

South FTN and Key Connections

Appendix B - Climate Change Assessment

November 2023

Version 1.1

Document Status

Responsibility	Name
Author	
Reviewer	
Approver	

Revision Status

Version	Date	Reason for Issue
0.1	01/06/23	Interim issue for SME review
1.0	23/06/23	Issue for IQA
1.1	9/11/23	Final

Table of Contents

1	Introduction.....	4
1.1	Purpose.....	4
1.2	Scope of assessment	4
2	Intervention Framework Methodology	6
2.2	Te Tupu Ngātahi Intervention Framework	6
3	Summary of Climate Change Response.....	8
4	Interventions, Recommendations and Actions	8
4.1	Great South Road FTN	8
4.1.1	Can the project be eliminated?	9
4.1.2	Can GHG emissions be reduced?	10
4.1.3	Can the project be optimised?	11
4.2	Takaanini FTN	12
4.2.1	Can the project be eliminated?	13
4.2.2	Can GHG emissions be reduced?	14
4.2.3	Can the project be optimised?	15
4.3	Popes Road Upgrade	15
4.3.1	Can the project be eliminated?	16
4.3.2	Can GHG emissions be reduced?	16
4.3.3	Can the project be optimised?	17
4.4	Croskery Road Upgrade.....	17
4.4.1	Can the project be eliminated?	18
4.4.2	Can GHG emissions be reduced?	18
4.4.3	Can the project be optimised?	19
4.5	Great South Road between Waihoehoe Road and Drury Interchange	19
4.5.1	Can the project be eliminated?	20
4.5.2	Can GHG emissions be reduced?	20
4.5.3	Can the project be optimised?	21
4.6	DBC response to climate change	21

1 Introduction

New Zealand has made international commitments to reduce GHG emissions, which the Climate Change Response (Zero Carbon) Amendment Act 2019 directly respond to. These commitments (and the need for climate action) are driving changes to the social, political, and legislative environment. Transport emissions are a key focus of New Zealand's climate response and the legislation and policy on Greenhouse Gas (GHG) emissions and targets are continuing to evolve.

With a role in development of future infrastructure in Tamaki Makaurau, Te Tupu Ngātahi Supporting Growth has a role in influencing future vehicle kilometres travelled (VKT). Te Tupu Ngātahi is responding to the dual challenges of growth and VKT reduction by encouraging mode shift through each stage of its development processes.

1.1 Purpose

This report is not an assessment of the climate change merits or challenges of growth itself. It instead considers that should the growth occur then what could be done to respond to greenfield growth in a sustainable manner e.g., enable urban residents to make travel behaviour decisions that support better climate change outcomes.

This report documents the climate change considerations made as a part of the preparation of the South FTN¹ and Key Connections Detailed Business Case (DBC). It reassesses the recommended option within the Indicative Business Case (IBC) undertaken in 2018 to respond to changes that have occurred since i.e. policy changes. It details where specific GHG reduction interventions or considerations have been made following the approach and methodology developed by Te Tupu Ngātahi. This includes:

- How the intervention framework (further detailed below) and methodology has been applied.
- Actions and recommendations identified from the initial climate change assessment.
- How the recommendations have been addressed by the DBC.
- Identification of considerations for future phases of the projects.

Following on from the DBC, Notice of Requirements (NoRs) will be lodged for route protection and a more detailed assessment of effects will be undertaken.

1.2 Scope of assessment

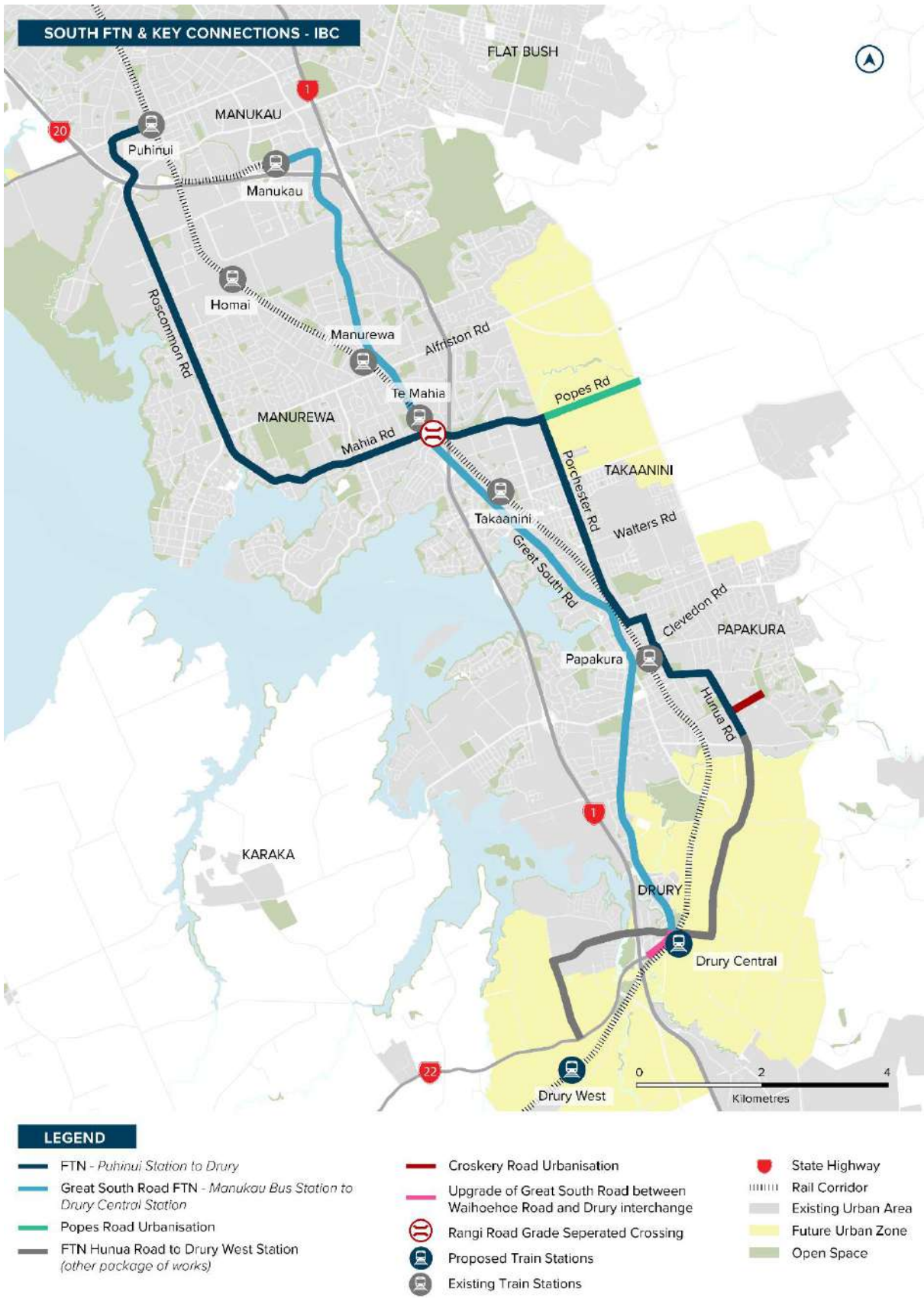
The scope of the DBC includes the following and are as shown in **Figure 1-1**:

- Great South Road (GSR) FTN
- Takaanini FTN
- Upgrades to Popes Road
- Upgrades to Croskery Road
- Upgrades to Great South Road between Waihoehoe Road and Drury interchange

¹ Frequent Transit Network

Figure 1-1 shows the IBC recommended option for the FTN DBC scope of works.

Figure 1-1 : Takaanini FTN IBC recommended option



2 Intervention Framework Methodology

Three broad categorisations of GHG emissions (“carbon”) are being considered in this assessment:

1. **Embodied carbon:** The quantum of carbon from the creation, movement and installation of construction materials. Construction carbon emissions can be measured using emissions factors which translate material quantities into tCO₂e, e.g. tonnes of concrete used into tonnes of carbon dioxide equivalent. The Waka Kotahi Beta Preliminary Emissions Estimation Tool (PEET) is being used to consider construction (including embodied) emissions through the DBC and Notices of Requirement (NoRs) processes.
2. **Enabled carbon:** The carbon released from the ongoing operation of the asset which in this case the use of the local and strategic transport network. Te Tupu Ngātahi uses the Waka Kotahi Vehicle Emissions Prediction Model (VEPM) modelling to consider enabled emissions through Vehicle Kilometres Travelled (VKT).

2.2 Te Tupu Ngātahi Intervention Framework

Te Tupu Ngātahi has developed an intervention framework (mechanisms & tools) for considering climate change at different stages of the route protection process. The intervention framework forms the basis to interrogate and evaluate the planned networks to identify opportunities for emissions reduction – primarily at the route protection stage that is the focus of the Te Tupu Ngātahi programme. It is a best practice approach to develop confidence that opportunities have been maximised to reduce GHG emissions for whole of life emissions (which include emissions associated with the construction of the infrastructure, and with its use, and eventual disposal).

Our intervention approach for considering and responding to climate change at different stages of the business case and route protection process is focused on an ***Eliminate – Reduce – Optimise*** intervention framework as shown in **Figure 2-1**.

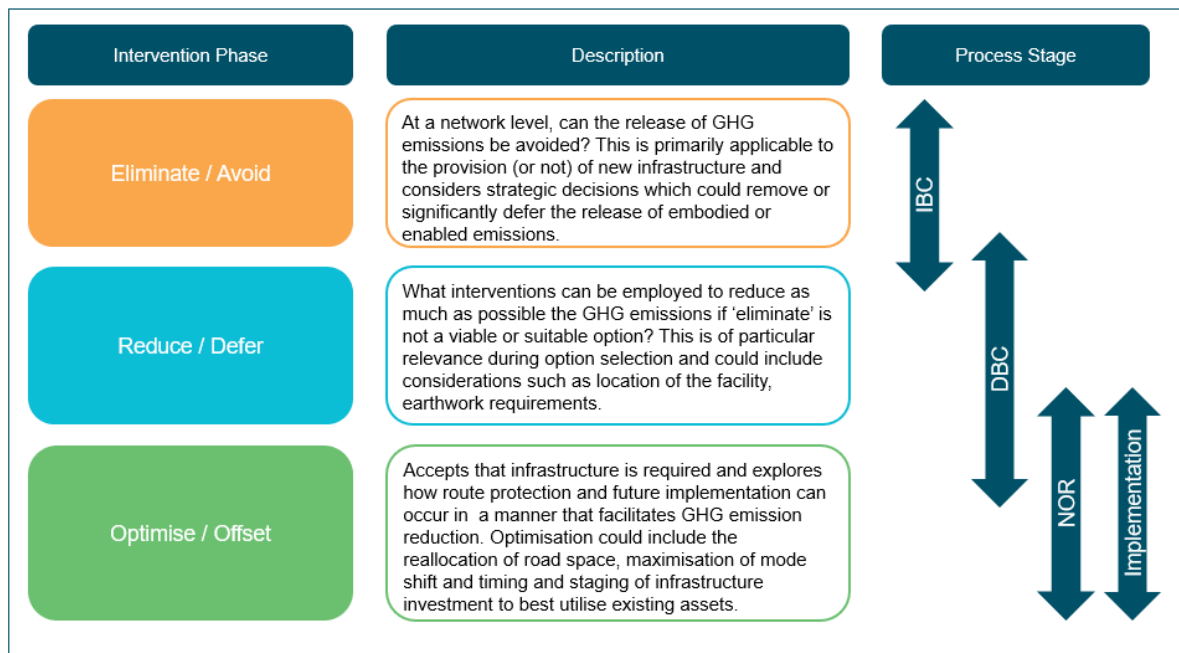
This framework is a hierarchical approach that increases in detail and focus as the programme progresses. It aligns with the Avoid – Shift – Improve (ASI) methodology regularly used in transportation planning² and in global carbon management specifications such as PAS 2080:2016³.

The ability to influence carbon emissions changes as projects move from Indicative Business Case (IBC) to Detailed Business Case (DBC) and Notice of Requirement (NoR) or Implementation design. As such, the assessment is reconsidered at each stage to ensure climate change aspects and perspectives are covered.

² Example: Waka Kotahi [Whakarāpopoto a Aotearoa](#) (national summary), page 10.

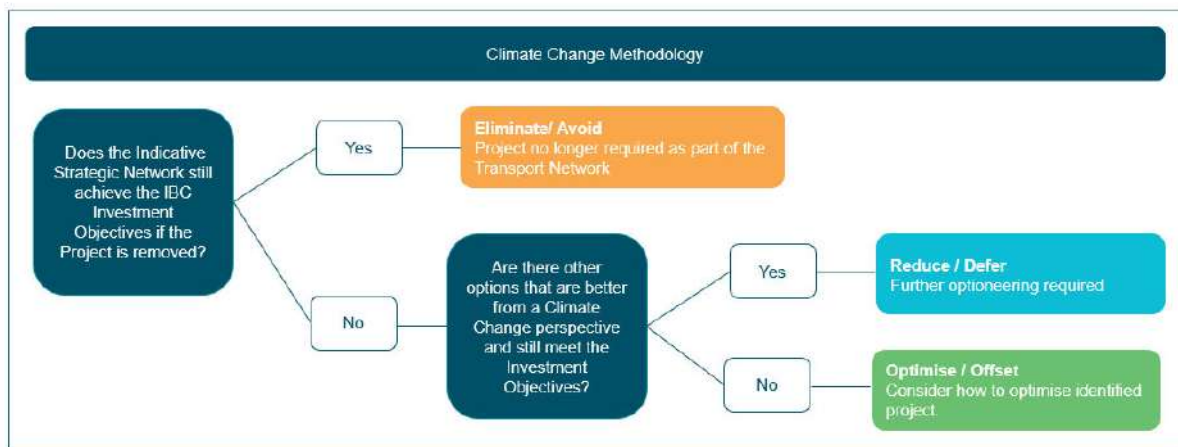
³ PAS 2080:2016 Carbon Management in Infrastructure (UK).

Figure 2-1 Eliminate - Reduce - Optimise Intervention Framework



The intervention framework requires considering embodied and enabled carbon in both an integrated and sequential way. The assessment explores the practical interventions as they apply to the whole of life emissions at each stage of infrastructure development decisions from both a network and project view. The decision-making process is shown in **Figure 2-2** below.

Figure 2-2 Decision making process



The following steps have been taken to consider climate change in this DBC:

- DBC addressed the outcomes of the climate change assessment in the development of the recommended transport network.
- Identification of climate change interventions to be considered further during future implementation stages.

It is noted that Waka Kotahi Project Emissions Estimation Tool (PEET) has not been used as part of the DBC. This is primarily due to the route protection nature of this DBC and the level of design that has been undertaken to understand the amount of land that would be required to support a future

project. In addition, much of the optioneering is for the DBC is for existing roads and a PEET estimate would be unlikely to differentiate the options given the project is focused on upgrades and widening. However, the principles of the PEET tool have been considered as part of the optioneering and MCA processes and includes consideration such as reduced cross sections and length of new roads. It is expected that as design progresses in the future, a more detailed assessment of emission sources would be undertaken.

3 Summary of Climate Change Response

The projects were considered against all three elements of the Eliminate – Reduce – Optimise framework and a summary of the resulting applicable responses are shown below. The following is noted:

- All projects were considered for elimination at a high level, none were identified to be eliminated as they are an integral part of the transport network, and their elimination will be counter-intuitive to climate change outcomes.
- All projects had opportunities to use the optioneering process to consider reduction of GHG emissions.
- All projects were identified to consider further climate change optimisation of the project.

Project	Consider Elimination?	Consider Reduction?	Consider Optimisation?
Great South Road FTN		✓	✓
Takaanini FTN		✓	✓
Popes Road		✓	✓
Croskery Road		✓	✓

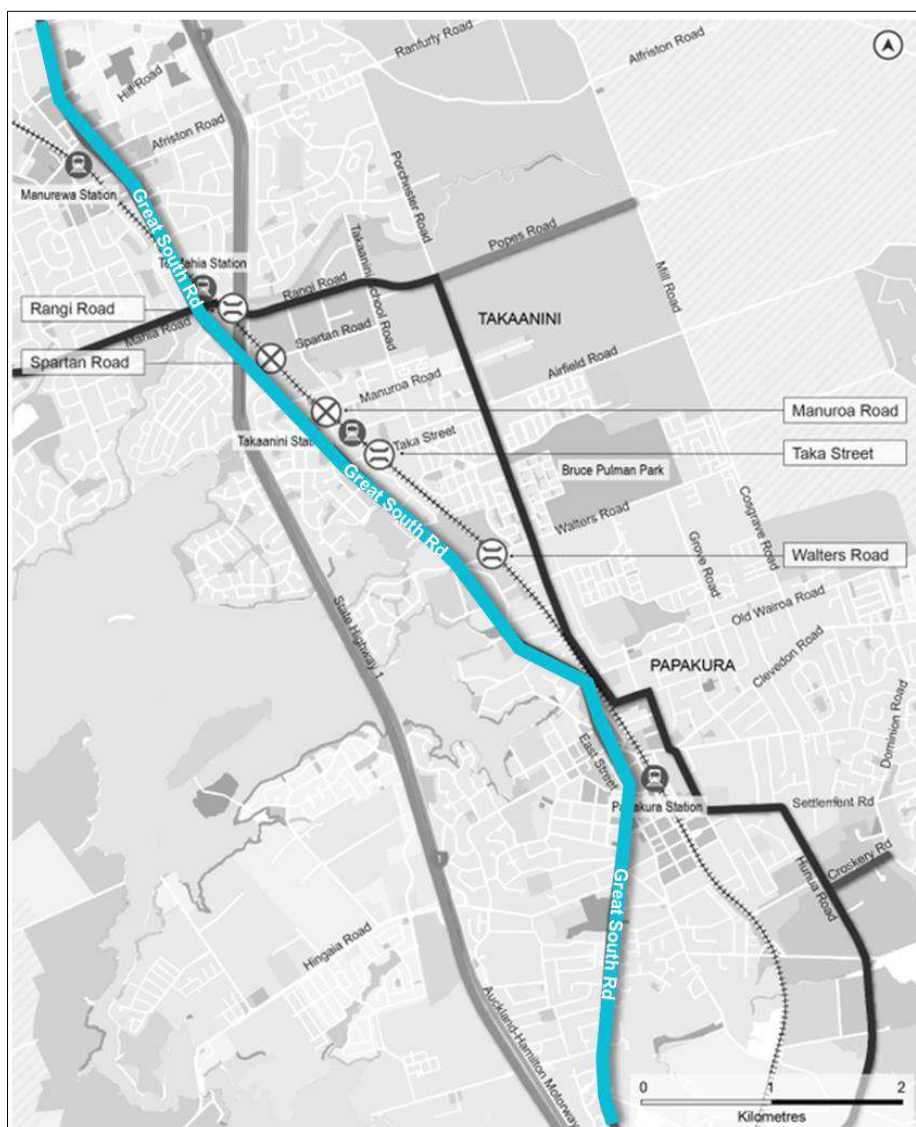
A full summary of climate change considerations is included in the following sections.

4 Interventions, Recommendations and Actions

The DBC considered climate change impact throughout the optioneering process which is discussed in the following sections. Refer to the DBC for more information about the detailed optioneering process.

4.1 Great South Road FTN

This is an end-to-end FTN between Drury Central Station and Manukau Bus Station. An existing FTN service (Route 33) runs from Otahuhu Station through to Papakura Station which covers the section between Manukau Station through to Papakura Station considered within the DBC.



4.1.1 Can the project be eliminated?

Over 75% of residents in the South currently drive to work. Public transport uptake is low with the 2018 Census Journey to Work data indicating a mode share of 11% and 12% for residents in Papakura and Takaanini respectively.

One of the key driving factors is the lack of access to the public transport network especially areas that are not serviced by the rail network. Currently, there is only one FTN, Route 33, available in the South which terminates at Papakura. All other bus services are either local or on-demand which are less attractive as they are less frequent, therefore, less convenient. Thus, without any planned measures in the future to serve the large growth area in Drury, there will be a continued reliance on private vehicles. Furthermore, intensification under the MDRS and Plan Change 78 will ultimately generate more trips and the provision for public transport will be key to drive mode shift in the right direction.

Whilst the Great South Road FTN competes with the rail service, they serve different functions. The FTN is there to support the rail, serving those that are not directly within the walkable catchment of the rail stations. It also caters for short distance trips and is an alternative should there be an incident

or event resulting in the rail network becoming inoperable. Therefore, it provides additional public transport network resilience and improves travel choice for the surrounding residents.

The embodied carbon investment to provide for a high-quality FTN i.e., through bus priority amongst other upgrades directly responds to the emission reduction plan. Thus, a benefit in mode shift and in reducing enabled GHG emissions.

Therefore, the project is critical in supporting overall mode shift and climate change response and cannot be eliminated.

4.1.2 Can GHG emissions be reduced?

The reduction opportunities identified and how the DBC progressed these climate change reduction opportunities are shown in **Table 4-1**.

Table 4-1 : Identified GHG Reduction Opportunities for GSR FTN

Reduction opportunity	DBC Response
Is there an alternative solution?	As the corridor exists, already runs FTN services, and is one of the few north-south corridors in the south it is not considered there are alternative options to better support climate emission reduction outcomes.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement options assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied emissions and balancing any required earthworks.	- The DBC identified Great South Road being within an existing constrained brownfield site. Thus, a constrained four lane cross section with separated active facilities and bus lanes in each direction was considered where there was insufficient road space to minimise embodied emissions. - In addition, the corridor was sectioned and optioneered to further maximise climate change outcomes. In a broad sense, the assessment considered four approaches to meet the project objectives: <u>Approach A</u>: Prioritise a transport mode (e.g. full bus lanes or active mode improvements but not both). <u>Approach B</u>: Remove an element from cross-section (e.g. bus lanes in one direction only) <u>Approach C</u>: Existing Road reserve already sufficient to accommodate all desired cross section elements (i.e. >26.5m) <u>Approach D</u>: Applying the desired form and function cross-section. Section 1a, 1b: Manakau Station Road and GSR to Browns Road. It was identified this section is sufficiently wide to accommodate the desired cross-section. This will require reconstruction of kerbs and channel, thus likely to trigger stormwater treatment in the form of wetlands. There are existing active mode facilities in the form of separated shared paths along this section of the corridor as well as four lanes in both directions. Hence, the retention of the shared paths in Section 1B and reconfiguring the kerbside lanes to bus lanes will

Reduction opportunity	DBC Response
	minimise construction impacts and will greatly reduce enabled and embodied emissions. Although this does not provide the best transport outcome, it is considered a balanced approach that minimises the impacts and still meet project objectives and climate change outcomes. • Section 1c: Browns Road to Weymouth Road (Manurewa Town Centre excluded). The existing corridor is constrained and would require widening to achieve the optimal outcome impacting properties on both sides. The DBC explored the different approaches with Approach B being the recommended option. This will provide a northbound bus lane with separated active mode facilities. It is anticipated to meet the investment objectives without the anticipated impacts of other approaches including that of embodied emissions. • Section 2: Weymouth Road to Mahia Road. Similar to Section 1c, the existing corridor is constrained and the different approaches were explored. Similar to Section 1c, the recommended approach was Approach B as it will meet the investment objective without the intended impacts including that of embodied emissions. • Section 3 -Mahia Road to Takaanini Station and Section 4- Takaanini Station to Subway Road. The road reserve in both sections is sufficiently wide to provide for the proposed 30m cross-section. However, applying this would result in significant impacts due to batters and tie-in works. Thus, to reduce embodied emissions, a reduced cross -section of 26.5m (Approach C) was recommended. • Section 5 – Wellington Street to Waihoehoe Road. Similar to Section 1c and 2, there are constrained parts of the corridor where widening will be required that will result in significant impacts. The recommended approach is Approach B with northbound bus lanes and separated active modes. This will reduce embodied emissions and achieve the outcomes sought.

