-28. Table 4-29 provides a summary of the assessment undertaken.

Table 4-28: Pukekohe Local – South-West corridor option MCA scoring

MCA Criteria	Scores		
Options	**SW1**	**SW2**	**SW3**
Transport Outcomes			
Safety	1	1	2
Integration	1	1	2
Access	2	1	3
Resilience	1	1	1
Travel Choice	2	1	2
Cultural			
Heritage	-4	-4	-4
Social			
Land use futures / integration with planned landuse	2	1	1
Urban design	-3	-2	-2
Land requirement / property	-3	-3	-2
Social cohesion	2	-1	2
Human health and wellbeing	-1	-2	0
Environment			
Landscape / visual	-2	-3	-2
Stormwater	-1	-1	-1
Ecology	-2	-5	-3
Natural hazards	-3	-3	-2
Construction impacts			
Embodied carbon emissions	-3	-3	-3
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-2	-2	-2
Construction costs / risk / value capture	-2	-2	-2

Table 4-29: Pukekohe Local – South-West option assessment findings summary

Criteria	Summary of performance
Transport Outcomes	All options have a positive effect on safety and improve connectivity for the strategic network and travel choice. SW1 introduces a freight route close to a school, which is not ideal and would likely be subject to further speed reductions. SW2 is less direct freight and general traffic would likely use the existing Helvetia Rd and Seddon St instead. Neither of these options is ideal and option along Helvetia Road (SW3) was preferred.
Heritage	All options have impacts to heritage. Including potential impacts on the Borough Power House, 20th century (CHI item 15070), plaque marking the site of the First Presbyterian Church from 1868 (CHI item 12531), Pukekohe multidenominational Cemetery, from 1882, and War Memorial (CHI item 19319), Nehru Hall from 1953 (CHI item 15868)
Social	**Land use** SW3 was the preferred option as it provides a more direct connection, integrates more directly with the FUZ, serves more of the existing urban area. SW2 creates areas of residual land within the rural area, which may encourage development beyond the FUZ and existing urban areas. Both SW1 and SW2 provide similar connections. **Urban design** All options have interface issues. The second segment of SW2 runs along the urban boundary and would define the urban edge and this is the preferred option. **Land requirement** SW3 was the preferred option as partial acquisitions only would be required. SW1 would require approximately 40 full residential acquisitions and would also impact the cemetery on Nelson Street. SW2 would require 5 properties zoned rural production would be adversely affected, potentially requiring full acquisition. The cemetery, residential properties and commercial properties along Nelson Road would be similarly impacted in SW2. **Social cohesion** All options provide a connection to Franklin Care Centre, Pukekohe Indian Community Centre, Pukekohe Cemetery and Pukekohe Hill School and Tamaoho School. SW3 was the preferred option. SW1 severs open space (reserve) where there is an existing connection. SW2 has less existing residential catchment in being located partially within the rural area, less connections to facilities and it severs a large open space. **Health and wellbeing** Existing urban area, receivers including Franklin Care Centre, Cemetery, Indian Community Centre, Pukekohe Hill School, Tamaoho School. SW1 was preferred as involves upgrade to existing corridor rather than completely new road.
Environmental	**Landscape and visual** SW1 visual amenity effects likely limited to residences immediately adjacent to corridor. SW2 would have a limited loss of vegetation required to facilitate the route along existing corridor, however vegetation required to facilitate the route in the rural environment, including a block of vegetation to the north west (SEA). SW1 was the preferred option.

Criteria	Summary of performance
	Stormwater There are existing floodplains and existing culverts under these roads, all may require culvert upgrades and flood effect mitigation depending on flood displacement of the upgrade works. SW3 was the preferred option as there would be minimal new hardstand and no flooding effects are expected. **Ecology** SW3 was the preferred option as it impacts limited individual and scattered mature trees (largely exotic) and provided the opportunity to avoid the stream corridor. SW1 had one new stream crossing (Whangapouri), with potential associated wetlands and limited impacts to individual and scattered mature trees (including exotic trees in Jutland Road South Playground). SW2 involved the partial or complete loss of SEA_T_5384 (Regionally - Critically Endangered WF8 - Kahikatea, pukatea forest). Impacts on a stand of mature indigenous forest (including potential bat risk) and smaller areas of indigenous forest and a potential natural wetland and was the least preferred option. **Natural Hazards** SW3 was the preferred option as the majority of the alignment lies on volcanic soils. Both SW1 and SW2 interacted with the tuff crater, with soft and compressible soils anticipated, passing in to basalt and tuff. At Whangapouri Creek soft/compressible soils are anticipated.
Construction impacts	**Embodied carbon emissions** Limited differentiation between options. SW3 was preferred due to reduced extent of earthworks. **Construction impacts on infrastructure/utilities** All options have impacts on local network utilities only. Protection of services or relocation is likely required. **Construction disruption** All options require lane narrowing or temporary traffic control needs to be implemented during construction on the existing roads. **Construction costs** There was limited differentiation between options.
Partner feedback	Key feedback from SMEs during workshops included: • Acknowledgement in the difficulty in providing for a safe and direct cycle route and freight corridor in the existing urban environment. • A preference for option 3 as is generally already used by freight. Option 1 is likely to impact a number of new residential areas. Ngaati Te Ata Waiohua supported an upgrade to cycleway and path and supports reducing impacts on property in existing urban areas.

4.5.4.5 Discarded Alternatives

Table 4-30: Options to be discarded

Option	Reason
SW2	Impacts a SEA with critically endangered species. Indirect, people would use existing roads.
SW1	Next to school (30km speed reduction). Not ideal location for freight movement.

4.5.4.6 Recommended Corridor Option

SW3 (eastern alignment utilising Nelson St, Ward St, West St, and Helvetia Rd) is the preferred option. It had marginally better scoring of transport outcomes, is indicated as an AT future bus route and has a better catchment for existing and future areas.

Recommendations for route refinement are to investigate upgrading the existing road reserve (20m wide cross section rather than a 24m wide cross section) to reduce property impacts. This corridor is in an existing urban area with many residential houses along the alignment.

4.5.5 Pukekohe North-West Corridor Assessment (NoR 7)

4.5.5.1 South IBC assessment summary

The IBC looked at the southwest and northwest together as “western arterials”. See South-West Section 4.5.4.1.

4.5.5.2 Gap Analysis IBC to DBC

See South-West Section 4.5.4.2.

4.5.5.3 Alternatives Development

The Pukekohe North-West options were split into two segments for assessment purposes as shown in Figure 4-20.

- Segment 1 – north-south: two options; and
- Segment 2 – east west: two options.

The following options were developed for each segment:

Segment 1:

- **NW Option 1A:** upgrade of Helvetia and Heights Road; and
- **NW Option 1B:** new connection via a western alignment in the edge of the FUZ.

Segment 2:

- **NW Option 2A:** a new transport corridor connecting Heights Road to and including an upgrade of Butcher Road to SH22; and
- **NW Option 2B:** connection utilising Heights Road to SH22.

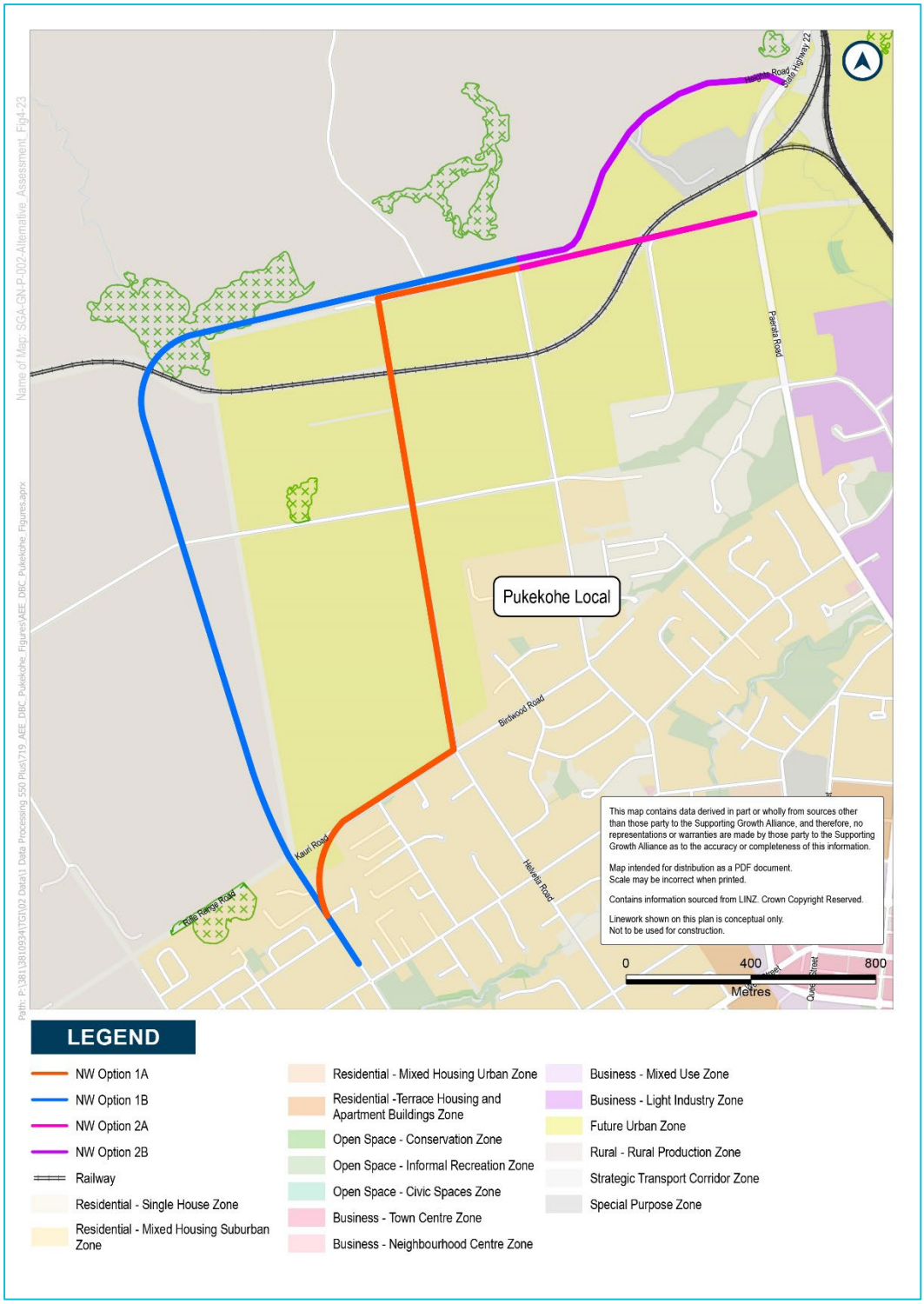


Figure 4-20: Pukekohe Local – North-West corridor options

4.5.5.4 Alternatives Assessment

Table 4-31: Pukekohe Local – North-West corridor options MCA scoring

MCA Criteria	Scores			
	Segment 1		Segment 2	
	NW1A	NW1B	NW2A	NW2B
Transport Outcomes				
Safety	3	1	3	2
Integration	3	2	3	1
Access	3	2	3	2
Resilience	1	2	3	1
Travel Choice	2	1	3	1
Cultural				
Heritage	-2	0	0	0
Social				
Land use futures	3	1	3	1
Urban design	-1	0	-1	0
Land requirement / property	-3	-2	-1	-1
Social cohesion	1	0	0	0
Human health and wellbeing	0	-1	-1	0
Environment				
Landscape / visual	-2	-3	-1	-1
Stormwater	-3	-2	-1	-1
Ecology	-2	-5	-3	-2
Natural hazards	-4	-3	-4	-1
Construction impacts				
Embodied carbon emissions	-3	-3	-3	-3
Construction impacts on infrastructure	-2	-2	-2	-1
Construction Disruption	-1	-1	-1	-1
Construction costs / risk / value capture	-2	-2	-2	-2

Table 4-32: Pukekohe Local – North-West corridor option assessment findings summary

Criteria	Summary of performance	
	Segment 1	**Segment 2**
Transport Outcomes	NW1A is the preferred option. It aligns best with the transport outcomes. NW1B does not address existing safety issues on the roads.	NW2A is the preferred option. It aligns best with the transport outcomes. NW2B has poor integration as some growth areas south of Heights Road are poorly connected and little benefit for access and travel choice.
Heritage	NW1B is the preferred option. NW1A has possible impacts on Pukekohe Police Lockup.	Limited differentiation between options.
Social	**Land use** NW1A is the preferred option over NW1B under this criteria as NW1B creates areas of residual land within the rural area, which may encourage development beyond the FUZ and existing urban areas. Both options provide similar connections. While providing a corridor outside the FUZ reduces the amount of developable land taken up, the connections created are less direct and less integrated with the existing and future urban areas. **Urban design** All NW options have minor access and interface challenges. NW1A would bring traffic through the middle of a residential area, reducing amenity outcomes. NW1B is preferred. **Land requirement** NW1B was preferred due to the reduced property impact. A greater number of acquisitions required by NW1A. **Social cohesion** NW1A was preferred over NW1B as it provides greater connection between existing residential areas. **Health and wellbeing** Existing industrial and residential receivers. NW1A was the preferred option as it predominantly uses existing roads, where air quality, noise and vibration effects are existing and expected.	**Land use** NW2A is our preferred option over NW2B under this criteria as NW2B would potentially encourage development within the rural area. Both options provide similar connections, however, the corridor within the FUZ would provide greater integration as a central connection. **Urban design** NW2A may isolate some areas while NW2B allows more flexibility in terms of access and future development. **Land requirement** NW2B was not preferred as it follows an existing route and preference was for NW2A as a new connection. **Social cohesion** While NW2A and NW2B have the same score, NW2A was preferred. The differentiator being that it is a more direct route, slightly closer to Pukekohe residential and business areas. It also provides two crossings over the rail line. **Health and wellbeing** Existing industrial and residential receivers. NW2B was the preferred option as it predominantly uses existing roads, where air quality, noise and vibration effects are existing and expected.
Environmental	**Landscape and visual**	**Landscape and visual**

Criteria	Summary of performance	
	NW1B does not logically follow the underlying topography and cuts across an incised catchment and stream system within its northern reaches. **Stormwater** NW1B was preferred as it had a much lower interaction with floodplain areas and overland flowpaths. **Ecology** NW1A was preferred as it avoids stream or wetland impacts. Kauri trees impacted on Kauri Road; however, these are planted and not mature. NW1B comprises two very high value stream crossings, within SEA_T_5281. Regionally Critically endangered (WF7) Puriri Forest, nationally critical long-tailed bats recorded and was least preferred. **Natural Hazards** All options involved partial new construction through swamp/tuff crater, with associated soft/compressible soils. Preference was for NW1A which is mostly upgrade of existing roads.	NW2A and NW2B both scored the same due to underlying landscape patterns (topography and vegetation), notable trees and the level of potential visual effects. **Stormwater** NW2B was preferred as it would add minimal new hardstand (impervious area) to the catchment. **Ecology** NW2B follows existing road and therefore impacts likely minimal. **Natural Hazards** Options involved partial new construction through swamp/tuff crater, with associated soft/compressible soils. Preference for NW2B as a short option and upgrades mostly to existing roads.
Construction impacts	**Embodied carbon emissions** There was a negligible difference in lane km and structures. There was limited differentiation between NW1A and NW1B. **Construction impacts on infrastructure/utilities** NW1A and NW1B scored the same as both require local protection or relocation of gas transmission pipe. NW1B could also require overhead powerline to be undergrounded. **Construction disruption** Currently a greenfield site in rural area with limited sensitive receivers. Limited differentiation between options. **Construction costs** There was limited differentiation between options due to complex construction over the rail crossing.	**Embodied carbon emissions** NW2A was preferred as it was the shorter option. **Construction impacts on infrastructure/utilities** NW2B was preferred as it would interfere the least with infrastructure/utilities. **Construction disruption** Currently a greenfield site in rural area with limited sensitive receivers. Limited differentiation between options. **Construction costs** There was limited differentiation between options due to complex construction over the rail crossing.
Partner feedback	Key feedback from SMEs at workshops included: • Grade separation is required where corridors intersection with the Glenbrook rail line.	

Criteria	Summary of performance
	• Discussion on the ongoing use of the rail line by Glenbrook Steel Mill and their plans to expand. • Option NWB navigates a sharp turn at Helvetia/Heights Road. • The topography at Heights Road needs to be carefully considered. Key matters raised during hui with Manawhenua representatives included: • NW1B is not supported as it impacts SEA, Puriri forest, and includes 2 new crossings of the Whangapouri stream. • Ngāti Tamaoho discussed plans for papakaainga development at the Marae that backs on to Helvetia Road. On a site visit with Ngaati Te Ata Waiohua and Ngāti Tamaoho in July 2022 the following matters were discussed: • The SEA was viewed from the end of Helvetia Road. Ngāti Tamaoho emphasised the preference for option NW1A avoiding the route (NW1B) near the SEA. • In terms of the Butcher Road option – Ngaati Te Ata Waiohua noted no issue with taking a new alignment (NW2A) and not selecting the upgrade of Heights Road (NW2B). • Regarding the Pukekohe Local Arterials corridor assessment, Ngāti Te Ata supported the rationale: SEAs have been avoided, use of existing roads, moving roads closer to existing infrastructure (rail and pylons), supports the work undertaken.

4.5.5.5 Discarded Alternatives

Table 4-33: Options to be discarded

Option	Reason
NW1B	The option most negatively scored and mentioned by specialists as least preferred. It will impact a SEA (endangered Puriri Forest), likely to impact known location of bats, requires two new stream crossings (-5).
NW2B	Steep topography, poor integration with the growth areas south of Heights Road. Would involve a large crossing of NIMT, Glenbrook rail line and Whangapouri Stream to connect to the NE quadrant.

4.5.5.6 Recommended Corridor Option

Options **NW1A** (upgrade of Helvetia and Heights Road) and **NW2A** (a new transport corridor connecting Heights Road to and including an upgrade of Butcher Road to SH22) are the recommended corridor options as they were the most favoured by specialists through the MCA. NW1A avoids a SEA and requires no new stream crossings. NW2A provides the most direct connection and reduces complexity in connection to the NE quadrant.

Recommendations for route refinement include further investigation of crossing the Glenbrook rail line and connection with SH22 and Pukekohe NE quadrant.

4.6 Corridor Assessment Conclusion

The following options are recommended to progress to the route refinement assessment which will refine the alignment of each option and form an integrated transport network for the Drury West, Paerata and Pukekohe areas.

Table 4-34: Summary of recommended corridor options

Corridor Assessment Option Package	Recommended Corridor Option	Recommendations for further investigation during Route Refinement
Drury West	DW1 and DW2	• Reduce impacts on the Ngakoroa Stream.
Paerata Local	PS3 and PS5	• A more direct route for PS5. • Consideration of topographical constraints of upgrading Sim Road/Cape Hill Road for PS3. • Consideration of a connection to the Paerata Station (formerly known as the Southern Connector at Draft Strategic South DBC) and connectivity with Paerata Rise development.
North-South	NS8 and East Option	• For NS8 - reduce impacts on private properties where possible and consideration of property access. • The East Option – to reduce impacts on the ONF Pukekohe Tuff Ring.
Pukekohe Local		
Pukekohe North-East Arterial	NE1	• Reduce impacts on active development around the Pukekohe East Road area.
Pukekohe South-East Arterial	SE1 D and SE2B	• SE1D: A section of Pukekohe East Road will also need to be upgraded to support this route. • SE2B: Further investigation in the best place to cross the existing rail line and reduce property impacts.
Pukekohe South-West Arterial	SW3	• Investigate upgrading the existing road reserve (20m wide cross section rather than a 24m wide cross section) to reduce property impacts. This corridor is in an existing urban area with many residential houses an social infrastructure along the alignment.
Pukekohe North-West Arterial	NW1A and NW2A	• Further investigation of crossing the Glenbrook rail line and connection with SH22 and NE quadrant.

5 Route Refinement Assessment

The route refinement assessments for the Pukekohe Transport Network further develops the recommended options from the corridor assessments. The assessment uses the same MCA framework as corridor assessment. The recommended corridor options were split into components (or packages) for the route refinement assessment. These are set out in Figure 5-1 and Table 5-1.

An initial form and function assessment of the options is undertaken at corridor assessment, and this is confirmed again at the route refinement stage to inform option development and assessment.

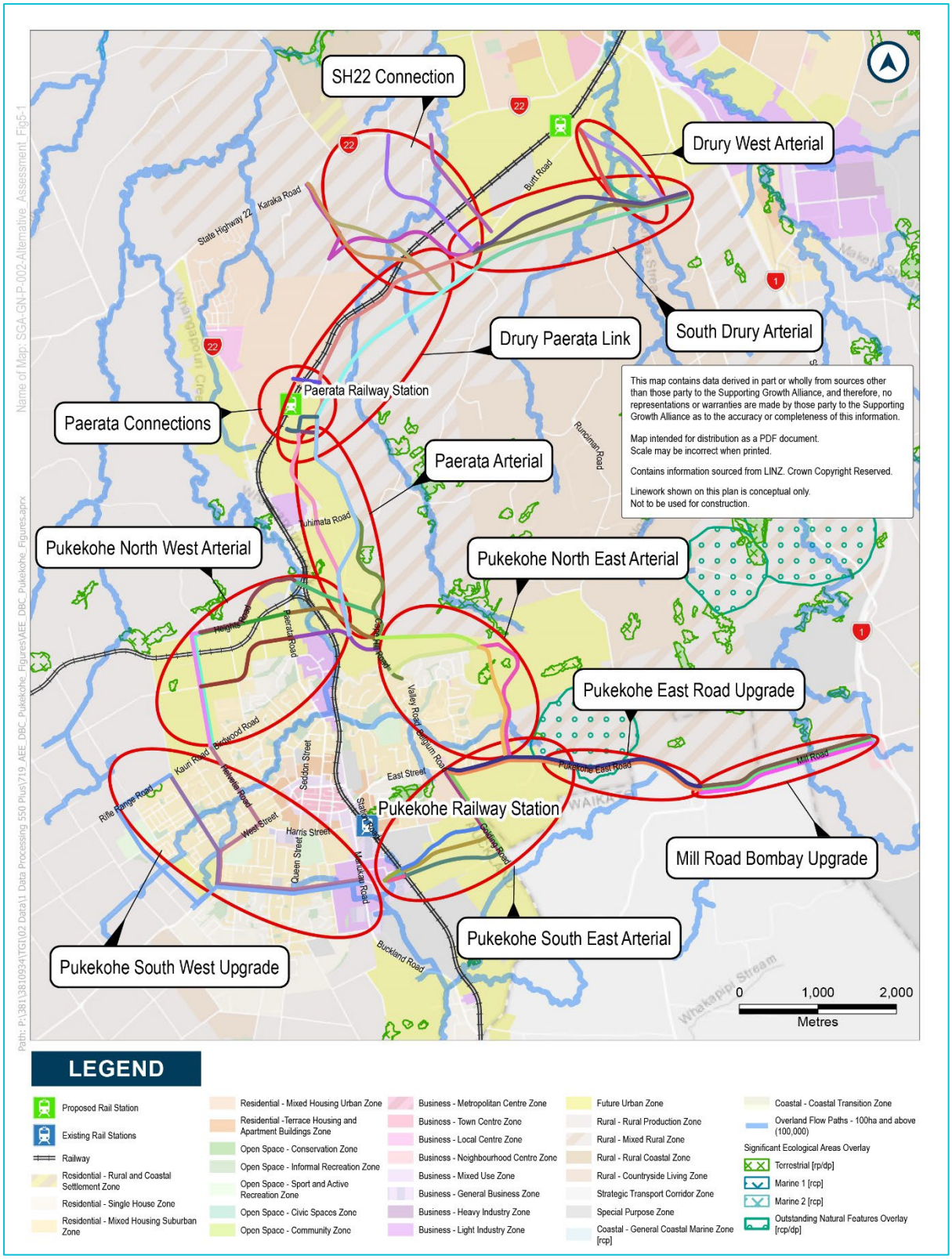


Figure 5-1: Route Refinement Options Assessment Packages

Table 5-1: Refinement Packages and Options

Route Refinement Package	Options
Drury West Arterial (NoR 1)	• Drury West Arterial Option 1 (DW_1) • Drury West Arterial Option 2 (DW_2)
Drury to Pukekohe Link (NoR 2)	South Drury Arterial segment • South Drury Arterial Option 1 (SD_1) • South Drury Arterial Option 2 (SD_2) • South Drury Arterial Option 3 (SD_3)
	SH22 Connection segment • SH22 Connection Option 1 (SH22_1) • SH22 Connection Option 2 (SH22_2) • SH22 Connection Option 3 (SH22_3) • SH22 Connection Option 4 (SH22_4)
	Drury-Paerata Link segment • Drury-Paerata Link Option 1 (PL_1) • Drury-Paerata Link Option 2 (PL_2)
	Paerata Arterial segment • Paerata Arterial Option 1 (PA_1) • Paerata Arterial Option 2 (PA_2)
Paerata Connections (NoR 3)	Sim Connection segment: • Sim Connection Option 1 (PC_1A) • Sim Connection Option 2 (PC_1B) Paerata Station Connection segment: • Paerata Station Connection Option 1 (PC_2A) • Paerata Station Connection Option 2 (PC_2B)
Pukekohe North-East Arterial (NoR 4)	Pukekohe North-East Arterial Segment 1 • Option 1 (PNEA_S1_O1) • Option 2 (PNEA_S1_O2) • Option 3 (PNEA_S1_O3) Pukekohe North-East Arterial Segment 2 • Option 1 (PNEA_S2_O1) • Option 2 (PNEA_S2_O2) Pukekohe North-East Arterial Segment 3 • Option 1 (PNEA_S3_O1) • Option 2 (PNEA_S3_O2)
Pukekohe South-East Arterial (NoR 5)	Pukekohe South-East Arterial Segment 1 • Option 1 (PSEA_S1_O1) • Option 2 (PSEA_S1_O2) • Option 3 (PSEA_S1_O3)

Route Refinement Package	Options
	Pukekohe South-East Arterial Segment 2 • Option 1 (PSEA_S2_O1) • Option 2 (PSEA_S2_O2) • Option 3 (PSEA_S2_O3) Pukekohe South-East Arterial Segment 3 • Option 1 (PSEA_S3_O1) • Option 2 (PSEA_S3_O2) • Option 3 (PSEA_S3_O3)
Pukekohe South-West Arterial (NoR 6)	• Assessment of options within the existing road reserve.
Pukekohe North-West Arterial (NoR 7)	Pukekohe North-West Arterial Segment 1 • Option 1 (PNWA_S1_O1) • Option 2 (PNWA_S1_O2) • Option 3 (PNWA_S1_O3) Pukekohe North-West Arterial Segment 2 • Option 1 (PNWA_S2_O1) • Option 2 (PNWA_S2_O2) • Option 3 (PNWA_S2_O3)
Mill Road Bombay Upgrade – Pukekohe East Road Upgrade (NoR 8 AC and NoR 8 WDC)	Mill Road upgrade • Option 1 MR_1 • Option 2 MR_2 • Option 3 MR_3 Pukekohe East Road upgrade • Option 1 PE_O1 • Option 2 PE_O2

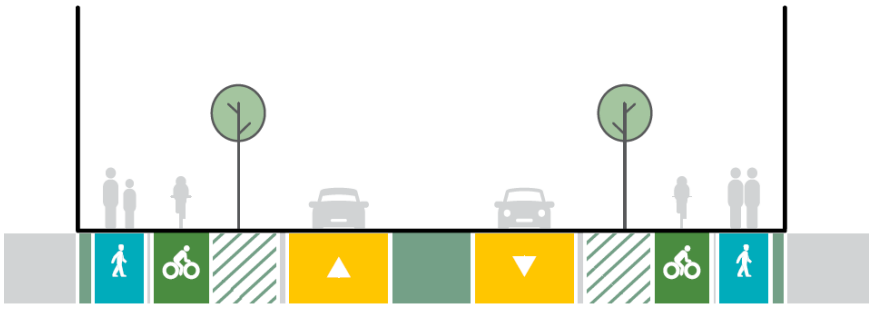
5.1 Drury West Route Refinement – NoR 1

5.1.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken for the Drury West connection to inform option development and assessment. Table 5-2 provides a summary of the assumptions and outcomes of the assessment.

Table 5-2: Drury West Form and function assumptions and summary

Criteria	Summary
Purpose	Provides an arterial connection from SH22/Jesmond Road to the edge of FUZ. Connecting to Drury West Town Centres, Drury West Rail Station and access to the strategic corridors (SH1, SH22). It also provides a new rail crossing over the rail line improving local connectivity in Drury West area.

Criteria	Summary
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	• P2 – Attracts activity from across a subregion or neighbouring local board area • M2 – Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	7, 000 - 9,000
Speed	50 kph speed limit
Public transport (indicative 2048)	• 27 buses per hour (section from Jesmond to Rail line) • 11 buses per hour(section from Rail line to Runciman Road) • Priority lanes north of rail line and intersections south of rail line
Freight	Level 3 Route

5.1.2 Alternatives Development

Two Drury West options underwent a route refinement assessment through the MCA framework by each technical specialist (refer Figure 5-2):

- **DW_7:** a new transport corridor from Drury West Station to Great South Road with a more easterly alignment; and
- **DW_8:** new transport corridor from Drury West Station to Great South Road (via the Drury South Connection) with a more north south alignment.

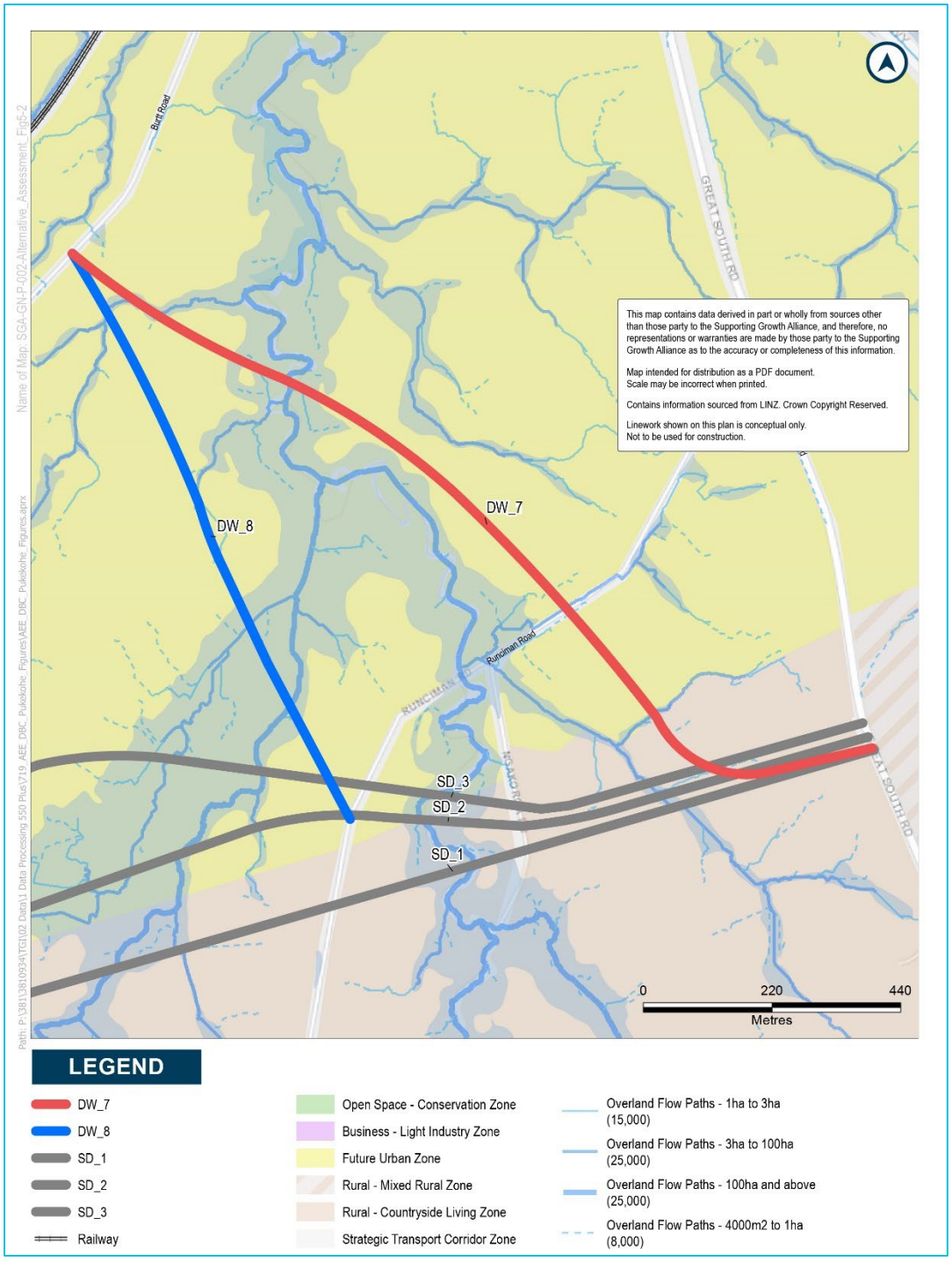


Figure 5-2: Drury West route refinement options

5.1.3 Alternatives Assessment

Options were assessed against the MCA framework by each technical specialist. Table 5-3 and Table 5-4 provide a summary of the assessment.

Table 5-3: Drury West route refinement MCA scoring

MCA Criteria	Scores	
Options	**DW7 (east)**	**DW8 (west)**
Transport Outcomes		
Safety	2	2
Integration	1	2
Access	1	2
Resilience	2	2
Travel Choice	2	2
Cultural		
Heritage	0	0
Social		
Land use futures / integration with planned landuse	1	3
Urban design	0	1
Land requirement / property	-3	-2
Social cohesion	1	1
Human health and wellbeing	-1	-1
Environment		
Landscape / visual	-2	-1
Stormwater	-2	-3
Ecology	-4	-4
Natural hazards	-2	-2
Construction impacts		
Embodied carbon emissions	-2	-1
Construction impacts on utilities / infrastructure	-2	-2
Construction Disruption	-1	-1
Construction costs / risk / value capture	-2	-2

Table 5-4: Drury West route refinement assessment findings summary

Criteria	Summary of performance
Transport Outcomes	Both options have a positive effect on safety and improve connectivity for the strategic network and travel choice. DW7 provides multi-modal access but serves a smaller catchment for Drury West areas particularly on the western side. DW8 serves a higher residential catchment on both sides within Drury West areas.
Heritage	No recorded heritage features. No difference between options.
Social	**Land use** Both options connect directly to the station and adjacent to the proposed industrial centre which integrates with the FUZ. DW7 the integration is limited due to the presence of the flood plain. DW8 was preferred as it provides better integration with the FUZ. Identified developer interest to the north-east. No known granted consents/plan changes in this area. **Urban design** Both options include a large amount of earthworks which would limit the ability of the corridor to present an active interface between the public and private realm in these locations. Being located in the FUZ, future development can respond to the corridor, mitigating some amenity effects. DW8 was the preferred option because it was considered slightly more flexible for future development to respond to the corridor. **Land requirement** DW8 is the preferred option due to less impacts on property. DW7 requires greater land acquisition compared to DW8. **Social cohesion** No difference between options. Both provide access between two strategic corridors, improves access to employment and communities. **Health and wellbeing** No difference between options. Existing rural residential receivers. Construction effects and operational noise for existing dwellings.
Environmental	**Landscape and visual** DW7 and DW8 avoid all landscape related overlays and notable trees. Visual amenity effects were limited to rural residential properties within the localised setting of the southern part of the route for both DW7 and DW8. DW8 was preferred as it avoided areas of established vegetation and only occasional shelterbelts being affected. **Stormwater** DW7 was preferred as it is shorter overall and more direct, this would result in less new impervious surfaces and therefore less of an effect on the hydrology of the area.

Criteria	Summary of performance
	Ecology DW7 and DW8 were likely to have impacts on planted native / exotic riparian vegetation, likely used by TAR species bats and copper skink. Overall likely impact for both options was considered to be high. **Natural Hazards** DW7 was preferred due to the terrain, mostly poorly consolidated dune sand. The embankments for DW8 were likely subject to settlement from prospective compressible deposits and the rest of the terrain was variable including liquifiable deposits.
Construction impacts	**Embodied carbon emissions** There was a negligible difference in lane km and structures. DW7 was least preferred due to impact on wetlands and biomass (that can act as carbon sinks). **Construction impacts on infrastructure/utilities** Limited differentiation between options. Localised protection or relocation required. Co-ordination required with Transpower in detailed design phase to confirm vertical clearance. **Construction disruption** Currently a greenfield site in rural area with limited sensitive receivers. Limited differentiation between options. **Construction costs** DW7 was considered least preferred due to potentially higher costs associated with a longer crossing of an identified minor natural hazard.
Partner and public feedback	**Partner** A matter raised in SME workshops was the consideration of how the collector network will connect with the Drury West options in the future. There are a number of stream crossings and flood plains in this area. A Manawhenua representative gave feedback on the preference for the proposed Drury West Arterial to limit crossings of the Ngakoroa Stream, due to iwi aspirations of leaving the stream in a better condition than it is currently. **Public** Limited feedback was received on the Drury West Arterial options during public engagement. Potential property impacts were raised in the limited feedback – in particular on working farms. At the public open days, there was general conversations with some attendees on support for connections to the proposed rail stations such as the Drury West station.

5.1.4 Discarded Alternatives

Table 5-5 summarises the reasons for discounting the options individually.

Table 5-5: Discarded options and reasons

Option	Reason
DW7	DW7 was discounted because it has a smaller residential catchment, is in a greater area of flood plain and has greater impacts on vegetation including riparian vegetation.

5.1.5 Preferred Option

DW8 (a more direct new transport corridor from Drury West Station) was the preferred option because it has a larger future residential catchment, better integrates with future development, affects fewer properties and has reduced landscape and visual impact.

Further considerations for design refinements include:

- Refinement of intersection forms (for example single or multi lane roundabouts); and
- Access for properties to the south on Ngakoroa Road and realigned Runciman Road.

5.1.6 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

- The placement of stormwater wetlands to reduce impacts on the Ngakoroa Stream and riparian corridor.
- Positioning and intersection spacing for the tie ins with Runciman Road.

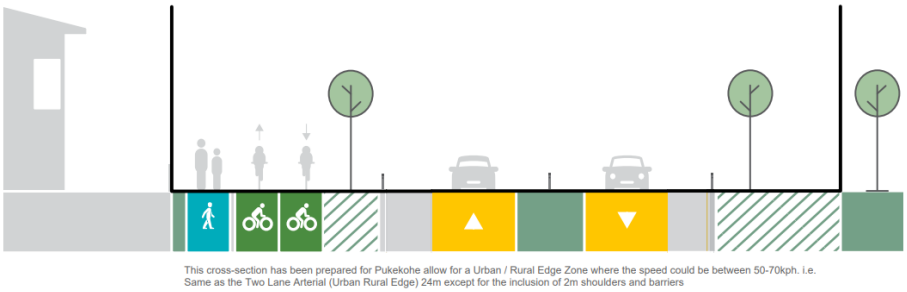
5.2 South Drury Route Refinement – a segment of NoR 2

5.2.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-6 provides a summary of the assumptions and outcomes of the assessment.

Table 5-6: South Drury form and function assumptions and summary

Criteria	Summary
Purpose	Provides an arterial connection in Drury West. It runs east-west on the edge of the FUZ providing a strategic connection to Drury South Interchange and connecting Drury West with Paerata.

Criteria	Summary
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side
Function	• P1 - Predominantly local function with a small catchment of users • M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	22,000-24,000
Speed	50-60 kph speed limit
Public transport (indicative 2048)	• 8-10 buses per hour • Priority at intersections is required
Freight	Level 2 connects to regional freight corridor on SH1

5.2.2 Alternatives Development

Three options were developed to provide a strategic connection improving east-west movement connecting SH1 and SH22. Each route has a slightly different alignment in relation to the FUZ and the integration with DW options. The options are shown in Figure 5-3 below:

- **SD_1:** new connection located in the Rural Zone;
- **SD_2:** a connection along the FUZ boundary; and
- **SD_3:** a northern connection within the FUZ.

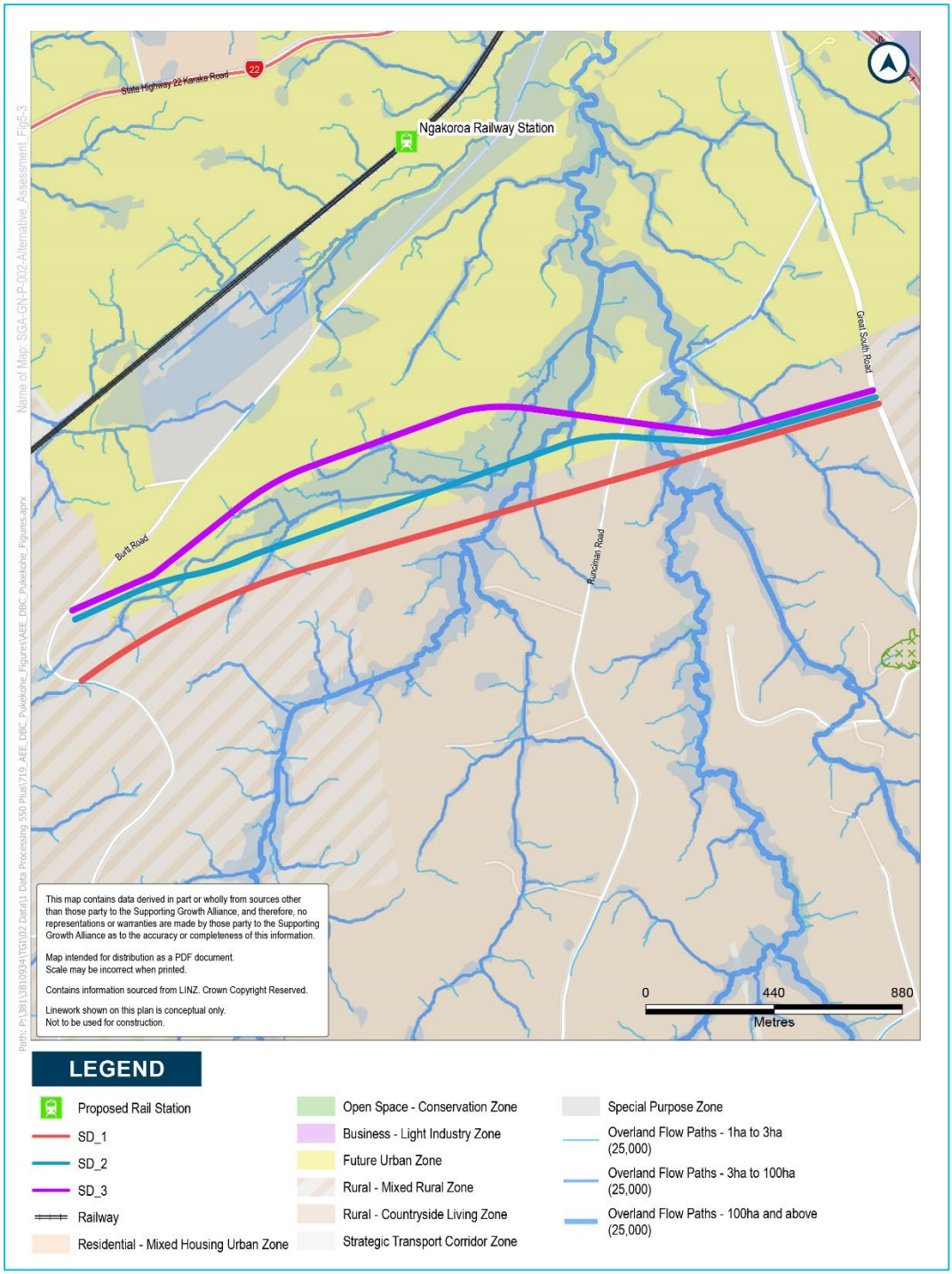


Figure 5-3: South Drury route refinement options

5.2.3 Alternatives Assessment

Options were assessed against the MCA framework by each technical expert, refer to Table 5-7. Commentary is provided in Table 5-8

Table 5-7: South Drury route refinement MCA scoring

MCA Criteria	Scores		
Options	**SD_1 (south)**	**SD_2 (central)**	**SD_3 (north)**
Transport Outcomes			
Safety	3	3	1
Integration	2	2	0
Access	1	1	1
Resilience	2	2	1
Travel Choice	1	2	2
Cultural			
Heritage	0	0	0
Social			
Land use futures / integration with planned landuse	-1	1	2
Urban design	-3	2	1
Land requirement / property	-3	-2	-3
Social cohesion	1	1	1
Human health and wellbeing	0	0	0
Environment			
Landscape / visual	-2	-3	-2
Stormwater	-2	-3	-3
Ecology	-4	-4	-4
Natural hazards	-2	-4	-4
Construction impacts			
Embodied carbon emissions	-1	-2	-1
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-1	-1	-1
Construction costs / risk / value capture	-2	-2	-3

Table 5-8: South Drury route refinement MCA assessment findings summary

Criteria	Summary of performance
Transport Outcomes	All options reduce the likely future traffic on rural roads, reduce traffic on SH22 and improve access to key destinations. Option SD_3 was least preferred due to the high traffic volumes within the FUZ increases the potential for movement and place conflicts. SD_2 which follows the FUZ edge was preferred as it was considered to provide the best integration with actives modes and PT.
Heritage	No recorded heritage.
Social	**Land use** SD_2 was preferred as it integrates with future development, defines the rural urban boundary and increase separation between the Transpower Pylons and future residential development. SD_1 was not considered to be well integrated and SD_3 was not preferred as it would reduce the amount of developable land in the FUZ. **Urban design** SD_2 was the preferred option as it would assist in defining the rural urban boundary and increase separation between the Transpower Pylons and future residential development. SD_1 was the least preferred as the alignment was within the rural zone and considered unable to respond to the corridor. This option would create an awkward linear area of FUZ between the rural area and the flood plain. SD_3 is also not preferred, but it was noted this alignment was within the FUZ and would be able to respond to the corridor, mitigating some amenity effects, however, would still have an impact. **Land requirement** SD_2 would have the least impact on property and was the preferred option. SD_1 would impact the greatest number of properties and was the least preferred option. SD_3 would impact on a number of large agricultural blocks. **Social cohesion** The design is for a two-lane arterial on the edge of the FUZ zone so it is unlikely there will be significant severance effects for any option. **Health and wellbeing** All options provide a new corridor which introduces new sources of noise and air emissions. However, the route is in a rural area with limited sensitive receivers (existing community).
Environmental	**Landscape and visual** All options avoid landscape related overlays. Visual amenity is limited to rural residential properties (south of FUZ). SD_2 was the preferred option as it would result in minimal vegetation loss. SD_1 would likely involve the loss of mature vegetation (shelterbelt planting). SD_3 was not preferred as it affects two potential parks identified in structure plan. **Stormwater**

Criteria	Summary of performance
	SD_1 was the preferred options as it is more direct and would have the least effect on hydrology. SD_2 and SD_3 would have greater effect on hydrology / stream erosion. **Ecology** SD_2 was the preferred option as effects on existing environment likely lower as within the FUZ i.e., the environment would be subject to change and disruption prior to the construction of the project. SD_1 and SD_3 were not preferred as wetland offset requirements could be significant. Monitoring and mitigation required such as bat hop over-vegetation and lighting controls. **Natural Hazards** SD_1 approach embankments will be subject to potential settlement and liquefaction from soft and loose soils but the extent is significantly less than SD_3. Therefore, SD_1 is preferred. SD_2 was not preferred as much of the route is aligned with watercourses which will require diversion, culverting and associated embankments. SD_3 crosses and re-crosses the flood plain of the Ngakoroa Stream and its tributaries three times requiring five stream crossings, which is not preferred.
Construction impacts	**Embodied carbon emissions** SD_1 and SD_3 were considered more preferable based on lane km and structure. SD_2 was least preferred based on lane km and structures. **Construction impacts on infrastructure/utilities** Limited differentiation between options. A number of overhead powerlines require localised protection or relocation. **Construction disruption** Majority of the work to be undertaken offline through the greenfield. Disruption to the local traffic is expected as the new intersection gets built, might require localised diversion route due to construction works. **Construction costs** Similar road corridor both requiring road widening and construction of structures. SD_3 was the least preferred due to ground conditions (hazards) which would increase construction complexity and cost.
Engagement	**Partners** Key feedback from SMEs at workshops included: • Consideration of the tie in with Burtt Road. • Consideration of highly productive soils in the rural zone. Manawhenua agree alignment should be north of pylons. **Public** Limited feedback was received for the South Drury Connection options during public engagement. Potential property impacts were raised, particularly to working farms.

5.2.4 Discarded Alternatives

Table 5-9 summarises the reasons for discounting the options individually.

Table 5-9: Options to be discarded

Option	Reason
SD_1	SD_1 was discounted because it is not well integrated with future development as it is located within the rural zone, would result in oddly shaped parcels of land outside the FUZ in the rural zone, and affected the greatest number of properties.
SD_3	SD_3 was discounted because as it would be likely to result in movement and place conflict in the future urban communities (as the corridor will be used by large number of vehicles travelling through the area) and provided less network resilience compared to the other two options. It also had the greatest effect on hydrology/stream erosion and presented difficult ground conditions (hazards) for design and construction.

5.2.5 Preferred Option

SD_2 (a connection along the FUZ boundary) is the preferred option as it provides a good interface at the urban edge of the FUZ and can assist in defining the rural urban boundary, has less impact on developable land, has less potential impacts on vegetation.

5.2.6 Tie-In Assessment

Following the identification of a preferred route refinement option for Drury West (assessment in Section 5.2.6) and South Drury Connection there was a further assessment undertaken to determine the tie-in between the two transport corridors. Figure 5-4 and Table 5-10 outlines each option considered.

Table 5-10: Description of tie in options for Drury West / South Drury Arterial

Tie In Option	Description / Reason
DW_SD_1	Creates a new tie in with Runciman Road and a new intersection with the proposed Drury West connection and South Drury Connection.
DW_SD_2	Creates a new four leg intersection with Runciman Road, Drury West, the proposed South Drury Connection and a new three-leg intersection with Runciman Road further to the south.
DW_SD_3	Creates a new four leg intersection with Runciman Road, Drury West, the proposed South Drury Arterial and re-aligns Runciman Road to integrate with the Drury South Interchange.

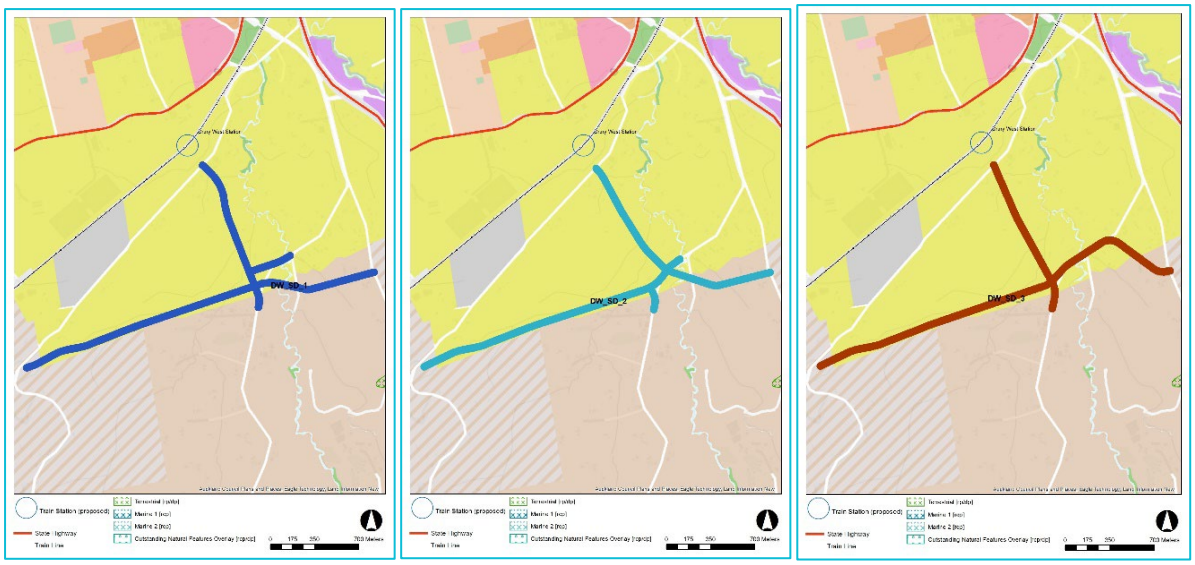


Figure 5-4: Drury West / South Drury tie-in options

A summary of the assessment is outlined below:

Table 5-11: Drury West / South Drury tie-in options MCA scoring

MCA Criteria	Scores		
Options	**DW_SD_1**	**DW_SD_2**	**DW_SD_3**
Transport Outcomes			
Safety	1	1	0
Integration	2	1	-1
Access	2	1	1
Resilience	3	2	1
Travel Choice	3	2	1
Cultural			
Heritage	0	0	0
Social			
Land use futures / integration with planned landuse	2	2	1
Urban design	2	2	1
Land requirement / property	-3	-2	-2
Social cohesion	1	1	1
Human health and wellbeing	-1	-1	-1
Environment			

Landscape / visual	-1	-1	-1
Stormwater	-2	-2	-2
Ecology	-4	-4	-3
Natural hazards	-3	-3	-3
Construction impacts			
Embodied carbon emissions	-2	-2	-1
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-2	-2	-2
Construction costs / risk / value capture	-3	-3	-2

Table 5-12: Drury West / South Drury tie-in option MCA key findings

Criteria	Summary of performance
Transport Outcomes	**Safety** DW_SD_1 and 2 scored the same, however, DW_SD_1 is preferred over the other options as it is more direct and separates local and regional trips better. DW_SD_3 scored less than the other two options due to the mix of local and strategic corridors, which makes it more difficult for active modes. **Integration** DW_SD_1 is preferred as it is on the FUZ boundary and provides good integration with strategic corridor not travelling through urban areas. DW_SD_2 and 3 is mostly on FUZ boundary but due to mixing local and strategic functions, scored lower. **Access** DW_SD_1 is preferred as there is more access opportunities for all modes. DW_SD_2 and 3 has reduced access due to the alignment. **Resilience** DW_SD_1 segregates local and strategic traffic improving resilience and therefore is preferred compared to DW_SD_2 and 3. **Travel choice** All options provide more travel choice for all road users, with the most travel choice being provided through DW_SD_1, which scored the highest out of the three options.
Heritage	No recorded heritage.
Social	**Land use** The corridor predominantly traverses the FUZ, however, does traverse the Rural Zone at the eastern end. DW_SD_1 and 2 scored the same. DW_SD_3 is less preferred as it is favourable to keep the route on the edge of the FUZ to maximise developable land. **Urban design**

Criteria	Summary of performance
	DW_SD_3 leaves an area of FUZ on the south side of the option in the eastern segment. DW_SD_1 and 2 scored the same and are therefore preferable as the corridor defines the edge of the FUZ. **Land requirement** DW_SD_1 is least preferable as it requires the greatest numbers of property acquisition (with potentially 9 full acquisitions and 10 partial). DW_SD_1 and 2 have a similar score with option 2 being marginally more preferrable due to a lesser impact on two properties. Both DW_SD_1 and 2 require approximately 8 full acquisitions either 9 or 8 partial acquisitions respectively. **Social cohesion** All options were scored the same and they all provide access between two strategic corridors, improving access to employment and communities. **Health and wellbeing** All options have existing rural residential receivers and scored the same.
Environmental	**Landscape and visual** All options scored the same and include construction of new roading infrastructure within existing rural area (within the eastern portion of the alignment). This will result in the loss of small areas of vegetation. The northern part of the route is located within the Structure Plan area of anticipated future urban development (Industrial, THAB, MHS). All options avoid landscape overlays, however, there will be visual amenity effects to rural residential properties. **Stormwater** All options require 6 stream crossings, and significant floodplain filling. DW_SD_3 is preferred. **Ecology** DW_SD_1 and 2 will have high overall ecological impacts and are scored the same. DW_SD_3 will have moderate ecological impacts and therefore, is there preferred option. **Natural Hazards** All options are scored the same and entail construction on extensive deposits of variable (potentially soft) alluvium.
Construction impacts	**Embodied carbon emissions** DW_SD_3 reduces the overall construction of new road infrastructure and may not require construction of two new bridges as active modes bridge could be constructed instead. This is therefore the preferred option scoring higher than the other two options. **Construction impacts on infrastructure/utilities** DW_SD_1 and 2 cross the 1200 CS watermain at Runciman Road. All options interact with the Transpower line and are scored the same. **Construction disruption** For DW_SD_1 and 2, the majority of the work to be undertaken offline through the greenfield. For all options, disruption is likely with the build of the new intersection. This is likely to have an increased adverse effect for DW_SD_3. All options are scored the same.