The main reduction opportunity is in balancing the impacts and the outcome sought. This has been addressed through the optioneering process in the DBC.

4.1.3 Can the project be optimised?

The main opportunities identified for further optimisation were associated with maximising mode shift as detailed in Table 4-2.

Table 4-2 Optimisation actions identified

Optimisation action	Description and climate change outcomes
Quality and frequency of the bus services	• Consider increasing the frequency along the route as growth occurs to improve the overall accessibility and attractiveness of public transport. This will positively impact enabled emissions.
Facility design and location	• Strategically locate bus stops to allow easy transfer between bus and rail to further promote mode shift.

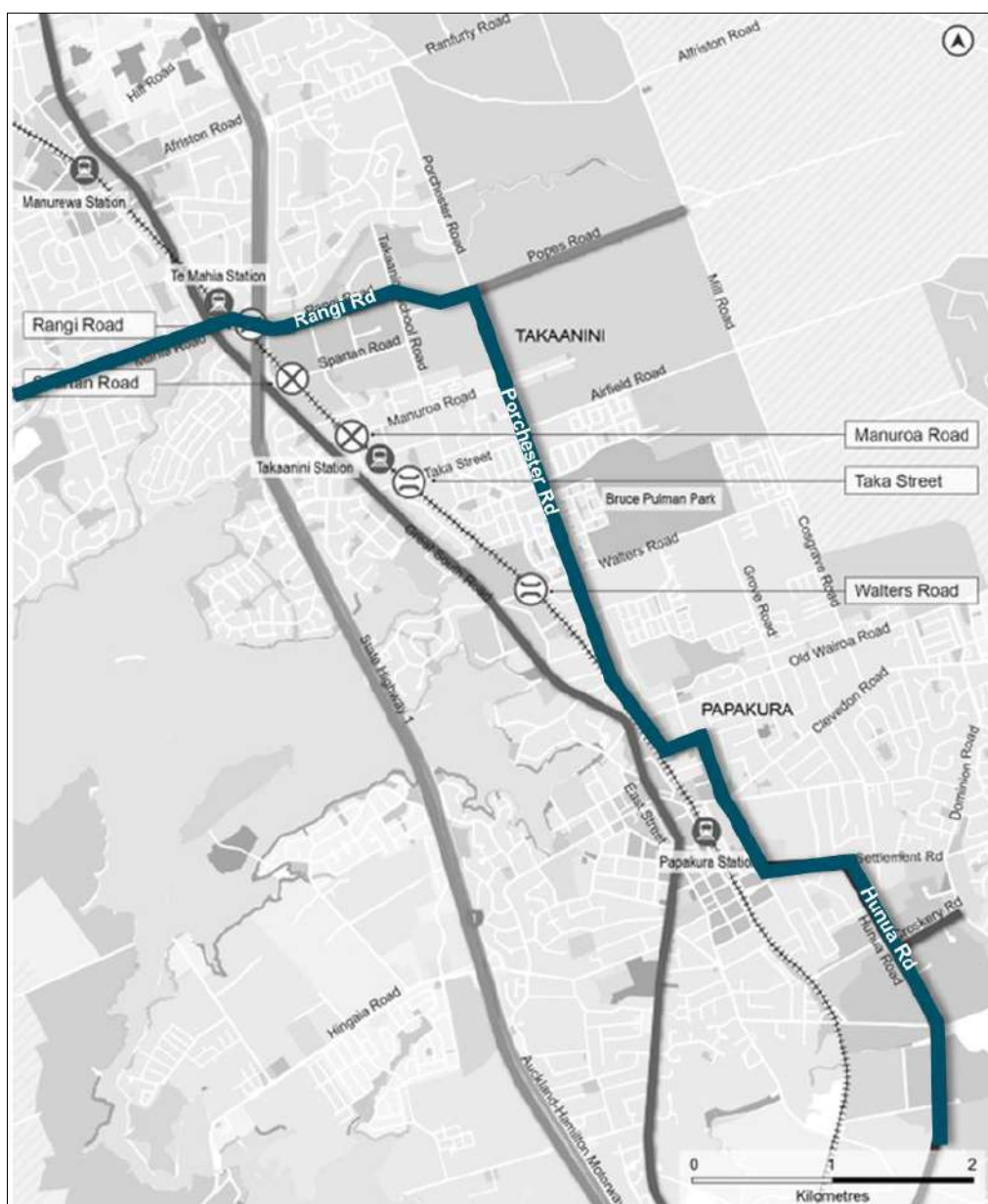
Optimisation action	Description and climate change outcomes
	• Safety measures such as midblock pedestrian crossings should be considered at later stages to facilitate safe crossings. • Provision of active mode network connections between the frequent transit network and the rapid transit network allowing a seamless transfer. This would improve the attractiveness for mode share and positively influence enabled emissions.
Timing for implementation	• The project looks at providing for the long-term growth however, given the brownfield nature of the corridor, the problems identified such as, over-reliance on private vehicles, lack of access to a high-quality PT and poor PT reliability exists today. If Connected Communities, which looks at providing an interim short-term solution does not proceed, the implementation timing for the project could be bought forward. This will enable mode shift to occur in the right direction and have a positive influence on enabled emissions.

The main optimisation actions identified include the timing for implementation and quality and frequency of the bus service and facility.

4.2 Takaanini FTN

This service runs between Drury West Station and Manukau Bus Station⁴. The section between Drury to Papakura was developed under a separate DBC thus, the DBC continues from Papakura. This will be a new FTN service intended to cater for the new Takaanini including the future growth areas which is currently serviced by local and on-demand services.

⁴ Note this was previously to Puhinui Station as per the IBC instead of to Manakau Bus Station. Changes since the IBC can be found within the main DBC document.



4.2.1 Can the project be eliminated?

As noted in **Section 4.1.1**, current public transport uptake is low and there is limited access to the public transport network especially east of the rail network. This area includes the new Takaanini FUZ which is currently served by local connectors and on-demand services. Without any planned public transport and active mode improvements, ridership and mode shift will remain low as there is a continued reliance on private vehicles.

The embodied carbon investment to provide for a high-quality FTN i.e through bus priority and active mode upgrades directly responds to emission reduction. Thus, benefit in mode shift and in reducing enabled GHG emissions.

Therefore, the project is critical in supporting overall mode shift and climate change response and cannot be eliminated.

4.2.2 Can GHG emissions be reduced?

The reduction opportunities identified and how the DBC progressed these climate change reduction opportunities are shown in **Table 4-3**.

Table 4-3 :Identified GHG Reduction Opportunities for Takaanini FTN

Reduction opportunity	DBC Response
Is there an alternative solution?	There are no other FTN corridors currently planned within the area. The closest will be the Great South Road FTN and the rail which is well outside of the walking distance for the area. Thus, it is considered there are no other alternatives to better support climate change reduction outcomes.
Corridor optioneering	- The corridor optioneering for the DBC re-evaluated the IBC recommended option. This considered maximising the catchment area which will have a greater influence on mode shift and consequently emission reduction. Thus, the DBC recommended option considered the east-west crossing across Alfriston Road to connect to the Manurewa Station which will reduce the need for a new Rangi Road viaduct. This will reduce both enabled and embodied carbon. The corridor considered going down Grove Road instead of Porchester Road to reduce the catchment overlap of the PT network. Therefore, increasing greater coverage and uptake. - In addition, a new north-south connection through the Takaanini FUZ area was considered during the optioneering process. However, given the uncertainty of the Takaanini FUZ as well as construction complexities given the ground conditions it was considered the use of existing roads will be more beneficial. This will support the existing community even if development does not occur allowing positive mode share to happen and it reduces the embodied carbon during construction. Thus, better support emission reduction.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement options assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied emissions and balancing any required earthworks.	- The DBC identified areas along the proposed corridor being within existing constrained brownfield areas. Thus, in these areas, a constrained four lane cross section or two-lane cross section was considered to minimise embodied emissions. - The section of Alfriston Road was further optioneered given the anticipated impact with the proposed cross section including embodied emissions. The assessment recommended to reduce the cross-section to an eastbound bus lane between Magic Way and Porchester Road as the additional westbound bus lane would provide limited uplift in benefits including mode share benefits but with significant impacts. The remainder of the Alfriston Road will be four lanes with bus lanes in each direction and separated active mode facilities. Although this will have significant impacts, this section serves a high number of buses and without the facilities, the quality of service will reduce discouraging public transport uptake. Thus, negatively influence enabled emissions.

The main reduction opportunity is in balancing the impacts and the outcome sought. This has been addressed through the optioneering process in the DBC.

4.2.3 Can the project be optimised?

The main opportunities identified for further optimisation were associated with maximising mode shift as detailed in **Table 4-4**.

Table 4-4 Optimisation actions identified

Optimisation action	Description and climate change outcomes
Quality and frequency of the bus services	Consider increasing the frequency along the route as growth occurs to improve the overall accessibility and attractiveness of public transport. This will positively impact enabled emissions.
Facility design and location	Safety measures such as midblock pedestrian crossings should be considered at later stages to facilitate safe crossings between bus stops.
Timing for implementation	The timing of the project could be reconsidered and respond to if and when the growth and development occurs. This could enable mode shift in the right direction. This should be balanced with delays in construction where lower emission materials and/or fuels are available which leads to a reduction in embodied emissions.

The main optimisation actions identified include the timing for implementation and quality and frequency of the bus service and facility.

4.3 Popes Road Upgrade

This is currently a two-lane corridor with an existing speed limit of 60km/hr within a rural environment. With the corridor between Porchester Road and Mill Road situated within the Takaanini FUZ area, it is proposed to upgrade the existing road to suit the future urban environment and provide active mode upgrades.



4.3.1 Can the project be eliminated?

If this project is eliminated, then there will be a gap in the active mode network connection from the FUZ through to the wider transport network reducing accessibility by active modes. Therefore, the project will support mode shift and climate change outcomes and cannot be eliminated.

Therefore, the project is critical in supporting overall mode shift and climate change response and cannot be eliminated.

4.3.2 Can GHG emissions be reduced?

The reduction opportunities identified and how the DBC progressed these climate change reduction opportunities are shown in Table 4-5.

Table 4-5 :Identified GHG Reduction Opportunities for Popes Road

Reduction opportunity	DBC Response
Is there an alternative solution?	As the corridor exists and the scope of the project is about providing for the future form with active mode facilities rather than for vehicle capacity, it is considered there are no other alternative options to support climate emission reduction outcomes.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement options assessment with respect	- The route refinement process confirmed that in the FUZ land use, the full width of the two-lane corridor would be sought to provide for the future growth. - Consideration was given to a constrained two-lane cross section to minimise the embodied carbon, however the stormwater treatment required meant widening will be required regardless. Although, this

Reduction opportunity	DBC Response
to reduced cross sections, retention of existing carriageway to minimise new embodied emissions and balancing any required earthworks.	means additional embodied carbon, however given this is a route protection business case, during detailed design this could be investigated further to reduce the embodied carbon.

4.3.3 Can the project be optimised?

The main opportunities identified for further optimisation were associated with maximising mode shift as detailed in Table 4-6.

Table 4-6 Optimisation actions identified

Optimisation action	Description and climate change outcomes
Intersection/ mid-block efficiency	Consider during detailed/implementation design how to maximise safety and active mode connections along Popes Road. This will have a positive effect on mode shift and associated emission reduction.
Timing for implementation	The timing of the project could be reconsidered and respond to if and when the growth and development occurs. This could enable mode shift in the right direction. This should be balanced with delays in construction where lower emission materials and/or fuels are available which leads to a reduction in embodied emissions.

4.4 Croskery Road Upgrade

Croskery Road is an existing two-lane collector road situated within the industrial area. As the area develops and Hunua Road becomes a key strategic corridor, Croskery Road serves as a key east-west corridor. It has also been identified as a key cycle/ micromobility connection and identified as a key route within the Drury-Opaheke structure plan.



4.4.1 Can the project be eliminated?

If this project is eliminated, then there will be a gap in the active mode network connection reducing accessibility by active modes. Therefore, the project will support mode shift and climate change outcomes and cannot be eliminated.

Therefore, the project is critical in supporting overall mode shift and climate change response and cannot be eliminated.

4.4.2 Can GHG emissions be reduced?

The reduction opportunities identified and how the DBC progressed these climate change reduction opportunities are shown in **Table 4-7**.

Table 4-7 :Identified GHG Reduction Opportunities for Croskery Road

Reduction opportunity	DBC Response
Is there an alternative solution?	As the corridor exists and the scope of the project is about providing for the future form with active mode facilities rather than for vehicle capacity, it is considered there are no other alternative options to support climate emission reduction outcomes.
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement	As the area is well built-up, an optimised two-lane cross section that narrowed the kerb line to enable walking and cycling facilities to be built on both sides of the road. This will reduce the construction embodied emissions.

Reduction opportunity	DBC Response
options assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied emissions and balancing any required earthworks.	

4.4.3 Can the project be optimised?

The main opportunities identified for further optimisation were associated with maximising mode shift as detailed in Table 4-6.

Table 4-8 Optimisation actions identified

Optimisation action	Description and climate change outcomes
Intersection/ mid-block efficiency	Consider during detailed/implementation design how to maximise safety and active mode connections along Croskery Road. This will have a positive effect on mode shift and associated emission reduction.
Timing for implementation	The timing of the project could be reconsidered and respond to if and when the growth and development occurs. This could enable mode shift in the right direction. This should be balanced with delays in construction where lower emission materials and/or fuels are available which leads to a reduction in embodied emissions.

4.5 Great South Road between Waihoehoe Road and Drury Interchange

This is an existing two-lane corridor with a speed limit of 50km/hr. It interfaces with several adjoining projects including the Drury Central Station and the upgrade of the Waihoehoe Road intersection. It is an important connection as it provides direct access onto State Highway 1. It is proposed to upgrade this section of road to a four-lane corridor with active mode facilities.



4.5.1 Can the project be eliminated?

If this project is eliminated, then there will be a gap in the active mode network from the Drury interchange to the Waihoehoe Road intersection and limited access to the Drury Central station. If left as a two-lane corridor, this may create a bottleneck and impact the state highway and potentially increase enabled emissions as congestion increases.

Therefore, the project will support mode shift and climate change outcomes and cannot be eliminated.

Therefore, the project is critical in supporting overall mode shift and climate change response and cannot be eliminated.

4.5.2 Can GHG emissions be reduced?

The reduction opportunities identified and how the DBC progressed these climate change reduction opportunities are shown in **Table 4-9**.

Table 4-9 :Identified GHG Reduction Opportunities for Croskery Road

Reduction opportunity	DBC Response
Is there an alternative solution?	As the corridor exists and the scope of the project is about providing for the future form with active mode facilities and improving access to the proposed Drury Central station via active modes, it is considered there are no other alternative options to support climate emission reduction outcomes.

Reduction opportunity	DBC Response
Route refinement An opportunity was identified to consider incorporating a climate lens into the route refinement options assessment with respect to reduced cross sections, retention of existing carriageway to minimise new embodied emissions and balancing any required earthworks.	Consideration was given to a constrained four-lane cross section to minimise the embodied carbon. Given this is a route protection business case, during detailed design this could be investigated further to reduce the embodied carbon.

4.5.3 Can the project be optimised?

The main opportunities identified for further optimisation were associated with maximising mode shift as detailed in Table 4-10.

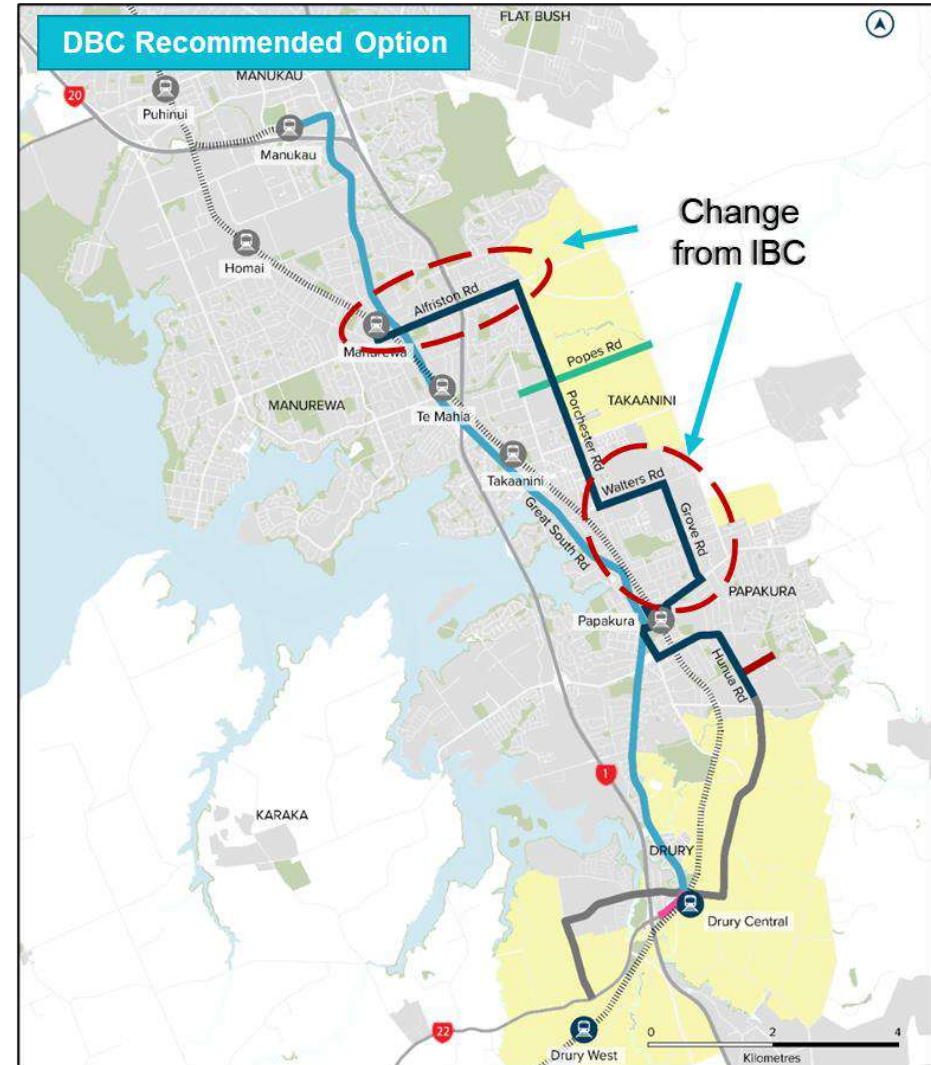
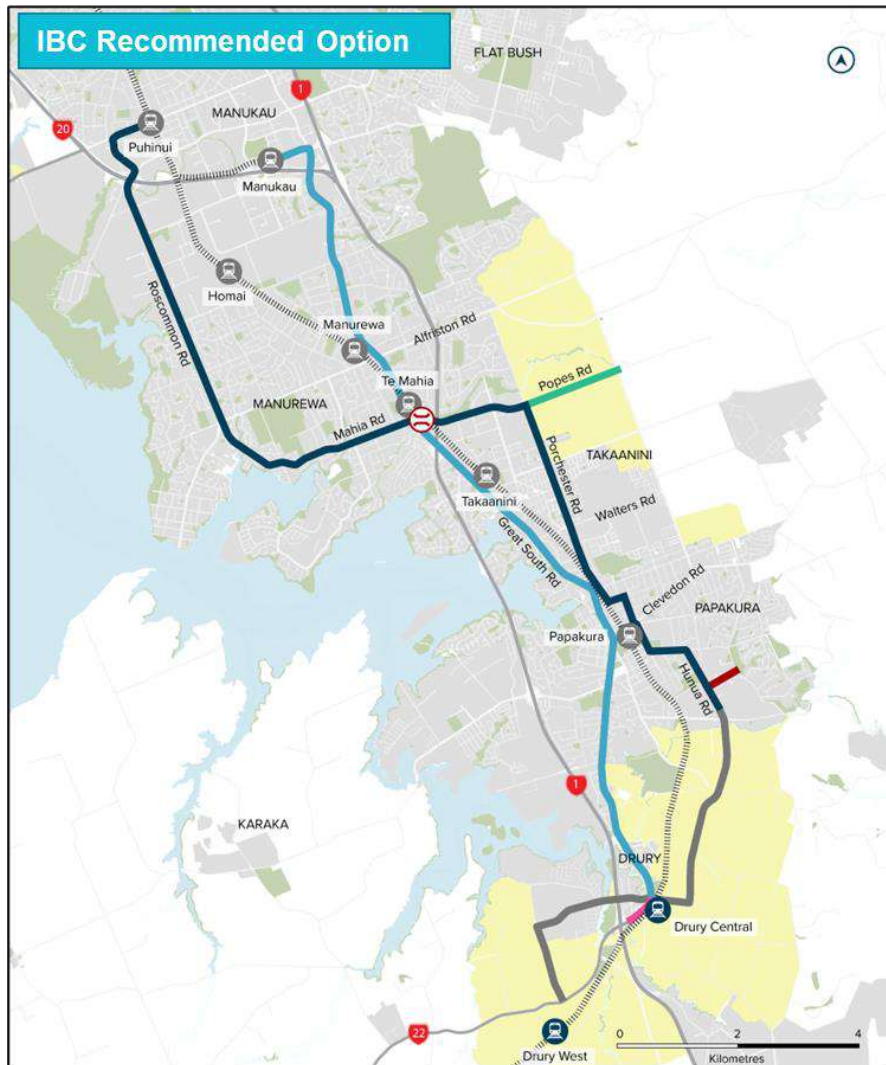
Table 4-10 Optimisation actions identified

Optimisation action	Description and climate change outcomes
Intersection/ mid-block efficiency	Consider during detailed/implementation design how to maximise safety and active mode connections along Great South Road. In addition, bus stop locations should be considered during the next phase as well to maximise connectivity to the Drury Central station. This will have a positive effect on mode shift and associated emission reduction.

4.6 DBC response to climate change

The DBC and IBC preferred option are shown in Figure 4-1. This reflects the change for the Takaanini FTN as part of the climate change response above. The other major consideration was in the route refinement process whereby the cross section was optimised to minimise the impacts and embodied emissions though still achieve the mode shift outcomes sought. This was particularly relevant through the brownfield areas i.e., along Great South Road.

Figure 4-1 : DBC and IBC Recommended Option



South FTN and Key Connections

Appendix C: Options Assessment Report

June 2023

Version 1.1

Document Status

Responsibility	Name
Author	██████████
Reviewer	██████████████████
Approver	██████████

Revision Status

Version	Date	Reason for Issue
1.0	23/6/2023	Issue for IQA review
1.1	1/11/2023	FINAL

Disclaimer

This is a draft document for review by specified persons at Auckland Transport and the New Zealand Transport Agency. This draft will subsequently be updated following consideration of the comments from the persons at Auckland Transport and the New Zealand Transport Agency. This document is therefore still in a draft form and is subject to change. The document should not be disclosed in response to requests under the Official Information Act 1982 or Local Government Official Information and Meetings Act 1987 without seeking legal advice.