Criteria	Summary of performance
	Construction costs DW_SD_3 is the preferred option reduces the overall construction of new road infrastructure. It may not require construction of two new bridges as active modes bridge could be constructed instead.

5.2.7 Discarded and Preferred Options

Table 5-13 summarises the reasons for discounting the options individually.

Table 5-13: Options to be discarded

Option	Reason
DW_SD_2	Has the potential to create movement and place conflict as has some mix of local and strategic functions. Has impacts on access.
DW_SD_3	Provides less improvement in resilience. The mix between local and strategic functions will make it more difficult for active modes and movement and place conflict. This option leaves an area of FUZ on the south side of the proposed alignment reducing the available developable land.

The preferred option for the tie in was **DW_SD_1** (creating a new tie in with Runciman Road and a new intersection with the proposed Drury West connection and South Drury Connection). This option is located at the FUZ boundary providing better integration than the other tie in options. The option was considered likely to provide more access opportunities for all modes and improved resilience.

5.2.8 Preferred Option Summary

The emerging preferred option for South Drury Connection is **SD_2** (connection along the FUZ boundary) with the **DW_SD_1 tie in** (creating a new tie in with Runciman Road). These provides a good interface at the urban edge of the FUZ and can assist in defining the rural urban boundary, has less impact on developable land, has fewer potential impacts on vegetation.

5.2.9 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

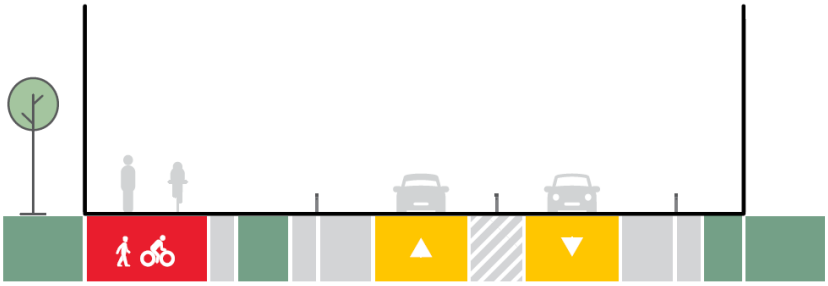
- At the connection with Burtt Road, the alignment was shifted west to reduce impacts on a gully with exotic wetland and mature trees and south to reduce property impacts.
- The active mode facilities were located on the northern side of the alignment (where within/adjacent to FUZ) rather than being located on both sides of the alignment.

5.3 SH22 Connection Route Refinement - a segment of NoR 2

5.3.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-14 provides a summary of the assumptions and outcomes of the assessment.

Table 5-14: SH22 Connection form and function assumptions and summary

Criteria	Summary
Purpose	Connects SH22 to the new north-south corridor. This connection improves travel options, with access to the strategic active modes corridor, crosses the NIMT, improves local access between Drury West and Paerata, provides an alternative to SH22 and direct connectivity to proposed Drury South Interchange at SH1.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side with integration with SH22
Function	• P1 - Predominantly local function with a small catchment of users • M1 - Low strategic network significance. Provides predominantly local access for people, goods and services
Flows (ADT 2048)	7, 000 - 10,000
Speed	60-85 kph speed limit
Public transport (indicative 2048)	N/A
Freight	Level 2/3

5.3.2 Alternatives Development

Four options were developed for the SH22 Connection:

- **SH22_1:** connection utilising Sim Road;
- **SH22_2:** a route crossing NIMT and streams connecting with Sim Road;
- **SH22_3:** connection utilising Bycroft Road; and
- **SH22_4:** eastern most option bordering the FUZ.

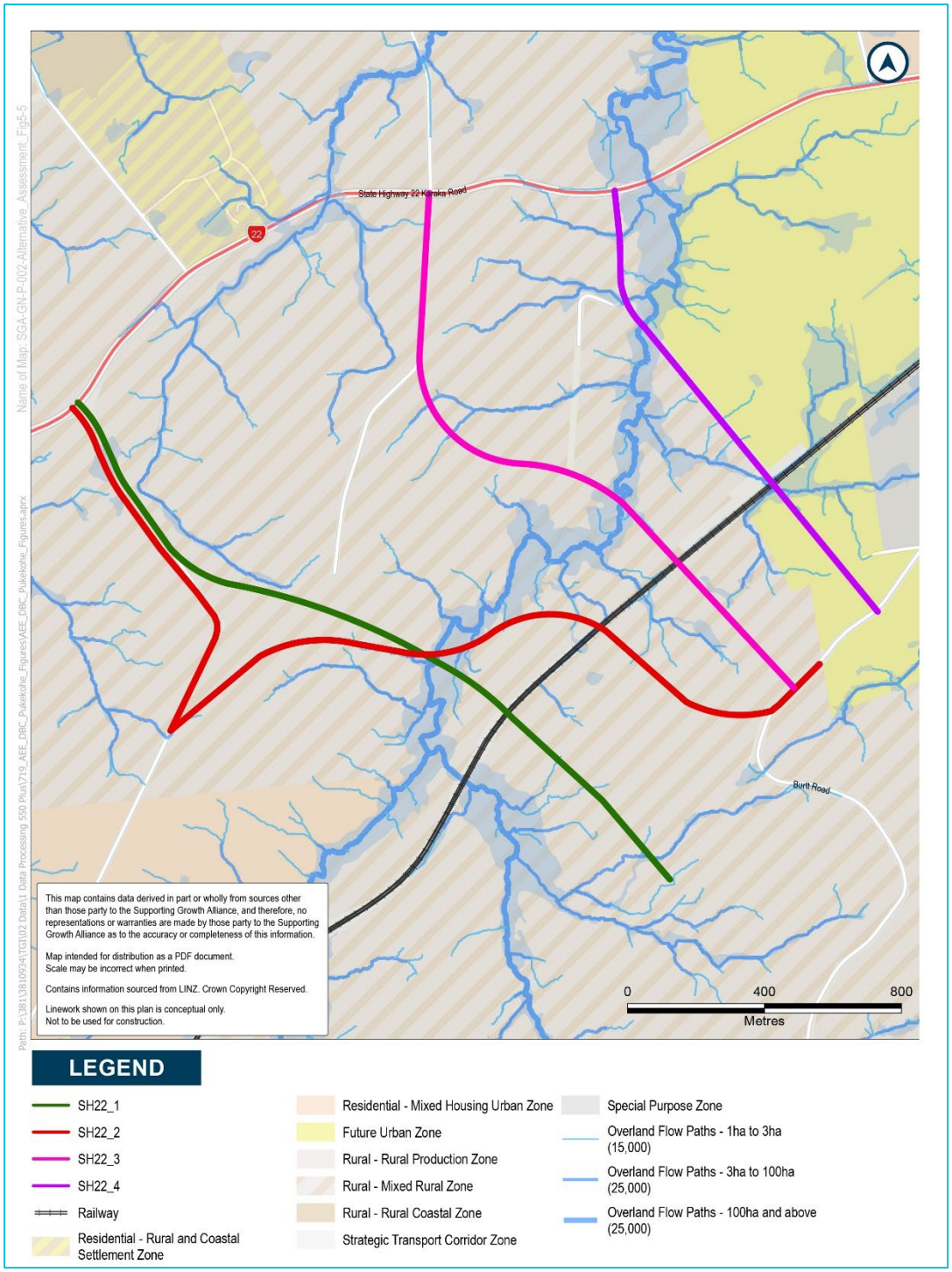


Figure 5-5: SH22 Connection route refinement options

5.3.3 Alternatives Assessment

Options were assessed against the MCA framework by each technical specialist.

Table 5-15: SH22 Connection route refinement MCA scoring

MCA Criteria	Scores			
Options	**SH22_1**	**SH22_2**	**SH22_3**	**SH22_4**
Transport Outcomes				
Safety	1	0	1	1
Integration	2	1	1	1
Access	2	1	1	1
Resilience	3	2	1	1
Travel Choice	2	1	1	1
Cultural				
Heritage	0	0	0	-2
Social				
Land use futures / integration with planned landuse	1	-1	-2	2
Urban design	-2	-2	-2	1
Land requirement / property	-2	-1	-1	-1
Social cohesion	2	1	1	1
Human health and wellbeing	0	0	0	-1
Environment				
Landscape / visual	-1	-2	-2	-2
Stormwater	-1	-2	-1	-1
Ecology	-4	-4	-4	-4
Natural hazards	-2	-2	-2	-3
Construction impacts				
Embodied carbon emissions	-2	-2	-2	-1
Construction impacts on utilities / infrastructure	-2	-3	-2	-2
Construction Disruption	-2	-2	-2	-2
Construction costs / risk / value capture	-2	-3	-2	-2

Table 5-16: SH22 Connection route refinement assessment findings summary

Criteria	Summary of performance
Transport Outcomes	All options provide some benefits for integration, access, resilience and travel choice. However, SH22_1 provided better network wide integration with SH22, better balancing of movement and place and significant network-wide improvement in resilience compared to other options. SH22_2 and SH22_3 provide limited or no access improvements. SH22_4 provides limited integration and could create movement and place conflicts.
Heritage	No heritage recorded for SH22_1, SH22_2 and SH22_3. SH22_4 had the potential to impact Karaka Railway station and was the least preferred.
Social	**Land use** SH22_4 was the preferred option as it is located adjacent to / within the FUZ and includes the upgrade of existing roads. SH22_1 was not preferred as it was considered to provide access benefits for the existing Paerata Rise community by providing a better connection from the south at Sim Road, however, could encourage development outside the FUZ. SH22_2 was less preferred as it was predominantly within rural land and considered to have limited integration and would impact on highly productive soils. SH22_3 was considered the least preferred as it was also within rural land and resulted in less integration, impacts on highly productive soils and could result in development outside the FUZ. **Urban design** SH22_1, SH22_2 and SH22_3 were likely to change the character and amenity of the area and due to being in the rural zone were considered less likely to have the opportunity to respond to the corridor in the future. SH22_4 also had limited capacity for development to respond to change however, provided the opportunity for a defined edge for FUZ north of the railway. **Land requirement** SH22_4 was preferred as it impacts on the least number of properties but does require at least one full acquisition. SH22_1 was least preferred as it was likely to impact on the greatest number of properties. **Social cohesion** SH22_1 was the preferred option as it resulted in improved connection for Paerata Rise community and Karaka School. All other options result in improved access to Karaka School. **Health and wellbeing** SH22_4 was the least preferred due to its proximity to 485 Burtt Road (catholic St Ignatius of Loyola Catholic College). Limited differentiation between other options with
Environmental	**Landscape and visual**

Criteria	Summary of performance
	SH22_1 was preferred as it has reduced stream crossings, follows natural topography and would minimise vegetation loss. SH22_2 would likely require the loss of established vegetation. SH22_3 would also require some vegetation loss including shelterbelts and blocks of trees affected adjacent to the stream. SH22_4 had vegetation loss anticipated along Woodlyn Drive and nearby streams. **Stormwater** SH22_3 was the preferred option as it also has a lower impact on hydrology and includes the use of existing roads. SH22_2 was the least preferred as it would have the greatest impact on hydrology, part of the alignment will directly fill a stream tributary and will require stream diversion. SH22_1 had a low impact on streams and a medium impact on hydrology and SH22_4 had the least impact on hydrology but would require some channel bank works to protect the crossing. Both these options were considered acceptable. **Ecology** SH22_4 was the preferred option due to its location (partially) within FUZ. It was recommended the alignment go east of Oira Creek, within FUZ, avoiding the need for a large bridge crossing. SH22_2 was the least preferred option due to significant direct habitat loss and fragmentation of key habitat corridors for bats and wetland birds. SH22_1 and SH22_3 largely avoided direct habitat impacts but fragmentation of key habitat corridors was still a concern. The magnitude of effects on existing environment was likely to be higher as outside the FUZ. **Natural Hazards** SH22_4 was the least preferred as the alignment along Woodlyn Road along valley margin will extend length over settlement-susceptible and possibly liquefiable alluvium (Q1al). For all other options the majority of the alignment is over terrain underlain by Takaanini (Puketoka) Formation soils with a section near the Oira Creek over variable alluvium.
Construction impacts	**Embodied carbon emissions** SH22_4 was the preferred option based on lane km and large structures. All other options scored the same. **Construction impacts on infrastructure/utilities** SH22_2 was the least preferred due to the number of utilities which required localised protection or relocation. All options impacted some utilities including overhead powerlines. **Construction disruption** Limited differentiation between options. Disruption to current local traffic (temporary traffic management including lane narrowing) due to works on existing roads and crossing of rail line for all options. **Construction costs** SH22_2 was the least preferred due to the length of the road corridor and auxiliary works to Sim Road which would require road widening and construction of structures. All other options were similar and would require road widening and bridges.

Criteria	Summary of performance
Engagement	**Partners** Key feedback from SMEs during workshops was: • Consideration of highly productive soils • Growth pressure around transport corridors in the rural zone Ngaati Te Ata Waiohua support the rationale whereby the connection is closer to Paerata Rise to capture traffic from the west to use the alternative connection to SH22. Manawhenua are also supportive of avoidance of SEAs, and designation being moved closer to existing infrastructure such as rail and pylons. Overall, supportive of proposal. **Public** Those that provided feedback on the State Highway 22 Connection during public engagement, wanted additional connections to support traffic to and from Karaka (to the north of the project area).

5.3.4 Discarded Alternatives

Table 5-17 summarises the reasons for discounting the options individually.

Table 5-17: SH22 Connection Options to be discarded

Option	Reason
SH22_2	SH22_2 was discounted as it is less integrated with existing or proposed development, provides a less direct connection, has increased impacts on ecological features including streams and wetlands.
SH22_3	SH22_3 was discounted as it provides limited access improvements, is less likely to take traffic off SH22 due to its location to the east and was least preferred in terms of flooding and ecology due to the earthworks in and around streams.
SH22_4	SH22_4 was discounted as it has the potential for movement place conflict being close to FUZ with the amount of through traffic using the connection and has potential impacts on heritage item Karaka Railway station.

5.3.5 Preferred Option

The preferred option is **SH22_1 (connection utilising Sim Road)**, as it provides a direct and attractive connection between SH22 and south Drury and the Paerata to Drury link. SH22_1 generally follows the natural topography and has reduced stream crossings, minimal vegetation loss and reduced impacts on ecological features including streams and wetlands.

Following the MCA scoring process, a refinement to move to the southwest close to the Paerata Rise development was created (SH22_1A, shown in Figure 5-6).

Option SH22_1 (with design refinement SH22_1A) is recommended because it additionally provides accessibility benefits to the Paerata Rise development.

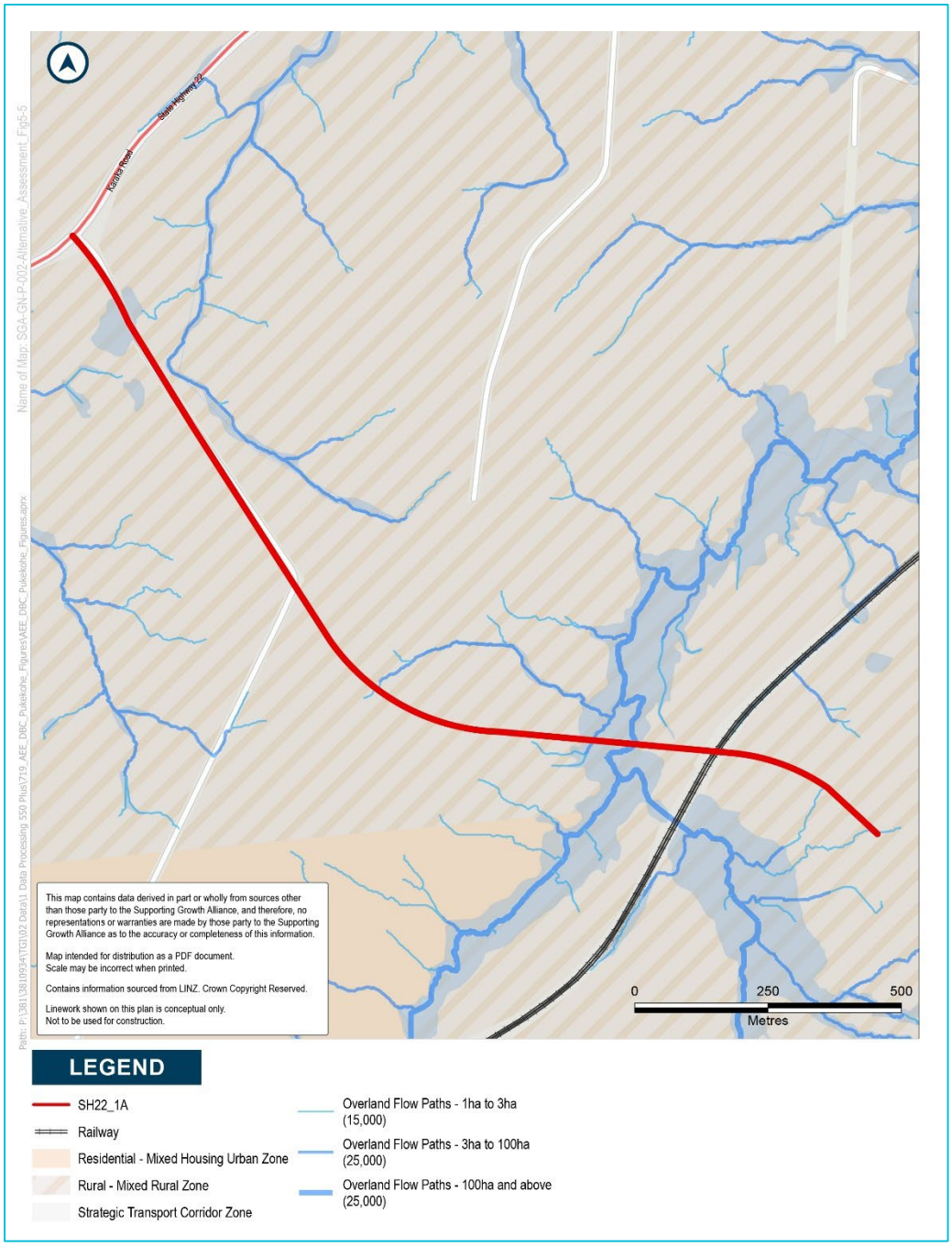


Figure 5-6: Option SH22_1A (refined option)

5.3.6 Road Widening Assessment

Once the preferred SH22 Connection option was selected (SH22_1A) which utilises Sim Road, it was then investigated which side of the road to widen. The three options for widening were:

- **SR_1:** widening to the west side;
- **SR_2:** widening on both sides from the centre; and
- **SR_3:** widening on the eastern side.

The assessment of the SH22 Connection Sim Road widening is set out Table 5-18. Commentary is provided in Table 5-19.

Table 5-18: Sim Road widening options MCA scoring

MCA Criteria	Scores		
Widening options	**SR_1 (west)**	**SR_2 (centre)**	**SR_3 (east)**
Transport Outcomes			
Safety	1	1	1
Integration	2	2	2
Access	2	2	2
Resilience	3	3	3
Travel Choice	2	2	2
Cultural			
Heritage	0	0	0
Social			
Land use futures / integration with planned land use	1	1	1
Urban design	0	0	0
Land requirement / property	-1	-1	-1
Social cohesion	1	1	1
Human health and wellbeing	-1	-1	-1
Environment			
Landscape / visual	-1	-1	-1
Stormwater	-1	-1	-1
Ecology	-1	-1	-2
Natural hazards	0	0	0
Construction impacts			
Embodied carbon emissions	-1	-1	-1
Construction impacts on utilities / infrastructure	-1	-1	-1
Construction Disruption	-1	-1	-1
Construction costs / risk / value capture	-1	-1	-1

Table 5-19: Sim Road widening option MCA key findings

Criteria	Summary of performance –Sim Road widening options
Transport Outcomes	**Safety**

Criteria	Summary of performance –Sim Road widening options
	All options scored the same and will reduce the likely future traffic on SH22 resulting in safety benefits. **Integration** All options scored the same and will provide better network wide integration with SH22 and better balancing movement and place. **Access** All options scored the same and will provide improved access between Paerata and Drury West FUZ. By mode significant improvement to freight and general traffic, a modest improvement in access for active modes. **Resilience** All options scored the same and will provide significant network-wide improvement in resilience. **Travel Choice** All options scored the same and will provide significant improvement for general traffic and freight. The options will increase car mode share and reduce VKT.
Heritage	No recorded heritage affected Sim Road widening options.
Social	**Land use** SR_1, 2 and 3 are scored the same, as it is within the existing rural zone and there is a low likelihood of change in the future environment. **Urban design** SR_1, 2 and 3 are scored the same as they are outside of FUZ and will have impact on amenity and character of immediately adjacent sites. **Land requirement** SR_1, 2 and 3 are scored the same. Multiple acquisitions required, SR_1 (west) is the least preferred due to the potential impact on the existing dwellings. SR_2 (centre) is the most preferred due to least impact on the dwellings on either side of the road. **Social cohesion** SR_1, 2 and 3 all upgrade of existing road and are scored the same. **Health and wellbeing** Existing rural residential receivers for SR_1, 2 and 3, which all scored the same.
Environmental	**Landscape and visual** SR_1, 2 and 3 are all scored the same and follow existing Sim Road alignment. This will have visual amenity impacts on surrounding houses. There are no landscape related overlays impacted. **Stormwater** SR_1, 2 and 3 are all scored the same and follow the terrain ridge along Sim Road. There is only very limited local effects from widening on either side or centrally. New pavement will have local effects and can be mitigated. **Ecology** SR_1, 2 and 3 has impacts which are limited to mature vegetation, SR_2 is preferred. SR_3 is least preferred and there is potential impact on stream / riparian corridor east of Sim Road. **Natural Hazards**

Criteria	Summary of performance –Sim Road widening options
	SR_1, 2 and 3 all scored the same as there are limited impacts on natural hazard.
Construction impacts	**Embodied carbon emissions** SR_1, 2 and 3 all scored the same as it is a standard road widening construction. **Construction impacts on infrastructure/utilities** SR_1, 2 and 3 all scored the same and will have low adverse effects existing local utilities network. **Construction disruption** SR_1, 2 and 3 all scored the same and will have low adverse effects on disruption during construction as existing households are quite spaced from each other and future land use is rural. **Construction costs** SR_1, 2 and 3 will have low adverse effect as it is a standard road widening exercise, and all scored the same.

5.3.7 Discarded and Preferred Options

Table 5-20 summarises the reasons for discounting the options individually.

Table 5-20: Options to be discarded Sim Road widening

Option	Reason
SR_1 (west)	This option has the highest property impacts and some limited impacts on vegetation.
SR_3 (east)	This option has the potential for the highest ecological effects.

For the widening of Sim Road, the preferred option is **SR_2** (to widen on both sides of the road) to reduce impacts on ecological features to the west of the alignment while providing the best opportunity for integration. Through further design refinement, it is recommended to reduce impacts on existing dwellings where possible.

5.3.8 Preferred Option Summary

Option **SH22_1 (with design refinement SH22_1A)** is recommended because it provides a direct and attractive connection between SH22 and south Drury and the Paerata to Drury link and provides accessibility benefits to the Paerata Rise development. SH22_1 generally follows the natural topography and has reduced stream crossings, minimal vegetation loss and reduced impacts on ecological features including streams and wetlands. **Widening on both sides (SR_2)** of Sim Road is recommended to reduce impacts on ecological features with opportunities to reduce impacts on existing dwellings.

5.3.9 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

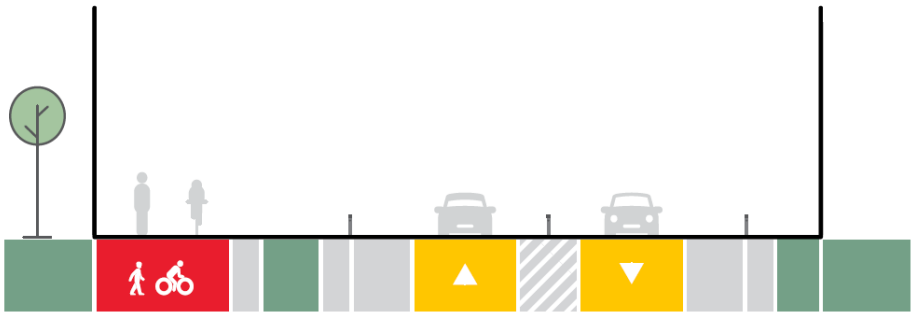
- Placement of stormwater wetlands to reduce environment effects on the stream and riparian corridor and wetland habitat.
- Including a bridge (instead of embankment) near the roundabout connecting to Drury – Paerata Link Segment)to reduce impacts on existing wetland and stream/riparian habitat.
- Widening to the north side of the road to reduce direct impacts on existing dwellings.

5.4 Drury-Paerata Link Route Refinement - a segment of NoR 2

5.4.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-21 provides a summary of the assumptions and outcomes of the assessment.

Table 5-21: Drury-Paerata Link form and function assumptions and summary

Criteria	Summary
Purpose	Improves the wider network connectivity, safety and resilience between Drury West and Pukekohe with a primary general traffic and freight function.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side
Function	• P1 - Predominantly local function with a small catchment of users • M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	16,000-17,000
Speed	80 kph speed limit
Public transport (indicative 2048)	N/A
Freight	Level 2

5.4.2 Alternatives Development

Two options were developed for the Drury-Paerata Link route refinement assessment as shown in Figure 5-7:

- **PL_1**: a new transport corridor in the Rural Zone further south of the NIMT; and
- **PL_2**: a new transport corridor closer to the NIMT line.

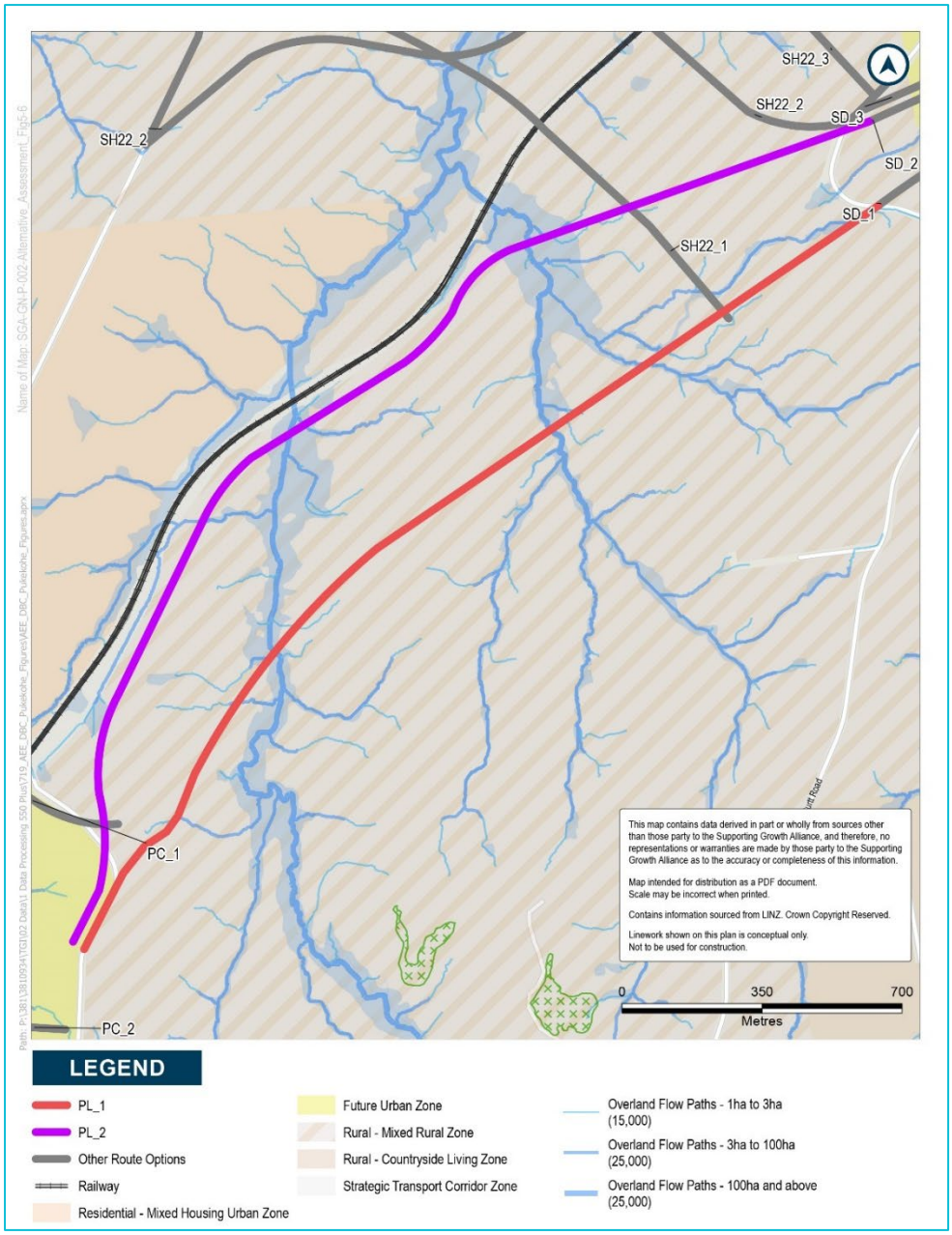


Figure 5-7: Drury-Paerata Link route refinement options

5.4.3 Alternatives Assessment

Two options were assessed against the MCA framework by each subject matter expert for the Drury-Paerata Link route options, as set out in the table below.

Table 5-22: Drury-Paerata Link route refinement MCA scoring

MCA Criteria	Scores	
Options	**PL_1 (south)**	**PL_2 (north)**
Transport Outcomes		
Safety	2	2
Integration	1	1
Access	2	2
Resilience	2	2
Travel Choice	2	2
Cultural		
Heritage	0	0
Social		
Land use futures / integration with planned landuse	1	2
Urban design	-3	-2
Land requirement / property	-1	-2
Social cohesion	0	0
Human health and wellbeing	0	0
Environment		
Landscape / visual	-2	-2
Stormwater	-1	-1
Ecology	-4	-4
Natural hazards	-3	-2
Construction impacts		
Embodied carbon emissions	-1	-1
Construction impacts on utilities / infrastructure	-1	-1
Construction Disruption	-1	-1
Construction costs / risk / value capture	-2	-2

Table 5-23: Drury-Paerata Link route refinement assessment findings summary

Criteria	Summary of performance
Transport Outcomes	Both options were considered to improve access between Drury West and Paerata areas, although limited improvements for active mode access were identified. There were significant network-wide improvements in safety and resilience.
Heritage	No recorded heritage.
Social	**Land use** Both options were considered to provide a new connection between Drury and Paerata FUZ and an interface with Paerata station. PL_2 was preferred as it follows the existing train line so does not have such an impact on the availability of developable land (albeit rural zoned). **Urban design** Both options were likely to result in impacts on the character and amenity of rural zoned land which is unable to respond to the new corridor. However, PL_2 was preferred as co-locating the new road with the NIMT corridor would reduce the impacts on character and amenity. **Land requirement** Both options impacted the same number of properties. PL_1 was likely to require only partial acquisitions and was slightly preferred. **Social cohesion** There was limited differentiation between options as the area is mostly rural with some small businesses. The design is for a two-lane arterial so it is unlikely there will be significant severance effects. **Health and wellbeing** While the alignment would introduce a new corridor no sensitive receivers were identified.
Environmental	**Landscape and visual** Both corridors were similar and require the loss of established vegetation present along the stream corridors and an established block of vegetation north of Sim Road. Visual amenity effects limited to rural residential properties within the localised setting of the route. However, a slight preference for PL_2 due to the potential to co-locate infrastructure. **Stormwater** PL_1 was preferred as it had a lesser impact on hydrology. PL_2 was less preferred due to the need to upgrade rail culverts and would have a greater impact on hydrology. **Ecology** Strong preference for PL_2 as the magnitude of effects on existing environment likely lower as associated with existing rail corridor. For PL_1 significant direct habitat loss and fragmentation of key habitat corridors for bats and wetland birds. Due to limited existing vegetation effects may be difficult to mitigate. **Natural Hazards**

Criteria	Summary of performance
	PL_2 preferred as crosses less of the volcanic deposits and is more closely aligned to topographic contours. PL_1 crosses areas of possible liquefaction, and the alignment may be transiting across several landslides.
Construction impacts	**Embodied carbon emissions** Options were considered likely to have similar embodied emissions profile. **Construction impacts on infrastructure/utilities** Both options similarly crosses utilities which required protection or relocation. **Construction disruption** Greenfield site so limited disruption. Options scored the same however for PL_2 coordination with Kiwi Rail will be required. **Construction costs** There was limited differentiation between options as they require road widening and new bridge structures. PL_2 is slightly shorter than PL_1.
Engagement	**Partners** Key feedback from SMEs during workshops included: • Opportunities to tie in with the proposed regional active mode corridor (along NIMT). • Leaving adequate clearance for rail crossings to allow for future four tracking and future regional active mode corridor. During the 12 October 2022 Hui, Ngaati Te Ata Waiohua supported the Drury to Paerata Link alignment being closer to the rail corridor (Option PL_2). **Public** There was high level support from the wider community for improved connections for future generations.

5.4.4 Discarded Alternatives

Table 5-24: Options to be discarded summarises the reasons for discounting the options individually.

Table 5-24: Options to be discarded

Option	Reason
PL_1	PL_1 was discounted because it has greater potential ecological effects (on wetlands, streams, vegetation and habitat loss) and visual impacts could result in fragmentation the rural zoned land.

5.4.5 Preferred Option

Option **PL_2 (a new transport corridor closer to the NIMT line)** is preferred as co-locates transport and rail corridor, has reduced visual impact and less potential ecological effects on wetlands, streams, vegetation and habitat loss. It also has less fragmentation of rural land including productive soils.

5.4.6 Tie-In Assessment

Following the identification of preferred route refinement options for the SH22 Connection, South Drury and Drury-Paerata Link, was a further assessment was required to determine the tie-ins. Three options for the tie in were investigated as set out in Table 5-25 and Figure 5-8:

Table 5-25: SH22 / South Drury / Drury-Paerata Link tie-in options

Option	Description / Reason
SH22_PL_1	A new four leg intersection connection SH22 connection project, South Drury project and Drury-Paerata Link project and a realigned Burtt Road. This option includes a major realignment of Burtt Road.
SH22_PL_2	A new four leg intersection connection SH22 connection project, South Drury project and Drury-Paerata Link project and a realigned Burtt Road. This option includes a minor realignment of Burtt Road.
SH22_PL_3	Two new intersections, one with the SH22 connection project to the Drury-Paerata Link project and other intersection is a four-leg intersection includes Drury Paerata Link project, South Drury project and Burtt Road. This option includes the minor realignment of Burtt Road.

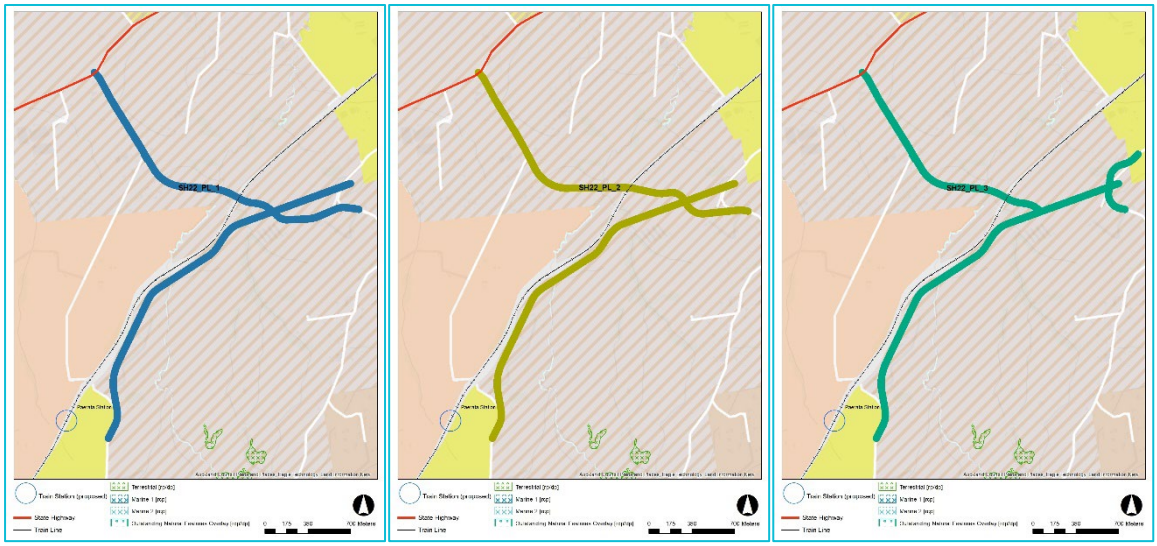


Figure 5-8: SH22 / South Drury / Drury-Paerata Link tie-in options

A summary of the assessment is provided below:

Table 5-26: SH22 / South Drury / Drury-Paerata Link tie-in MCA scoring

MCA Criteria	Scores		
Tie-in options	**SH22_PL_1**	**SH22_PL_2**	**SH22_PL_3**
Transport Outcomes			
Safety	1	1	2
Integration	2	2	2
Access	1	1	2

Resilience	1	1	2
Travel Choice	2	2	2
Cultural			
Heritage	0	0	0
Social			
Land use futures / integration with planned landuse	1	1	1
Urban design	-1	-1	-1
Land requirement / property	-2	-2	-2
Social cohesion	1	1	1
Human health and wellbeing	-1	-1	-1
Environment			
Landscape / visual	-2	-2	-2
Stormwater	-1	-1	-1
Ecology	-3	-2	-3
Natural hazards	-2	-2	-2
Construction impacts			
Embodied carbon emissions	-2	-2	-1
Construction impacts on utilities / infrastructure	-2	-2	-2
Construction Disruption	-2	-2	-2
Construction costs / risk / value capture	-3	-3	-2

Table 5-27: SH22 / South Drury / Drury-Paerata Link tie-in assessment findings summary

Criteria	Summary of performance:
Transport Outcomes	**Safety** SH22_PL 1 and 2 result in easier access to rural roads reducing safety. SH22_PL 3 is safer as it separates rural, local and strategic traffic, and therefore scored the highest. **Integration** SH22_PL 1, 2 and 3 all improve integration in the wider network with has limited differences between options. All options scored the same. **Access**

Criteria	Summary of performance:
	SH22_PL 3 scored the highest with slightly better access improvement than SH22_PL 1 and 2. **Resilience** SH22_PL 3 scored the highest with slightly better resilience improvement than SH22_PL 1 and 2. **Travel Choice** SH22_PL 1,2 and 3 all scored the same with equal improvement to travel choice.
Heritage	No recorded heritage affected by the tie in options.
Social	**Land use** All options are within the rural zone where there is a low likelihood of change, except SH22_PL 3, which integrates with the FUZ. SH22_PL3 is therefore preferred. **Urban design** SH22_PL 1, 2 and 3 are scored the same all options are outside of FUZ, will have impact on amenity and character of immediately adjacent sites from earthworks **Land requirement** SH22_PL 1, 2 and 3 are scored the same. SH22_PL 1 potentially requires one full acquisition and potentially one other property. It aligns with property boundaries which reduces impacts on property. SH22_PL 2 has similar impacts but avoids the full acquisition of one land parcel and is the preferred option. SH22_PL 3 has similar impacts to SH22_PL 1 but is least preferred due to the full acquisitions two properties. **Social cohesion** SH22_PL 1,2 and 3 all provide a new connection for Paerata Rise and are scored the same. **Health and wellbeing** No sensitive receivers for SH22_PL 1,2 and 3.
Environmental	**Landscape and visual** SH22_PL 1,2 and 3 are all scored the same and include the construction of new roading infrastructure within existing rural area, connecting with existing Sim and Burtt Roads. The here options avoid landscape related overlays but does not follow topography and crosses respective streams. All options will result in vegetation loss. **Stormwater** SH22_PL 1,2 and 3 are all scored the same and result in stream crossings. **Ecology** SH22_PL 1,2 and 3 will all impact streams and wetlands. SH22_PL 2 is scored higher than SH22_PL 1 and 3 and is therefore preferred as appears to minimise impacts on streams and wetlands. **Natural Hazards** SH22_PL 1,2 and 3 have scored the same and have similar ground conditions, but SH22_PL 1 is preferred due reduced earthworks.
Construction impacts	**Embodied carbon emissions**

Criteria	Summary of performance:
	SH22_PL 1 and 2 are scored the same as the road corridor and bridge structure length is similar. **Construction impacts on infrastructure/utilities** SH22_PL 1,2 and 3 are all scored the same and require coordination with Transpower, as the options run under the Transpower line south of Runciman Road. Potentially more adverse effect (relocation of pylons) if vertical clearance insufficient. **Construction disruption** SH22_PL 1,2 and 3 have all scored the same and will result in disruption to current local traffic. There will also be disruption crossing the rail line. **Construction costs** Both options SH22_PL 1 and 2 require significant road extension of Burtt Road. Road corridor and bridge length similar for these options. SH22_PL 3 is preferred despite challenging topography.

5.4.7 Discarded and Preferred Options

Table 5-28 summarises the reasons for discounting the options individually.

Table 5-28: Options to be discarded

Option	Reason
SH22_PL_1	This option provides reduced access improvements and resilience. It also has higher construction costs as requires a significant extension of Burtt Road. This has the greatest potential impacts on wetland.
SH22_PL_2	Similar to Option 1 this option provides reduced access improvements and resilience as well as higher construction costs due to the extension of Burtt Road.

SH22_PL_3 (two new intersections) was the preferred option for the tie in due to the better access improvements and greater improvements in resilience. SH22_PL_3 also had the least development within identified highly productive land.

5.4.8 Preferred Option Summary

PL_2 (a new transport corridor closer to the NIMT line) is preferred as co-locates transport and rail corridor, has reduced visual impact and less potential ecological effects on wetlands, streams, vegetation and habitat loss. It also has less fragmentation of rural land including productive soils.

SH22_PL_3 (two new intersections) is the preferred option for the tie in due to the better access improvements and greater improvements in resilience. SH22_PL_3 also had the least development within identified highly productive land.

5.4.9 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

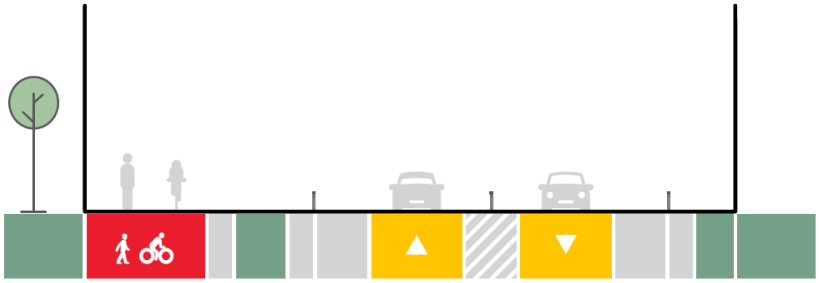
- Through engagement with KiwiRail, the alignment was shifted south to provide further space for maintenance activities.
- The alignment was also shifted south to reduce impacts on areas of Machaerina sedgeland ecosystem and exotic wetland.
- Lengthening of a bridge over the Oira Creek to manage flood hazard effects.
- Relocation of two stormwater wetlands to reduce impacts on the riparian area / flood plain.

5.5 Paerata Arterial Route Refinement - a segment of NoR 2

5.5.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-29 provides a summary of the assumptions and outcomes of the assessment.

Table 5-29: Paerata Arterial form and function assumptions and summary

Criteria	Summary
Purpose	Runs through the eastern edge of Paerata FUZ, increasing connectivity to Paerata station and town centre. The corridor is proposed as an urban arterial with connection to Paerata and Drury West in north and to Pukekohe local connections to the south.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side with integration with SH22
Function	• P2 - Attracts activity from across a subregion or neighbouring local board area • M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	12,000 - 20,000
Speed	50 kph speed limit
Public transport (indicative 2048)	• 10-12 buses per hour • Priority at intersections is required
Freight	Level 3

5.5.2 Alternatives Development

Two options were developed for the Paerata Arterial route refinement assessment as shown Figure 5-9:

- **PA_1:** an upgrade of Sim Road along the edge of the FUZ, connecting into Cape Hill Road; and
- **PA_2:** a new transport corridor through the centre of the FUZ.

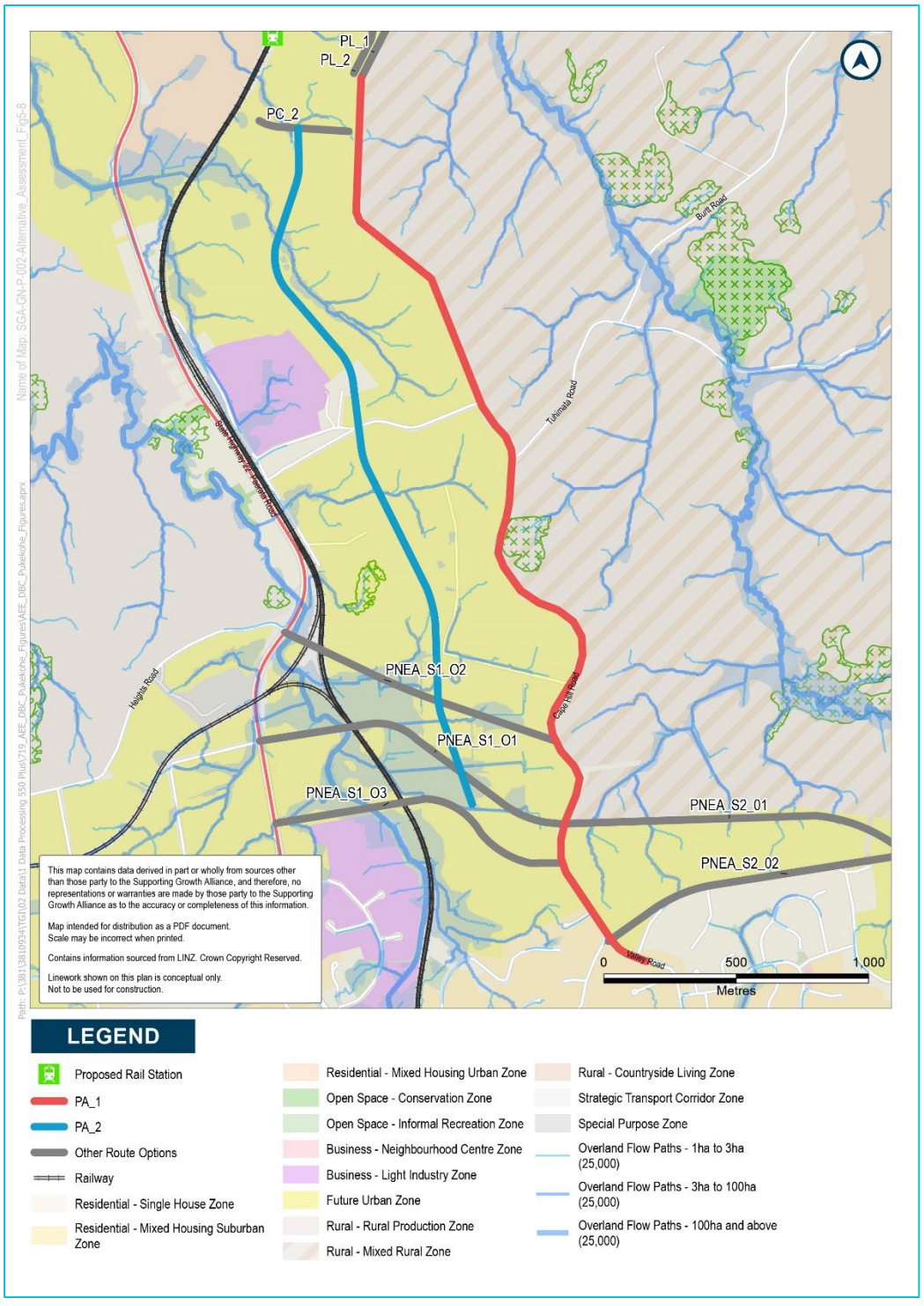


Figure 5-9: Paerata Arterial route refinement options

5.5.3 Alternatives Assessment

Two options were assessed for the Paerata Arterial route refinement assessment against the MCA framework by each subject matter expert in Table 5-30. Commentary is provided in Table 5-31.

Table 5-30: Paerata Arterial route refinement MCA scoring

MCA Criteria	Scores	
Options	**PA_1 (east)**	**PA_2 (west)**
Transport		
Safety	3	2
Integration	3	2
Access	2	3
Resilience	2	2
Travel Choice	2	3
Cultural		
Heritage	0	-2
Social		
Land use futures / integration with planned landuse	1	2
Urban design	1	-3
Land requirement / property	-1	2
Social cohesion	0	0
Human health and wellbeing	0	2
Environment		
Landscape / visual	-2	-2
Stormwater	-1	-3
Ecology	-3	-3
Natural hazards	-2	-3
Construction impacts		
Embodied carbon emissions	-2	-1
Construction impacts on utilities / infrastructure	-2	-1
Construction Disruption	-3	-1
Construction costs / risk / value capture	-3	-2

Table 5-31: Paerata Arterial route refinement assessment findings summary

Criteria	Summary of performance
Transport Outcomes	PA_1 was the preferred option as it minimises movement place conflicts in the urban environment and provides good integration between key destinations. This alignment also improves resilience for general traffic and freight movements between Paerata and Pukekohe. PA_2 integrates with Paerata FUZ on both sides. However, has a higher movement place conflict due to the number of through movements using the corridor. The route will improve resilience in the local Paerata area. However, this is limited without upgrades on Cape Hill Road for better traffic and freight movements between Paerata and Pukekohe.
Heritage	PA1 was the preferred option as no recorded heritage. PA_2 had the potential to impact on Paerata Primary school building.
Social	**Land use** PA_1 is located with Paerata FUZ on one side and rural zoning on the other. The location of the route the outside of the FUZ allows higher vehicle movements to pass on the outside of future residential development. This alignment also maximises future development opportunity in the FUZ and overall is considered to be better integrated. PA_2 was less preferred as the route cuts through the FUZ resulting in less developable land and the potential earthworks required could reduce the area of FUZ available to develop. **Urban design** PA_1 was the preferred option and scored positively as it could be used to define the rural urban boundary and provides maximum development flexibility. Moreover, using the existing road corridor would limit impacts on the character and amenity of the surrounding area. PA_2 provides a connection through the middle of the FUZ, directly connecting to the Paerata Station in a legible manner. However, it would limit the opportunities for development of FUZ. **Land requirement** PA_2 was preferred as it had less impact on properties. However, this option would have a significant impact on several large rural blocks. The route may impact on the development potential of the FUZ zoned land. PA_1 potentially impacted a greater number of properties, however, there was an opportunity to use the existing road which could mitigate some acquisition. **Social Cohesion** PA_1 scored slightly higher as was likely to provide an alternative connection with existing light industrial area near Paerata centre. PA_2 is mostly rural with some small businesses. The design is for a two lane arterial it is unlikely there would be significant severance effects. **Health and wellbeing** Both options were considered to introduce a new corridor with limited sensitive receivers.
Environmental	**Landscape and visual**

Criteria	Summary of performance
	PA_1 was the preferred option as visual impacts were likely to be limited within the localised setting of the route with the potential to provide mitigation planting and sensitive design outcomes along Cape Hill Road. PA_2 was not preferred as runs through a block of established vegetation south of Tuhimata Road and an area for a proposed new suburban park (5ha-10ha) in the structure plan. **Stormwater** PA_1 was preferred as it follows the ridge and existing road, this option crosses no streams and uses existing pavement to the maximum extent, this option has minimal impact on stream hydrology, flooding or water quality. PA_2 is a new road crossing and impacts several small streams and number of smaller flow paths. The southern extent passes through floodplain and would generate flood effects that would need mitigation. **Ecology** Both options were likely to impact on bats. PA_1 was slightly preferred as while it had the potential to impact the east side of Cape Hill Road, where indigenous vegetation occurs in the SEA_T_4380 and other small fragments adjacent to the road it mostly avoids streams and wetlands. **Natural Hazards** PA_1 was preferred due to the terrain. Although the alignment is based on widening existing roads, the narrow Sim Road ridge could entail significant earthworks to accommodate the road width, especially on the east side where the ground falls away steeply. PA_2 crosses a mapped geological fault in this low-lying ground raises the prospect of liquefaction risk and the need to mitigate it.
Construction impacts	**Embodied carbon emissions** PA_2 was preferred based on the lane kilometres of road. However, PA_1 includes the opportunity to reuse material. **Construction impacts on infrastructure/utilities** Both options cross overhead powerlines and other utilities which would require local protection or relocation. PA_1 was least preferred as it also crosses the gas transmission line. **Construction disruption** PA_1 was least preferred as disruption to local traffic (temporary traffic management including lane narrowing and potentially requiring a temporary road as a diversion) on Sim Road, Cape Hill Road and Valley Road for 3.8km. PA_2 involves construction in greenfield area with limited receivers. **Construction costs** PA_2 was preferred as PA_1 is significantly longer and requires full reconstruction of the existing road to improve existing horizontal and vertical alignments.
Partner and Public Feedback	**Partner** Key feedback from SMEs at workshops included: • A request for consideration of a new corridor to connect the extents of Sim to Sim (paper road) across the NIMT be included in the network. This would increase accessibility and provide an alternative crossing of the rail corridor which would relieve through movements past the Paerata Station.