Table of Contents

1	Introduction.....	4
1.1	The South FTN Project	4
1.2	Purpose and scope of this report.....	4
1.3	Report Structure.....	4
	PART A: WHOLE-OF-PROJECT CONSIDERATIONS	7
2	The business case process until now	7
2.1	Summary of the business case process	7
2.2	Relevant recommendations of the South IBC.....	7
3	Gap Analysis – what’s changed since the IBC?	11
4	General Methodology	14
4.1	Process Summary.....	14
4.1.1	Gap analysis and confirmation of DBC optioneering scope	15
4.1.2	Route optioneering	16
4.1.3	Form and Function Assessment	17
4.1.4	Location refinement.....	19
4.2	Corridor Segmentation	19
	PART B: GREAT SOUTH ROAD FTN	22
5	Gap Analysis and confirmation of optioneering scope.....	22
6	Form and Function	23
6.1	Corridor Form and Function	23
6.2	Intersection Assessment	26
7	Location Refinement	27
8	Preferred Option	28
	PART C: TAKAANINI FTN.....	30
9	Gap Analysis and confirmation of optioneering scope.....	30
9.1	Implications of the draft Future Development Strategy.....	31
10	Route Optioneering	32
10.1	Route Option Development.....	32
10.1.1	Longlist screening	32
10.1.2	Shortlisted options.....	34
10.2	Route Option Assessment	37
10.2.1	North-South options	37
10.2.2	East-West options	43
10.3	Preferred route	47
11	Form and Function	48
11.1	Corridor Form and Function	48
11.2	Intersection Assessment	49

12	Location Refinement	51
13	Preferred Option	52
PART D: COMPLEMENTARY CORRIDORS		54
14	Gap analysis and confirmation of optioneering scope	54
14.1	Implications of the draft Future Development Strategy.....	56
14.2	Implications of potential freight network changes.....	56
15	Form and Function	56
15.1	Corridor Form and Function	56
15.2	Intersection Assessment	57
16	Location Refinement	58
17	Preferred Options	59

1 Introduction

1.1 The South FTN Project

The South Frequent Transit Network (**FTN**) Project (**the Project**) is one of two long-term transport interventions (along with the Takaanini Level Crossings (**TLC**) Project) proposed for the area of South Auckland between Manukau and Drury as part of the Te Tupu Ngātahi Supporting Growth Programme (**Te Tupu Ngātahi**¹). These projects are part of a wider planned multi-modal transport network intended to support growth and enable mode shift in South Auckland. The wider strategic context for the identification of this network is covered in the main Detailed Business Case (**DBC**) document and in sections 2 and 3 of this report, and is not repeated here.

The Project proposes road upgrades intended to enable the operation of high-quality FTN² bus services along two routes – referred to as the Great South Road FTN, and the Takaanini FTN (see Figure 1-1). Improved active mode facilities are also proposed along both routes. In addition to the two FTN routes, the Project scope incorporates the urbanisation of three complementary (non-FTN) corridors – Popes Road, Croskery Road, and Great South Road to the south of Waihoehoe Road (see Figure 1-1). The total Project extent is over 32km in length.

1.2 Purpose and scope of this report

This report documents the optioneering process which has resulted in the recommended option for the Project identified in the DBC. This process has deductively assessed options in terms of:

- **Route optioneering** – that is, macro/network-level consideration of different route/alignment options for the Project;
- **Form and functional requirements** – which inform the physical extent of the corridors comprising the Project; and
- **Location refinement decisions** – that is, detailed consideration of how location choices (and resultant Project boundaries) may best reduce the adverse effects of the Project.

While the optioneering process documented in this report was undertaken specifically to inform the recommendations of the DBC, it has also been undertaken with a view to informing the consideration of alternative sites, routes, and methods for the Project under section 171(1)(b) of the Resource Management Act 1991 (**RMA**).

1.3 Report Structure

This report is divided into four parts (Parts A-D) to separate out optioneering considerations that are relevant to the whole of the Project (Part A) from the optioneering considerations relevant to each of the constituent routes (Part B for the Great South Road FTN, Part C for the Takaanini FTN, and Part D for the complementary corridors). Each part in turn comprises sections outlining the pertinent optioneering processes. This structure is summarised at Table 1-1 below.

¹ Te Tupu Ngātahi is a collaboration between Auckland Transport (**AT**) and Waka Kotahi NZ Transport Agency (**Waka Kotahi**) to investigate, plan, and undertake route protection for the strategic transport networks needed to support Auckland's growth over the next 30 years.

² FTN services are defined in AT's Regional Public Transport Plan (**RPTP**) as bus routes operating at least every 15 minutes between 7am-7pm every day, supported by priority measures.

Table 1-1 – Structure of this report

Part	Section	Matters covered
A – Whole-of-Project considerations	2	The business case process until now
	3	Gap Analysis
	4	General methodology
B – Great South Road FTN optioneering	5	Implications of the gap analysis
	6	Form and Function
	7	Route refinement
	8	Preferred option
C – Takaanini FTN optioneering	9	Implications of the gap analysis
	10	Corridor Assessment
	11	Form and Function
	12	Route refinement
	13	Preferred option
D – Complementary (non-FTN) corridors – Popes Road, Croskery Road, and Great South Road (Drury)	14	Implications of the gap analysis
	15	Form and Function
	16	Route refinement
	17	Preferred option

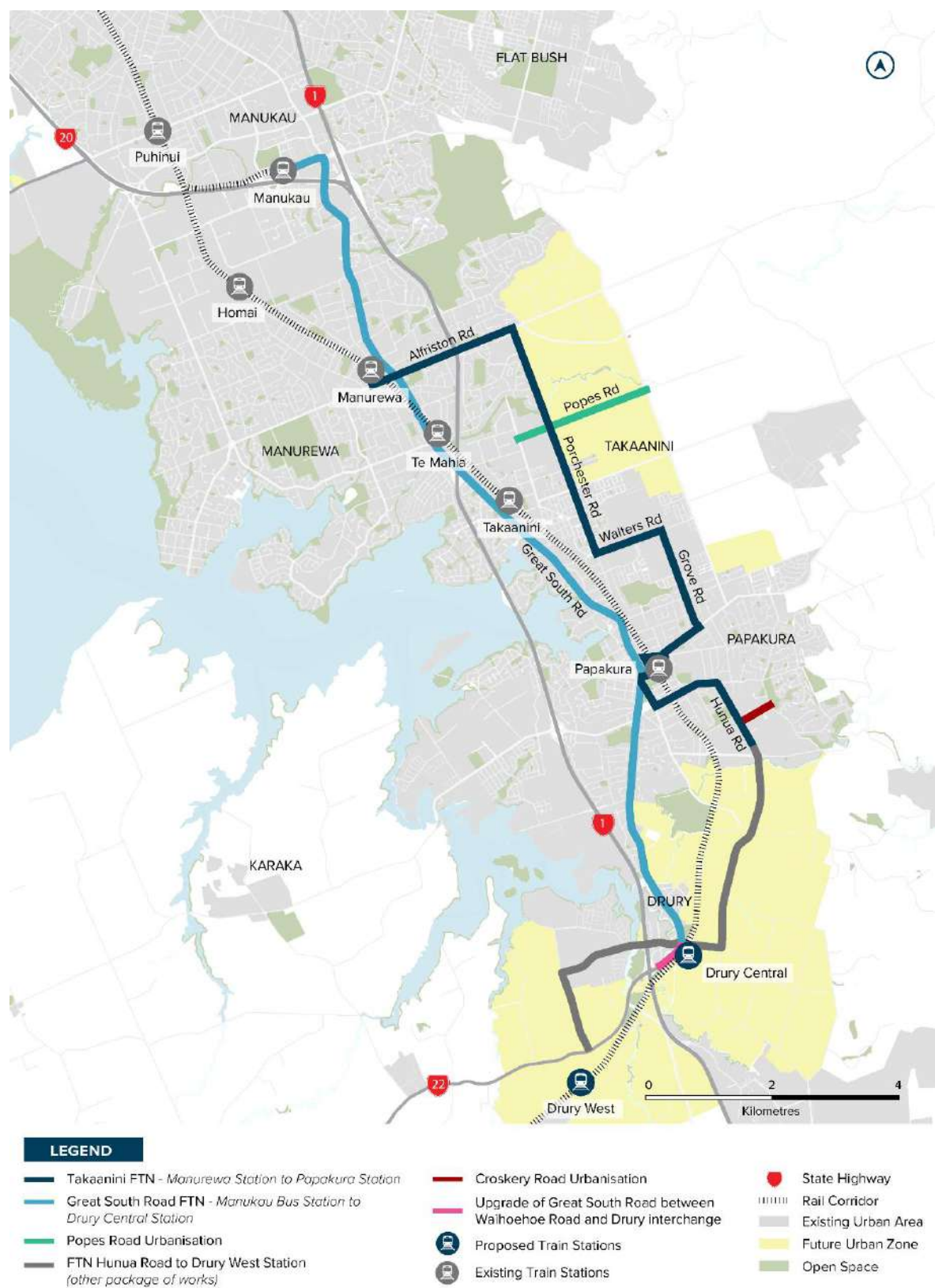


Figure 1-1 – South FTN Project Extent

PART A: WHOLE-OF-PROJECT CONSIDERATIONS

2 The business case process until now

2.1 Summary of the business case process

Optioneering has taken place through the following business case processes:

- A Programme Business Case (**PBC**) was completed in 2016 and identified a high-level draft preferred transport network across all of Auckland's growth areas;
- Four Indicative Business Cases (**IBC**) were completed in 2019 (for the Warkworth, Northern, North-Western, and the Southern growth areas), each identifying an Indicative Strategic Transport Network (**ISTN**) for each sub-region; and
- A total of nine Detailed Business Cases (**DBC**) are either complete or underway (including the South FTN DBC), each covering a package of projects derived from the wider ISTN.

The consideration of options becomes more detailed at each successive business case step – the initial focus is on identifying the networks at a high level, with focus subsequently narrowing to increasingly detailed project-specific considerations. The optioneering process documented in this report focuses on the DBC, which in turn used the South IBC as its starting point. The pertinent recommendations of the IBC are summarised in section 2.2.

2.2 Relevant recommendations of the South IBC

The initial IBC option longlist comprised some 484 network and corridor options for transport interventions for the entire Southern growth area. This was narrowed down to an amalgamated longlist of 151 options following a screening process, which were sorted according to relevant modes/intervention categories for shortlisting. The 'strategic connections' category included 'Mass Transit – Bus' options, intended to "provide access to and from areas not well serviced by the rail corridor... improve connecting public transport services to support rail... [and] provide high quality public transport directly into new urban areas"³.

Following multiple Multi-Criteria Assessments (**MCA**), the following four FTN options were included in the ISTN (see Figure 2-1):

- **Option MT3C** – FTN on Great South Road from Drury to Manukau;
- **Option MT4I** – FTN between Drury and Takaanini via Jesmond Road, Bremner Road, Waihoehoe Road, the proposed Ōpāheke North-South Arterial, Porchester Road, Popes Road, Rangī Road (subsequently crossing State Highway 1 (**SH1**) and the North Island Main Trunk (**NIMT**) to join option MT3C on Great South Road);
- **Option MT4K** – FTN between Drury and Puhinui via SH1 bus shoulders, Mahia Road, and Roscommon Road; and
- **Option MT4L** – Express bus transit between Drury and Manukau via SH1 bus shoulders, Orams Road, and Druces Road.

³ South IBC Appendix B – Options Assessment Report, p. 223.

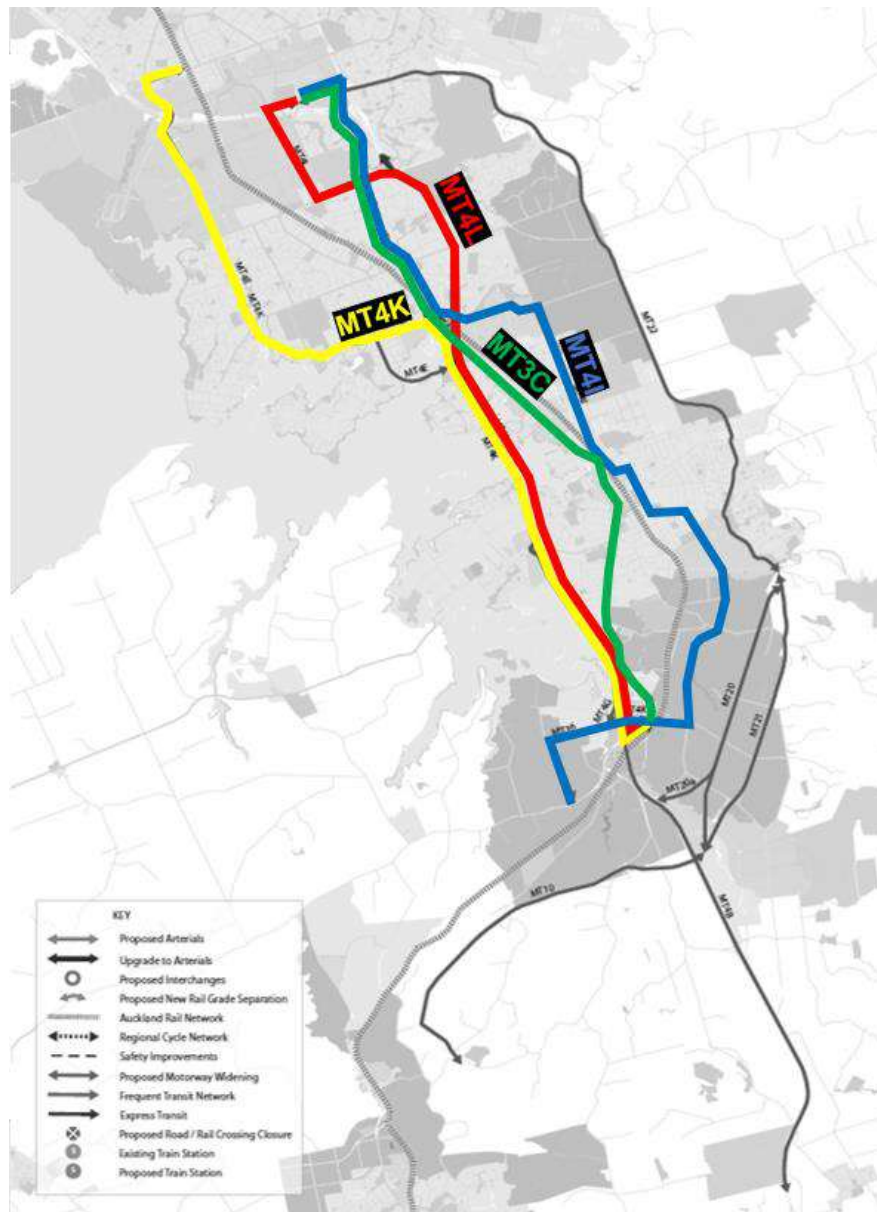


Figure 2-1 – FTN options included in the ISTN – MT3C, MT4I, MT4K, and MT4L. Other FTN routing options which were discarded at the IBC shortlisting stage are shown in grey.

In addition to these FTN options, the IBC shortlist also included option groupings for ‘Drury-Ōpāheke eastern arterials’, and ‘Takaanini East-West Crossings’. A number of options from these shortlist groupings interact with the FTN options and were included in the ISTN, most relevantly including:

- **Option AR10** – comprising the proposed Ōpāheke North-South arterial (forming part of FTN option MT4I noted above), and the urbanisation of Hunua Road and Croskery Road (see Figure 2-2); and
- **Option EW9B** – comprising a series of east-west connections in the Takaanini area with grade-separated rail crossing. This option included an east-west corridor comprising a viaduct over SH1 and the NIMT connecting Rangī Road to Mahia Road, and urbanisation of Rangī Road and Popes Road (see Figure 2-3). This route forms part of option MT4I.

These options were all included in the ISTN (see Figure 2-4), and thus formed the starting point for the South FTN DBC.

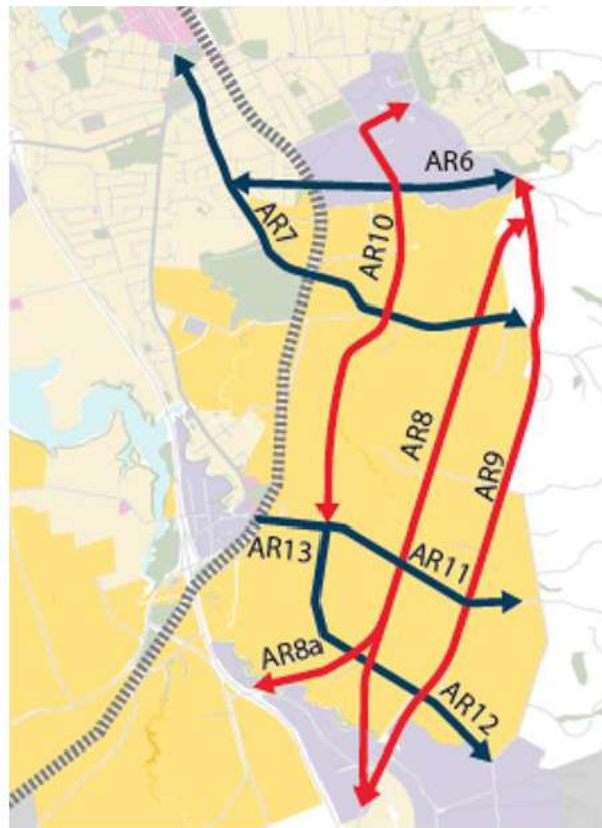


Figure 2-2 – Shortlisted IBC options for Drury-Ōpāheke eastern arterial options – note option AR10 (included in the ISTN) which includes the Ōpāheke North-South arterial, the urbanisation of Hunua Road, and Croskery Road which forms part of FTN option MT4I.

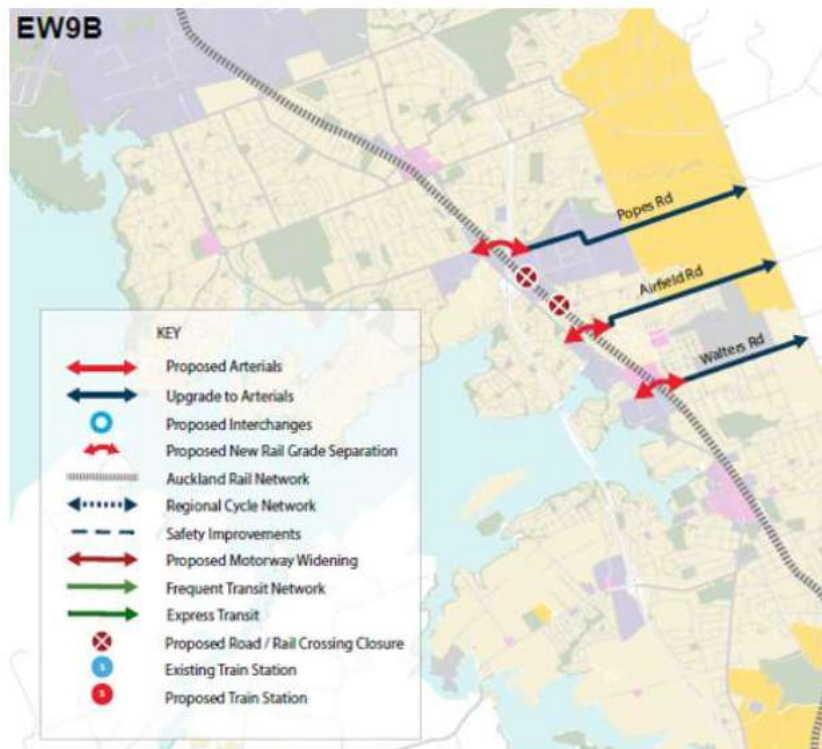


Figure 2-3 – Preferred IBC option for Takaanini east-west crossings as included in the ISTN, including the northernmost corridor encompassing a Rangi Road viaduct, and upgrades to Rangi Road and Popes Road (note the eastern extents of Airfield and Walters Road shown in this map were not included in the ISTN – see Figure 2-2 below).

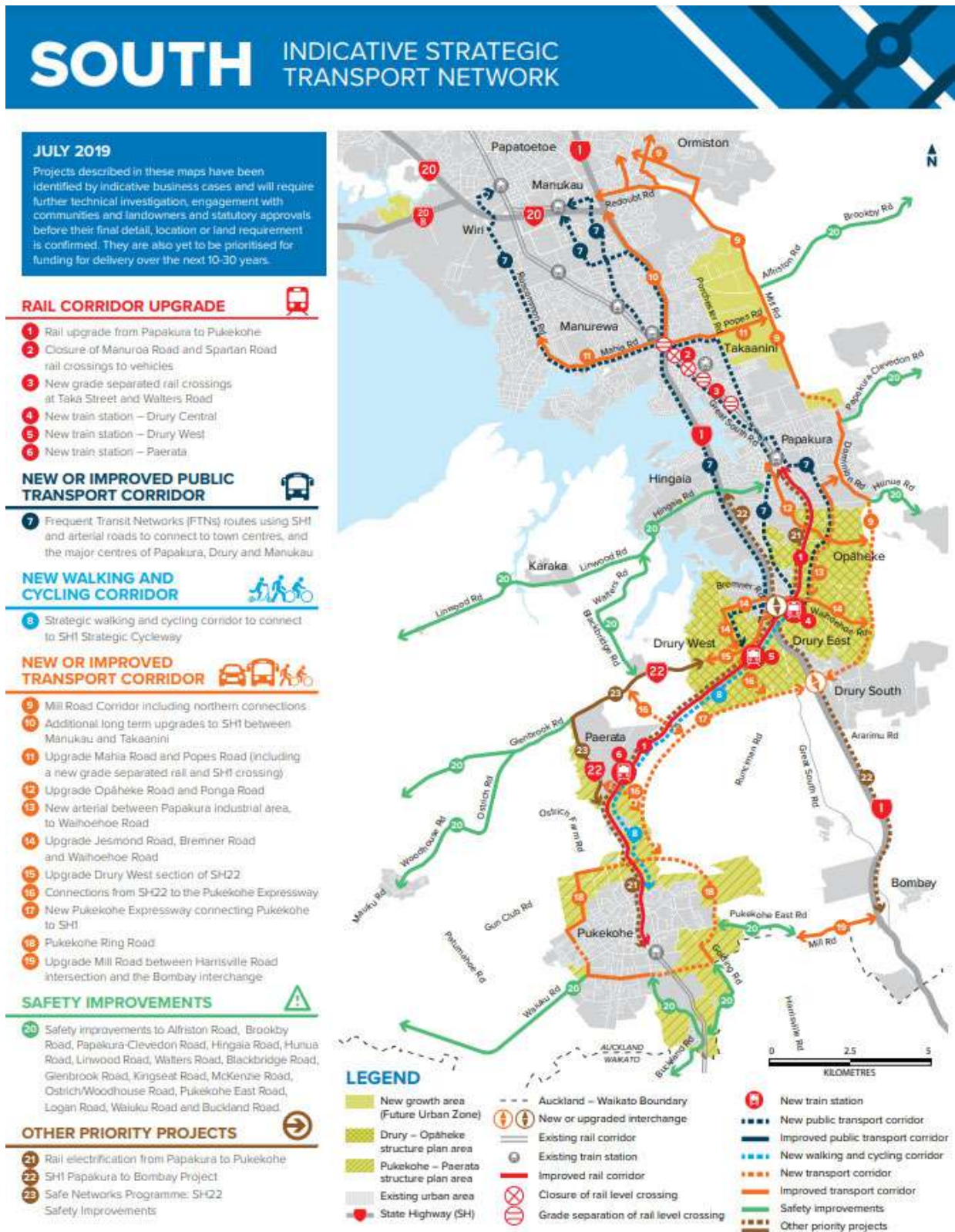


Figure 2-2 – South Indicative Strategic Transport Network – note the four FTN routes identified in the IBC shown in dark blue annotated as ‘7’, the east-west crossing including the Rangi Road viaduct shown in orange annotated as ‘11’; and Croskery Road forming part of the corridor shown in orange annotated as ‘13’.

3 Gap Analysis – what’s changed since the IBC?

At the outset of the South FTN DBC, a gap analysis was undertaken to capture changes in the strategic context that have occurred since the completion of the South IBC; and test the IBC assessment and conclusions in the context of new information. This process recognises that the IBC was completed in 2019, that changes in the context for the Project have occurred in the intervening period; and that such changes could change the scope of optioneering required for the DBC and/or the merits of conclusions in the IBC.

The gap analysis is set out at section 4 of the main DBC document and is not repeated in full here. However, the key contextual changes that are directly relevant to the scope and merits of options for the South FTN Project are summarised in Table 3-1.

Table 3-1 – Key contextual changes since the South IBC pertinent to the South FTN Project

Change	Explanation / relevance to South FTN optioneering
Changes to related transport projects	
Decision to progress the southern portion of IBC option MT4I as part of the Drury Arterials Package	The portion of IBC FTN route option MT4I between Drury and Papakura is proposed to utilise Jesmond Road, Bremner Road, Waihoehoe Road, a new Ōpāheke north-south arterial road, and Hunua Road. This part of the route follows IBC option AR10 shown above. With the exception of Croskery Road, these corridors have subsequently been progressed as part of the Drury Arterials DBC by Te Tupu Ngātahi, and are now designated. Accordingly, this section of the corridor is out of scope with no further optioneering required (apart from Croskery Road which is now in the scope of the South FTN DBC).
Decision to progress SH1 shoulder lanes as part of the Waka Kotahi Papakura-to-Drury (P2D) Project.	Two of the FTN route options identified in the IBC (options MT4K and MT4L) utilise sections of SH1 between Drury and Manukau. The shoulder lanes necessary to support such services now fall within the scope of Waka Kotahi’s P2D Project, and accordingly are now outside the scope of the South FTN Project. Accordingly, no further optioneering has taken place progressing options utilising SH1. It is noted that these options also utilised a section of Great South Road east of the Drury Interchange. The decision to discard these options results in the need to examine this section of Great South Road separately (see Part D of this report).
Decision to progress Mahia and Roscommon Road corridors separately from South FTN DBC.	One of the FTN route options identified in the IBC (option MT4K) utilises the Mahia and Roscommon Road corridors. These two corridors are now being progressed as part of a separate project by AT, and funding was secured to run a new FTN route along these corridors as part of Auckland Council’s 2022-23 Annual Budget. Moreover, an FTN connection from Mahia/Roscommon to Puhinui Station as envisaged in option MT4K was confirmed to no longer be supported by AT subject matter experts (SME). Accordingly, no further optioneering has taken place progressing options utilising Mahia and Roscommon Roads.
Progress on Single-Stage Business Cases (SSBC) for shorter-term interventions on Great South Road	Great South Road north of Papakura was a part of the Connected Communities programme of business cases to identify shorter-term bus, active mode, and safety improvements. Part of this extent overlaps with the option MT3C identified in the South IBC which proposed a longer-term FTN along Great South Road between Manukau and Drury. Accordingly, the South FTN DBC has given due consideration to these SSBCs to ensure alignment between the proposed short and long-term interventions along Great South Road.

Change	Explanation / relevance to South FTN optioneering
Decision to re-scope Mill Road under the NZ Upgrade Programme (NZUP)	The Mill Road Project was proposed as a four-lane strategic corridor between Manukau and Drury in the South IBC. It has subsequently been rescoped as a two-lane corridor focused on safety improvements at its northern end by 2028, with the remainder of the corridor to be route protected subsequently. The relevance of this is that two perpendicular east-west corridors – Popes Road and Croskery Road – still likely have strategic significance as connections to Mill Road. These are now included in the South FTN DBC as complementary (non-FTN) corridors (see Part D of this report).
Decision to implement NZUP Drury package	In addition to the P2D Project, two projects identified in the South IBC – the Drury Central Station and the urbanisation of Waihoehoe Road – have since been designated/consented (in the case of Drury Central) and designated (in the case of Waihoehoe Road), and funded under NZUP with a view towards implementation by 2025. This has left an adjoining short section of Great South Road in Drury in need of corresponding planning for urbanisation to ensure that the projects form a cohesive whole. This section of Great South Road is now in the scope of the South FTN DBC as a complementary (non-FTN) corridor.
Growth and Land Use	
Legislation and policy directing councils to enable increased housing supply	The National Policy Statement on Urban Development (NPS-UD) and the Medium Density Residential Standards (MDRS) (legislated through the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021 set clear direction for councils to enable increased housing supply in high-growth areas. Auckland Council's response came in the form of Plan Change 78 (PC78) which was notified in August 2022. These changes signal that growth in South Auckland will continue to be provided for, which in turn will result in travel demands necessitating multi-modal transport improvements such as the South FTN Project.
Updates to Auckland Forecasting Centre (AFC) growth scenarios	The DBC considers changes in land use assumptions, and utilises the most current land use assumptions available from the AFC. Since the completion of the IBC, there have been updates to growth scenarios used in Auckland which are reflected in this DBC. Scenario I11.6 has been used in this DBC which is consistent with current regional models, and no significant changes have been identified in comparison with the previous version I11.4 which was used in the IBC.
Private Plan Changes	Since the IBC, Plan Changes 52 and 58 have been approved along Great South Road in the Ōpāheke area; and Plan Change 67 has also upzoned parts of the Hingaia Peninsula. Recently approved plan Changes 48, 49, 50, 51, and 61 in the Drury area will enable significant urbanisation at the southern end of the Project extent. Moreover, the Project team is aware that pre-lodgement discussions are underway for large Plan Changes in the Alfriston and Ardmore areas. These Plan Changes signal that growth in the Project area is continuing to be planned and provided for, which in turn will result in travel demands necessitating multi-modal transport improvements such as the South FTN Project.
Transport and Climate Change legislation and policy	
Government Policy Statement on Land Transport (GPS) 2021 (and indicative GPS 2024)	The current GPS signals greater focus on projects that provide for better travel options/mode shift to sustainable modes, and contribute to a low-carbon transport system that supports emissions reduction. This direction is further strengthened in the indicative 2024 GPS which elevates emissions reduction to being the overarching focus for transport investment. The South FTN Project is well-aligned with these directives.
Passage of the Zero Carbon Act and	The Climate Change Response (Zero Carbon) Amendment Act 2019 set in place a framework for emissions reduction comprising a long-term target of net-zero

Change	Explanation / relevance to South FTN optioneering
associated long-term target and Emissions Reduction Plans (and parallel amendments to the RMA)	greenhouse gas emissions by 2050, and a system of quintennial emissions budgets and Emissions Reduction Plans (ERP) as 'stepping stones' to the long-term target. The first ERP, published in 2022, sets a target of reducing vehicle kilometres travelled (VKT) by 20 percent by 2035 through providing better travel options. The South FTN Project is well-aligned with this objective. In parallel, sections 70A and 104E of the RMA have been amended to enable the consideration of greenhouse gas emissions on climate change in both plan-making and consenting decisions. Furthermore, sections 61, 66, and 74 of the RMA have been amended to require that local authorities must have regard to ERPs and national adaptation plans when making and amending regional policy statements, regional plans, and district plans. Finally, the NPS-UD set under the RMA sets an objective that New Zealand's urban environments support reductions in greenhouse gas emissions; and a related policy requiring planning decisions to contribute to well-functioning urban environments, which urban environments which support reductions in greenhouse gas emissions. All of the above considerations place an increased onus for transport projects to demonstrate how they contribute to greenhouse gas emissions reduction.

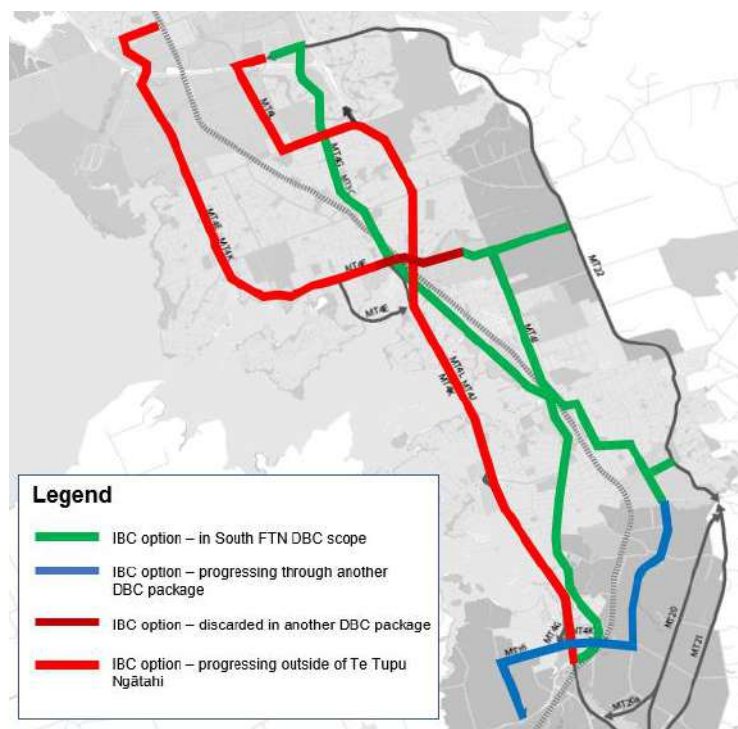


Figure 3-1 – Status of IBC FTN options at the commencement of the South FTN DBC process (N.B. Alignments through DBC process evolved as outlined later in this report).

The contextual changes summarised in Table 3-1 have directly informed the scope of Project and the optioneering documented in this report. In particular:

- Changes to related projects have resulted in a reduced scope of optioneering to be taken forward in the DBC compared with the FTN options identified in the IBC. The four FTN routes identified in the IBC are now reduced to two routes as a result of decisions to remove SH1, Mahia Road, and Roscommon Road from the scope (see Figure 3-1);
- Some sections of the remaining routes have already been designated as part of the Te Tupu Ngātahi's Drury Arterials package (i.e. the Ōpāheke North-South Arterial between Papakura and

Drury). However, this package omitted adjoining sections of Hunua Road and Croskery Road, which are now part of this DBC (see Figure 3-1);

- Changes to land use, transport, and climate change legislation and policy are strongly aligned with the South FTN Project, and provide strong justification to proceed with further investigation of options for the remaining FTN options; and
- Decisions on the scope of NZUP projects, in particular Mill Road and the Drury package, have informed the need to include complementary corridors (Popes Road, Croskery Road, and Great South Road at Drury) in the South FTN DBC scope.

4 General Methodology

4.1 Process Summary

The optioneering process applied to each of the Project corridors is shown in Figure 4-1. In essence, the process can be split into the following deductive steps:

- Steps to identify the preferred **routes** for the Project;
- Steps to identify the preferred **form and function** for each part of the Project to determine its physical extent; and
- Steps to refine the detailed **location** of any road widening/realignment required to accommodate the preferred form and function along the preferred route.

The process is described in greater detail below.

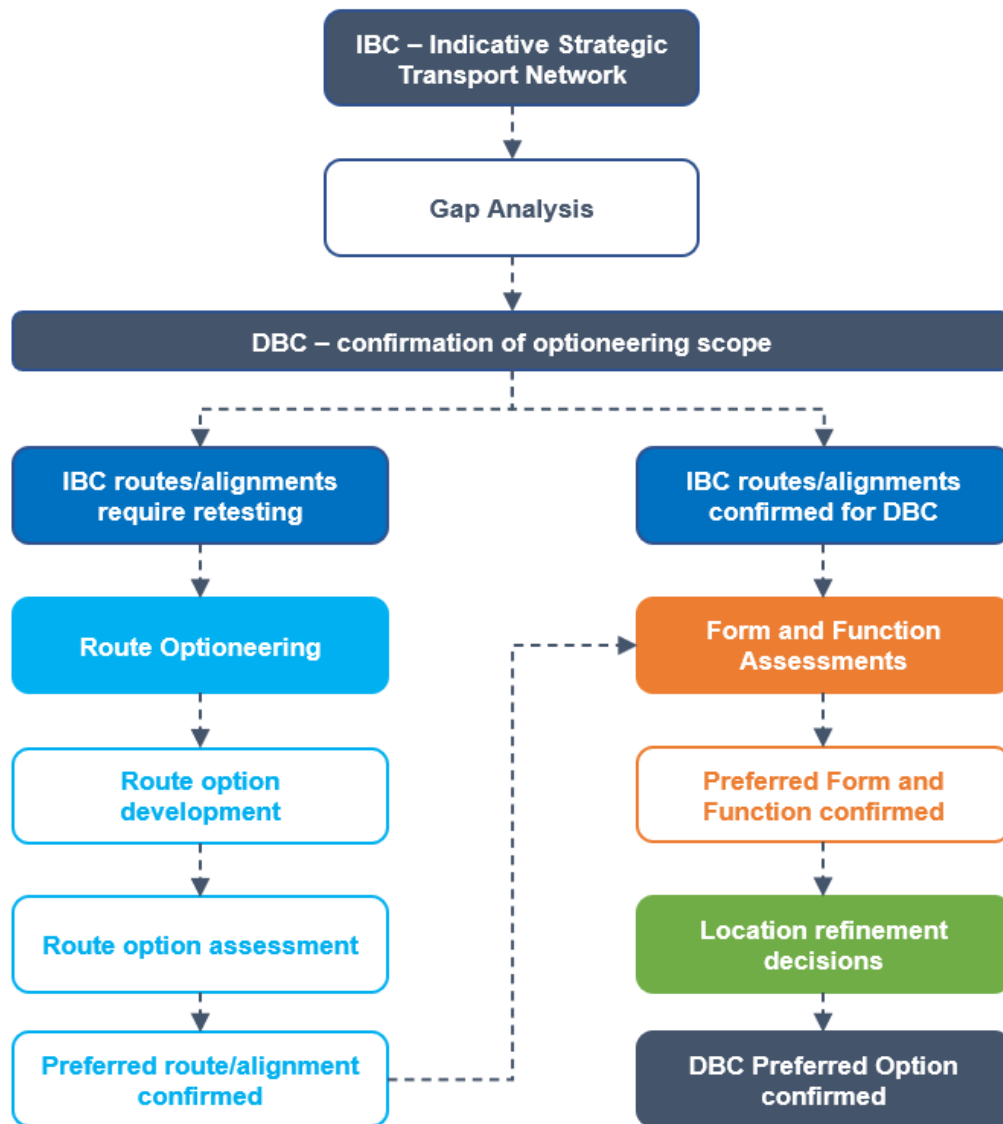


Figure 4-1 – DBC optioneering process

4.1.1 Gap analysis and confirmation of DBC optioneering scope

As summarised in section 2, the South IBC recommended several FTN corridors and related arterial roads for inclusion in the ISTN. The South FTN DBC advances this subset of projects from the ISTN, and thus uses the ISTN as a starting point for further optioneering.

The first optioneering stage is a gap analysis which captures the contextual changes that have occurred between the IBC and DBC processes. As noted in section 3, this process recognises that the IBC was completed in 2019, that changes in the project context have occurred in the intervening period; and that such changes could change the scope of optioneering required for the DBC and/or the merits of conclusions in the IBC.

The contextual changes identified in the gap analysis that are pertinent to optioneering for the whole Project are summarised in section 3 of this report. The localised optioneering for each part of the Project (in Parts B, C, and D of this report) identifies which changes from this wider summary are of particular relevance to the route or section in question.

The key aim of the gap analysis process is to confirm the necessary scope of optioneering for the DBC. In the case of the South FTN Project, the key scoping matter to be determined at the outset is whether or not the IBC route/alignment in question needs to be retested in light of contextual changes. This can include the identification of new options beyond the scope of previously assessed options; and retesting of previously discarded options.

Where retesting is needed, a process of further route optioneering is initiated. Where retesting is not needed, the step is omitted, and the IBC route is validated and taken forward as the basis for subsequent form and function assessment and location refinement.

4.1.2 Route optioneering

Where retesting of an IBC route option is needed, a process of further route optioneering is undertaken. This includes both the development of options to meet the DBC investment objectives, and the assessment of those options. As noted above, where the IBC route is validated through the gap analysis process, this step of further route optioneering is not undertaken.

Option Development

The purpose of option development is to ensure that an appropriate range of routes/alignments to meet the DBC investment objectives are identified for assessment. Inputs to option development included the use of Waka Kotahi's Early Assessment Sifting Tool (**EAST**), consideration of bus routing options provided by AT Metro in Remix software, as well as desktop assessment and constraints analysis.

Option Assessment

The Te Tupu Ngātahi MCA Framework was the primary method used to assess route options where this level of assessment was necessary. This process required all options in a given option grouping to be scored by relevant SMEs against the DBC investment objectives, and a set of MCA assessment criteria (see Table 4-1). This assessment used an eleven-point scoring scale (see Table 4-2), and also required the experts to provide commentary and rationale for their scores.

Table 4-1 – Te Tupu Ngātahi MCA Framework

MCA topic	No.	Criterion	Measure
Investment Objectives			See main DBC document for investment objectives and measures.
Heritage	1a	Heritage	See MCA Framework appendix for detailed explanation of measures for each criterion.
	1b	Manawhenua ⁴	
Socio-economic impacts	2a	Land use futures	
	2b	Urban design	
	2c	Land requirement	
	2d	Social cohesion	
	2e	Human health and wellbeing	

⁴ Note Manawhenua did not wish to score this criterion numerically, and accordingly it was excluded from scoring.

MCA topic	No.	Criterion	Measure
Natural Environment	3a	Landscape and Visual	
	3b	Stormwater	
	3c	Ecology	
	3d	Natural Hazards	
Transport	4a	Transport System Integration	
	4b	User Safety	
Construction Impacts	5a	Construction impacts on utilities / infrastructure	
	5b	Construction Disruption	
	6	Construction costs / risk / value capture	
Non-Scored Criteria		Stakeholder / Project Partner feedback	
		Policy Analysis	
		Indicative costs	
		Mana Whenua	

Table 4-2 – MCA Scoring Scale

	-5	-4	-3	-2	-1	0	1	2	3	4	5
Type	Adverse					Neutral	Positive				
Magnitude	High				Low		Low		High		
Significance	Regional				Local		Local		Regional		
Extent	Substantial				Low		Low		Substantial		
Duration	>20 years				<1 year		<1 year		>20 years		

In identifying a preferred route/alignment option, aggregate scoring or weighting of MCA criteria were not produced. This ensured that preferred options were reached through balanced consideration of all criteria, and that the MCA would not prejudice further feedback received through the engagement process from project partners, stakeholders, and the public.

4.1.3 Form and Function Assessment

Following the identification of a preferred route for each part of the Project, the preferred form and function was then identified to determine its physical extent. The assessment informing the physical extent was divided into corridors (i.e. midblocks), and intersections using the following processes respectively.

Corridor Form and Function (CFAF) process

The CFAF process has been established by Te Tupu Ngātahi to provide a consistent methodology to define the form and functional requirements for transport corridors, and ensure that all modes are

considered. It is based on the AT Roads and Streets Framework (**RASF**) guidance which considers both ‘movement’ and ‘place’ significance.

In practice, the process systematically considers a range of transport inputs denoting the ‘movement’ significance for each transport mode (e.g. predicted future traffic volumes, bus network planning and predicted bus volumes, and status as freight or active mode routes); and factors denoting the ‘place’ significance such as adjoining land use. The typical output of the process is the identification of a suitable midblock cross-section from a suite of modular concept designs.

Intersection Assessment process

In parallel to the CFAF process, an intersection assessment process is undertaken to identify which intersections along each route require upgrades, which indicative intersection controls are to be applied where upgrades are required, and the resultant footprint implications.

In identifying which intersections require upgrades as part of the Project, a filtering process was applied which selected intersections based on the following considerations:

- Whether an intersection upgrade would provide for **more efficient and reliable bus services** – reducing the number of intersections that cause disruption to bus through movement. As part of this, spacing between proposed signalised intersections was considered;
- Whether an intersection upgrade would provide **safe crossing points for pedestrians and cyclists** to access the public transport network and connect to amenities based on walking catchments;
- Whether there were any **site-specific safety concerns** such as poor visibility, horizontal/vertical grade issues, and existing uncontrolled intersections at crossroads;
- **Side road factors** – i.e. the traffic volumes, complexity, status within the road hierarchy; and whether the side road provides access to key destinations such as schools, rapid transit stations, or the wider strategic road network; and
- T-intersections with local roads are generally priority controlled now, and it has been assumed that they will remain priority-controlled in the future.

In selecting the preferred intersection form at each site, a number of matters were considered including safety, operational efficiency, urban design/land use integration, public transport operations, engineering and environmental constraints, property constraints, and other site-specific factors. The selection process adopts a ‘Safe System’ approach which recommends roundabouts as the first choice for at-grade intersections due to the safety benefits for vehicular traffic resulting from the slowing of through traffic and reduction of conflict points. Where roundabouts are not considered appropriate, signalised intersections are then considered.

These assessment tools are designed to enable project teams to select appropriate form and function options from a set of modular concept designs developed at a Programme-wide level for both midblock cross-sections and intersection forms. This approach is taken on the basis that it provides for a suitable level of detail for route protection and design efficiency, whilst allowing for future design flexibility and changes at the time of implementation. However, in case of the South FTN Project, the process of defining a preferred form and function has required some refinement and further development of the modular designs to account for local contextual constraints, and the wide range of

present-day road configuration starting points. These are documented where relevant in Parts B, C, and D of this report.

As part of the above processes, the preferred form and function options were the subject of consultation and endorsement by owner organisation SMEs.

Further details of both the corridor and intersection form and function assessment process are included in **Appendix G: Transport Outcomes Report**.

4.1.4 Location refinement

Following the identification of a preferred form and function for each part of the Project, the final step of the optioneering process was to identify and refine the footprint for each part of the Project. This step required reconciliation of a number of expert and technical inputs in a workshop setting, considering factors such as:

- Opportunities to avoid or reduce impacts on known environmental and cultural features, values, and/or constraints⁵;
- The need to set designation boundaries which ensure that reasonable access to and use of adjoining properties and buildings can be maintained;
- Any advantages or disadvantages associated with requiring land that relate to its ownership status (e.g. publicly or privately-owned) or zoning/planning controls (e.g. urban or future urban); and
- The need for designation boundaries to provide for the construction, operation, and maintenance of the Project.

Following the above location refinement considerations, the emerging preferred options proceeded to concept design. This included consideration of vertical and horizontal alignment, allowances for earthworks, the configuration of access for affected properties, and stormwater requirements including indicative attenuation and treatment devices. Full details of the design process are detailed in **Appendix H: Design Report**, and are only repeated in this report to the extent necessary to document optioneering.

4.2 Corridor Segmentation

To apply the above optioneering process on a localised basis, the Project corridors have been divided into sections as shown in Table 4-3 and Figure 4-2. Localised optioneering was necessary given the significant contextual differences that exist over a near-33km Project extent. The various sections are referred to throughout the remainder of this report as necessary.

It is noted that the segmentation outlined in Table 4-3 was not able to be undertaken until **after** routes were confirmed – accordingly, segmentation for each corridor took place between route optioneering and the form and function assessment. Segmentation sought to break the corridor into manageable areas for further localised assessment, and took account of a number of factors including areas of similar land use along the corridor, as well as the location of interfacing railway stations (which in turn form the centre-points for future upzoning under PC78).

Segmentation is summarised here for ease of report navigation.

⁵ These were the subject of analysis reconciling of a number of expert and technical inputs, and in the first instance included matters identified in Part 2 of the RMA, matters for which RMA policy documents direct avoidance, and provisions cascading from those policies (e.g. AUP overlays).