Criteria	Summary of performance
	• Support for PA_2 as the arterial and a future collector delivered by developers being the spine for PT and active modes. **Public** Limited feedback was provided on the Paerata Arterial in public engagement. However, from the feedback received, potential property impacts were a concern on Sim Road (south) and Cape Hill Road and the potential effect on farms. There were also some concerns raised that a four-lane road is no longer proposed.

5.5.4 Discarded Alternatives

Option PA_2 was discarded as it has a higher movement place conflict due to the number of through movements using the corridor. It would also require upgrades on Cape Hill Road for better traffic and freight movements between Paerata and Pukekohe.

5.5.5 Preferred Option

Option PA_1 (an upgrade of Sim Road along the edge of the FUZ, connecting into Cape Hill Road) was recommended as it minimises movement place conflicts in the urban environment and provides good integration between key destinations. This alignment also improves resilience for general traffic and freight movements between Paerata and Pukekohe.

Through the assessment, a hybrid alignment (**Option PA_1A refined**) was proposed which included the northern extent of PA_1 to use Sim/Cape Hill Road and then moving west to more closely align to PA_2 in the southern portion. This is shown in Figure 5-10 below. **Option PA_1A refined (a new transport corridor along the edge of the FUZ, transitioning to the centre of the FUZ)** is preferred as it combines the PA_1 benefit of minimising movement place conflicts in the urban environment being located on the edge of the FUZ, and the PA_2 benefit of avoiding the SEA and steep topography in the southern portion of the alignment.

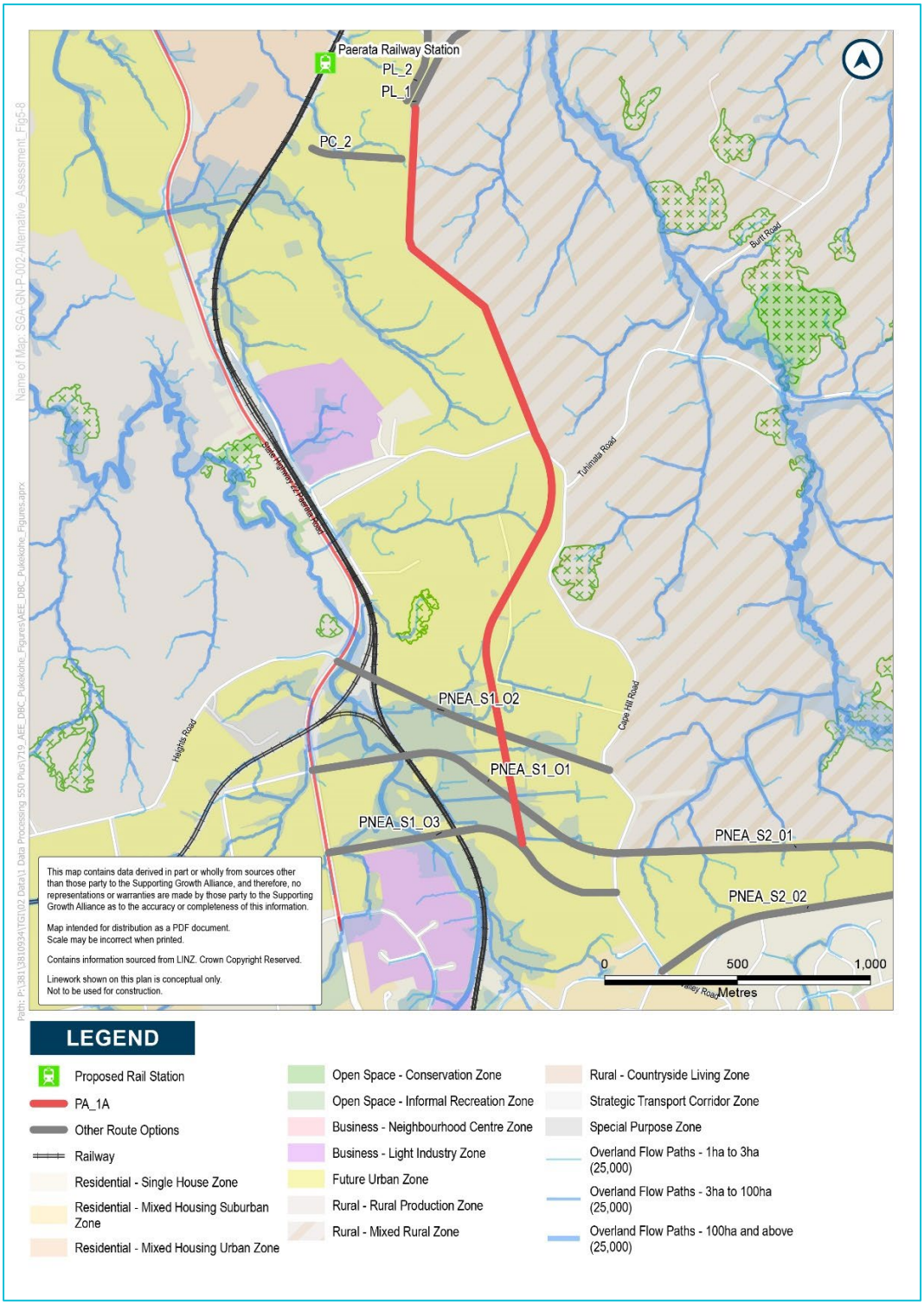


Figure 5-10: Option PA_1A (refined option)

Further considerations for design include:

- Minimise property effects (in particular at the southern end near Sim Road) and consider access for these properties.
- Discuss opportunities for the AMC corridor with AT KiwiRail.
- Investigation of connections to the Paerata Rail Station and across the rail corridor to the Paerata Rise development. See next section.

5.5.6 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

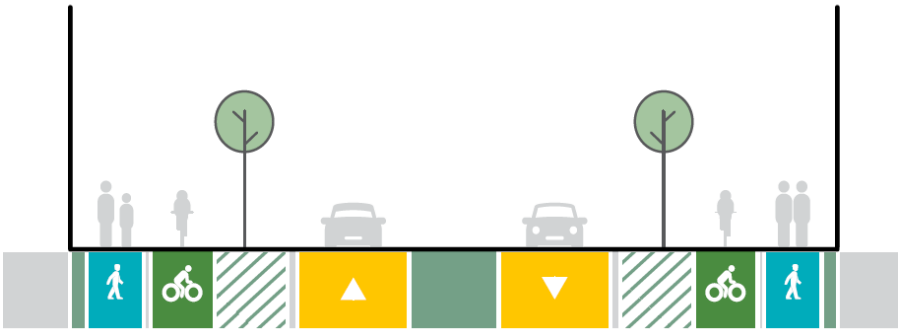
- The alignment was shifted to the west to reduce impacts to wetland habitat near Cape Hill Road / Sim Road.
- The alignment was also shifted to the west to reduce impacts on existing rural dwellings.
- Realignment to reduce impacts on a wetland, a stand of mature native trees (mostly Totara) and SEA_T_4380.

5.6 Paerata Connections – NoR 3

5.6.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-32 provides a summary of the assumptions and outcomes of the assessment.

Table 5-32: Paerata Connections form and function assumptions and summary

Criteria	Summary
Purpose	The Paerata Connections provide key connections to SH22, Sim Rd, Paerata station, Paerata Rise Development and centres. These two connections are the primary east-west connection for all modes and crossing over the railway (NIMT).
Cross Section	 The indicative cross-section is 24m wide and includes two general vehicle lanes and active transport on both sides of the transport corridor. Both connections cross over the NIMT.
Function	• M2 – Medium strategic network significance with increasing volume of users. • P2 – Attracts activity from across a subregion or neighbouring local board area.
Flows (ADT 2048)	6, 000 – 7, 000
Speed	50 kph speed limit
Public transport	8-12 buses per hour (priority at intersections)

Criteria	Summary
Freight	Level 3 Freight Route – connecting to/between strategic freight areas where planning and design should consider the efficient movement of freight

5.6.2 Alternatives Development

For the purpose of the route refinement assessments, Paerata Connections were divided into two segments: the Paerata Station Connection segment and the Sim Connection segment.

Two options were developed for each segment, as shown in Figure 5-11 below:

- **Paerata Station Connection segment options: PC_2A and PC_2B** provide a connection between Sim Road (Paerata Arterial) and the Paerata Rail Station. PC_2B from Sim Road and interacts with facilities supporting the Paerata Rail Station; and
- **Sim Connection segment options: PC_1A and PC_1B** provide a connection over the railway (NIMT) between the Paerata Arterial to Sim Road (north). PC_1A follows the Sim Road paper road and PC_1B provides a new road connection.

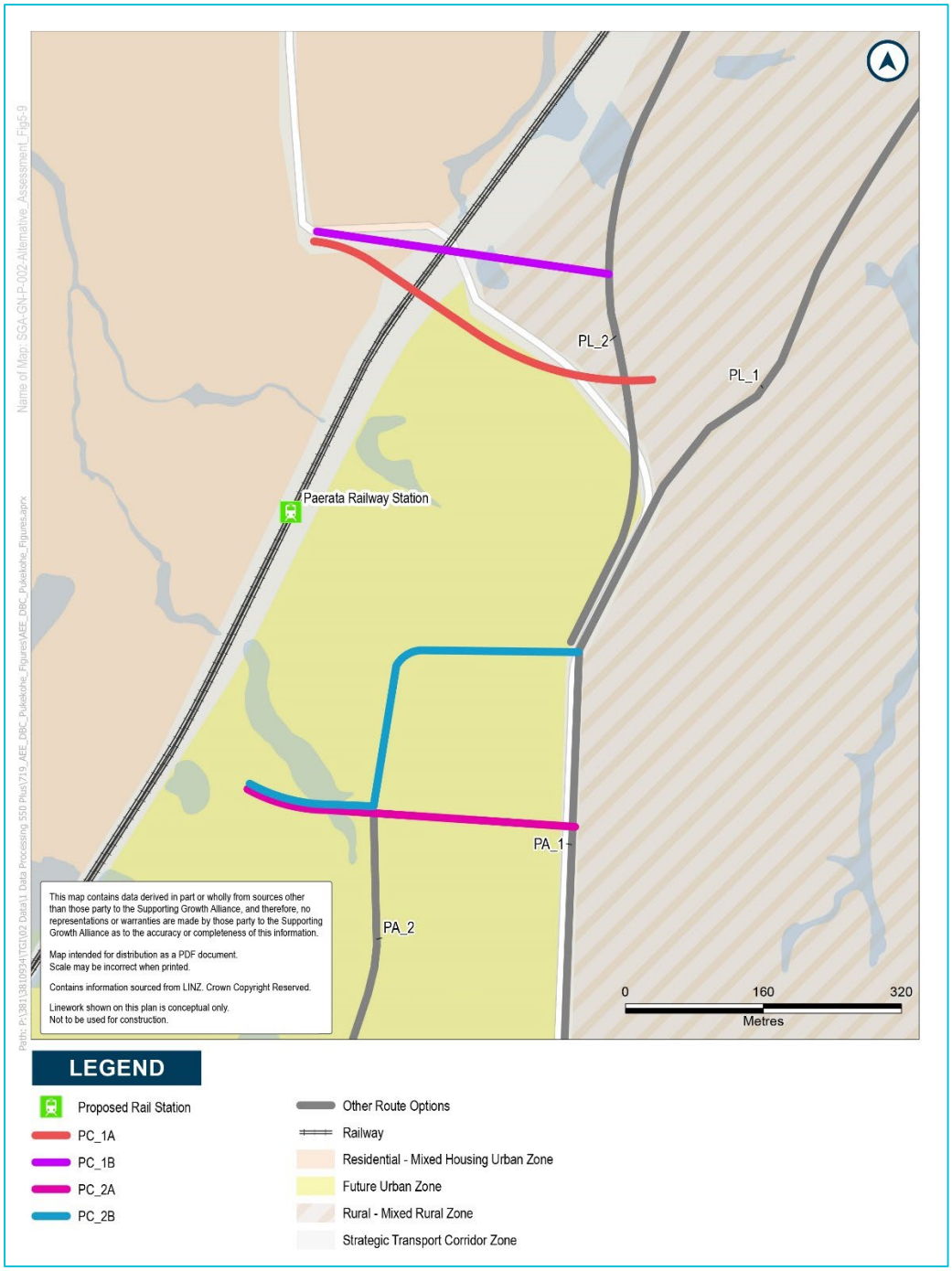


Figure 5-11: Paerata Connections route refinement options

5.6.3 Alternatives Assessment

Two options were assessed for each of the Paerata Connections route refinement assessment against the MCA framework by each technical specialist shown in Table 5-33. Commentary is provided in Table 5-34.

Table 5-33: Paerata Connections route refinement MCA scoring

MCA Criteria	Scores			
Options	**Paerata Rail Station**		**Sim Connection**	
	PC_2A	**PC_2B**	**PC_1A**	**PC_1B**
Transport Outcomes				
Safety	2	2	2	2
Integration	3	2	3	2
Access	3	2	3	2
Resilience	2	2	2	2
Travel Choice	3	3	2	2
Cultural				
Heritage	0	0	0	0
Social				
Land use futures / integration with planned land use	3	2	3	2
Urban design	3	2	3	1
Land requirement / property	-1	-1	-1	-2
Social cohesion	0	0	2	2
Human health and wellbeing	0	0	-1	-1
Environment				
Landscape / visual	-1	-1	-1	-1
Stormwater	-1	-1	-1	-1
Ecology	-3	-2	-3	-3
Natural hazards	-3	-3	-2	-2
Construction impacts				
Embodied carbon emissions	-1	-1	-2	-2
Construction impacts on utilities / infrastructure	-1	-1	-1	-1
Construction Disruption	-1	-1	-1	-1
Construction costs / risk / value capture	-2	-3	-2	-3

Table 5-34: Paerata Connections route refinement assessment findings summary

Criteria	Summary of performance – Paerata Rail Station Connection	Summary of performance – Sim Connection
Transport Outcomes	**Safety** PC_2A and PC_2B scored the same. However, 2A has a safer geometry being a straight connection. **Integration** PC_2A integrates better with the FUZ on both sides and with the Paerata Rail Station, compared with PC_2B, and therefore scored higher. **Access** PC_2A and 2B enable better localised access to opportunities on both sides, shorter, multi-modal access for buses and active modes connecting to Paerata rail station. PC_ 2B would require a slightly longer trip compared to PC_2A for both buses and active modes connecting to the Paerata Railway Station, hence why PC_2A is preferred. **Resilience** Both options provide improved resilience in the local Paerata area. Strategic traffic gets a shorter and more direct alignment. PC_2B will result in traffic accessing very close to the Paerata Station therefore reducing overall resilience resulting in PC_2A being a preferred choice. **Travel Choice** Both options are scored the same and provide significant improvement for all modes and will reduce VKT.	**Safety** PC_1A and 1B both result in shorter trips over the railway crossing and will improve overall safety of the network. Both options scored the same. **Integration** PC_1A and 1B provide network wide integration by better connecting communities which may be affected by rail severance. PC_1A is preferred as it runs closer to the FUZ boundary. **Access** PC_1A and 1B improve access within Paerata areas for all modes and provides better connectivity due to proximity to the FUZ. This is more so the case for PC_1A as it provides better connectivity, being located closer to the FUZ, hence why PC _1A scored higher. **Resilience** PC_1A and 1B scored the same. Both options provide improved resilience in the local Paerata area. Strategic traffic gets a shorter and more direct alignment. **Travel Choice** Both options are scored the same and provide significant improvement for all modes and will reduce VKT.
Heritage	No heritage recorded.	No heritage recorded.
Social	**Land use** PC_2A and 2B provide for a transport corridor through FUZ land, which the Pukekohe Paerata Plan Structure Plan show planned to be THAB zone. PC_ 2B is slightly less integrated due to the dog leg in the road. **Urban design** PC_2A and 2B provide clear and direct connection over the NIMT corridor, connecting Paerata rise with the Paerata Station and the new area of FUZ providing for connected communities. PC_2A is preferred as the straight	**Land use** PC_1A and 1B increase connectivity over the NIMT, past the Paerata Rail Station and connect directly to the Paerata Rise development, providing for integration with land use development. PC_ 1B has slightly reduced integration due to being located only within the rural zone and further away from the FUZ. **Urban design** PC_ 1B scored lower than PC_1A due to being located in the rural zone bringing changes to character of the area, where development is not expected to occur.

Criteria	Summary of performance – Paerata Rail Station Connection	Summary of performance – Sim Connection
	connection provides for development flexibility adjacent to the station location, compared to option 2 which the weave in the route may reduce legibility. **Land requirement** PC_2A and PC_2B, scored the same as only one property is impacted for both options. **Social Cohesion** PC_2A and 2B have no existing urban areas. **Health and wellbeing** PC_2A and B introduce a new corridor and no existing sensitive receivers identified.	PC_1A provides a direct and clear connection over the NIMT corridor, connecting Paerata Rise with the new area of FUZ providing for connected communities. The location of the corridor on the edge of the FUZ can assist in defining the urban boundary at the north of the FUZ. **Land requirement** PC_1B is less integrated with the FUZ, and solely within rural land, increasing property effects, resulting in the preferred option being PC_1A. PC_1B may also result in residual land in the rural zone. **Social Cohesion** PC_1A and 1B allow movements past the Paerata Rail Station and connect directly to the Paerata Rise development, providing for integration with the development. Both options scored the same. **Health and wellbeing** PC_1A and 1B score the same as the corridor connects to Paerata Rise development. There is currently no development in this location. The development will be provided at phase 4 based on Paerata Rise master plan, resulting in some impacts. However, there is opportunity for construction of Paerata Connection at same time as urban development, resulting in less adverse effects than if urban environments were existing.
Environmental	**Landscape and visual** PC_2A and B propose a new road alignment through FUZ land, and the alignment appears to avoid all other landscape related overlays. There is limited visual amenity effects anticipated as the alignment spans through FUZ land. Both options scored the same. **Stormwater** Both options scored the same as neither option involve stream crossings. Options have minimal impact on stream hydrology, flooding or water quality. **Ecology** PC_2A and B are likely to avoid streams and wetlands. PC_2A may have an	**Landscape and visual** PC_1A and 1B scored the same. Both options may result in adverse visual amenity effects existing rural properties proximate to the alignment. **Stormwater** Both options scored the same as neither option involve stream crossings. Options have minimal impact on stream hydrology, flooding or water quality. **Ecology** PC_1A and 1B will have moderate ecological effects, due to impacts on mature exotic trees and portions of the scrub which are likely to be utilised by TAR bat and lizard species (i.e., long-

Criteria	Summary of performance – Paerata Rail Station Connection	Summary of performance – Sim Connection
	indirect impact on Puriri Forest, which is not the case for PC_2B. Therefore, PC_2B is slightly more preferred ecologically. **Natural Hazards** PC_2A and B involve the construction of a new corridor in rural greenfield for segment one. Most of the alignment will lie on undifferentiated tephra (Qut), which are likely to be weaker soils than the lithic tuff (Qst). PC_2B is slightly favourable option due to more investigation data near the proposed alignment (DH122 & DH129), however, both options scored the same.	tailed bats and copper skinks). Both options scored the same. **Natural Hazards** Both options scored the same with no available geotechnical information in the vicinity of the options. The options crossover three geologies: Lithic Tuff (Qst), Undifferentiated tephra (Qut) and Takaanini Formation (PPQt).
Construction impacts	**Embodied carbon emissions** PC_2A and B scored the same. PC_2A is shorter, and both options do not require bridging. **Construction impacts** PC_2A and B cross chorus comms, spark cable, FX network and overhead power at intersection with Sim Road. Both options scored the same. **Construction disruption** PC_2A and B are scored the same and are currently greenfield rural sites within the FUZ. The options may result in minor disruption on Sim Road. **Construction costs** PC_ 2A is the shortest option and therefore preferred, compared to PC_2B.	**Embodied carbon emissions** PC_1A and 1B scored the same. PC_1B is slightly shorter, and both options require bridging which increases embodied carbon emissions. **Construction impacts** PC_1A and 1B scored the same. Services are overhead powerlines, chorus comms, FX network, Spark, and Vodafone. **Construction disruption** PC_ 1B will result in disruption to local traffic (temporary traffic management including lane narrowing) due to works on Sim Road for 0.4km. This is also the case for PC_ 1a, but to a lesser extent (0.15km). **Construction costs** PC_1A is preferred as the bridge crossing the rail at optimum angle (perpendicular to rail line) which will help minimise the bridge length and associated costs.
Partner and Public Feedback	**Partner** Option PC 1A and 1B directly respond to feedback from SMEs at workshops where a request was made for consideration of an additional corridor to connect the extents of Sim Road across the NIMT to assist in relieve through movements past the Paerata Station.	

5.6.4 Discarded Alternatives

For segment 1 (Paerata Rail Station Connection), option PC_2B was discarded as was a longer option resulting in slightly longer trips than PC_2A for both buses and active modes connecting to the Paerata Railway Station. Additionally, option PC_2B did not integrate as well with the FUZ on both sides and the Paerata Rail Station.

For segment 2 (Sim Connection), option PC_1B was discarded because it requires more complex bridge construction and is less integrated with the FUZ.

5.6.5 Preferred Option

- For segment 1**, PC_2A (direct connection)** is preferred as it is the most direct route to both the Paerata Rail Station and the Paerata Rise development and onwards to SH22, reducing travel time and providing a direct and legible connection. It also best integrates with the FUZ on both sides.
- For segment 2, **PC_1A (following the Sim Road paper road)** is preferred as it provides good integration between key destinations, utilises a paper road, integrates better with the FUZ and has a less complex bridge construction.

5.6.6 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

- Through engagement with KiwiRail, refinements to connect to KiwiRail Paerata Rail Station.

5.7 Pukekohe North-East Route Refinement – NoR 4

5.7.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-35 provides a summary of the assumptions and outcomes of the assessment.

Table 5-35: Pukekohe Local – North-East form and function assumptions and summary

Criteria	Summary
Purpose	Arterial corridor from SH22 in the north-west to Pukekohe East Road in the south-east. Its primary function is for general traffic, freight, and active mode links between neighbourhoods and alleviating traffic on Cape Hill and Valley Road.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	• P1 - Predominantly local function with a small catchment of users

Criteria	Summary
	• M2 - Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	5,000-15,000
Speed	50 kph speed limit
Public transport (indicative 2048)	N/A
Freight	Level 2

5.7.2 Alternatives Development

The North-East Arterial was split into three segments for assessment purposes during route refinement, as shown in the figure below.

- Segment 1: between SH22 and Cape Hill Road;
- Segment 2: between Cape Hill Road and the end of Grace James Road; and
- Segment 3: north-south from the end of Grace James Road to Pukekohe East Road.

After public engagement and significant opposition to the route refinement options for the Pukekohe NE Arterial, in particular segment 2 option PNEA_S2_02 (upgrading Grace James Road) and segment 3 option PNEA_S3_01, further options were developed (PNEA_S1_04, PNEA_S2_03 and PNEA_03_03) and options re-tested with the new information obtained to inform the options assessment. All options are shown in Figure 5-12.

The new information included:

- Public feedback – opposition to the upgrade of Grace James Road from residents in the area and freight community.
- Additional transport modelling.
- Site visits by project team to further understand ecological features.

In summary, the following options were developed:

Segment 1:

- **PNEA_S1_O1:** a new transport corridor between SH22 and Cape Hill Road utilising a paper road;
- **PNEA_S1_O2:** a new transport corridor between SH22 and Cape Hill Road - northernmost alignment;
- **PNEA_S1_O3:** a new transport corridor between SH22 and Cape Hill Road (southernmost alignment); and
- **PNEA_S1_O4:** a new transport corridor between SH22 and Cape Hill Road (further north than PNEA_S1_01) utilising a paper road.

Segment 2:

- **PNEA_S2_O1:** a new transport corridor along the FUZ boundary;

- **PNEA_S2_O2:** utilising the existing transport corridor along Grace James Road; and
- **PNEA_S2_O3:** a new transport corridor in the Rural Zone.

Segment 3:

- **PNEA_S3_O1:** a western alignment;
- **PNEA_S3_O2:** an eastern alignment that curves to the west; and
- **PNEA_S3_O3:** an eastern alignment.

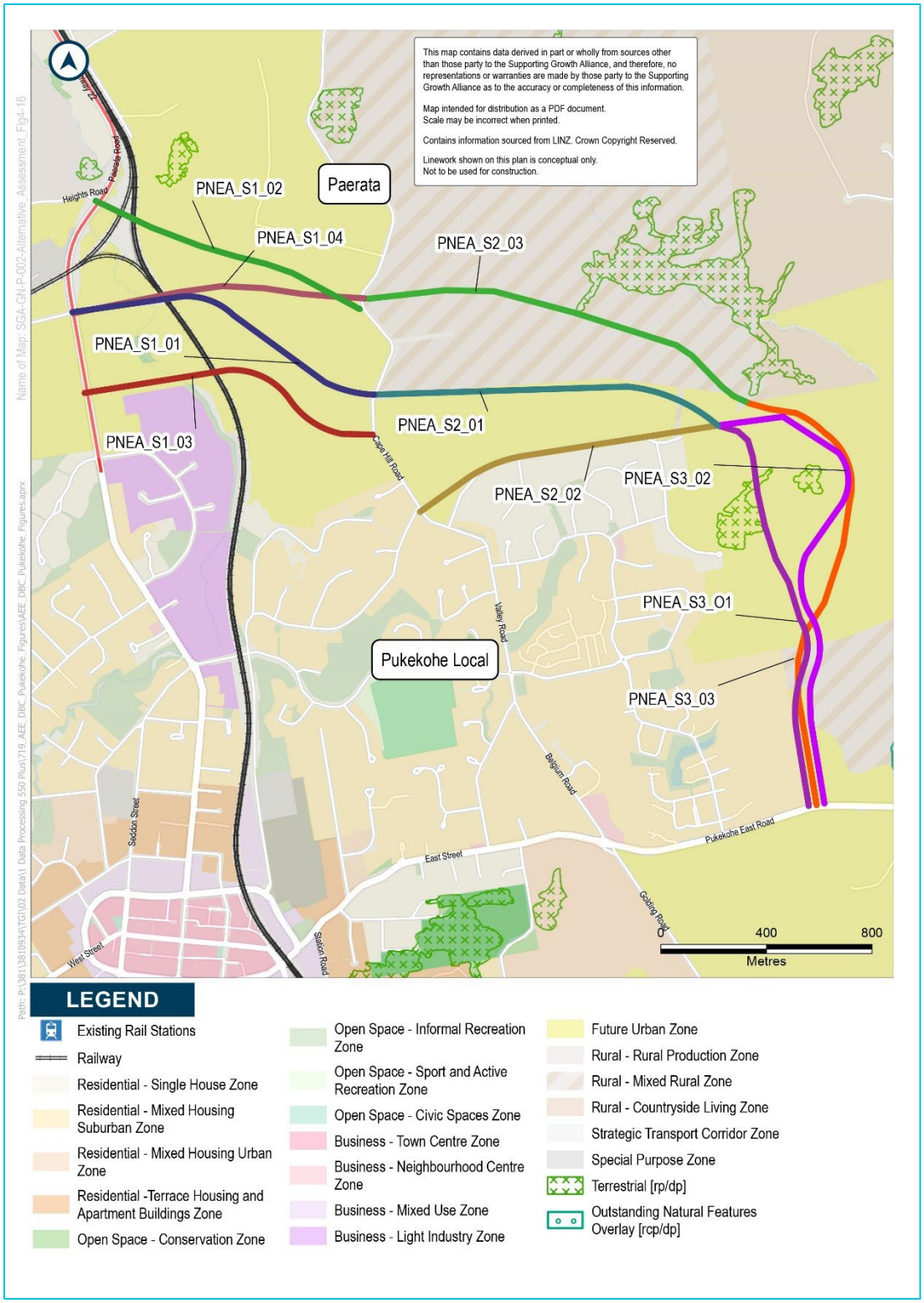


Figure 5-12: Pukekohe North-East route refinement options

5.7.3 Alternatives Assessment

The options were assessed against the MCA framework by each technical specialist in Table 5-36. Commentary is provided in Table 5-37.