Table 4-3 – Corridor Sections

Report reference	Route	Section	Extent	Length
Part B (sections 5-8)	Great South Road FTN	1a	Manukau Station Road (Davies Avenue to Great South Road)	4.8km
		1b	Great South Road (Manukau Station Road to Browns Road)	
		1c	Great South Road (Browns Road to Northcrest Way)	
		2	Great South Road (Weymouth Road to Mahia Road)	1.0km
		3	Great South Road (Mahia Road to Takaanini Station)	1.6km
		4	Great South Road (Takaanini Station to Subway Road)	3.6km
		5	Great South Road (Wellington Street to Waihoehoe Road)	4.5km
		Subtotal		
Part C (sections 9-13)	Takaanini FTN	6	Weymouth Road and Alfriston Road (Selwyn Road to Porchester Road)	2.3km
		7	Porchester Road (Alfriston Road to Airfield Road)	3.8km
		8	Porchester Road, Walters Road, Grove Road, Clevedon Road, Railway Street	5.4km
		9	Wood Street, Ōpāheke Road, Settlement Road, Hunua Road	2.5km
		Subtotal		
Part D (sections 14-17)	Complementary (non-FTN) Corridors	Popes Road (Takanini School Road to Mill Road)		2.2km
		Croskery Road (Hunua Road to Dominion Road)		0.6km
		Great South Road (Waihoehoe Road to Firth Street)		0.3km
		Subtotal		
Total Project Extent				32.6km

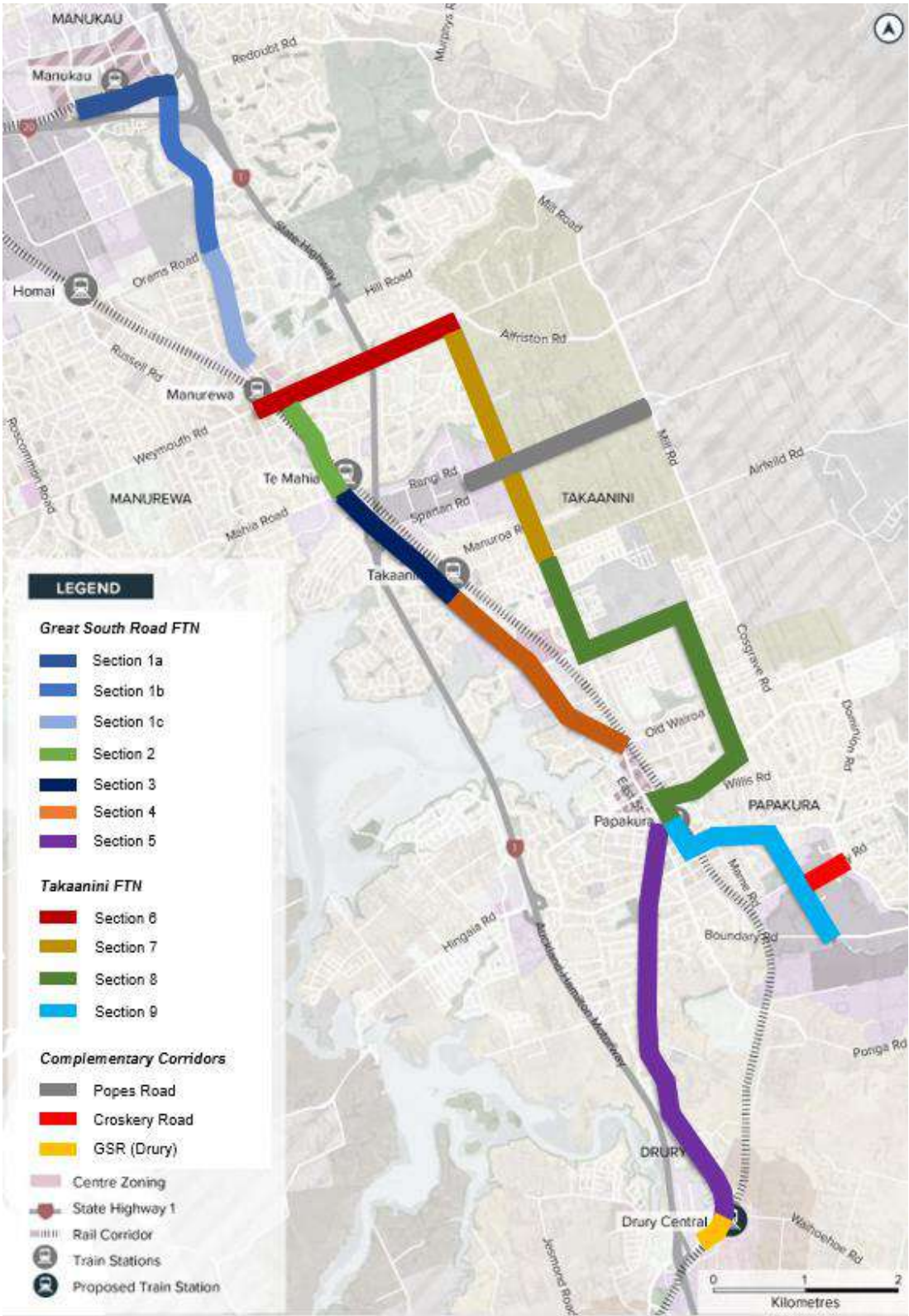


Figure 4-2 – South FTN Corridor Segmentation

PART B: GREAT SOUTH ROAD FTN

5 Gap Analysis and confirmation of optioneering scope

As noted in section 2.2, the ISTN included an FTN route on Great South Road between Drury and Manukau (referred to in the IBC as option MT3C as shown at Figure 2-1). This route was the starting point for DBC optioneering on the Great South Road FTN route. The methodology outlined in section 4 requires the implications of new information identified in the gap analysis to be considered with a view to establishing the necessary scope of further optioneering in the DBC.

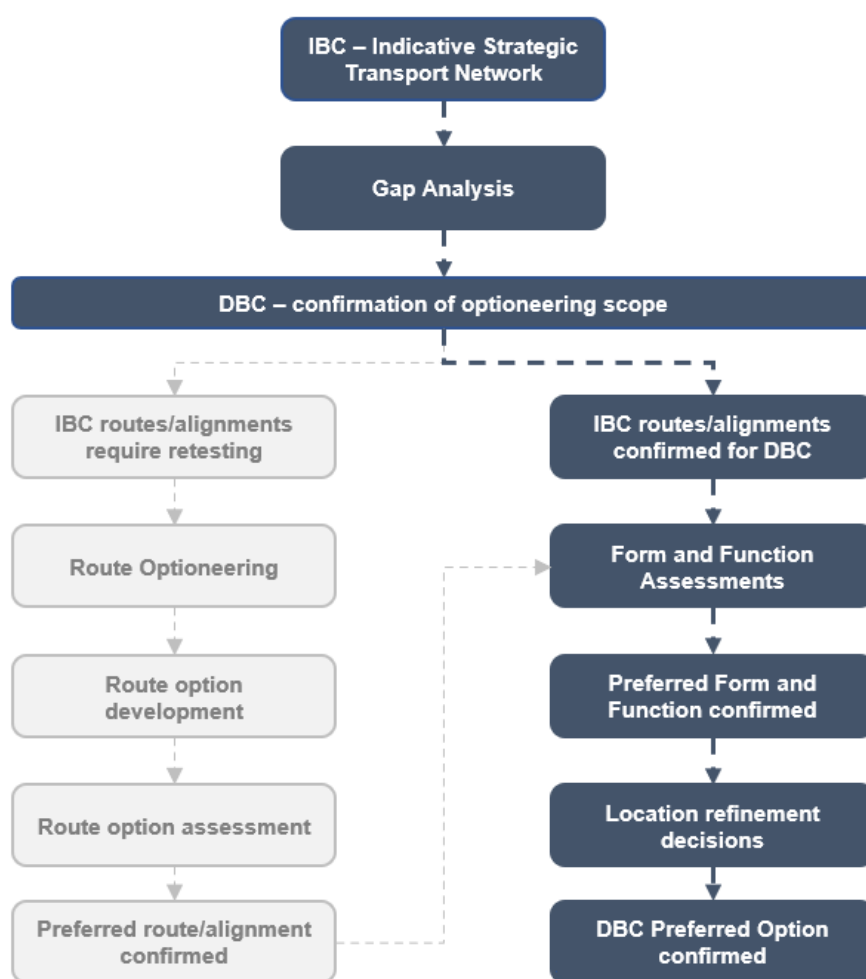


Figure 5-1 – Optioneering process adapted for the Great South Road FTN. Note omission of the route optioneering process steps.

In making this determination, the following conclusions on the Great South Road FTN were reached through the gap analysis process (summarised in section 3):

- None of the related transport projects outlined in Table 3-1 are a substitute for a Great South Road FTN. Therefore, the various changes to and decisions on these projects that have occurred since 2019 do not weaken the case for a Great South Road FTN. The closest related project identified are the Connected Communities SSBCs for Great South Road north of Papakura, which are not a

substitute for the longer-term interventions extending south to Drury envisaged in the South IBC and this DBC. Changes to and decisions on the remaining projects do not weaken the case for a Great South Road FTN, and in some cases (e.g. Mill Road rescoping) arguably strengthen it;

- Legislative and policy direction to enable increased housing supply, updates to AFC growth scenarios, and Private Plan Changes all signal that the areas on and around Great South Road between Manukau and Drury will continue to experience urban growth and increased demand on the transport network. PC78 proposes to enable significant growth in this area over and above the currently operative provisions of the AUP:OP; and recently approved plan changes 52 and 58 (in Ōpāheke), 67 (in Hingaia); and 48, 59, 50, 51, and 61 (in Drury) all signal continued growth in travel demand on Great South Road;
- The type of multi-modal interventions envisaged for Great South Road – namely enhanced FTN bus services and active mode improvements – are entirely consistent with the transport and climate change legislation and policy directives outlined in Table 3-1;
- In addition to the above, Great South Road remains a strategically significant north-south arterial route for all transport modes given the lack of alternative routes in the network. This is reflected in AT's Future Connect classifications, and AT Metro's future network planning. While additional north-south connections and network improvements are planned to increase network capacity and resilience, none are considered a direct substitute or replacement for Great South Road; and
- The road exists, and any parallel corridors will not be functionally equivalent.

For the above reasons, there was not considered to be any reason to further retest the route for the Great South Road FTN – accordingly IBC option MT3C was validated and confirmed as the route and extent in the DBC for the Great South Road FTN. Accordingly, the route optioneering process step was omitted, and the corridor proceeded directly to form and function assessment and location refinement (see Figure 5-1).

At this point, the Great South Road FTN route was divided into five sections as outlined in section 4.2 to allow for localised form and function assessment and location refinement optioneering.

6 Form and Function

6.1 Corridor Form and Function

As noted in section 4.1.3 of the general methodology, the CFAF process as developed and applied at the Programme-wide level is intended to use land use and transport planning inputs to define functional requirements for the corridor in question, and identify a suitable midblock cross-section from a set of modular concept designs. This approach is taken on the basis that it provides for a suitable level of detail for route protection and design efficiency, whilst allowing for future design changes and flexibility at the time of implementation.

In the case of the Great South Road FTN, the initial output of the CFAF process was the application of a four-lane FTN arterial cross-section to the entire length of the route (see Figure 6-1). This conceptual design incorporates one general traffic lane and one bus lane per direction, separated active mode facilities in each direction, and space for berms and a central median (see Figure 6-1). This cross-section was initially applied, with care taken to use the location refinement principles outlined in section 4.1.4 where third-party land was identified as being needed.

This initial approach was ultimately not followed for the Great South Road FTN for several reasons as follows:

- Significant third-party land requirements along the corridor, with over 1,300 properties directly affected along its 15.5km length. This significant property requirement in large part resulted in high costs and effects not justified by the Project's level of strategic benefit;
- The application of a generic cross-section did not account for local contextual constraints, and the wide range of present-day road configurations along Great South Road – in short, some sections have the necessary width already, while others require significant third-party land;
- The application of a generic cross-section also triggers land requirements even where third-party land is not required to meet the desired transport functions – for instance where reconfiguration of the corridor layout requires additional stormwater treatment not otherwise required. This is a significant contributor to the aforementioned third-party land requirements; and
- The nature of transport demands is relatively tidal in a number of sections of the corridor, meaning that there are opportunities to meet the investment objectives with a less impactful cross-section configuration (e.g. bus lanes in one direction only). This is discussed in greater detail in **Appendix G: Transport Outcomes Report**.



Figure 6-1 – Four-lane FTN arterial cross-section

Given the above issues, a bespoke reassessment of the required form and function for each section of the Great South Road corridor was undertaken on a section-by-section basis to confirm the preferred physical form of the section to be taken forward to the location refinement stage. Several approaches were considered in this process as summarised in Table 6-1.

Table 6-1 – Approaches considered in form and function reassessment

Premise	Approach	
Fit within (or largely within) existing road reserve and retain existing kerblines	A	Prioritise a transport mode (e.g. full bus lanes or active mode improvements but not both)
	B	Remove an element from cross-section (e.g. bus lanes in one direction only)
	C	Existing road reserve already sufficient to accommodate all desired cross-section elements (i.e. >26.5m)
Full road space reallocation and/or road widening	D	Apply full four-lane FTN arterial cross-section

The results of this reassessment are summarised in Table 6-2 below. It is noted that the applicability of the various approaches differs according to the different circumstances along the corridor, and accordingly that not every approach is compared in every section. The merits of the various approaches are discussed in the main DBC document and **Appendix G: Transport Outcomes Report**. Further detail on the design outcomes of the preferred approaches can be found in **Appendix H: Design Report**.

The specific cross-sections assessed in each section are shown in **Appendix B** of this report.

Table 6-2 – Summary of preferred form and function approaches

Section	Existing width	Approaches considered				Key reasons for preferred approach
		A	B	C	D	
1a	>30m	N/A	N/A	Preferred	Discarded	- Existing road width sufficient – no/minimal third-party land requirements. - Avoids property impacts associated with Approach D (e.g. stormwater treatment). - Achieves desired level of service for public transport, and maintains/improves level of service for active modes.
1b	>30m	N/A	N/A	Preferred	Discarded	
1c	20m	Discarded	Preferred	N/A	Discarded	- Achieves a northbound bus lane which is the direction of highest anticipated travel demand. - Ensures separated facilities for active modes. - Lesser third-party land requirement than other approaches.
2	20m	Discarded	Preferred	N/A	Discarded	
3	30m	N/A	N/A	Preferred	Discarded	- Note some variation within section 4 – hence both approach B and C preferred. - Existing road width sufficient – no/minimal third-party land requirements. - Achieves desired level of service for public transport, and maintains/improves level of service for active modes.
4	20-30m	N/A	Preferred	Preferred	Discarded	
5	<27m	Discarded	Preferred	N/A	Discarded	- Achieves a northbound bus lane which is the direction of highest anticipated travel demand. - Ensures separated facilities for active modes. - Lesser third-party land requirement than other approaches.

6.2 Intersection Assessment

As noted in section 4.1.3 of the general methodology, an intersection assessment process was undertaken in parallel to the CFAF to identify which intersections required upgrades, the indicative intersection controls in these locations, and the resultant footprint implications. Similarly to the CFAF process, the approach developed and applied across the programme for the intersection assessment was to use land use and transport planning inputs to define functional requirements for the corridor in question, and identify a suitable intersection layout from a set of modular intersection designs.

The intersection filtering process identified sixteen intersections requiring interventions along the Great South Road FTN route between Manukau and Drury. These were identified based on the considerations listed in section 4.1.3 of the general methodology, and are listed in Table 6-3.

As noted in section 4.1.3, the intersection form at each site was identified based on a range of factors including safety, operational efficiency, urban design/land use integration, public transport operations, engineering and environmental constraints, property constraints, and other site-specific factors. While roundabouts are the typical first choice for at-grade intersections recommended in 'Safe System' guidance, it is recommended that the majority of intersections along the Great South Road FTN route are signalised. The key reasons for the adoption of signals in these locations are:

- Complex existing intersections with multi-lane approaches;
- A highly urbanised context with limited space available without significant property impacts;
- Very high vehicular traffic volumes; and
- Strategic walking and cycling network functions and a need to allow for safe crossing facilities in the context of high traffic volumes.

Table 6-3 summarises the forms identified for key intersections following this assessment. The rationale and detail for the configurations for each intersection is included in **Appendix G: Transport Outcomes Report**.

Table 6-3 – Proposed intersection forms resulting from intersection assessment

Corridor section	Intersection	Proposed form
1b	Great South Road / Manukau Station Road / Redoubt Road	Signals
	Great South Road / SH1 offramp	Signals
	Great South Road / Kerrs Road / Pacific Events Centre Drive	Signals
	Great South Road / Browns Road / Orams Road	Signals
1c	Great South Road / Grand Vue Road	Signals
	Great South Road / Hill Road / Station Road	Signals
2	Great South Road / Weymouth Road / Alfriston Road	Signals
	Great South Road / McAnnalley Street	Signals
	Great South Road / Mahia Road	Signals
4	Great South Road / Taka Street	Signals

Corridor section	Intersection	Proposed form
5	Great South Road / Walters Road	Dual-lane roundabout
	Great South Road / Subway Road	Signals
	Great South Road / Wellington Street	Signals
	Great South Road / Beach Road	Signals
	Great South Road / Rosehill Drive	Signals
	Great South Road / Park Estate Road	Signals

7 Location Refinement

As noted in section 4.1.4 of the general methodology, a process of reconciling expert and technical inputs in a workshop setting applied to decisions on the location of any road widening and realignment (i.e. third-party land requirements) to accommodate the preferred form and function along the preferred routes.

Table 7-1 sets out the key matters identified for each section which have informed the extent and location of third-party land requirements. These generally emphasise where environmental features and identified constraints constitute clear ‘differentiators’.

Table 7-1 – Key differentiating features/constraints informing application of location refinement principles

Section	Third-party land requirement? ⁶	Key differentiating features/constraints informing application of location refinement principles
1a	None	N/A
1b	None	N/A
1c	Moderate	- Desire to avoid or reduce impacts on Sikh Temple (east side, chainage 3950), Presbyterian Church (east side, chainage 4300), historic heritage place at Cenotaph Park (east side, chainage 4450), scheduled military milepost (east side, chainage 3800), notable tree (east side, chainage 3800) and a Rest Home (west side, chainage 3280). - Several new-build medium-density multi-unit residential developments on both sides. Each presents a challenge in terms of avoidance (i.e. the ability to maintain a 1.5m front yard in the first instance), and/or boundary setting where the street frontage unit will need to be acquired.
2	High	Lack of clear differentiating factors.
3	Low	Lack of clear differentiating factors.

⁶ Qualitative scale of land requirement is taken from **Appendix L: Route Protection Strategy**.

Section	Third-party land requirement? ⁶	Key differentiating features/constraints informing application of location refinement principles
4	Low	- Desire to avoid or reduce impacts on notable trees (east side, chainage 9600 and 10000; and west side at chainage 10200), significant ecological area (SEA) to the west of the Longford Park esplanade reserve and Awhinatia Health centre (west side, chainage 9600), fire station (east side, chainage 10100), historic heritage buildings (churches) at chainage 10200-10500 (west side). - Several new-build medium-density multi-unit residential developments on both sides. Each presents a challenge in terms of avoidance (i.e. the ability to maintain a 1.5m front yard in the first instance), and/or boundary setting where street frontage units will need to be acquired. - Large industrial premises including a Fonterra distribution facility (west side, chainage 8200).
5	Moderate	- Desire to avoid or reduce impacts on historic heritage feature (War Memorial) at the corner of Ōpāheke Road and Great South Road (east side), Papakura Cemetery (east side, chainage 11400-11700), SEAs (bush areas on both sides of road at chainage 12000), notable trees at chainage 12300-12500 (east side), Drury Presbyterian Cemetery (west side, chainage 15100), Drury School (east side, chainage 15000). - Plan Changes 52 and 58 and associated frontage controls on the eastern side (between Park Estate Road and Parkhaven Drive). - Effects on Otūwairoa / Slippery Creek to be considered.

The Design Report also addresses the consequential/ancillary design features resulting from the optioneering process (e.g. stormwater treatment devices and earthworks), and these considerations are not repeated here. The General Arrangement drawings included in Appendix H show the resultant corridor location/alignment and proposed designation boundaries.

8 Preferred Option

Following the application of the above process, a preferred option for the Great South Road FTN was identified. Its route and form and function are shown conceptually in Figure 8-1 below. The detailed alignment and boundaries are shown in the General Arrangement drawings appended to **Appendix H: Design Report**.



Figure 8-1 – Great South Road FTN preferred option.

PART C: TAKAANINI FTN

9 Gap Analysis and confirmation of optioneering scope

As noted in section 2.2, the ISTN included an FTN route between Drury and Takaanini serving existing urban and FUZ areas generally east of SH1 and the NIMT, before connecting to Great South Road to the west of SH1 and the NIMT (referred to in the IBC as option MT3C; which also included sections of options EW9B and AR10 as shown at Figures 2-1, 2-2, and 2-3). This route was the starting point for DBC optioneering on the Takaanini FTN route. The methodology outlined in section 4 requires the implications of new information identified in the gap analysis to be considered with a view towards establishing the necessary scope of further optioneering in the DBC.

In making this determination, the following conclusions on the Takaanini FTN were reached through the gap analysis process (summarised in section 3):

- A number of factors identified in the gap analysis have prompted a retesting of the Rangi Road Viaduct assumed as part of IBC option MT4I (and the associated sections of options MT4K and EW9B). Given that the Rangi Road Viaduct also formed part of the ISTN for Takaanini level crossing removal, these matters were considered concurrently as part of optioneering for both the TLC and South FTN DBCs. The key factors prompting this retesting included:
 - The high likely cost, complexity, and levels of embodied carbon likely associated with the Rangi Road Viaduct relative to other options for providing an east-west connection (noting that the Viaduct would be over 500m long, and would traverse SH1, the NIMT, the Papakura Stream, and Transpower's electricity transmission corridor). The embodied carbon issue was of particular relevance given the recently increased emphasis in legislation and policy (see Table 3-1) on greenhouse gas emissions reduction, which includes embodied carbon from transport infrastructure assets; and
 - The confirmation by AT SMEs that the routing option along Mahia and Roscommon Road to Puhinui Station (part of option MT4K) was no longer supported as part of the FTN scope. This affects the logic underpinning the need for a Rangi Road Viaduct in terms of connections from the west (see Figure 2-1).
- The decision to progress IBC option AR10 (and by extension the southern portion of option MT4I) as part of the Drury Arterials package means that optioneering and route protection for this section is already complete. Accordingly, this section of the corridor is now out of scope with no further optioneering needed (apart from Croskery Road which is addressed in Part D of this report). The southern end of the Takaanini FTN can connect to the already designated Ōpāheke North-South Arterial at the intersection of Boundary and Hunua Roads to complete the route envisaged in the IBC;
- Legislative and policy direction to enable increased housing supply, updates to AFC growth scenarios, and Private Plan Changes all signal that the areas around the Takaanini FTN project area will continue to experience urban growth and increased demand on the transport network.; and

- The type of multi-modal interventions envisaged for the Takaanini FTN – namely FTN bus services and active mode improvements – are entirely consistent with the transport and climate change legislation and policy directives outlined in Table 3-1.

In light of the above, there remains a strong case for the Takaanini FTN; but a clear need to further retest the route and extent of the corridor. Accordingly, the route optioneering step was required to confirm a route and extent for the Takaanini FTN prior to proceeding to form and function assessment and option refinement (see Figure 9-1).

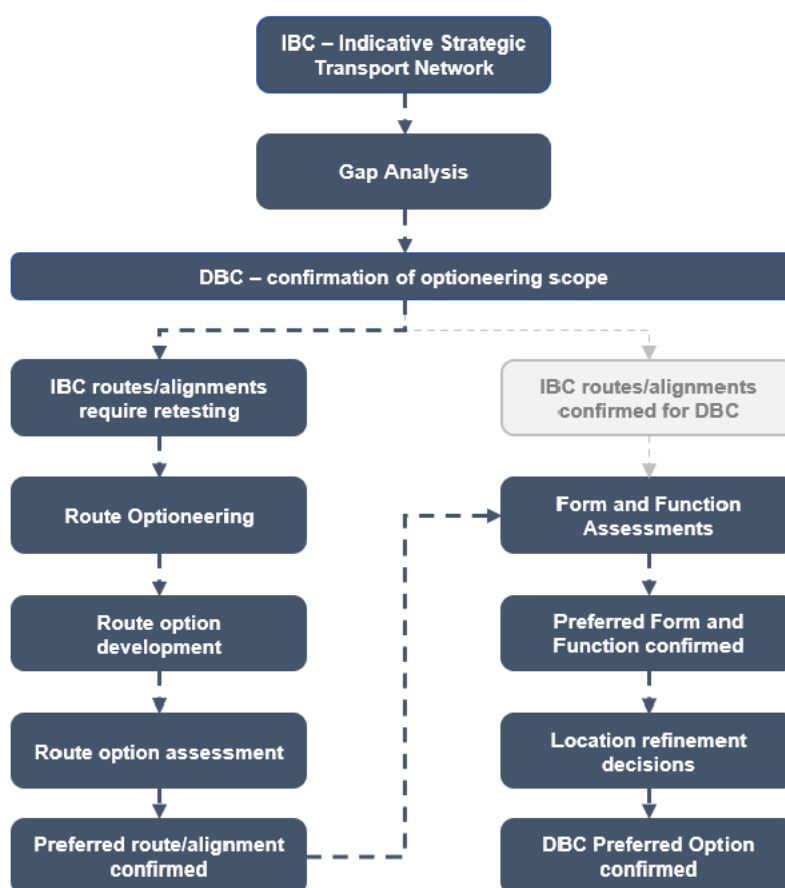


Figure 9-1 – Optioneering process adapted for the Takaanini FTN

9.1 Implications of the draft Future Development Strategy

In response to NPS-UD requirements, Auckland Council published a draft Future Development Strategy (**FDS**) in April 2023. The draft FDS proposes changes to the spatial composition of urban growth in Auckland, including removal of the Takaanini Future Urban Zone (**FUZ**). This area was identified as an area for long-term urbanisation under the Council's Future Urban Land Supply Strategy (**FULSS**), and remains zoned FUZ. Given the timing of the draft FDS, it was not considered during the gap analysis undertaken at the outset of the Project.

The draft FDS is yet to be finalised, and would need to be followed by plan changes to take practical effect, and accordingly has yet to make a material difference to the recommendations of this report. However, it does introduce some uncertainty to the land use context for the South FTN Project, in

particular the sections of the Takaanini FTN route which adjoin the FUZ. It is recommended that the options assessment is re-examined in future when the draft FDS has been finalised and its implications are clearer.

10 Route Optioneering

10.1 Route Option Development

10.1.1 Longlist screening

As outlined in section 4.1.2, Waka Kotahi's EAST tool was used to undertake an initial screening of route options. This process identified a longlist of eighteen options for different sections of the route with the intent of identifying a shortlist for assessment through an MCA process. The options in this instance comprise sections of a route with a view towards different sections being 'mixed and matched' to form a preferred route. The longlisted options can be divided into the following three categories:

- **North-south route sections** to provide connectivity generally between Manurewa and Papakura to the east of the NIMT and SH1 (noting that the need to proceed further south of Papakura as originally envisaged in IBC option MT3C has been negated by the Drury Arterials DBC). It is noted that option MT3C used Porchester Road, Ingram Street, Priclor Street, Marne Road, and Settlement Road as its north-south route in this area;
- **East-west route sections** to provide connectivity from the areas served by north-south route sections to the east of the NIMT and SH1, and areas to the west. It is noted that option MT3C used Popes Road and Rangī Road as its east-west connection connecting Porchester and Great South Roads. As noted above, the decision to discount the Rangī Road Viaduct from the TLC DBC means that this route is no longer possible, and an alternative east-west route is required; and
- **Route sections from AT Metro Remix files** – these were included to ensure all possible combinations of routes under consideration by AT Metro transport planners in this area were considered as options for FTN routing.

The eighteen longlisted options are shown in Figure 10-1, and the results of the EAST assessment are summarised in Table 10-1.

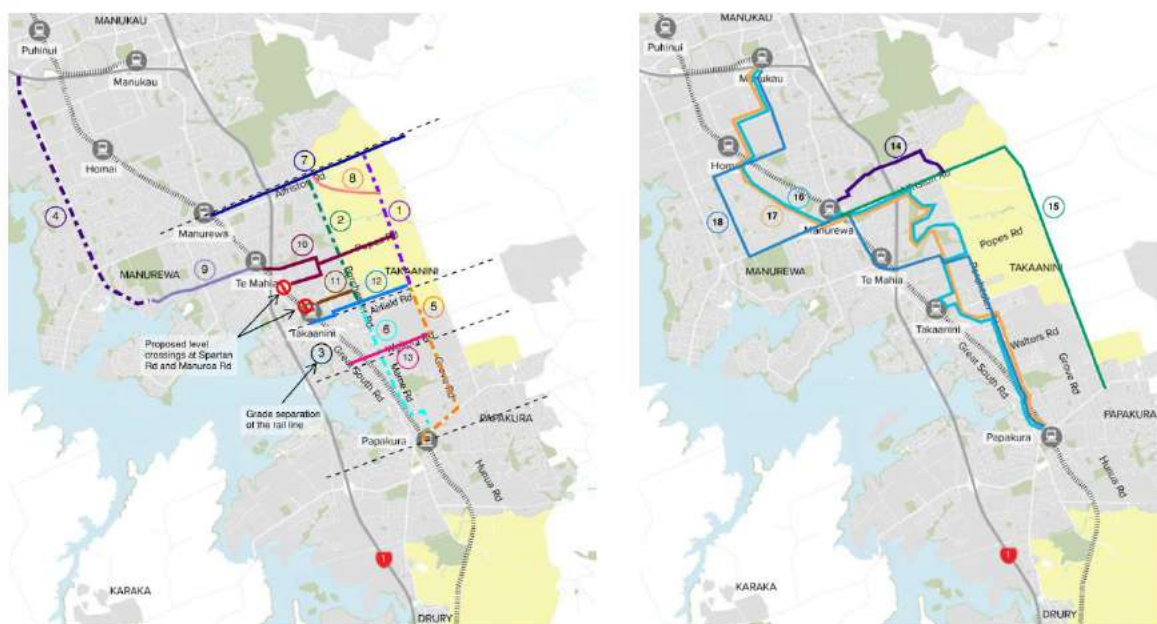


Figure 10-1 – North-south and east-west route sections (left) and route sections from AT Metro remix files (right)

Table 10-1 – Summary of longlist EAST assessment

No.	Option	Progress to shortlist?	Comment
North-South Route Sections (north of Airfield Road)			
1	Wastney Road / new road between Alfriston and Airfield Roads	Yes	North-south option through FUZ, new section of road needed.
2	Porchester Road between Alfriston and Airfield Roads	Yes	North-south option using existing roads, bisects existing urban area to west and FUZ to east.
3	Grade-separation of the NIMT between Alfriston and Walters Roads	No	Option does not address investment objectives as it competes with rail.
4	Roscommon Road	No	Option is being progressed separately by AT and provides no connectivity east of NIMT/SH1.
North-South Route Sections (south of Airfield Road)			
5	New road (continuing option 1) / Grove Road between Airfield Road and Papakura	Yes	North-south option through FUZ, new section of road needed.
6	Porchester Road and Marne Road between Airfield Road and Papakura (continuing option 2)	Yes	North-south option using existing roads.
East-West Route Sections (north of Airfield Road)			
7	Alfriston Road and Ranfurly Road east of Manurewa	Yes	

No.	Option	Progress to shortlist?	Comment
8	Alfriston Road between Manurewa and Wastney / new road (adjoins option 1)	Yes	East-west routes linking Takaanini FUZ and Manurewa Station / Great South Road.
9	Mahia Road west of Great South Road (adjoins option 10)	No	Option being progressed separately by AT (as noted in section 3).
10	Rangi Road and Popes Road between Great South Road and new road (adjoins option 1)	Yes	Option includes Rangi Road Viaduct (noting clear need to re-test this option was identified through gap analysis – see section 9).
11	Manuroa Road and Station Road east of Takaanini Station	Yes	Provides a link from Takaanini FUZ to Takaanini Station and Great South Road.
12	Airfield Road and Taka Street between Great South Road and new road (adjoins option 5)	Yes	
East-West Route Sections (south of Airfield Road)			
13	Walters Road between Great South Road and Grove Road	Yes	AT SMEs have identified this as a key east-west connection, providing access to Bruce Pulman Park.
AT Metro Remix Route Sections			
14	Alternative east-west connection via Hill Road	No	A less direct alternative to the Alfriston Road options.
15	Alternative north-south and east-west connections via Mill Road and Alfriston Road	No	Will only capture half of FUZ, hence a low catchment served. Mill Road addressed in separate project.
16	Manukau Station to Papakura Station via Russell Road, Magic Way, and Porchester Road	No	Each of these options includes collector roads and will result in a circuitous route.
17	Manukau Station to Papakura Station via Russell Road, Takanini School Road, and Porchester Road	No	
18	Manukau Station to Papakura Station via Druces Road, Browns Road, Rowandale Avenue, Weymouth Road, Great South Road, Rangi Road, Popes Road, and Porchester Road.	No	

From the above summarised EAST assessment, the longlist of eighteen route sections was rationalised to a shortlist of ten route sections for shortlist MCA assessment.

10.1.2 Shortlisted options

The ten options identified from the EAST assessment for shortlist assessment were split into two option groupings for assessment – north-south options and east-west options. These are summarised below.

North-South Options

The EAST assessment identified four north-south options. These are referred to as follows (see Figure 10-2):

- **Option 1.1** – Porchester and Marne Road between Airfield Road and Papakura (referred to in the EAST assessment as option 6);
- **Option 1.2** – Porchester Road between Alfriston Road and Airfield Road (referred to in the EAST assessment as option 2);
- **Option 2.1** – New Road / Grove Road between Airfield Road and Papakura (referred to in the EAST assessment as option 5); and
- **Option 2.2** – Wastney Road / New Road between Alfriston and Airfield Roads (referred to in the EAST assessment as option 1).



Figure 10-2 – North-South shortlisted options

East-West Options

The six east-west options from the EAST assessment were split out into a shortlist of six sub-options north of Airfield Road (see Figure 10-3) and five south of Airfield Road (see Figure 10-4) to allow for more localised assessment:

Shortlisted options north of Airfield Road were:

- **Options 1.1, 1.2, and 1.3** (derived from options 7 and 8 from the EAST assessment) – respectively comprising:
 - Alfriston Road between Manurewa and Porchester Road;
 - Alfriston/Ranfurly Roads from Porchester Road to Wastney Road; and
 - Alfriston Road from Ranfurly Road to Wastney Road; and
- **Options 2.1, 2.2, and 2.3** (derived from option 10 in the EAST assessment) – respectively comprising:
 - Rangi Road between Great South Road and Porchester Road via the Rangi Road Viaduct;
 - Spartan Road and Popes Road between Great South Road and Porchester Road; and
 - Popes Road between Porchester Road and New Road (see north-south option 2.2).

Shortlisted options south of Airfield Road were:

- **Option 3** (referred to in the EAST assessment as option 11) – Manuroa Road and Station Road east of Takaanini Station;
- **Options 4.1 and 4.2** (derived from option 12 in the EAST assessment) – respectively comprising:
 - Airfield Road between Porchester Road and New Road (see north-south options 2.1 and 2.2); and
 - Taka Street and Airfield Road between Great South Road and Porchester Road;
- **Options 5.1 and 5.2** (derived from option 13 in the EAST assessment) – respectively comprising:
 - Walters Road between Porchester Road and Grove Road; and
 - Walters Road west of Porchester Road.



Figure 10-3 – East-west shortlisted options – north of Airfield Road (left); and south of Airfield Road (right)

10.2 Route Option Assessment

10.2.1 North-South options

Initial MCA Assessment

The shortlisted north-south options were assessed using the Te Tupu Ngātahi MCA Framework described in section 4.1.2. The assessment scoring is summarised in Table 10-2 below.

Table 10-2 – Summary of initial north-south route option MCA assessment

Criteria	Scoring			
	South of Airfield Road		North of Airfield Road	
	Option 1.1	Option 2.1	Option 1.2	Option 2.2
IO 1: Access	2	1	3	4
IO 2: Integration	1	-1	3	4
IO 3: Travel choice and climate change	2	1	3	4
Historic Heritage	-2	-2	-2	-2
Land Use Futures	3	-1	3	2
Urban Design	1	-3	2	2
Land Requirement	-4	-4	-3	-1
Social Cohesion	4	-1	3	2
Human Health and Wellbeing	-2	-2	-2	-1
Landscape / Visual	0	0	-1	-1
Stormwater	-1	-2	-1	-4
Ecology	-1	-2	-4	-4
Natural Hazards	-4	-3	-2	-3
Transport System Integration	3	1	3	3
User Safety	1	-3	1	2
Construction Impact	-2	-1	-1	-1
Construction Disruption	-2	-2	-2	-1
Construction costs/risks	-2	-3	-2	-3

The key outcomes from this assessment for options to the north of Airfield Road are that:

- **Option 1.2** performs well against the investment objectives although not as favourably as Option 2.2 given that Option 2.2 will better support growth in the Takaanini FUZ. It scores as highly adverse for ecology based on an assumed widening and potential impact on high value wetlands. However, route refinement will likely improve the score and is preferred over Option 2.2 given that it is existing infrastructure; and
- **Option 2.2** performs the best against the investment objectives. However, it scores highly adverse for stormwater and ecology as it is a new road to be built on peat soils which will be challenging from a stormwater perspective and will impact low-to-high value wetlands in the area. In addition, the uncertainty of the Takaanini FUZ means there is uncertainty in the expected catchment for this route.

For options to the south of Airfield Road:

- **Option 1.1** scores favourably against the investment objectives given that it services an existing residential catchment. It scores highly favourably against social cohesion as it will provide and improve connectivity between areas anticipating intensified residential development to community facilities. However, the option was assessed as highly adverse for natural hazards due to likely settlement of existing properties as a result of earthworks and underlying soil conditions; and
- **Option 2.1** scores poorly against investment objective 2 as the proposed alignment runs through the existing Bruce Pulman Park. This will have a negative impact as it does not integrate or align with the intended land use. It also scores moderately adverse against urban design as it will cause severance to the Bruce Pulman Park and the Holy Trinity Catholic Primary School.
- The negative scoring for **Option 2.1** was largely attributed to the option cutting through Bruce Pulman Park. Feedback from specialists indicated the scoring would change if the assessment only considered the corridor up to Walters Road to avoid severing the park. Accordingly, the team considered a modified option should be assessed to fairly ascertain the preferred option.

Further North-South Assessment (south of Airfield Road)

Figure 10-4 shows the modified iteration of option 2.1 south of Airfield Road for further assessment. This option utilises Porchester Road north of Walters Road (i.e. part of option 1.1) to avoid impacts on Bruce Pulman Park, before turning east-west along Walters Road to connect with Grove Road and Clevedon Road (i.e. part of option 2.1) to connect to Papakura.

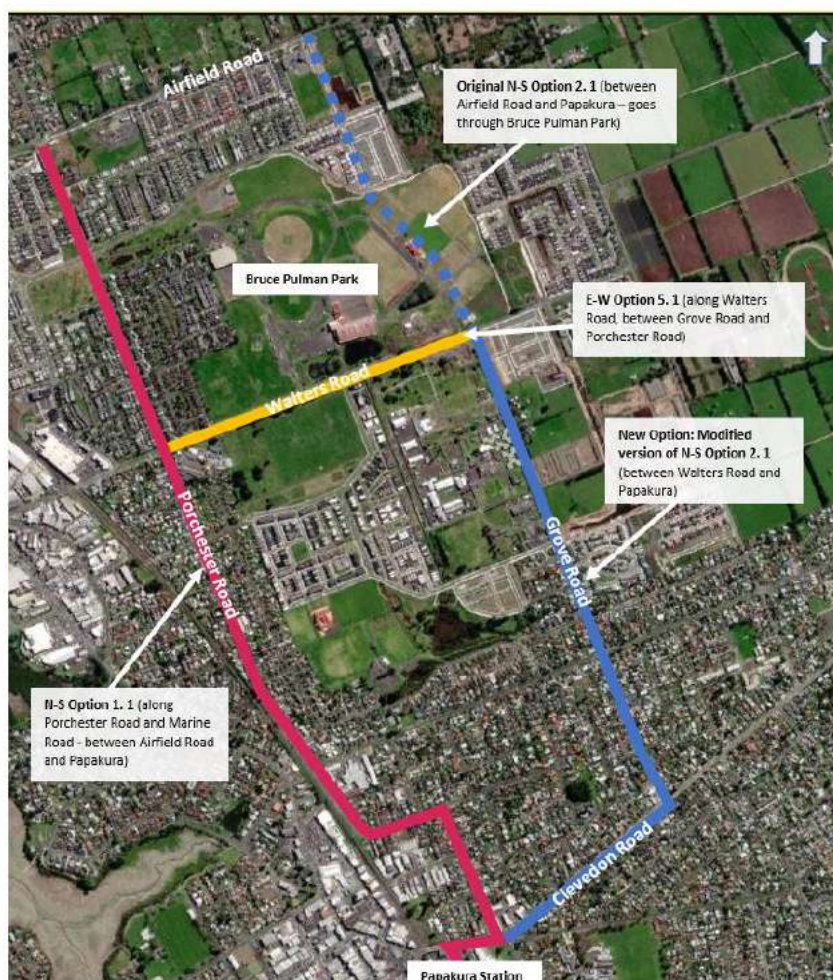


Figure 10-4 – Modified option 2.1, utilising Porchester Road north of Walters Road, Grove Road south of Walters Road, and Walters Road itself to connect them.

The modified option 2.1 was then tested against option 1.1 using the MCA Framework. This assessment is summarised in Table 10-3 below.

Table 10-3 – Summary of further north-south route option MCA assessment

Criteria	Scoring	
	Option 1.1	Modified Option 2.1
IO 1: Access	2	3
IO 2: Integration	1	2

IO 3: Travel choice and climate change	2	3
Historic Heritage	-2	-2
Land Use Futures	2	1
Urban Design	1	0
Social Cohesion	3	2
Human Health and Wellbeing	-2	-2
Landscape / Visual	0	1
Stormwater	-1	-2
Ecology	-1	-1
Natural Hazards	-4	-3
Transport System Integration	2	3
User Safety	1	2
Construction Impact	-2	-1
Construction Disruption	-2	-2
Construction costs/risks	-2	-3

The key outcomes from this assessment are that:

- **The modified option 2.1** scores more favourably against the investment objectives and transport criteria than Option 1.1 as the option will provide existing residential areas to the east of the NIMT with high quality public transport which it currently lacks; and
- As noted in the initial assessment, **option 1.1** was assessed as highly adverse against natural hazards due to likely settlement of existing properties as a result of earthworks and underlying soil conditions.

Accordingly, the modified option 2.1 is the preferred route option south of Airfield Road.

South of Papakura

The above assessment identifies a preferred north-south route as far south as its connection with the Papakura metropolitan centre via Clevedon Road. Given that the intent of the Takaanini FTN (as envisaged in IBC option MT4I) is to ultimately connect with the Ōpāheke North-South Arterial (already route protected as part of the Drury Arterials package) at the intersection of Hunua and Boundary Roads, all routing options were assumed to end on Hunua Road. This means that the only routing matter to consider is how to get from Clevedon Road to the intersection of Hunua and Boundary Roads.

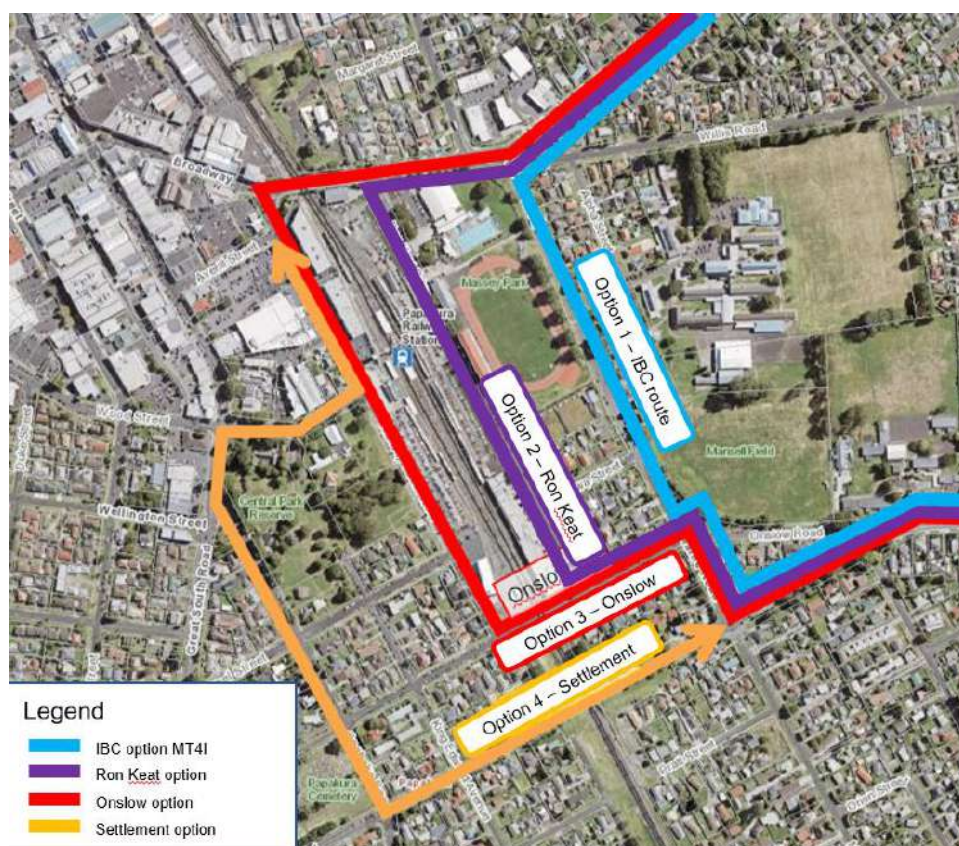


Figure 10-4 – Options for connecting Clevedon Road with Hunua Road.

The Project team identified four possible routes to connect these points (see Figure 10-6). A preferred route was identified with AT, and follows Railway Street West, Great South Road, Ōpāheke Road, Settlement Road, and Hunua Road (see Figure 10-6).