Table 5-36: Pukekohe North-East Route Refinement MCA scoring

MCA Criteria	Scores									
Options	**Segment 1**				**Segment 2**			**Segment 3**		
	PNEA_S1_O1	**PNEA_S1_O2**	**PNEA_S1_O3**	**PNEA_S1_O4**	**PNEA_S2_O1**	**PNEA_S2_O2**	**PNEA_S2_O3**	**PNEA_S3_O1**	**PNEA_S3_O2**	**PNEA_S3_O3**
Transport Outcomes										
Safety	1	1	1	1	1	1	1	1	1	1
Integration	2	2	2	3	2	0	2	2	1	2
Access	3	1	3	2	2	1	2	2	1	2
Resilience	2	2	2	2	2	2	2	2	1	2
Travel Choice	2	2	2	2	2	2	2	2	2	2
Cultural										
Heritage	0	0	0	0	0	0	0	0	0	0
Social										
Land use futures / integration with planned landuse	2	2	2	2	1	2	1	2	2	1
Urban design	0	1	0	1	0	-2	-2	-2	-3	-3
Land requirement / property	-1	-1	-1	-1	-2	-1	-1	-2	-1	-1
Social cohesion	0	0	0	0	0	0	0	0	0	0
Human health and wellbeing	0	0	0	-1	0	-1	-1	-1	-1	-1
Environment										
Landscape / visual	-1	-1	-2	-1	-4	-1	-4	-3	-3	-3

Stormwater	-2	-1	-2	-1	-2	-1	-2	-1	-1	-1
Ecology	-2	-4	-3	-2	-4	-2	-4	-4	-4	-4
Natural hazards	-4	-4	-4	-2	-2	-1	-3	-2	-2	-3
Construction impacts										
Embodied carbon emissions	-1	-2	-2	-1	-2	-1	-1	-1	-2	-1
Construction impacts on utilities / infrastructure	-3	-3	-2	-1	-1	-2	-1	-1	-1	-1
Construction Disruption	-1	-1	-1	-2	-1	-2	-2	-1	-1	-2
Construction costs / risk / value capture	-2	-2	-3	-2	-3	-2	-2	-2	-2	-2

Table 5-37: Pukekohe North-East route refinement assessment findings summary

Criteria	Summary of performance		
	Segment 1	Segment 2	Segment 3
Transport Outcomes	PNEA_S1_O1 and PNEA_S1_O3 would both integrate well with urban environments, improve access and resilience for all modes and provides equal access opportunities on both sides. PNEA_S1_O4 was preferred as it was considered to provide better network integration is better for traffic from Paerata Arterial and Pukekohe NW arterial. PNEA_S1_O2 was the least preferred as does not provide good access opportunities to a lot of existing and future developments.	PNEA_S2_O3 was the preferred option as the alignment outside the FUZ would likely reduce movement conflicts and provide better network integration for high traffic coming off Paerata Arterial. The alignment was also likely to facilitate direct east west connection from Pukekohe NW arterials. PNEA_S2_O1 would maximise the development potential of the FUZ and improves access and resilience for all modes. PNEA_S2_O2 was not preferred as it is very close to existing residential development, will increase movement place conflict in urban environments.	PNEA_S3_O1 and PNEA_S3_O3 were preferred as they better integrate with the urban/suburban development. PNEA_S3_O2 was not preferred as it is further from residential developments in the western end, will reduce the integration benefits. Moreover, the indirect alignment for active mode users, reduce access benefits.
Heritage	No recorded heritage.	No recorded heritage.	No recorded heritage.

Criteria	Summary of performance		
Social	**Land use** There was limited differentiation between options as a new corridor which integrates with FUZ to the southeast. **Urban design** PNEA_S1_O2 was the preferred option as it has the least earthworks and shortest bridge. PNEA_S1_O1 and PNEA_S1_O3 had slightly increased earthworks for bridge abutments. **Land requirement** PNEA_S1_O2 was least preferred as it impacts a number of properties. **Social cohesion** There was limited differentiation between options the design is for a two-lane arterial it is unlikely there will be significant severance effects. **Health and wellbeing** Limited differentiation between options. Introducing new corridor within an area with a small number of sensitive receivers (rural residential)	**Land use** PNEA_S2_O2 was preferred as the upgrade to existing road, the corridor is contained within the FUZ / existing residential area. It will integrate the best with future development and limit the development of land outside the FUZ. **Urban design** PNEA_S2_O1 was the preferred option. PNEA_S2_O2 was not preferred due to the impact on the adjacent housing with earthworks encroaching on the front yards. **Land requirement** PNEA_S2_O2 was the preferred option. PNEA_S2_O1 and PNEA_S2_O3 would have more impact on rural land by not following existing route. **Social cohesion** There was limited differentiation between options, as the design is for a two-lane arterial it is unlikely there will be significant severance effects. **Health and wellbeing** PNEA_S2_O1 and PNEA_S2_O3 were preferred as there are limited sensitive receivers. PNEA_S2_O2 was not preferred as existing residential receivers on Grace James Drive. Look to minimise effects by widening on north side.	**Land use** All options provide a new corridor primarily within the FUZ with some areas zoned rural. Both options interact with some private plan changes in the area. **Urban design** Due to topography, there are some larger areas of earthworks. PNEA_S3_O1 was preferred as it is the more direct alignment of the two. **Land requirement** PNEA_S3_O2 was the preferred option as reduced number of full acquisitions. **Social cohesion** There was limited differentiation between options and the design for a two-lane arterial is unlikely to generate significant severance effects. **Health and wellbeing** Limited differentiation between options with effects on small number of rural residential receivers or all options.
Environmental	**Landscape and visual** PNEA_S1_O2 was the preferred option as would	**Landscape and visual** PNEA_S2_O2 was the preferred option due to minimal vegetation removal	**Landscape and visual** PNEA_S3_O2 was the preferred option as it avoids impacts on an SEA.

Criteria	Summary of performance		
	result in a limited extent of vegetation removal. PNEA_S1_O1 and PNEA_S1_O3 would affect large established trees along property boundaries. **Stormwater** PNEA_S1_O2 is the preferred option as it has minimal interaction with floodplain. PNEA_S1_O3 would also have minimal interaction with the floodplain. **Ecology** PNEA_S1_O1 is the preferred option as one stream crossing and bridge structure could avoid impacts to stream and riparian margin. PNEA_S1_O2 and PNEA_S1_O3 were not preferred and have greater impacts on wetlands and streams. **Natural Hazards** There was limited differentiation between options. Complex ground conditions with some adverse consequences coincides with complex engineering requirement.	and limited visual amenity effects to residential properties along the existing settlement edge. PNEA_S2_O1 was not preferred due to very complex topography. This option would require substantial alteration to this landform and landscape character. **Stormwater** PNEA_S2_O2 was the preferred option as the road follows the ridge and has no culverts or floodplain interaction. There were also reduced impacts to water quality and hydrology with his option. PNEA_S2_O1 was not preferred the new road will have the largest water quality and hydrology effects. **Ecology** All options have the potential to impact lizards. PNEA_S2_O2 was the preferred option as impacts on vegetation limited to planted indigenous vegetation, no new stream crossings (upgrading an existing corridor). PNEA_S2_O1 and PNEA_S2_O3 were considered likely to result in wetland and stream loss, with requirement for offset mitigation. **Natural Hazards** PNEA_S2_O2 was preferred as avoids stream and less earthworks required.	PNEA_S3_O1 was least preferred as it result in loss of established vegetation within an identified SEA and gullies and along property boundaries. The impact was considered likely to result in alteration to the landform and effects on landscape character. **Stormwater** PNEA_S3_O1 was the preferred option, and it would have the least impact on water quality and hydrology. PNEA_S3_O3 was similar to PNEA_S3_O1 but slightly longer which would have a higher impact on hydrology. **Ecology** PNEA_S3_O2 was the preferred option as better avoids higher value habitat, (SEAs and indigenous wetlands). PNEA_S3_O2 was not preferred as potentially significant wetland and stream loss and direct impact and fragmentation of SEA_T_4374. **Natural Hazards** There was limited differentiation between options. Terrain mostly underlain by volcanic soils bridge crossing over alluvium with potential for liquefiable soils.
Construction impacts	**Embodied carbon emissions** PNEA_S1_O1 was the preferred option.	**Embodied carbon emissions** PNEA_S2_O2 was the preferred option as it had less earthworks.	**Embodied carbon emissions** There was limited differentiation between options. PNEA_S3_O1 was

Criteria	Summary of performance		
	Construction impacts on infrastructure/utilities PNEA_S1_O3 was the preferred option. All options required localised protection of utilities (overhead powerlines). PNEA_S1_O1 and PNEA_S1_O2 were less preferred as also require relocation or protection of gas transmission line. **Construction disruption** There was limited differentiation between options. Currently all options are on greenfield in a rural area which would result in limited disruption. Coordination with KiwiRail required. **Construction costs** PNEA_S1_O1 and PNEA_S1_O2 both have a similar road corridor length requiring road widening.	**Construction impacts on infrastructure/utilities** PNEA_S2_O1 was preferred as less utilities requiring protection or relocation. PNEA_S2_O2 would require relocation services are underground power, chorus comms, watermain (100mmØ uPVC), and stormwater watercourses and pipes (up to 375mmØ). **Construction disruption** PNEA_S2_O1 was preferred as greenfield site. PNEA_S2_O2 not preferred due to disruption to local traffic (temporary traffic management including lane narrowing) due to works on Grace James Road **Construction costs** PNEA_S2_O2 was preferred as opportunity to use the existing road (and kerb on the north side).	the preferred option as it had less earthworks. **Construction impacts on infrastructure/utilities** There was limited differentiation between options. Crossing of 630mmØ watermain (distribution) and overhead powerline at intersection of Pukekohe East Road **Construction disruption** There was limited differentiation between options. Currently greenfield site (but FUZ). **Construction costs** There was limited differentiation between options. Similar length of road widening. PNEA_S3_O3 was least preferred due to complex topography.
Partner and Public Feedback	**Partner feedback** Key feedback during SME workshops included: • Freight is a key consideration in Pukekohe. • Consideration of how the collector network will connect with the NE Arterial • Grace James Road will change over time as the FUZ develops on the northern side. • Acknowledgement that the topography is challenging in this area. • Consideration of highly productive soils. Key feedback from Manawhenua representatives in hui included: • Opportunities for the restoration of the Whangapouri Creek. The water quality in the stream has degraded and its mauri has diminished; the whole catchment needs to be restored. • During 19 December 2022 Hui, Ngaati Te Ata Waiohua supported the recommended options for the Pukekohe NE Arterial in principle PNEA_S1_O4, PNEA_S2_O3, PNEA_S3_O3 subject to further technical assessments being undertaken which Ngaati Te Ata Waiohua would like to be engaged on. **Public feedback** In general, there was support for the Pukekohe Arterials during public consultation. The sentiment from the community is that the arterials are needed to remove traffic and congestion from the centre of Pukekohe and provide an alternative route for users that will connect existing and new residential areas.		

Criteria	Summary of performance		
	However, there was significant community opposition through feedback on options to the upgrade of Grace James Road (PNEA_S2_O2) which was shown in public engagement material) from local residents and freight community.		

5.7.4 Discarded Alternatives

Table 5-38 summarises the reasons for discounting the options individually.

Table 5-38: Options to be discarded

Option	Reason
PNEA_S1_O1	Less integration compared with PNEA_S1_O4.
PNEA_S1_O2	discounted as it is more complex to construct with large bridge structure crossing the rail corridor with significant earthworks near a stream and crosses a gas pipeline.
PNEA_S1_O3	discounted because it is more complex to construct with two bridge structures crossing the rail corridor and stream with significant earthworks and may impact on ecological features such a wetlands and bird habitat.
PNEA_S2_O1	discounted because of the impacts on ecological features such as wetlands, streams and vegetation, more complex construction due to topography and earthworks.
PNEA_S2_O2	Proximity to existing residential development, has the potential to increase movement place conflict in urban environments.
PNEA_S3_O1	Provides limited connectivity and greater impact on properties.
PNEA_S3_O2	It provides a less direct connection, is less integrated with likely future land use, affects a proposed (potential location) suburban park identified in the structure plan and requires greater earthworks.

5.7.5 Preferred Option

The preferred options for each segment of the Pukekohe North-East Arterial are:

- **Segment 1: PNEA_S1_O4** (a new transport corridor between SH22 and Cape Hill Road (further north that PNEA_S1_01) utilising a paper road) – This option provides the best integration for existing urban areas and the provides better network integration from Paerata Arterial and Pukekohe NW Arterial. The alignment also improves resilience and access for all modes. It has less of earthworks than other options, providing the opportunity for future development to establish an active interface to the corridor. It creates a direct east-west connection through the FUZ providing the most flexibility for future development.
- **Segment 2: PNEA_S2_O3** (a new transport corridor in the Rural Zone) – This option provides better network integration for high traffic flows coming off Paerata Arterial and provides a direct east west connection from Pukekohe NW arterials to Pukekohe East Road.
- **Segment 3: PNEA_S3_O3** (an eastern alignment) – This option integrates better (than the other options) with the urban/suburban developments and provides more opportunities for access for all

modes and improves the resilience for all modes. In particular, for the eastern portion of FUZ land (Runciman Road).

5.7.6 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

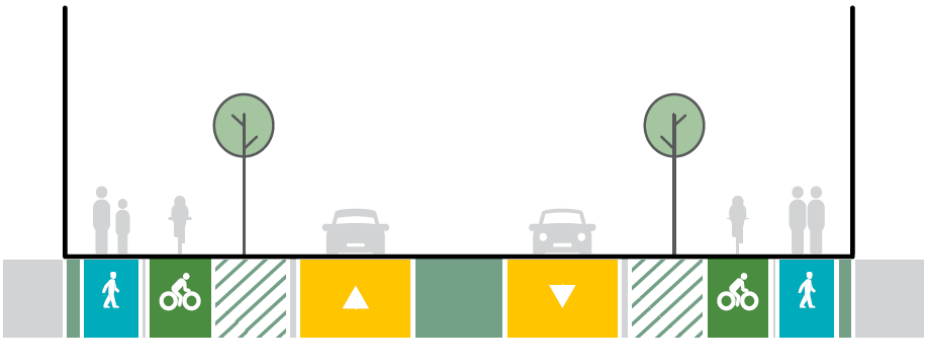
- Placement of a stormwater wetland (at the Butcher Road roundabout) to reduce natural stream / wetland loss.
- Placement of a stormwater wetland and realignment of the transport corridor to reduce direct impacts on SEA_T_4375 and a stand of indigenous vegetation.
- Refinement of the alignment to avoid mature trees, a stand of indigenous vegetation and exotic wetland.
- Placement of a stormwater wetland and refinement of the alignment to better align with future land development plans.

5.8 Pukekohe South-East Route Refinement – NoR 5

5.8.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-39 provides a summary of the assumptions and outcomes of the assessment.

Table 5-39: Pukekohe South-East form and function assumptions and summary

Criteria	Summary
Purpose	Arterial corridor from Pukekohe East Road, Golding Road and a new section to connecting across the NIMT to existing Pukekohe urban area. It serves an east-west function for general traffic, PT and active modes increasing connectivity and access within the FUZ to existing urban Pukekohe.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	• P2 – Attracts activity from across a subregion or neighbouring local board area. • M2 - Medium strategic network significance with increasing volume of users.

Criteria	Summary
Flows (ADT 2048)	With developer connections 4,000 - 7,000 Without developer connections +14,000
Speed	50 kph speed limit
Public transport (indicative 2048)	• 8-10 buses per hour • Priority lanes or priority at intersections required
Freight	Level 1B

5.8.2 Alternatives Development

The South-East Arterial was split into three segments for the purpose of route refinement assessment:

- Segment 1: three options to widen Golding Road – on one side (east or west) or both sides (central);
- Segment 2: three options east-west between Golding Road and the NIMT; and
- Segment 3: crossing across the NIMT to the industrial area.

The following options were developed for each segment:

Segment 1:

- **PSEA_S1_O1:** upgrades to Golding Road (central alignment);
- **PSEA_S1_O2:** upgrades to Golding Road (western alignment); and
- **PSEA_S1_O3:** upgrades to Golding Road (eastern alignment).

Segment 2:

- **PSEA_S2_O1:** a new transport connection (southern alignment);
- **PSEA_S2_O2:** a new transport connection (central alignment); and
- **PSEA_S2_O3:** a new transport connection (northern alignment).

Segment 3:

- **PSEA_S3_O1:** a new connection between Golding Road and the NIMT - northern connection;
- **PSEA_S3_O2:** a new connection between Golding Road and the NIMT - central connection; and
- **PSEA_S3_O3:** a new connection between Golding Road and the NIMT - southern connection.

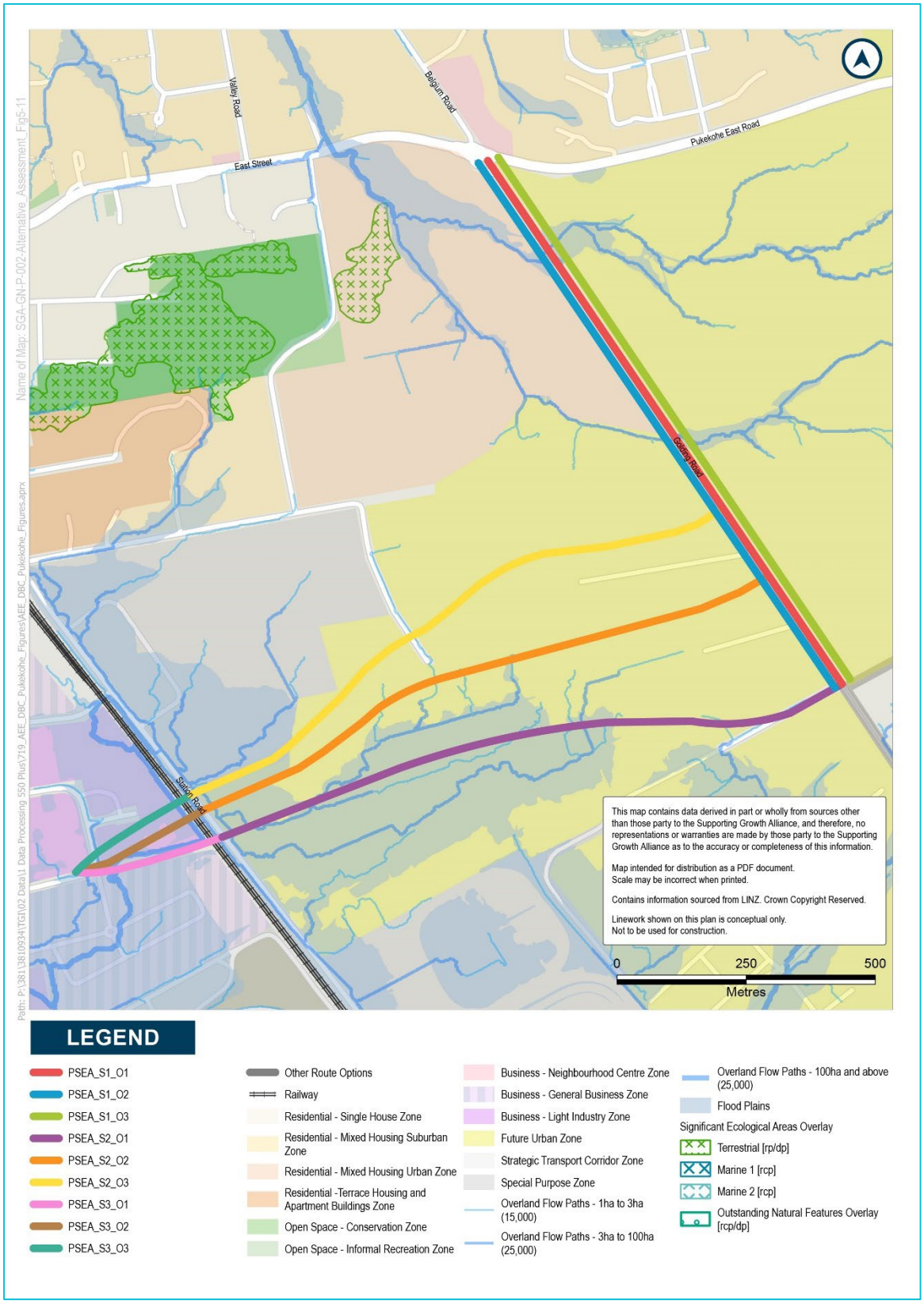


Figure 5-13: Pukekohe South-East route refinement options

5.8.3 Alternatives Assessment

Options were assessed against the MCA framework by each subject matter expert in Table 5-40. Commentary is provided in Table 5-41.

Table 5-40: Pukekohe South-East route refinement MCA scoring

MCA Criteria	Scores								
Options	**Segment 1**			**Segment 2**			**Segment 3**		
	PSEA_S1_O1	**PSEA_S1_O2**	**PSEA_S1_O3**	**PSEA_S2_O1**	**PSEA_S2_O2**	**PSEA_S2_O3**	**PSEA_S3_O1**	**PSEA_S3_O2**	**PSEA_S3_O3**
Transport Outcomes									
Safety	1	1	1	1	1	1	1	1	1
Integration	2	2	2	2	2	2	2	2	1
Access	2	2	2	2	2	2	2	2	1
Resilience	2	2	2	2	2	2	2	2	2
Travel Choice	2	2	2	2	2	2	2	2	2
Cultural									
Heritage	0	0	0	0	0	0	0	0	0
Social									
Land use futures / integration with planned landuse	3	2	2	2	3	2	1	1	1
Urban design	1	1	1	0	1	0	-1	-1	-1
Land requirement / property	-1	-1	-1	-1	-2	-2	-1	-2	-1
Social cohesion	0	0	0	1	2	2	1	2	2
Human health and wellbeing	-1	-1	-1	0	0	0	0	0	0
Environment									
Landscape / visual	-1	-2	-2	-1	-2	-2	-2	-2	-2
Stormwater	-1	-1	-2	-1	-2	-2	-2	-2	-1
Ecology	-1	-2	-2	-2	-3	-3	-3	-2	-1
Natural hazards	-2	-2	-1	-3	-2	-2	-2	-2	-2

Construction impacts									
Embodied carbon emissions	0	0	0	0	0	0	0	0	0
Construction impacts on utilities / infrastructure	-1	-1	-1	-1	-1	-1	-1	-1	-2
Construction Disruption	-2	-2	-2	-1	-1	-1	-3	-3	-3
Construction costs / risk / value capture	-2	-2	-2	-2	-2	-2	-2	-2	-2

Table 5-41: Pukekohe South-East route refinement assessment findings summary

Criteria	Summary of performance		
	Segment 1	Segment 2	Segment 3
Transport Outcomes	All options would result in safety improvements from taking strategic traffic from Pukekohe East Road and Pukekohe town centre and significantly improve access and access Pukekohe Town Centre and rail station. There would be significant improvements in resilience around Pukekohe town centre and improvements in mode choice through FUZ areas. Limited differentiation in options.	All options will reduce pressure on existing local roads and improve safety. All options provide positive integration for both existing and future land use and significantly improve E-W access. With any of the new alignments there will be a significant improvement in resilience around Pukekohe town centre and improved mode choice particularly through FUZ areas. Limited differentiation in options.	All options will reduce pressure on existing local roads and improve safety. All options provide positive integration for both existing and future land use and significantly improve E-W access. With any of the new alignments there will be a significant improvement in resilience around Pukekohe town centre and improved mode choice particularly through FUZ areas. Limited differentiation in options.
Heritage	No recorded heritage.	No recorded heritage.	No recorded heritage.
Social	**Land use** Proposed plan changes on both sides (Birch Land Development Consultants on western side and Traffic Planning Consultants Limited on eastern side). PSEA_S1_O1 (central option) was preferred as it provided better integration opportunities.	**Land use** PSEA_S2_O2 was the preferred option as a new corridor well integrated with FUZ. PSEA_S2_O1 was not preferred as it interacts with Birch Land Development proposal to the south. PSEA_S2_O3 was not preferred as it interacts with	**Land use** There was limited differentiation between options. While these options would provide a connection from FUZ to the industrial area the existing development limits opportunities for integration. **Urban design**

Criteria	Summary of performance		
	Urban design Limited differentiation between options. Minimal impact on the character and amenity of the surrounding environment. FUZ on either side will have opportunity to respond to the corridor. **Land requirement** Limited differentiation between options. Acquisition impact shared by all property owners along the route. **Social cohesion** Limited differentiation all options upgrade to Golding Road to support improved links between Golding Road and existing industrial development in Pukekohe. **Health and wellbeing** Limited differentiation between options. Existing corridor limited sensitive receivers identified generally rural land.	showgrounds special use zoning to the north. **Urban design** PSEA_S2_O2 was the preferred option as it provides more flexible future development environment and an opportunity to transition the interface with Pukekohe Showgrounds. PSEA_S2_O1 was the least preferred as it leaves a small pocket of industrial land of an awkward shape. **Land requirement** PSEA_S2_O1 was the preferred option as it had the least number of property acquisitions. **Social cohesion** PSEA_S2_O1 was the least preferred as it was limited in providing a link between Golding Road and industrial development in Pukekohe. **Health and wellbeing** Limited differentiation between options. Existing corridor limited sensitive receivers identified generally rural land.	There was limited differentiation between options, however PSEA_S3_O3 was lest preferred as there were more intersections to navigate e.g. active modes. **Land requirement** PSEA_S3_O1 was not preferred due to concerns over proximity to the Mitre 10 receiving yard and the impact that the bridge over the railway line will have. PSEA_S3_O2 and PSEA_S3_O3 would have a similar impact on properties. **Social cohesion** PSEA_S3_O1 was the least preferred as it would impact existing industrial development. Impacts to Mitre 10 complex located on the southern boundary of the culvert including loading and servicing. PSEA_S3_O2 and PSEA_S3_O3 would have a similar impact on existing development. **Health and wellbeing** Limited differentiation between options. Existing corridor limited sensitive receivers identified generally rural land.
Environmental	**Landscape and visual** Visual amenity effects limited to properties located along the Golding Road corridor. PSEA_S1_O1 was preferred as road widening along both sides of the road will limit overall loss of amenity. **Stormwater** PSEA_S1_O2 was the preferred option as downstream widening will have the least effect on	**Landscape and visual** PSEA_S2_O2 was located on more complex topography which includes a localised knoll and rising landform. PSEA_S2_O3 was also not preferred as it spans through a number of existing house sites. PSEA_S2_O1 was the preferred option as it avoids stream corridors and visual amenity effects limited to within the localised setting of the route.	**Landscape and visual** PSEA_S3_O3 was the preferred option as minimal vegetation loss is anticipated. PSEA_S3_O1 and PSEA_S3_O2 were not preferred due to the loss of a daylighted stream corridor. However, it was noted there would be limited visual amenity effects due to the existing urban (industrial) environment.