There were a number of reasons why this option was preferred as follows:

- AT considered it was an important functional requirement that the route provide a direct interchange with the Papakura train station, and that the route cross the NIMT to directly serve the Papakura metropolitan centre on the west side of the rail tracks. This ruled out options 1 (the IBC route) and option 2 (Ron Keat Drive) (see Figure 10-6);
- There is one road-over-rail crossing to the north of the station (Clevedon Road), which is the logical point to cross the tracks (given that the route already follows Clevedon Road);
- The Settlement Road routing option (Option 4 – see Figure 10-6) was preferred to cross the tracks to the south of the station as possible future rationalisation of the Onslow and Settlement Road crossings has been indicated as a possibility as part of the future four-tracking of the NIMT (both

existing crossings would need to be rebuilt to accommodate additional tracks). In this eventuality it was considered more likely that Settlement Road crossing remains, and that Onslow Road is closed given it is the more strategically significant east-west route for general traffic and freight (as indicated in AT's Future Connect portal);

- The option 4 routing also utilised intersection widening designations already secured as part of the Drury Arterials Network (e.g. at the corner of Ōpāheke Road and Settlement Road), ensuring future land take efficiencies; and
- Given the earlier noted assumption of a connection at the intersection of Boundary and Hunua Roads, all four options followed Settlement and Hunua Roads.

Preferred North-South Route Option

The above assessment has indicated that:

- **Option 1.2 (Porchester Road)** is the preferred north-south route option to the north of Airfield Road;
- **Modified option 2.1** (comprising a section of option 1.1 (Porchester Road), Walters Road, and Grove Road) is the preferred north-south route option to the south of Airfield Road to Papakura; and
- The preferred route option between Papakura and the intersection of Hunua and Boundary Roads follows Railway Street West, Great South Road, Ōpāheke Road, Settlement Road, and Hunua Road.

This preferred route option is shown in Figure 10-7.

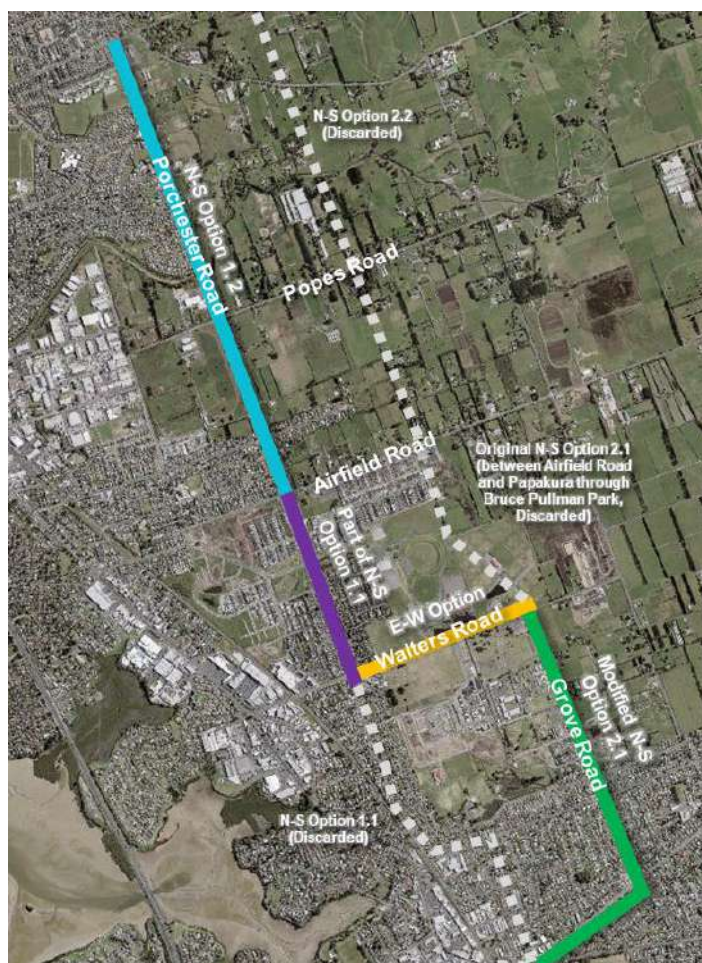


Figure 10-5 – Preferred North-South Route Option

10.2.2 East-West options

Implications of the North-South Assessment

The north-south and east-west route option assessments were undertaken sequentially, meaning that the outcomes of the north-south assessment influenced the scope of optioneering and outcomes undertaken for east-west route options. In particular:

- The preference for Porchester Road as a north-south route north of Walters Road (over a new alignment further to the east) has meant that east-west options further to the east of Porchester Road outlined in section 10.1.2 can be discarded without further assessment as part of the FTN route (because the remaining east-west options were premised on connecting with a north-south alignment further to the east). This removed the need to assess options 1.2, 1.3, 2.3, and 4.1; all of which were premised on connecting with a new north-south alignment further to the east of Porchester Road; and
- The inclusion of Walters Road as part of the preferred north-south route means that one of the east-west options (option 5.1, see Figure 10.4) is already included as part of the preferred route.

Given the above, the eleven east-west options shortlisted in section 10.1.2 were reduced to six for the purposes of MCA assessment as follows:

- Option 1.1 – Alfriston Road between Manurewa and Porchester Road;
- Option 2.1 – Rangi Road and Popes Road (via Rangi Road Viaduct);
- Option 2.2 – Spartan Road and Popes Road between Great South Road and Porchester Road;
- Option 3 – Manuroa Road and Station Road east of Takaanini Station;
- Option 4.2 – Taka Street and Airfield Road between Great South Road and Porchester Road; and
- Option 5.2 – Walters Road west of Porchester Road.

MCA Assessment

The shortlisted east-west options were assessed using the Te Tupu Ngātahi MCA Framework described in section 4.1.2. The assessment scoring is summarised in Table 10-4 below.

Table 10-4 – Summary of east-west route option MCA assessment

Criteria	Scoring					
	Option 1.1	Option 2.1	Option 2.2	Option 3	Option 4.2	Option 5.2
IO 1: Access	3	1	1	2	2	1
IO 2: Integration	2	0	1	2	2	0
IO 3: Travel choice and climate change	2	1	1	2	2	1
Historic Heritage	-1	-2	-1	-1	-1	-1
Land Use Futures	2	1	2	2	2	2
Urban Design	1	-3	1	-1	-1	0
Land Requirement	-4	-2	-1	-4	-1	-1
Social Cohesion	3	2	2	3	3	3
Human Health and Wellbeing	-2	-1	-1	-2	-2	0
Landscape / Visual	0	-3	0	0	0	0
Stormwater	-1	-3	-2	-1	-1	-1
Ecology	-3	-3	-4	-1	-1	-1
Natural Hazards	-1	-3	-3	-4	-4	-4
Transport System Integration	4	4	-3	2	2	1

Criteria	Scoring					
	Option 1.1	Option 2.1	Option 2.2	Option 3	Option 4.2	Option 5.2
User Safety	1	1	-3	2	2	1
Construction Impact	-1	-2	-1	-1	-1	-1
Construction Disruption	-2	-3	-2	-2	-2	-2
Construction costs/risks	-1	-4	-3	-3	-3	-3

The key findings of the assessment were as follows:

- **Option 1.1** performs the best against the investment objectives, land use futures and transport system integration as it will provide for the existing residential community and integrate well with the existing environment. However, it was assessed as highly adverse for land requirement given the established residential community;
- **Option 2.2** (which included the Rangi Road Viaduct) was not preferred given the significant adverse effects associated with a large 500m viaduct traversing SH1, the NIMT, the Papakura Stream, and Transpower's electricity corridor – these are reflected in the urban design, landscape and visual, stormwater, ecology, natural hazards, and construction disruption criteria. Moreover, the high cost, complexity, and high levels of embodied carbon associated with the option are reflected in the scoring for construction costs/risks;
- **Option 2.2** is anticipated to only have low positive benefits against the investment objectives given the industrial land use, meaning that catchment is limited. The option was assessed as highly adverse against ecology due to the potential impact on mature exotic and native trees as well as floodplains assessed as having moderate value;
- **Option 3** scores similarly to Option 1.1 in terms of investment objectives with the exception of investment objective 1 as it is anticipated to have a smaller catchment, and accordingly benefitting fewer people. Similar to Option 1.1, significant land requirements were anticipated, hence the low score. Option also assessed as highly adverse for natural hazards due to the soft soil conditions resulting in the risk of settlement and groundwater management required;
- **Option 4.2** scores similarly to Option 3 with respect to investment objectives and for similar reasons. Likewise, it scores highly adverse for natural hazards due to ground conditions and the associated risks; and
- **Option 5.2** was assessed as having low positive benefits in respect of the investment objectives. However, it was assessed as highly adverse against natural hazards due to the soft soil conditions and its associated risks.

The assessment has identified **Option 1.1 (Alfriston Road)** as a preferred east-west route option as it best responds to the investment objectives by providing an east-west connection through to the Manurewa Station. Further, it is not anticipated to have the high adverse impacts on the natural environment as some of the other options, despite some of these options scoring similarly to Option 1.1 in terms of the investment objectives. **Option 5.1 (Walters Road)** is also an east-west connection forming part of the preferred option given it was already identified in the north-south route option assessment (see section 10.2.1).

Decision to discount the Rangi Road Viaduct

A corollary of the above assessment is a decision to discount the Rangi Road Viaduct (part of option 2.2) from further consideration. As noted above, the option was discounted due to high costs, high complexity, high environmental effects, and high levels of embodied carbon – all stemming from the inherent scale and complexity associated with a >500m viaduct traversing SH1, the NIMT, the Papakura Stream, and Transpower's electricity transmission corridor.

Given that the Rangi Road Viaduct formed part of the ISTN network for both Takaanini level crossing removal and the South FTN, this optioneering was undertaken concurrently between the TLC and South FTN DBCs. Accordingly, the Rangi Road Viaduct has been discounted as an option under both DBCs. This confirms that the ISTN options MT4I (and associated options MT4K and EW9B) will not be progressed in the form originally envisaged in the South IBC.

10.3 Preferred route

From the assessments summarised above, the preferred options for both north-south and east-west sections of the Takaanini FTN route were assembled into a single preferred option for the route as a whole. This is shown in Figure 10-8 below, and forms the basis of all subsequent form and function and location refinement assessment.

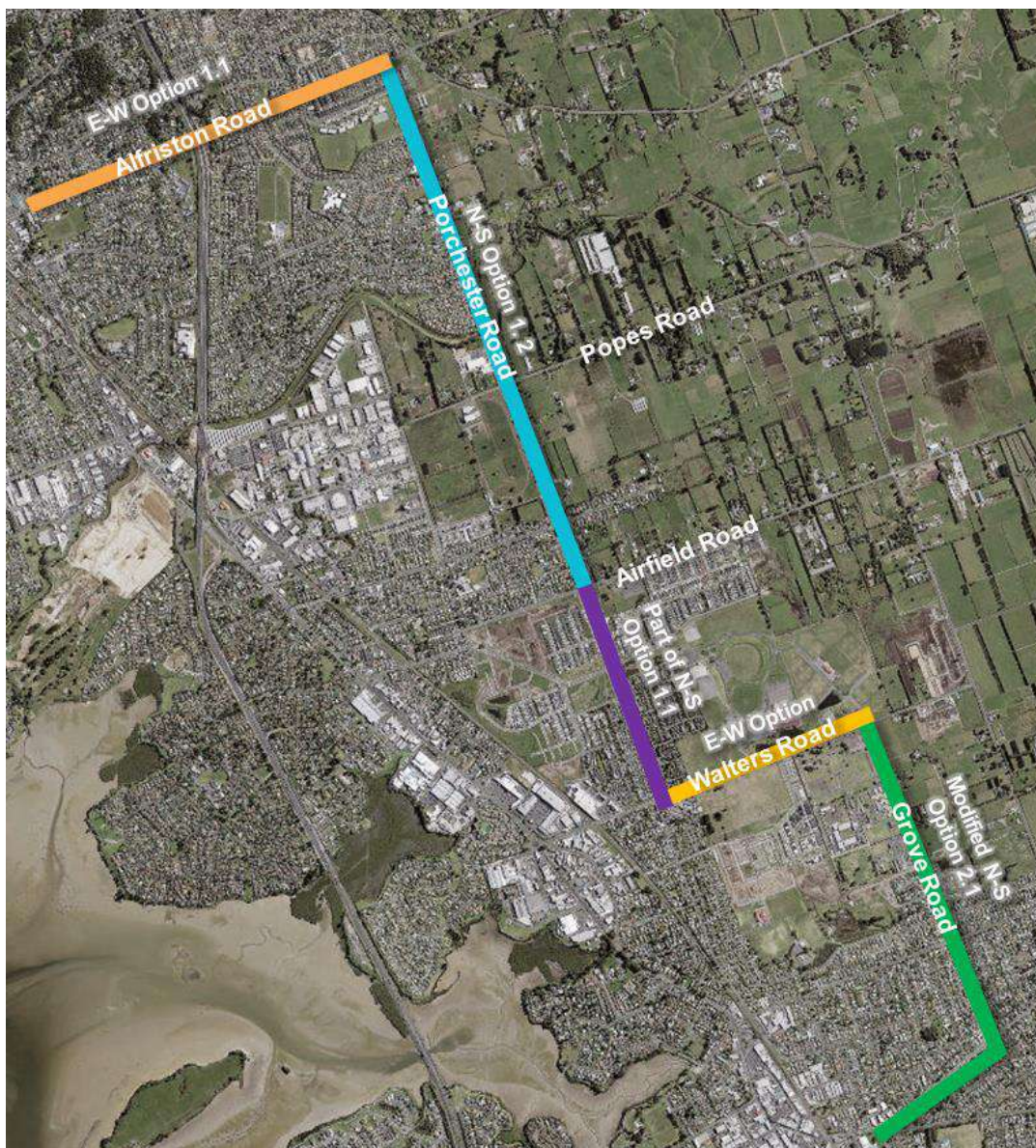


Figure 10-6 – Preferred route for the Takaanini FTN

11 Form and Function

11.1 Corridor Form and Function

As noted in section 4.1.3 of the general methodology, the CFAF process as developed and applied at the Programme-wide level is intended to use land use and transport planning inputs to define functional requirements for the corridor in question, and identify a suitable midblock cross-section from a set of modular concept designs. This approach is taken on the basis that it provides for a suitable level of detail for route protection and design efficiency, whilst allowing for future design changes and flexibility at the time of implementation.

In the case of the Takaanini FTN, the outputs of the CFAF process was the application of:

- **A four-lane FTN arterial** cross-section to section 6 (Alfriston Road), incorporating one general traffic lane and one bus lane per direction, separated active mode facilities in each direction, and space for berms and a median (see Figure 11-1); and
- **A two-lane FTN arterial** cross-section for the remainder of the route (sections 7-9) incorporating separated walking and cycling facilities (see Figure 11-2). No bus lanes are proposed for these sections of the route given the lower expected bus and general traffic volumes (as detailed in **Appendix G: Transport Outcomes Report**).



Figure 11-1 – Four-lane FTN arterial as proposed for Alfriston Road (section 6 of the Takaanini FTN).



Figure 11-2 – Two-lane FTN arterial as proposed for sections 7-9 of the Takaanini FTN.

Retesting of Alfriston Road

As was the case for sections of the Great South Road FTN, a reassessment of the Alfriston Road form and function was undertaken given the significant third-party land/property cost implications of applying the four-lane FTN arterial as shown in Figure 11-1. This included assessment of a similar range of form and function approaches considered for the Great South Road FTN, including:

- Prioritisation of a transport mode (e.g. full bus lanes or active mode improvements but not both);
- Removal of an element from the cross-section (e.g. bus lanes in one direction only); or
- Full road space reallocation and/or road widening through applying the full four-lane FTN arterial cross-section shown in Figure 11-1.

Following this assessment, it was concluded that the four-lane FTN arterial cross-section remained the preferred form and function option for the Alfriston Road corridor west of Magic Way; with the section to the east of Magic Way requiring eastbound bus lanes only. The reasons for generally retaining the four-lane FTN arterial cross-section, in spite of its significant third-party land requirements, are as follows:

- Lack of other east-west connections in the transport network which places significant demands on the Alfriston Road corridor for all modes;
- Significant predicted future bus volumes, with up to 26 buses per hour anticipated;
- The need to replace the SH1 and NIMT overbridges irrespective of corridor width;
- Poor outcomes for all transport modes and urban form without additional widening; and
- Inability to avoid significant property impacts with compromised solutions given the nature of land use along the corridor.

11.2 Intersection Assessment

As noted in section 4.1.3 of the general methodology, an intersection assessment process was undertaken in parallel to the CFAF to identify which intersections required upgrades, the indicative intersection controls in these locations, and the resultant footprint implications. Similarly to the CFAF process, the approach developed and applied across the programme for the intersection assessment is to use land use and transport planning inputs to define functional requirements for the corridor in question, and identify a suitable intersection layout from a set of modular intersection designs.

The intersection filtering process identified twenty intersections requiring interventions along the Takaanini Road FTN route between Manukau and Drury. These were identified based on the considerations listed in section 4.1.3 of the general methodology, and are listed in Table 11-1. The rationale and detail for the configurations for each intersection is included in **Appendix G: Transport Outcomes Report**.

As noted in section 4.1.3, the intersection form at each site was identified based on a range of factors including safety, operational efficiency, urban design/land use integration, public transport operations, engineering and environmental constraints, property constraints, and other site-specific factors. While roundabouts are the typical first choice for at-grade intersections recommended in 'Safe System' guidance, it is recommended that the majority of intersections along the Alfriston Road section of the route are signalised for the following reasons:

- Complex existing intersections with multi-lane approaches; and

- A highly urbanised context with limited space available without significant property impacts.

The majority of the remainder of the route has a two-lane midblock (see section 11.1 above). Accordingly, following the methodology outlined in section 4.1.3 has resulted in the identification of single-lane roundabouts as the preferred intersection form in the majority of cases. The exceptions are where signals have been recommended due to:

- Proximity of schools in some cases and the resultant need for safer crossing movements;
- The need to enable efficient turning movements for FTN buses; or
- Engineering constraints in the case of the Hunua/Croskery Road intersection.

Table 11-1 summarises the forms identified for key intersections following this assessment. The rationale and detail for the configurations for each intersection is included in **Appendix G: Transport Outcomes Report**.

Table 11-1 – Proposed intersection forms resulting from intersection assessment

Corridor section	Intersection	Proposed form
6	Weymouth Road / Manurewa Bus Interchange	Signals
	Alfriston Road / Claude Road	Signals
	Alfriston Road / Scotts Road	Signals
	Alfriston Road / Magic Way	Signals
	Alfriston Road / Porchester Road	Signals
7	Porchester Road / Popes Road	Dual-lane roundabout
	Porchester Road / Manuroa Road	Single-lane roundabout
	Porchester Road / Airfield Road	Single-lane roundabout
8	Porchester Road / Kauri Heart Avenue	Signals
	Porchester Road / Walters Road	Signals
	Walters Road / Grove Road	Signals
	Grove Road / Old Wairoa Road	Single-lane roundabout
	Grove Road / Clevedon Road	Single-lane roundabout
	Clevedon Road / Marne Road / Willis Road	Single-lane roundabout
	Clevedon Road / Broadway	As existing
9	Great South Road / Ōpāheke Road	As existing
	Ōpāheke Road / Settlement Road	Single-lane roundabout
	Settlement Road / Marne Road	Single-lane roundabout
	Settlement Road / Hunua Road	Single-lane roundabout
	Hunua Road / Croskery Road	Signals

12 Location Refinement

As noted in section 4.1.4 of the general methodology, a process of reconciling expert and technical inputs in a workshop setting applied to decisions on the location of any road widening and realignment (i.e. third-party land requirements) to accommodate the preferred form and function along the preferred routes.

Table 12-1 sets out the key matters identified for each section which have informed the extent and location of third-party land requirements. These generally emphasise where environmental features and identified constraints constitute clear ‘differentiators’.

Table 12-1 – Key differentiating features/constraints informing application of location refinement principles

Section	Third-party land requirement? ⁷	Key differentiating features/constraints informing application of location refinement principles
6	High	- Desire to avoid or reduce impacts on Church (north side, chainage 350), Cosmopolitan Club (north side, chainage 430), Housing for Elderly complex (south side, chainage 660), - Numerous residential new builds including large apartment complex (north side, chainage 560). Each presents a challenge in terms of avoidance (i.e. the ability to maintain a 1.5m front yard in the first instance), and/or boundary setting where street frontage units will need to be acquired. - The need to replace both SH1 and NIMT bridges drive significant property requirements.
7	Moderate	- Clear preference for any widening to be to the east given that land to the east of Porchester Road is zoned FUZ, while land to the west is already urbanised. - Desire to avoid or reduce impacts on churches/temples on east side, and Alfriston College on the west side, potential large wetland on the east side between Taipan Place and Papakura Stream. - Medium density residential new build at intersection of Porchester Road / Manuroa Road / Berwyn Road – presents a challenge in terms of avoidance (i.e. the ability to maintain a 1.5m front yard in the first instance), and/or boundary setting where street frontage units will need to be acquired.
8	Moderate	Medium density residential new build at intersection of Walters Road / Grove Road – presents a challenge in terms of avoidance (i.e. the ability to maintain a 1.5m front yard in the first instance), and/or boundary setting where street frontage units will need to be acquired.
9	Moderate	- Desire to avoid or reduce impacts on historic heritage features (Papakura Old Central School and War Memorial), Papakura Cemetery, and notable tree in road reserve near Settlement Road rail bridge. - Medium density residential new build at intersection of Settlement Road and Marne Road – presents a challenge in terms of avoidance (i.e. the ability to

⁷ Qualitative scale of land requirement is taken from **Appendix L: Route Protection Strategy**.

Section	Third-party land requirement? ⁷	Key differentiating features/constraints informing application of location refinement principles
		maintain a 1.5m front yard in the first instance), and/or boundary setting where street frontage units will need to be acquired.

The Design Report also addresses the consequential/ancillary design features resulting from the optioneering process (e.g. stormwater treatment devices and earthworks), and these considerations are not repeated here. The General Arrangement drawings included in Appendix H show the resultant corridor location/alignment and proposed designation boundaries.

13 Preferred Option

Following the application of the above process, a preferred option for the Takaanini FTN was identified. Its route and form and function are shown conceptually in Figure 13-1 below. The detailed alignment and boundaries are shown in the General Arrangement drawings appended to **Appendix H: Design Report**.



Figure 13-1 – Takaanini FTN preferred option

PART D: COMPLEMENTARY CORRIDORS

14 Gap analysis and confirmation of optioneering scope

As noted in section 2.2, each of the ‘complementary’ corridors originates from options identified as part of the ISTN through the IBC process; and have fallen into the scope of the South FTN DBC as a result of circumstances summarised in the gap analysis (see section 3).

These are outlined in Table 14-1 below.

Table 14-1 – Origins of the complementary corridors and why they are in South FTN DBC scope

Corridor	IBC option	Reasons for inclusion in South FTN DBC scope
Popes Road	Formed part of option EW9B which comprised east-west connections in the Takaanini area (see Figure 2-3).	- The decision to discount the Rangi Road Viaduct as part of the Takaanini FTN meant that option EW9B (and indeed option MT4L) was not possible in the form envisaged in the IBC. However, this decision only applied to the Rangi Road Viaduct, not to the wider east-west corridor including Popes Road. - Popes Road still likely has strategic significance as a future east-west connection between the north-south route formed by the Takaanini FTN and the future Mill Road corridor (and indeed further west via the TLC crossings).
Croskery Road	Formed the northernmost part of option AR10 (the Ōpāheke North-South Arterial), which in turn formed a part of FTN option MT4L (see Figures 2-1 and 2-2).	- The section of IBC option AR10 that formed part of FTN option MT4L has now been designated south of the intersection of Hunua and Boundary Roads (as part of the Drury Arterials package), and is part of the Takaanini FTN (see Part C of this report) to the north of the intersection. Croskery Road is therefore the only section not accounted for. - Croskery Road still likely has strategic significance as a future east-west connection between the north-south route formed by the Takaanini FTN and Ōpāheke North-South Arterial and the future Mill Road corridor.
Great South Road (Drury)	Formed the southernmost part of options MT4K and MT4L (SH1 FTN options), forming the connection between the SH1 Drury Interchange and Drury Central Station (see Figure 2-1).	- As noted in section 3, options MT4K and MT4L have not been taken forward into a DBC by Te Tupu Ngātahi, meaning that the upgrade of this section of Great South Road has not been provided for. - The designation/consenting and funding of the Drury Central Station and Waihoehoe Road urbanisation through NZUP have left this section of Great South Road requiring corresponding planning for urbanisation to ensure that the projects form a cohesive whole.