Criteria	Summary of performance		
	flooding. However, two existing culverts were likely to need lengthening and negligible floodplain effects from earthworks were predicted. **Ecology** PSEA_S1_O1 was the preferred option as it avoids mature indigenous trees along eastern side. PSEA_S1_O3 was the least preferred due to impact on mature indigenous vegetation / trees. **Natural Hazards** PSEA_S1_O3 preferred as stays away from volcanic explosive centre. PSEA_S1_O1 was the least preferred as crosses settlement-susceptible or liquefiable soils.	**Stormwater** PSEA_S2_O1was preferred as it has a low impact on floodplains and streams. **Ecology** PSEA_S2_O1 was the preferred option and would likely result in minor impacts as it is within a highly disturbed landscape. PSEA_S2_O2 and PSEA_S2_O3 were not preferred due to impacts on a stand of mature indigenous forest and potential for species including lizards and bats. **Natural Hazards** There was limited differentiation between options. Part of alignment located on Q1df alluvial fan deposits variable and potentially adverse soils.	**Stormwater** PSEA_S3_O3 was the preferred option as downstream widening will have the least effect on flooding. PSEA_S3_O2 was the least preferred as upstream widening will have the largest effect on flooding with the largest floodplain effects from earthworks. PSEA_S3_O1 was also not preferred as it would have a moderate effect on flooding and would require the removal of the artificial channel. **Ecology** PSEA_S3_O3 was the preferred option as it avoids streams and wetlands. PSEA_S3_O1 and PSEA_S3_O2 were not preferred due to impacts within riparian margin / and stormwater runoff channel. **Natural Hazards** There was limited differentiation between options. Part of alignment located on Q1df alluvial fan deposits variable and potentially adverse soils.
Construction impacts	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities** All options were similar with a number of services requiring protection or relocation. **Construction disruption** Disruption to local traffic (temporary traffic management including lane narrowing) due to works on Golding Road. **Construction costs**	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities** All options were similar and crossed local power at isolated locations only and crosses rail line and local roads. **Construction disruption** There was limited differentiation between options. All alignments cross the rail line at Station Road. Co-ordination with	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities** PSEA_S3_O3 was the least preferred as the protection or relocation of more local services would be required compared to Option 1 and 2 due to running through Austen Place. **Construction disruption** There was limited differentiation between options. All alignments

Criteria	Summary of performance		
	All options have the same length and involve road widening and were scored the same.	KiwiRail is required to minimise disruption. **Construction costs** All options have a similar length requiring road widening.	cross the rail line at Station Road. Co-ordination with KiwiRail is required to minimise disruption. **Construction costs** All options have a similar length requiring road widening.
Engagement	**Partner feedback** • Key feedback from SME workshops included: • Interaction with a number of private plan changes • Golding Road is a key connection to Waikato • Discussion on freight movement • Support for increased accessibility over the NIMT Manawhenua support upgrade of Golding Road. **Public feedback** In general, there was support for the Pukekohe Arterials during public consultation. The sentiment from the community is that the arterials are needed to remove traffic and congestion from the centre of Pukekohe and provide an alternative route for users that will connect existing and new residential areas. There was a request to look at options further south (in Waikato) to connect further east on Mill Road. In particular, for freight movements.		

5.8.4 Discarded Alternatives

Table 5-42 summarises the reasons for discounting the options individually.

Table 5-42: Options to be discarded

Option	Reason
PSEA_S1_O2	reduced integration opportunities with planned and future development
PSEA_S1_O3	reduced integration opportunities with planned and future development, had the greatest effect on the floodplain and on mature and native vegetation
PSEA_S2_O1	likely to impact on proposed urban development due to topography on Golding Road intersection and Pukekohe Showgrounds
PSEA_S2_O3	affects a greater number of properties, may impact the Pukekohe Showgrounds and impacts on a stand of mature indigenous forest
PSEA_S3_O1	significant property impacts including on a large commercial centre including the access
PSEA_S3_O3	results in a less direct connection including more intersections to navigate particularly for active modes, and requires additional existing services to be relocated adding to construction cost

5.8.5 Preferred Option

The preferred options for Pukekohe SE Arterial are:

- **Segment 1: PSEA_S1_O1 (upgrades to Golding Road – central alignment)** was the preferred option (widening on both sides) as it is better integrated with future development, shares property impacts equally, reduced impacts on mature and native vegetation.
- **Segment 2: PSEA_S2_O1 (a new transport connection – southern alignment)** was preferred as better integrates with future development, affects the least number of properties, does not require any stream crossings.
- **Segment 3: PSEA_S3_O2 (a new connection between Golding Road and the NIMT – central connection)** was preferred because it provides a direct connection and reduces impacts on large commercial centre including the access.

5.8.6 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

- Placement of stormwater wetland to reduce impacts on an existing stream corridor.
- Redesign and relocation of the stormwater wetland to the southeast of the alignment (near Pukekohe Showgrounds) to reduce impacts on existing mature vegetation and future transport connections.
- Relocation of a stormwater wetland provide for a potential access to Golding Road as part of future residential development.

5.9 Pukekohe South-West Route Refinement – NoR 6

5.9.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-43 provides a summary of the assumptions and outcomes of the assessment.

Table 5-43: Pukekohe South-West form and function assumptions and summary

Criteria	Summary
Purpose	Arterial corridor from Manukau Road in the east to Helvetia Road west in Pukekohe. It is a primary east-west road which helps in detracting general traffic and freight away from the town centre. Its primary function is for general traffic, freight and a focus on increasing active mode connectivity.

Criteria	Summary
Cross Section	 20m cross section, two general vehicle lanes, active modes.
Function	• P2 – Attracts activity from across a subregion or neighbouring local board area • M2 – Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	7,000 - 10,000
Speed	50 kph speed limit
Public transport (indicative 2048)	12 buses per hour
Freight	Level 2

5.9.2 Alternatives Development

Following the identification of a preferred route for the South-West Arterial at the corridor assessment stage (see Section 4.5.4) there was a further assessment to determine the upgrade of existing roads given the existing urban environment.

Due to the spatial constraints along this corridor, as it is completely within the existing built-up urban area of Pukekohe, options were developed to utilise the existing road reserve and had a bespoke options assessment process.

The options developed included:

- **Option 1:** A 20m cross-section with active modes on both sides of the road – with a 6.8m uni-directional cycle facility on each side;
- **Option 2:** A 20m cross-section with active modes on both sides of the road – with a 6.5m uni-directional cycle facility on each side;
- **Option 3:** A 20m cross-section with active modes on both sides of the road – with a 5.25m uni-directional cycle facility on each side;
- **Option 4:** Two-way cycleway on northern / eastern side only (3.2m cycleway on one side, 1.8m walking facility and 1.2 berm on each side); and
- **Option 5:** Two-way cycleway on southern / western side only (3.2m cycleway on one side, 1.8m walking facility and 1.2 berm on each side).

The South-West Arterial alignment was separated into three sections for assessment purposes as shown in Figure 5-14:

- Section 1: from Nelson Street to Ward Street;
- Section 2: from Puni Road to West Street; and
- Section 3: from West Street to Helvetia Road.

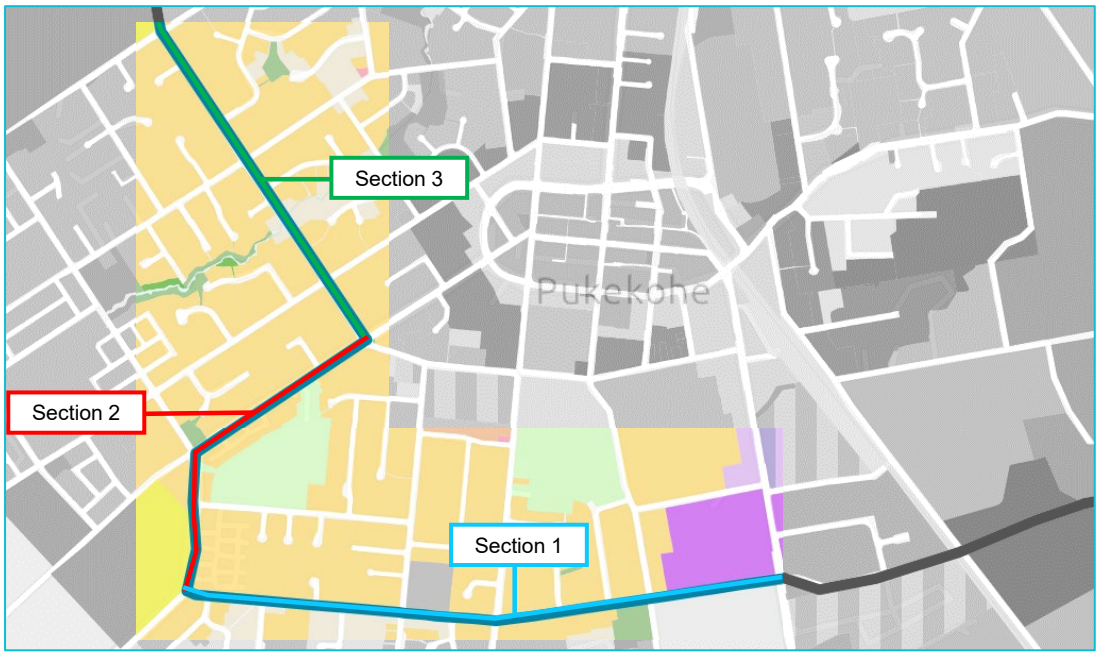


Figure 5-14: Sections assessed for Pukekohe South-West route refinement

5.9.3 Alternatives Assessment

The assessment process is set out in Figure 5-15 and included a comparative analysis of the level of service for active modes, property impacts and construction cost.

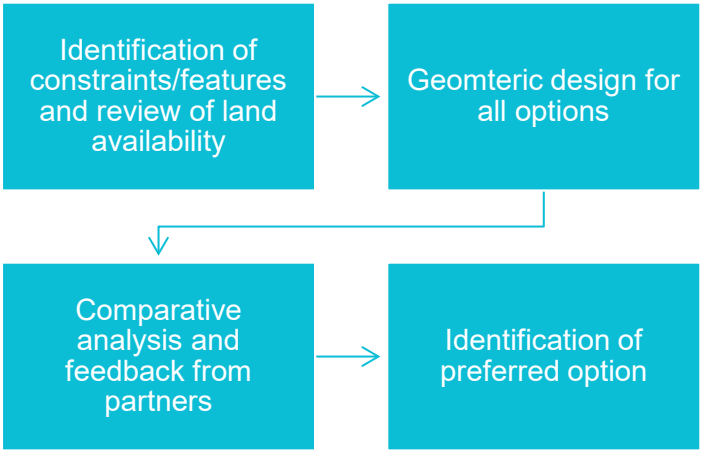


Figure 5-15: Comparative assessment for Pukekohe South-West

The comparative assessment involved rating each of the scenarios against the key indicators: walking safety, cycling safety, property impact and cost. The options were assessed either positively (ticks), indicating a positive outcome, with the higher number of ticks representing the highest benefit or their level of disbenefit (crosses), with the higher number of crosses representing the level of disbenefit. Table 5-44 provides a summary of the comparative assessment undertaken for the Pukekohe South-West Arterial.

Table 5-44: Summary of comparative assessment for Pukekohe South-West

Criteria	Summary											
	Section 1				Section 2				Section 3			
	Cycle safety	Walking safety	Property	Cost	Cycle safety	Walking safety	Property	Cost	Cycle safety	Walking safety	Property	Cost
Option 1 Uni-directional cycleway (6.8m)	√√√√	√√√√	XXXX	XXXX	√√√√	√√√√	XXX	XXXX	√√√√	√√√√	XXXX	XXXX
Option 2 Uni-directional cycleway (6.5m)	√√√√	√√√√	XXXX	XXXX	√√√√	√√√√	XXX	XXXX	√√√√	√√√√	XXXX	XXXX
Option 3 Uni-directional cycleway (5.25m)	√√√√	√√√√	XX	XXX	√√√√	√√√√	XX	XXX	√√√√	√√√√	XXX	XXX
Option 4 Bi-directional cycleway on North / East side	√√√	√√√√	XX	X	√√√	√√√√	√√√	X	√√√	√√√√	XX	XX
Option 5 Bi-directional cycleway on South / West side	√√√	√√√√	XX	X	√√√	√√√√	XX	X	√√√	√√√√	XX	X

Partner Feedback

SMEs provided the following feedback at workshops:

- Recognition of the highly constrained area and support to assess alternatives to reduce property impacts.
- Principle support for bi-directional cycleway to reduce property impacts in the existing urban area.
- A request to consider the provision of lighting and trees within the cross section and integration with future bus stops.

5.9.4 Discarded Alternatives

Table 5-45 summarises the reasons for discounting the options individually.

Table 5-45: Options to be discarded

Option	Reason
Option 1	High property impacts and large cost for construction
Option 2	High property impacts and large cost for construction
Option 3	High property impacts and large cost for construction

5.9.5 Preferred Option

Option 4 (bi-directional cycleway for north/east side) was recommended for segments 1 and 2 and **Option 5 (di-directional cycleway for south/west side)** was recommended for segment 3.

Options 4 and 5 (both being a bi-directional cycle facility on one side of the road) were preferred as they best utilise the existing road reserve, minimise impacts on property along the route, reduce costs, while still ensuring adequate accessibility.

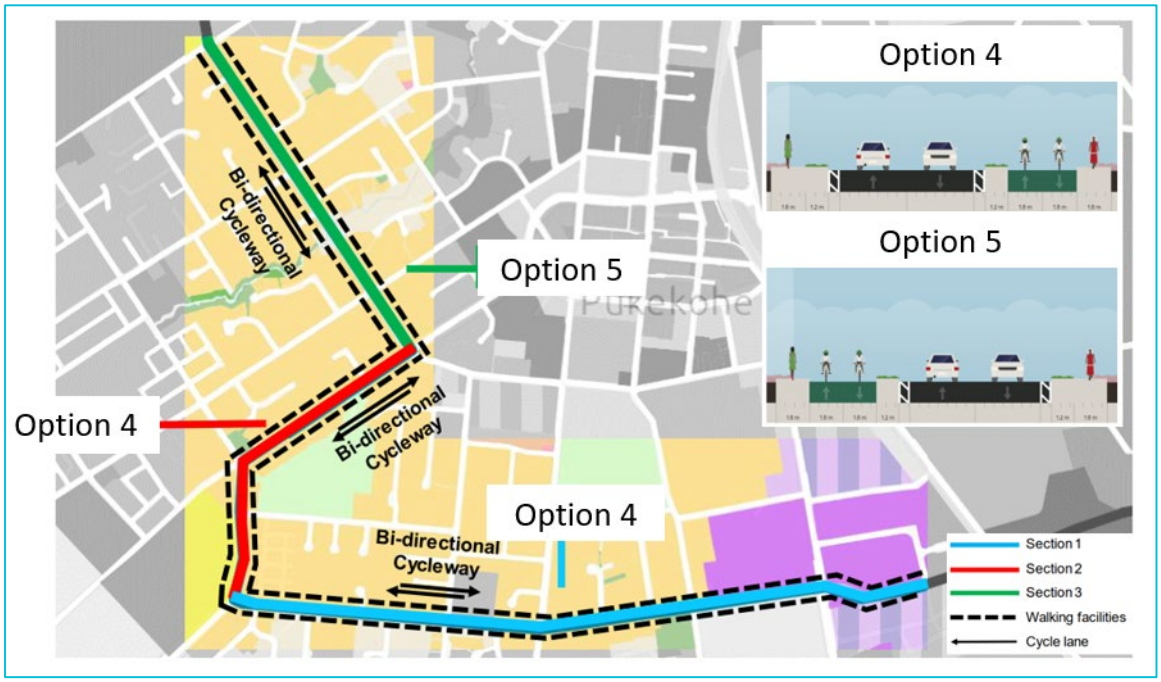


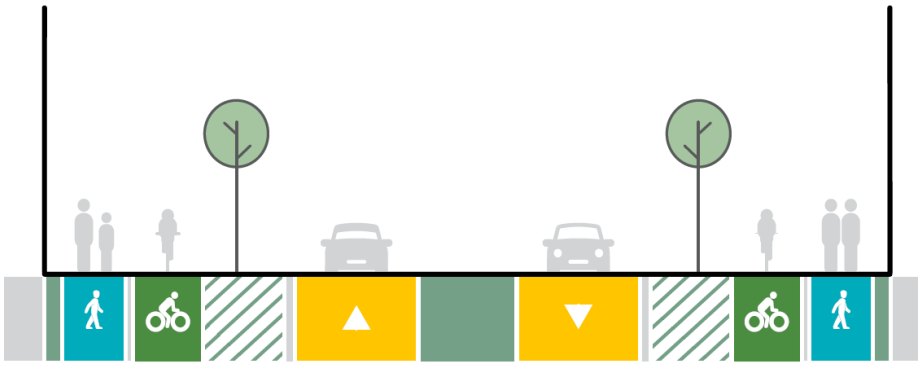
Figure 5-16: Preferred Option for South-West Corridor

5.10 Pukekohe North-West Route Refinement – NoR 7

5.10.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-46 provides a summary of the assumptions and outcomes of the assessment.

Table 5-46: Pukekohe North-West form and function assumptions and summary

Criteria	Summary
Purpose	Arterial corridor connecting SH22 to Ward St in Pukekohe. It is the primary north-south route for all modes in Pukekohe West.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on both sides
Function	• P2 - Attracts activity from across a subregion or neighbouring local board area • M2 - Medium strategic network significance with increasing volume of users
Flows (ADT 2048)	9,000 - 11,000
Speed	50 kph speed limit
Public transport (indicative 2048)	10-12 buses per hour
Freight	Level 2/3

5.10.2 Alternatives Development

The North-West Arterial was split into two segments for the purpose of route refinement assessment:

- Segment 1: widening of Helvetia Road (widening to the east, to the west, and on both sides from the centre)
- Segment 2: east west connection (via Butcher Road, Heights Road, or a new connection)

The following options were developed for each segment:

Segment 1:

- **PNWA_S1_O1:** widening of Helvetia Road on both sides from the centre;
- **PNWA_S1_O2:** widening of Helvetia Road on the eastern side; and
- **PNWA_S1_O3:** widening of Helvetia Road on the western side.

Segment 2:

- **PNWA_S2_O1**: east west connection via Butcher Road;
- **PNWA_S2_O2**: east west connection via Heights Road;
- **PNWA_S2_O3**: east west connection via new road; and
- **PNWA_S2_O3A**: east west connection via new road, tying into Butcher Road.

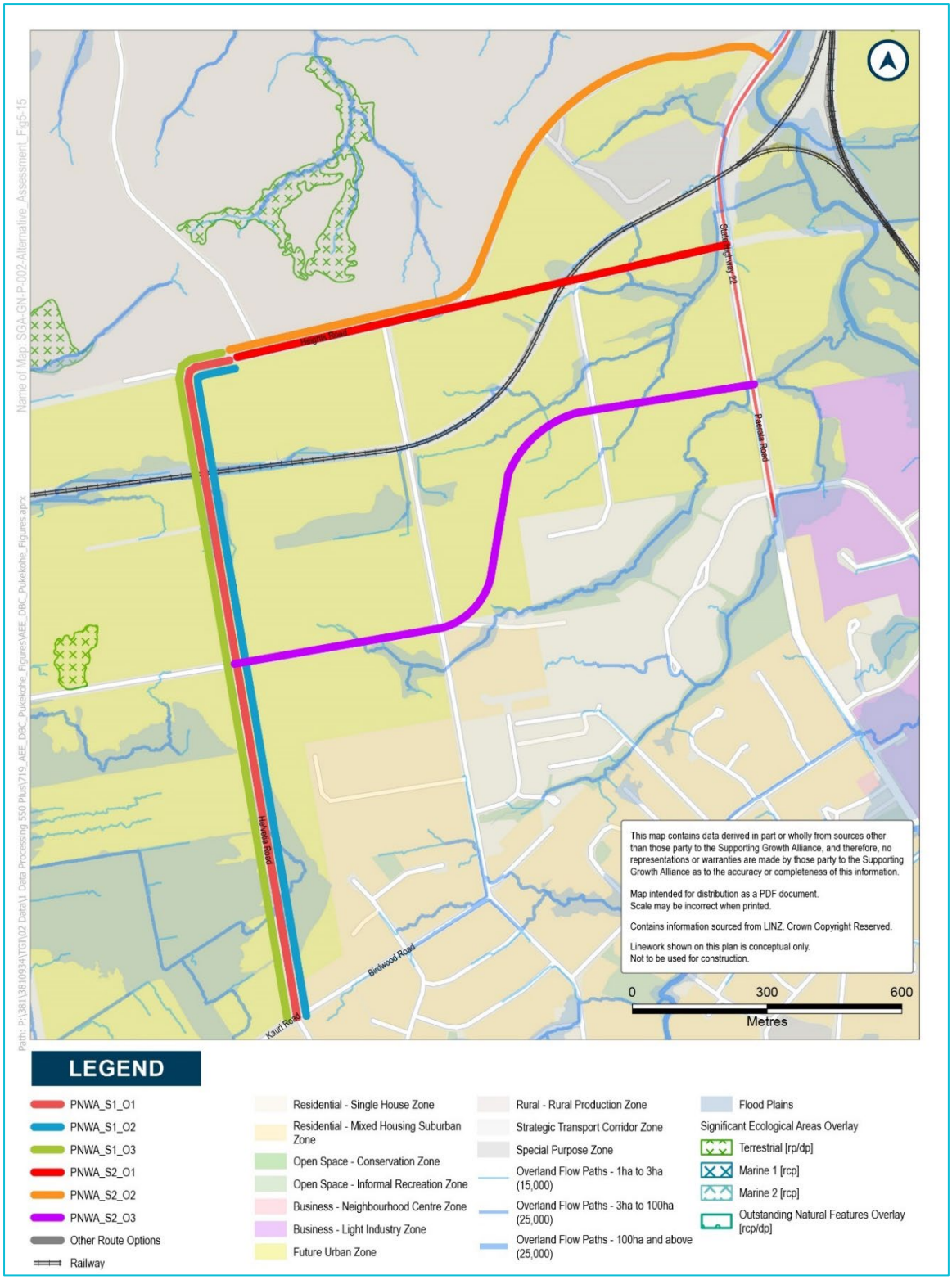


Figure 5-17: Pukekohe North-West route refinement options

5.10.3 Alternatives Assessment

Options were assessed against the MCA framework by each subject matter expert as set out in Table 5-47. Commentary is provided in Table 5-48.

Table 5-47: Pukekohe North-West route refinement MCA scoring

MCA Criteria	Scores					
	Segment 1			Segment 2		
Options	**PNWA_S1_O1**	**PNWA_S1_O2**	**PNWA_S1_O3**	**PNWA_S2_O1**	**PNWA_S2_O2**	**PNWA_S2_O3**
Transport Outcomes						
Safety	1	1	1	2	1	2
Integration	2	2	2	1	1	1
Access	2	2	2	2	1	2
Resilience	1	1	1	2	1	2
Travel Choice	2	2	2	2	1	2
Cultural						
Heritage	0	0	0	0	0	0
Social						
Land use futures / integration with planned landuse	3	2	2	3	1	3
Urban design	1	1	1	0	1	0
Land requirement / property	-1	-1	-1	-1	-1	-2
Social cohesion	-1	-1	-1	2	0	2
Human health and wellbeing	-1	-1	-1	0	0	-1
Environment						
Landscape / visual	-2	-1	-3	-1	-1	-3
Stormwater	-1	-2	-1	-1	-1	-2
Ecology	-2	-2	-2	-3	-1	-3
Natural hazards	-4	-4	-4	-2	-1	-2
Construction impacts						

Embodied carbon emissions	0	0	0	0	0	0
Construction impacts on utilities / infrastructure	-2	-2	-2	-2	-1	-1
Construction Disruption	-2	-2	-2	-2	-2	-1
Construction costs / risk / value capture	-2	-2	-2	-2	-2	-2

Table 5-48: Pukekohe North-West route refinement assessment findings summary

Criteria	Summary of performance	
	Segment 1	**Segment 2**
Transport Outcomes	There was limited differentiation between options (widening Helvetia Road). All options have positive safety effects from taking strategic traffic from Pukekohe town centre and improved integration with urban environments., multi-modal access for all road users and improvements to resilience.	Option PNWA_S2_O2 (Heights Rd) was least preferred (to upgrade Heights Road). It has a less direct connection to SH22 and the NE quadrant and wider strategic network. PNWA_S2_O1 and O3 provide better opportunities for active modes and public transport as are more integrated with the FUZ.
Heritage	No recorded heritage.	No recorded heritage.
Social	**Land use** Includes area within private plan change. Opportunity for developer to deliver part. **Urban design** All options involve minimal earthworks. However, are likely to result in heavy traffic through the middle of a residential area reducing amenity. **Land requirement** All options require at least one full acquisition. There was limited differentiation between options. However, widening on both sides of the road shares more equally the property impacts. **Social cohesion** There was limited differentiation between options and as a two lane arterial it is unlikely there would be significant severance effects.	**Land use** Includes area within private plan change. PNWA_S2_O1 and PNWA_S2_O3 mainly existing roads and integrates best with FUZ. **Urban design** Preference for PNWA_S2_O2 due to minimal impact on character. PNWA_S2_O1 and PNWA_S2_O3 have the potential to isolate the industrial area between the alignment and the railway. **Land requirement** PNWA_S2_O1 and PNWA_S2_O2 require only partial acquisitions. PNWA_S2_O3 is the least preferred. **Social cohesion** Two lane arterial it is unlikely there would be significant severance effects. PNWA_S2_O1 and PNWA_S2_O3 this

Criteria	Summary of performance	
	Health and wellbeing Existing industrial and residential receivers. There were limited differentiation between options.	route provides an improved connection with local shops on Paerata Road. **Health and wellbeing** Existing corridor limited sensitive receivers. PNWA_S2_O2 considered the need to consider access to the cemetery from Heights Road. PNWA_S2_O3 has existing residential receivers located on Butchers Road.
Environmental	**Landscape and visual** PNWA_S1_O1 effects vegetation along both sides of road. The alignment proximate to an identified Notable Trees within the AUP on the western side of the road. PNWA_S1_O3 includes loss of vegetation along the western side of road including northern corner. PNWA_S1_O2 was preferred due to the limited loss of established vegetation along the eastern side of the road. **Stormwater** PNWA_S1_O1 would have a moderate effect on flooding. PNWA_S1_O2 required upgrades to existing culverts and the upstream widening would have the largest effect on flooding. PNWA_S1_O3 was preferred as downstream widening of the road would have the least effect on flooding. **Ecology** No stream or natural wetland impacts. Historical wetlands appear to have been entirely drained and converted to pasture (historically would have been a peat bog / fen). Likely to impact stormwater ponds (potential for At Risk - Declining Copper skink and Dabchick on ponds) on east side and mature Totara (at property 130 Helvetia Rd, Gun Club Rd and 166 Heights Rd) on west side. PNWA_S1_O3 is the preferred option as minimises the impacts on ecology. **Natural Hazards** Preference is for PNWA_S1_O1. Options involved partial new construction through swamp/tuff crater, with associated soft/compressible soils. All options cross unnamed fault and anthropogenic fill.	**Landscape and visual** The alignment follows more complex topography (steep slopes and catchments). PNWA_S2_O2 was the preferred option as involves reduced loss of vegetation. PNWA_S2_O3 includes steeper slopes and gullies and loss of vegetation associated with the stream margins, shelter belts and planting lining Gun Club Road. PNWA_S2_O1 also involves loss of groupings of trees along the existing road edge. **Stormwater** PNWA_S2_O1 was preferred as it would have a minimal effect on flooding. PNWA_S2_O2 has no interaction with culverts or floodplains. PNWA_S1_O3 was the least preferred as it had higher flood effects. **Ecology** PNWA_S2_O2 was preferred as it avoids all streams, potentially impacts to wetlands at junction with SH22 and impacts likely restricted to mature exotic trees. PNWA_S2_O3 includes impacts to several stands of mature vegetation and riparian vegetation. PNWA_S2_O3 includes impacts to indigenous forest and potentially the SEA. **Natural Hazards** Preference is for PNWA_S2_O2 mostly over terrain underlain by volcanic soils. PNWA_S2_O1 crosses a geological fault. PNWA_S2_O3 includes geology which may include some soft compressible layers or possibly some loose materials subject to liquefaction.

Criteria	Summary of performance	
Construction impacts	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities** All options have a similar road corridor length requiring road widening. **Construction disruption** All options require protection or relocation of all services. **Construction costs** All options include disruption to local traffic.	**Embodied carbon emissions** Limited differentiation between options. **Construction impacts on infrastructure/utilities** All options have a similar road corridor length requiring road widening. PNWA_S2_01 will require relocation or strengthening of a gas pipeline. PNWA_S2_01 requires a significant bridge crossing over the Glenbrook line and Butcher Road will need to be raised impacting SH22. **Construction disruption** All options require protection or relocation of all services. **Construction costs** All options include disruption to local traffic.
Engagement	**Partner feedback** Key feedback from SMEs at workshops included: • Acknowledgement of the construction/engineering challenges due to rail crossings (Glenbrook line) and topography. • Proposed plan changes in the area. Opportunities to work with developers. **Public feedback** In general, there was support for the Pukekohe Arterials during public consultation. The sentiment from the community is that the arterials are needed to remove traffic and congestion from the centre of Pukekohe and provide an alternative route for users that will connect existing and new residential areas. Specifically for the NW Arterial, sentiment was mixed. Feedback indicated that people clearly do want a solution for traffic congestion but disagree with the proposal's route connecting future urban areas, including housing developments. Feedback also raised concerns of heavy vehicle (freight) movements through what is perceived as an already congested route or through existing (or proposed) residential areas. A request was made for a more western arterial in the rural zone. In particular for freight. This request was progressed by the project team as it did not support the FUZ and the planned urban growth.	

5.10.4 Discarded Alternatives

Table 5-49 summarises the reasons for discounting the options individually.

Table 5-49: Options to be discarded

Option	Reason
PNWA_S1_O2	Impacts several stands of mature indigenous trees along east side of Helvetia Road.

Option	Reason
PNWA_S1_O3	Impacts vegetation along the western side of road.
PNWA_S2_O1	More complex to construct with new rail crossings and more complex topography (steep slopes and catchments) and is adjacent to SEA and indigenous vegetation.
PNWA_S2_O2	More complex to construct with more complex topography (steep slopes and catchments). The topography will limit its attractiveness for active mode users, less direct connection to SH22 and NE quadrant. It is also adjacent to SEA and indigenous vegetation.

5.10.5 Preferred Option(s)

- **Segment 1: PNWA_S1_O1 (widening on both sides of Helvetia Road from the centre)** is preferred as it is better integrated with future development, shares potential property acquisition evenly on both sides of the road, and provides opportunity to reduce impacts on features.
- **Segment 2: PNWA_S2_O3 (east west connection via a new road)** is preferred because it is less complex to construct, provides more benefits for active modes and PT, reduces impacts on vegetation, uses existing roads (including a paper road), and reduces impacts on existing residential.

Further recommendations for design refinements include making the alignment as direct as possible but making best use of existing roads including paper road.

5.10.6 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

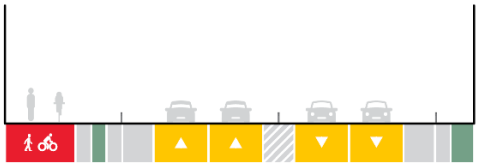
- The alignment was shifted to utilise existing roads at the intersection of Helvetia/Heights/Gun Club Roads. This improved integration with future development plans and reduced impacts on a small stand of indigenous vegetation (potentially totara).
- Placement of stormwater wetland located south-west of the roundabout with Butcher Road to reduce impacts on stream and riparian habitat.

5.11 Mill Road / Pukekohe East Road Upgrade Route Refinement – NoR 8

5.11.1 Form and Function

Following the methodology summarised in Section 3.4, a form and function assessment was undertaken to inform option development and assessment. Table 5-50 provides a summary of the assumptions and outcomes of the assessment.

Table 5-50: Mill Road / Pukekohe East form and function assumptions and summary

Criteria	Summary	Summary
	Pukekohe East Road	Mill Road
Purpose	Existing arterial section from the north-eastern ring road to Belgium Road. It has a high east-west function for general traffic and freight but also needs to accommodate buses and active modes.	Mill Road (Pukekohe) forms a primary east-west connection from SH1 to Pukekohe urban areas. This corridor is a strategic connection for traffic and freight, with a major rural active mode connection and has the potential to take on a State Highway function.
Cross Section	 24m cross section, 2 lane general traffic, walking and cycling on one side	 30m cross section, 4 General Traffic, walking and cycling on one side
Function	• P2 - Attracts activity from across a subregion or neighbouring local board area • M3 - High strategic significance with higher volume of users	• P1 - Predominantly local function with a small catchment of users • M3 - High strategic significance with higher volume of users
Flows (ADT 2048)	With developer connections: 14,000 - 19,000 Without developer connections: +20,000	30,000 - 32,000
Speed	50 kph speed limit	80 kph speed limit
Public transport (indicative 2048)	• 8-10 buses per hour • Priority at intersections required	N/A
Freight	Level 1B	Level 1B

5.11.2 Alternatives Development

Three options were developed for the widening of Mill Road Bombay (to four lanes):

- **MR_1:** widening on both sides from the centre;
- **MR_2:** widening on the south side; and
- **MR_3:** widening on the north side.

The widening of Mill Road Bombay is proposed to Harrisville Road. From this point, Pukekohe East Road is proposed to have an active mode upgrade into Pukekohe. As this is within the rural zone, a shared path will be placed on one side of the existing road. Two options were developed for the shared path:

- **PE_O1:** shared path to be located on the northern side; and
- **PE_O2:** shared path to be located on the southern side.

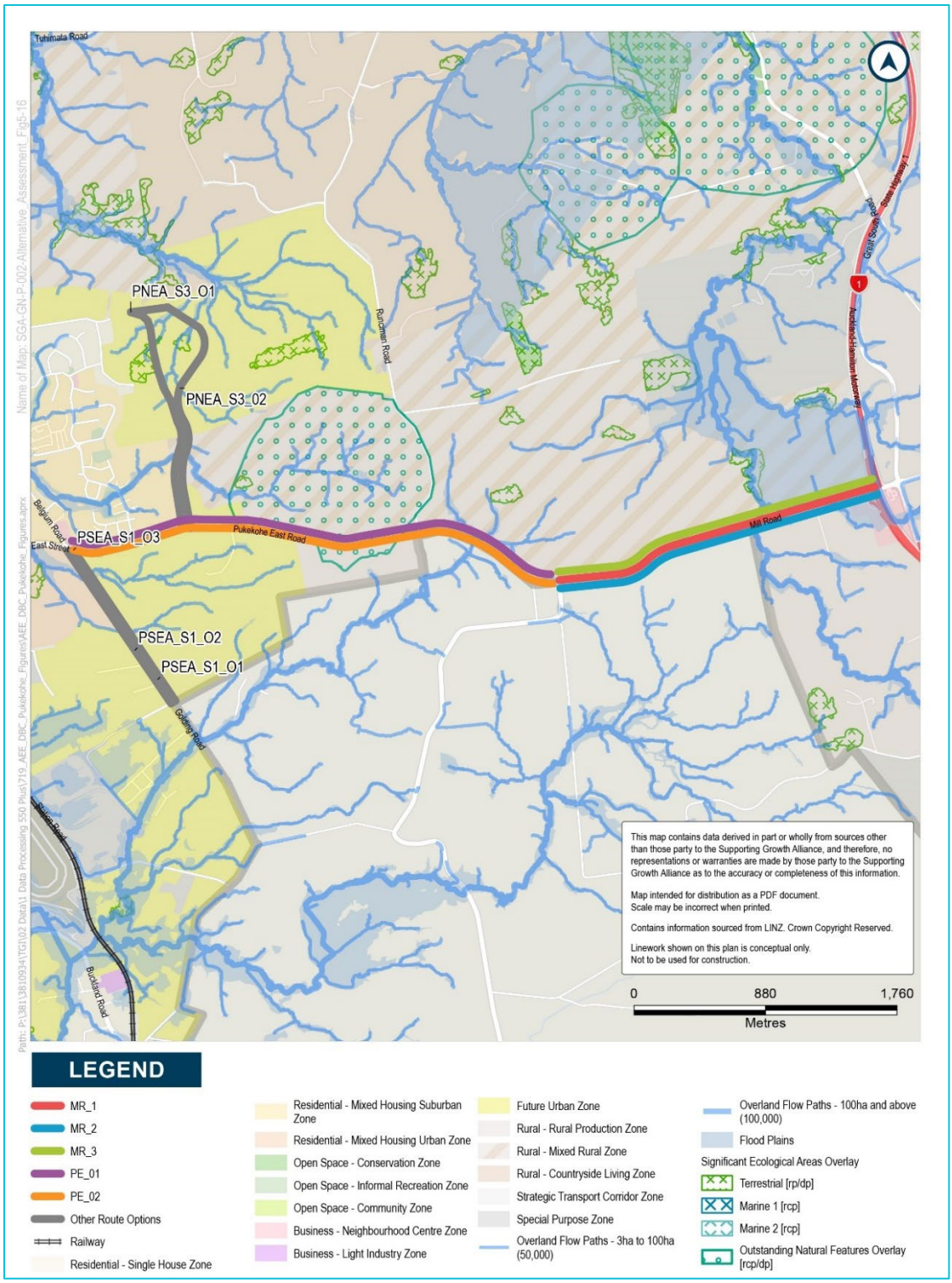


Figure 5-18: Mill Road Bombay and Pukekohe East Road Upgrade route refinement options

5.11.3 Alternatives Assessment

Options were assessed against the MCA framework by each subject matter expert as set out in Table 5-51. Commentary is provided in Table 5-52.

Table 5-51: Mill Road Bombay and Pukekohe East Road Upgrade route refinement MCA scoring

MCA Criteria	Scores				
	Mill Road			Pukekohe East Road	
Options	**MR_1 Centre**	**MR_2 South**	**MR_3 North**	**PE_O1 (north)**	**PE_O2 (south)**
Transport Outcomes					
Safety	1	1	1	2	2
Integration	0	0	0	2	2
Access	1	1	1	2	2
Resilience	3	3	3	2	2
Travel Choice	1	1	1	2	2
Cultural					
Heritage	0	0	0	0	0
Social					
Land use futures / integration with planned land use	3	1	2	1	1
Urban design	0	0	0	1	2
Land requirement / property	-1	-2	-2	-1	-1
Social cohesion	0	-1	0	-1	0
Human health and wellbeing	0	0	0	0	0
Environment					
Landscape / visual	-2	-3	-3	-3	-3
Stormwater	-1	-2	-1	-1	-1
Ecology	-3	-3	-3	-3	-3
Natural hazards	-1	-1	-1	-3	-2
Construction impacts					
Embodied carbon emissions	0	0	0	0	0
Construction impacts on utilities / infrastructure	-2	-2	-2	-2	-2

Construction Disruption	-3	-3	-3	-2	-2
Construction costs / risk / value capture	-2	-2	-2	-2	-2

Table 5-52: Mill Road Bombay and Pukekohe East Road Upgrade route refinement findings summary

Criteria	Summary of performance	
	Mill Road	**Pukekohe East Road**
Transport Outcomes	There was limited differentiation between options. All options provide increased reliance in the network, will take strategic traffic from SH1 to Pukekohe and south to Waikato and have positive safety benefits. As is located in the rural zone, there is no place and movement conflict. All options improve active mode access and provide network-wide improvement in resilience.	PE_O2 was the preferred option as it provides access to key destinations and crossings from SH1 to Golding Road.
Heritage	No recorded heritage.	No recorded heritage.
Social	**Land use** All options provide an improved connection to the local centre at the intersection of SH1. MR_1 was preferred as it upgrades both sides of the road. MR_2 was not preferred as it was considered to have the potential for more significant impacts to the local centre and MR_3 would similarly impact on growers on the northern side of Mill Road. **Urban design** All options were considered to impact on the existing character and amenity as the upgrade of the existing road is within the Rural Zone reducing the ability for future development to respond to the corridor. **Land requirement** MR_1 was the preferred option as would limit the impact on the BP Service Station complex as well as the hothouse facility at 187 Mill Rd. MR_2 would impact BP Service station and potential issues with contaminated land. MR_3 would impact NZ Hothouses complex at 187 Mill Rd. **Social cohesion** MR_2 was the least preferred due to the impact on the local centre at the intersection	**Land use** PE_O2 was preferred as it would better integrate with FUZ to the south of Pukekohe East Road. **Urban design** PE_O2 was preferred as it provides connection to future growth areas and existing activity in Bombay on south side of road. **Land requirement** Both Options will have an impact on large properties at the SH1 interchange. PE_O2 was slightly preferred due to impacts on the commercial development. **Social cohesion** PE_O2 was preferred as PE_O1 had the potential to impact on Pukekohe East Hall. **Health and wellbeing** Small number of existing rural residential receivers unlikely to be impacted by walking and cycling upgrades.

Criteria	Summary of performance	
	with SH1. MR_1 and MR_3 were equally preferred. **Health and wellbeing** There was limited differentiation between options. This is an existing corridor in the rural area with limited receivers there are some houses and community facilities.	
Environmental	**Landscape and visual** MR_1 was the preferred option. There would be some vegetation loss and loss of stream corridors north and south of the road. The southern and northern options would also directly impact properties close to the existing road. **Stormwater** There were no significant difference to hydrologic or water quality effects between options. MR_1 was likely to have a medium impact on flood effects. MR_2 was the least preferred as upstream widening have the greatest impact on flood effects. MR_3 was the preferred option as widening downstream would have the least impact on flood effects. **Ecology** A stand of mature Kauri trees is located the south of the existing road corridor. All options were likely to impact potential bat habitat. MR_2 was the preferred option based on the least earthworks. However, protection of the Kauri trees is significant and should be protected. **Natural Hazards** MR_2 was the preferred option. All options avoid areas of soft soil. MR_3 was least preferred as extends further into the valley of the Ngakaroa stream tributary and likely to encounter more alluvium of a variable nature and likely to entail greatest volume of earthworks.	**Landscape and visual** Both options could impact on the Pukekohe Tuff Ring (ONF). PE_O2 is the preferred option as it avoids the majority of the tuff ring on the north side of Pukekohe East Road. **Stormwater** No major difference to Active Mode Path (AMP) on either the northern or southern side with regard to stormwater effects. **Ecology** Overall preferred as less potential impact on wetlands, streams and mature indigenous vegetation. **Natural Hazards** Both options cross the mapped St Stephens Fault. PE_O2 was slightly preferred as PE_O1 had a greater risk of land instability.
Construction impacts	**Embodied carbon emissions** No difference between options. **Construction impacts on infrastructure/utilities** All options require protection or relocation of all services and there was limited differentiation between options. **Construction disruption**	**Embodied carbon emissions** No difference between options **Construction impacts on infrastructure/utilities** All options require protection or relocation of all services and there was limited differentiation between options. **Construction disruption**

Criteria	Summary of performance	
	All options include disruption to local traffic (temporary traffic management including lane narrowing) due to works on Mill Road. **Construction costs** All options have the same road corridor length and bridge structure length requiring road widening and construction of structures.	All options include shoulder closure of a high speed road and there was limited differentiation between options. **Construction costs** All options have extensive cut and fill and there was limited differentiation between options.
Engagement	**Partners** Key feedback from SMEs during workshop included: • To continue interface discussions with Waka Kotahi P2B team and the future Bombay Interchange upgrade. • Manoeuvring space is required within the BP complex. Ngaati Te Ata Waiohua would not oppose upgrading Pukekohe East Road (which is within the extent of the ONF area). This upgrade could provide an opportunity for more visibility of the tuff ring (through a walking / cycling path and viewing platform). **Public** Through public engagement, strong support was received for the upgrade of Mill Road and Pukekohe East Road. Feedback acknowledged that this road is a key strategic route into Pukekohe, with some pieces of feedback directing that the four-lane upgrade should be applied to the entire route.	

5.11.4 Discarded Alternatives

Table 5-53 summarises the reasons for discounting the options individually.

Table 5-53: Options to be discarded

Option	Reason
MR_2	Greater impacts on grower operation on north side of corridor and properties adjacent to the existing road. Impacts on native and mature vegetation.
MR_3	Impacts on local centre at intersection of SH1 and properties adjacent to the existing road. Impacts on native and mature vegetation.
PE_O1	Greater impacts on commercial development and social infrastructure. A greater impact on ecology (wetlands) and a greater risk of land instability. PE_O1 also did not provide the same connectivity to future growth areas and existing activity at SH1.

5.11.5 Preferred Option

The preferred option for Mill Road is **MR_1 (central widening of Mill Road)** as it has less impact on local centre at the SH1 interchange and potential effects on ecological features on either side of the corridor can be reduced through design.

Further considerations for design include:

- Investigation of stormwater treatment whether swales or kerb and channel (with wetlands) or a mixture of these.
- Integration with Waka Kotahi Papakura to Bombay project (SH1).
- Reduce impacts on ecological features on south and north side. In particular, likely significant kauri trees on southern side of road reserve.
- Reduce property effects where possible.

The preferred option for Pukekohe East Road is **PE_O2 (shared path on the southern side)** as it better integrates with future growth areas and existing activity in Bombay on south side of the road. PE_O2 also avoid the reduces impacts on Pukekohe East Tuff Ring an ONF. Widening to the south side also provides an opportunity to work with developers within the FUZ

Further considerations for design include sensitive design and consideration of the Pukekohe East Tuff Ring (ONF).

5.11.6 Concept Design Refinements

As set out in Section 3.10, following identification of the preferred option, an initial concept design was developed. Key technical specialist recommendations which informed iterative refinements to the concept design are summarised below.

- Placement of stormwater wetland to the south of Mill Road (near Morgan Road) to reduce impacts on wetland habitat.
- The alignment was shifted to the north to reduce impacts on habitat mature indigenous vegetation and Taraire, tawa, podocarp forest (WF9) (which is proximate to SNA within the Waikato jurisdiction).
- Placement of stormwater wetland towards eastern extent of proposed Mill Road Upgrade to reduce stream loss.

6 The Pukekohe Transport Network

The emerging preferred Pukekohe Transport Network is shown in Figure 6-1, which includes the following components:

- Drury West Arterial – NoR 1;
- Drury to Pukekohe Link - NoR 2
    - South Drury Connection;
    - SH22 Connection;
    - Drury-Paerata Link;
    - Paerata Arterial;
- Paerata Connections – NoR 3:
    - Paerata Rail Station Connection; and
    - Sim to Sim Connection;
- Pukekohe North-East Arterial – NoR 4;
- Pukekohe South-East Arterial – NoR 5;
- Pukekohe South-West Upgrade NoR 6;
- Pukekohe North-West Arterial NoR 7; and
- Mill Road and Pukekohe East Road Upgrade NoR 8 (AC and WDC).

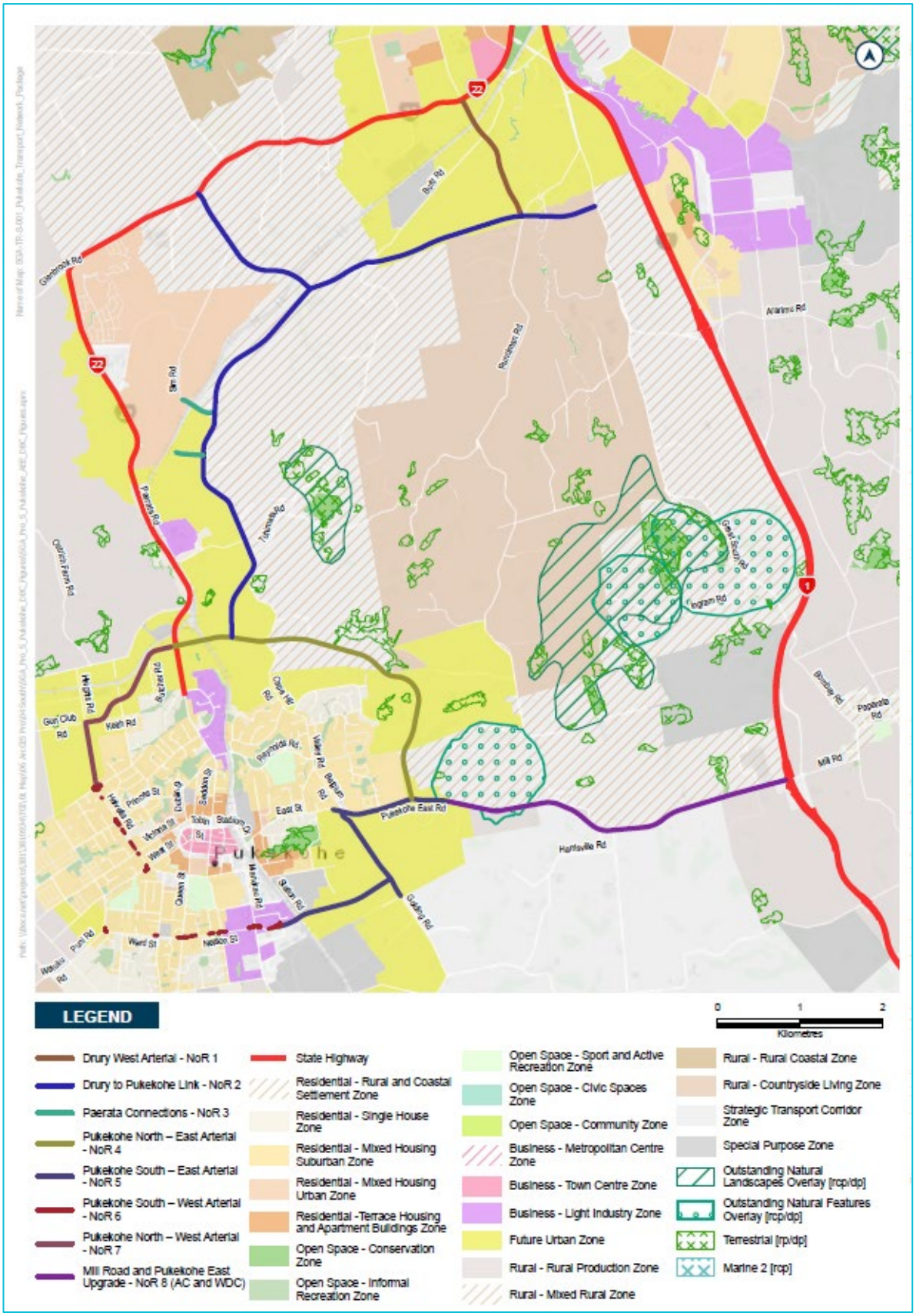


Figure 6-1: Pukekohe Transport Network

7 Alternative Statutory Methods

In accordance with section 171(1)(b) of the RMA, an evaluation of alternative methods was undertaken for Project. As part of the consideration of alternatives, the options for statutory approval that enable route protection and future implementation were considered in light of a number of contextual elements including project importance, urgency and complexity.

A range of RMA approval options were considered including:

- Designations;
- Resource consents;
- Landowner/developer negotiations;
- Plan changes (initiated or submitted on);
- Structure plans; and
- Traditional property acquisition.

Table 7-1 below summarises the strengths, weaknesses and suitability of each RMA approval option for the Project.

Table 7-1: Summary of possible RMA approval and consenting methods

Method	Summary of strengths and weaknesses within the Project context
Notices of requirements/ designations	A NoR(s) to designate land for a public work under the RMA provides a strong level of route protection. 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. If confirmed, the designation is included in the relevant district plan and provides certainty and visibility to the public about the intended land use, enabling informed development decisions. A designation maximises flexibility for future implementation, and also provides authorisation to undertake and maintain the works. It negates the need for additional land use consents to implement works authorised under the district plan provisions of the AUP:OP.
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 in a district plan and does not provide a method to protect the land not already under the ownership of a requiring authority. However, it can be advantageous to also seek resource consents (particularly for construction activities) under the RMA alongside other route protection methods in instances where projects are likely to proceed to construction once route protection is secured. Resource consents for regional matters will be sought at a later stage.
Landowner/developer negotiations	Landowner or developer negotiations were considered to enable the future implementation of the Pukekohe Transport Network. However, numerous owners are present within the area, and any route protection afforded by negotiations can be piecemeal if agreement cannot be reached with all parties. It is not compulsory for landowners or developers to enter into agreements, and it is likely to require significant time and resources to reach agreement, if this is possible at all.

Method	Summary of strengths and weaknesses within the Project context
Plan changes and/or structure plans	Providing for the Project through plan changes or by working with Council on structure plans was considered. However, the Pukekohe Transport Network area has two structure plans which have already been prepared. Structure Plans are not considered an appropriate mechanism to rely upon for route protection as they do not provide enough certainty in protection of privately-owned land, and they have no formal statutory weighting. A new plan change is not considered an appropriate mechanism to implement the network because the land surrounding portions of the network are already zoned for future development, are precincts or have established development.
Traditional property acquisition	Traditional property acquisition is not appropriate for the Pukekohe Transport Network because property is typically purchased closer to construction when detailed design is available. Purchasing land ahead of detailed design may result in too much or too little land being acquired which would need to be corrected at construction, or otherwise the design may have to be compromised. Traditional acquisition would also not protect temporary construction areas or provide route protection until following acquisition, leaving routes with multiple owners vulnerable to buildout in the interim.

Of the identified methods short term designations, legislation/ statutory document changes and resource consents were not considered appropriate methods for the Pukekohe Transport Network from the outset because they would not offer the appropriate long-term protection of land required to implement the Projects.

Designations were considered to be the most logical and effective method to protect the transport network in an evolving environment for the following reasons:

- A designation provides certainty to all parties including the community and affected landowners;
- It is a well-recognised and understood tool for route protection which also enables land acquisition processes through the link to the Public Works Act 1981;
- A designation maximises flexibility for future implementation;
- It negates the need for additional land use consents to implement works authorised under the district plan (s 9(3) of the RMA); and
- It will continually provide for future operation and maintenance requirements.