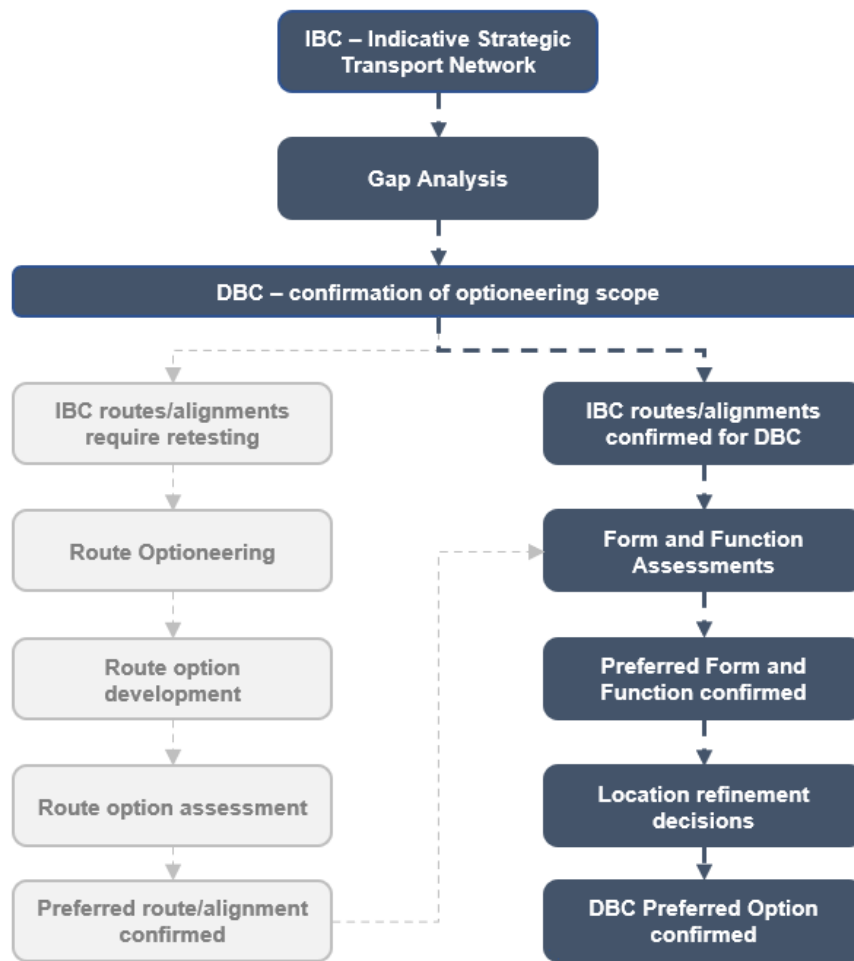


Figure 14-1 – Optioneering process adapted for Popes Road, Croskery Road, and Great South Road (Drury). Note omission of the route optioneering steps.

The methodology outlined in section 4 requires the implications of new information identified in the gap analysis to be considered with a view towards establishing the necessary scope of further optioneering in the DBC. In making this determination, the following conclusions were reached through the gap analysis on the three complementary corridors:

- The reasoning set out in Table 4-1 for each of the corridors identifies that each of the three corridors remains strategically important in the context of the wider network as it is now planned;
- Legislative and policy direction to enable increased housing supply, updates to AFC growth scenarios, and Private Plan Changes all signal that the areas around the Takaanini FTN project area will continue to experience urban growth and increased demand on the transport network;;
- The types of multi-modal interventions, namely urbanisation and active mode facilities, envisaged along the corridors are entirely consistent with the transport and climate change legislation policy directives outlined in Table 3-1; and
- All three corridors already exist. Given that FTN services are not proposed along these routes, there is no need to consider bus routing implications as was the case for the Takaanini FTN.

For the above reasons, there was not considered to be any reason to further retest the routes for Popes Road, Croskery Road, and Great South Road in Drury. Accordingly, the route optioneering process step was omitted, and the corridor proceeded directly to form and function assessment and location refinement (see Figure 14-1).

14.1 Implications of the draft Future Development Strategy

In response to NPS-UD requirements, Auckland Council published a draft FDS in April 2023. The draft FDS proposes changes to the spatial composition of urban growth in Auckland, including removal of the Takaanini FUZ. This area was identified as an area for long-term urbanisation under the Council's FULSS, and remains zoned FUZ. Given the timing of the draft FDS, it was not considered during the gap analysis undertaken at the outset of the Project.

The draft FDS is yet to be finalised, and would need to be followed by plan changes to take practical effect, and accordingly has yet to make a material difference to the recommendations of this report. However, it does introduce some uncertainty to the land use context for the Popes Road corridor given it traverses the Takaanini FUZ. It is recommended that the options assessment is re-examined in future when the draft FDS has been finalised and its implications are clearer.

14.2 Implications of potential freight network changes

There is some uncertainty at the time of writing as to the strategic role of Popes Road in the future freight network relating to a range of factors, including:

- Uncertainty as to the implications of a potential Alfriston Plan Change (currently in pre-lodgement discussions) for freight routing from freight generators to the east such as the Brookby Quarry;
- Uncertainty as to the form, function, and sequencing of the proposed Mill Road Corridor; and
- Implications of decisions relating to the Rangi Road Viaduct (see Part C of this report) for assumptions regarding freight routing.

Depending on the resolution of the above matters, the strategic significance of the Popes Road route as part of an east-west route connecting to Great South Road and SH1 via the proposed Manuia Road rail crossing (proposed as part of the TLC Project) may increase. This in turn may mean that further work needs to be undertaken in future to determine any route protection requirements to provide a freight connection between Popes Road and Manuia Road. Given the above uncertainties, this work has not been undertaken as a part of this business case. It is recommended that this is considered further in future work when the implications of the above uncertainties become clearer.

15 Form and Function

15.1 Corridor Form and Function

As noted in section 4.1.3 of the general methodology, the CFAF process as developed and applied at the Programme-wide level is intended to use land use and transport planning inputs to define functional requirements for the corridor in question, and identify a suitable midblock cross-section from a set of modular concept designs. This approach is taken on the basis that it provides for a suitable level of detail for route protection and design efficiency, whilst allowing for future design changes and flexibility at the time of implementation.

In the case of the three complementary corridors, the outputs of the CFAF process were the application of:

- **A two-lane arterial** cross-section for Popes Road and Croskery Road incorporating separated walking and cycling facilities (see Figure 15-1). No bus lanes are proposed for these corridors as they are not proposed as FTN bus routes; and
- **A four-lane arterial** cross-section for Great South Road (Drury) incorporating two general traffic lanes per direction, separated active mode facilities in each direction, and space for berms and a median (see Figure 15-2). No bus lanes are proposed for this part of the corridor as it is not proposed as an FTN bus routes. However, bus lanes are not precluded.



Figure 15-1 – Two-lane arterial as proposed for Popes Road and Croskery Road (indicative only).

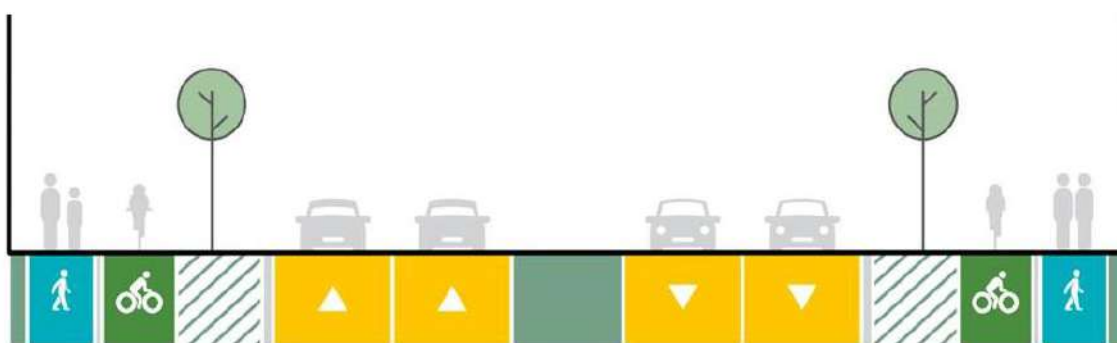


Figure 15-2 – Four-lane arterial as proposed for Great South Road (Drury).

In the case of Croskery Road, it is noted that the cross-section shown in Figure 15-1 can be readily accommodated within the existing road corridor without the need for third-party land.

15.2 Intersection Assessment

As noted in section 4.1.3 of the general methodology, an intersection assessment process is undertaken in parallel to the CFAF to identify the indicative controls required at key intersections, and the resultant footprint implications. Similarly to the CFAF process, the approach developed and applied across the programme for the intersection assessment is to use land use and transport

planning inputs to define functional requirements for the corridor in question, and identify a suitable intersection layout from a set of modular intersection designs.

In the case of the three complementary corridors, standalone intersection assessment was only undertaken for the intersection of Popes Road and Takanini School Road (see Table 15-1). The rationale and detail for the configurations for this intersection is included in **Appendix G: Transport Outcomes Report**. All other intersections along the three corridors were either:

- Already addressed as part of intersection assessment for the Great South Road or Takaanini FTN (given that the corridors intersect in some cases);
- Already assessed as part of another Te Tupu Ngātahi Project; or
- Anticipated to be assessed as part of a future project scope.

The circumstances pertaining to each intersection along the three complementary corridors is summarised in Table 15-1.

Table 15-1 – Complementary Corridors – intersections

Corridor	Intersection	Proposed form
Popes Road	Popes Road / Takanini School Road	Single-lane roundabout
	Porchester Road / Popes Road	Dual-lane roundabout (note addressed as part of Takaanini FTN, see Table 11-1).
	Porchester Road / Mill Road	TBC – Assumed to fall within future Mill Road project scope.
Croskery Road	Croskery Road / Hunua Road	Signals (note addressed as part of Takaanini FTN, see Table 11-1).
	Croskery Road / Mill Road	TBC – Assumed to fall within future Mill Road project scope.
Great South Road (Drury)	Great South Road / Waihoehoe Road	Signals – addressed as part of Drury Arterials package and to be implemented through NZUP (see Table 3-1)
	Great South Road / Firth Street	Addressed as part of Waka Kotahi Papakura-to-Drury (Stage 1B1) Project.
	Great South Road / SH1 Interchange	

16 Location Refinement

As noted in section 4.1.4 of the general methodology, a process of reconciling expert and technical inputs in a workshop setting applied to decisions on the location of any road widening and realignment (i.e. third-party land requirements) to accommodate the preferred form and function along the preferred routes.

Table 16-1 sets out the key matters identified for each section which have informed the extent and location of third-party land requirements. These generally emphasise where environmental features and identified constraints constitute clear ‘differentiators’.

Table 16-1 – Key differentiating features/constraints informing application of location refinement principles

Corridor	Third-party land requirement? ⁸	Key differentiating features/constraints informing application of location refinement principles
Popes Road	Low	- Stormwater conveyance channel on the south side of the road east of Porchester Road to be retained (see Appendix H: Design Report). This constraint pushes widening northwards. - Desire to avoid/reduce any impacts on Spark Data Centre on the south side of the road west of Porchester Road. - Otherwise – a lack of clear differentiating factors.
Croskery Road	None	N/A
Great South Road (Drury)	Moderate	- The need to integrate with adjoining projects – Waihoehoe Road urbanisation to the north, Drury Central Station to the east, and SH1 Papakura-to-Drury (Drury Interchange) to the south. - Desire to avoid/reduce impacts on Hingaia Stream where bridge replacement is required. - Desire to avoid/reduce impacts on Watercare's Waikato No.1 Watermain on the east side of the road. - Approaches to Hingaia Stream bridge need to be raised for flood immunity.

17 Preferred Options

Following the application of the above process, preferred options for Popes Road and Great South Road (Drury) were identified, and are shown conceptually at Figures 17-1 and 17-2 below. The detailed alignment and boundaries are shown in the General Arrangement drawings appended to **Appendix H: Design Report**.

⁸ Qualitative scale of land requirement is taken from **Appendix L: Route Protection Strategy**.

Further work on defining a preferred option for Croskery Road has not been progressed. As noted above, the preferred form and function can be accommodated within the existing road reserve with no third-party land needed. Accordingly, no designation is proposed (see **Appendix L: Route Protection Strategy**).

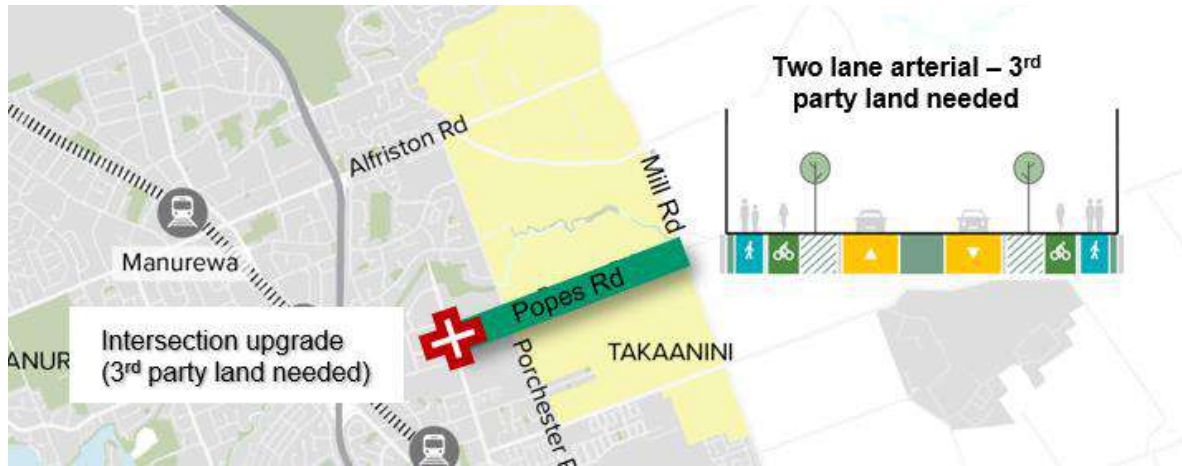


Figure 17-1 – Popes Road preferred option

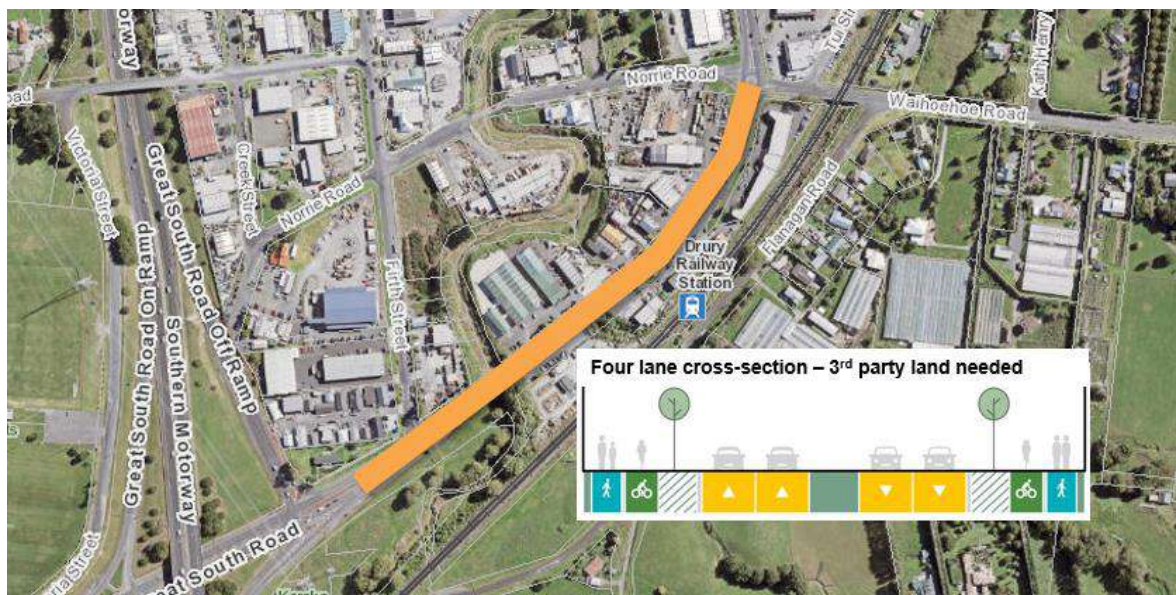


Figure 17-2 – Great South Road (Drury) preferred option

Appendix A: MCA Framework – Criteria

#	Criteria	Measure
1a	Heritage	Extent of effects on: sites and places of valued heritage buildings, scheduled trees (with heritage value) and places. sites and places of archaeological value. sites and places of European cultural heritage value
1b	Mana Whenua	Extent of <i>effects on sites and places of cultural heritage value to Manawhenua (including Sites and Places of Significance to Mana Whenua Schedule, Auckland Unitary Plan)</i>
2a	Land use futures / integration with planned land use	To what extent will the option impact on the future development of land (within the corridor, adjacent to it and impacted by it – ie consider all 3 scales), in relation to: • Integration with the future land use scenario (including any Structure Plans or Plan Changes) • Size and shape of potential development parcels to enable appropriate building typologies • Ability to consolidate residual land • Access that does not prevent neighbouring development
2b	Urban design	To what extent does the option support a quality urban environment (both current and future planned state)? particularly relating to: • Context and planned place making considerations • An inviting, pleasant and high amenity public realm • Open space integration • Active interface between public and private realm • Scale of long-term impact on the amenity and character of the surrounding environment.

2c	Land requirement	Scale of public / private land (m ² / number of properties / special status of impacted property) required to deliver the option.
2d	Social cohesion	Impact on, use, connectivity / accessibility for and to the existing urban areas including use and access to: • Employment • Other communities or within the same community • Shops / services / other community and cultural facilities / 'attractors' • Severance of the existing community (including consented) • Scale of effect on existing community facilities community and open space • Public access to the coast, rivers and lakes
2e	Human Health and Wellbeing	Will the option potentially affect any sensitive land uses nearby or consented (adjacent residential, childcare centres, hospitals, rest homes, marae and schools)? particularly relating to: • Air Quality • Contaminated land • Noise and vibration
3a	Landscape visual /	The extent of effects on: • The natural landscape and features such as streams, coastal edges, natural vegetation and underlying topography – acknowledging planned changes to area in light of urban land use / zoning • Natural character and outstanding natural features/landscapes including geological features (mapped and protected features)

3b	Stormwater	Impact of operational stormwater (both quantity and quality) on the receiving environment, including: • Potential flooding effects of the option within the catchment • Extent and consequences of likely mitigation measures
3c	Ecology	Extent of effects on: • Significant indigenous flora; • Significant habitats of indigenous fauna; • Indigenous biodiversity; • Stream / waterway ecology • Marine ecology
3d	Natural Hazards	Extent of effect on adverse geology; steep slopes; seismic impacts; other resilience risks (low level infrastructure near coastlines, inundation areas)
4a	Transport system integration	Extent the option achieves the following: • Connectivity / integration other transport modes (ie trains, buses, walking and cycling networks) • Wider transport system effects/benefits • Improve accessibility • Increase mode shift to public transport

4b	User safety	Extent of safety effects on all transport users, including: • People in public transport • people walking or cycling • People in private vehicles
5a	<u>Embodied carbon emissions</u>	<u>Consider the following design requirements:</u> • <u>Length (in km)</u> • <u>Area of impervious surface/ volume of earthworks</u> • <u>Specific infrastructure requirements (e.g. bridges, viaducts, tunnels etc.)</u>
5b	Construction impacts on utilities / infrastructure	Requirements for relocation / design of existing infrastructure, including: • Consideration of safety impacts • Risk of continuity of service over construction • Opportunities for integration with other bulk infrastructure
5c	Construction Disruption	Construction impacts on people and businesses regarding: • Traffic & noise • Earthworks related effects including dust • Quality of life and amenity • Economic impacts on businesses / community / town centres

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

Appendix B: Cross-sections assessed for Great South Road FTN

Section	Approaches Considered	Generic Cross-Section Considered
1a	C – Existing road reserve already sufficient to accommodate all desired cross-section elements	As existing.
	D – Apply full four-lane FTN arterial cross-section	
1b	C – Existing road reserve already sufficient to accommodate all desired cross-section elements	As existing.
	D – Apply full four-lane FTN arterial cross-section	
1c	A – Prioritise a transport mode	
	B – Remove an element from cross-section	

Section	Approaches Considered	Generic Cross-Section Considered
2	A – Prioritise a transport mode	
	B – Remove an element from cross-section	
3	C – Existing road reserve already sufficient to accommodate all desired cross-section elements	As existing.
	D – Apply full four-lane FTN arterial cross-section	
4	B – Remove an element from cross-section	
	C – Existing road reserve already sufficient to accommodate all desired cross-section elements	As existing.

Section	Approaches Considered	Generic Cross-Section Considered
	D – Apply full four-lane FTN arterial cross-section	
5	A – Prioritise a transport mode	
	B – Remove an element from cross-section	
	D – Apply full four-lane FTN arterial cross-section	

Technical Note

Date Prepared: 9/11/2023

Prepared by: [REDACTED]

Popes Road freight role

Purpose

The Te Tupu Ngātahi – South FTN project includes the urbanisation of Popes Road in the long-term network. The Popes Road corridor has been assessed in conjunction with the Takaanini Level Crossings DBC and the other key connections/ corridors in the South FTN DBC network. The assessment of Popes Road has responded to Auckland Transport's (AT's) future strategic freight network. Since the commencement of the South FTN DBC, there have been emerging potential private plan changes in the Alfriston area of the Takaanini FUZ. There has also been uncertainty around the form and timing of the Mill Road element in the preferred network identified by the South IBC (Indicative Business Case). It has also been identified that there is potential for changes to occur in the proposed long-term strategic freight network.

This memo sets out possible regional freight connections for AT to consider in the long-term wider strategic freight network. This memo identifies the freight connection that Te Tupu Ngātahi would propose in the case that the Alfriston Plan Change is confirmed/ strategic freight network changes and the potential next steps.

Document Status

Responsibility	Name
Author	[REDACTED]
Reviewer	[REDACTED]
Approver	[REDACTED]

Revision Status

Version	Date	Reason for Issue
0.1	08/06/2022	First draft for internal review
0.2	22/06/2023	Interim issue for SME review
1.0	23/06/2023	Issue for IQA
1.1	9/11/2023	Final

Table of Contents

1.	Background.....	2
1.2.	South IBC network.....	2
1.3.	DBC optioneering	2
1.4.	DBC gap analysis	3
1.5.	Current freight network.....	3
1.6.	Long-term freight network	4
1.6.1.	Freight movement	5
1.6.2.	Uncertainties	6
2.	Options	8
2.2.	Option 1: Alfriston Rd & Hill Rd	9
2.3.	Option 2: Popes Rd & Manuia Rd	11
2.4.	Option 3: Ranfurly Rd, Alfriston Rd & Takaanini Interchange	12
2.5.	Option 4: Ranfurly Rd, Alfriston Rd & Claude Rd	13
2.6.	Option 5: Ranfurly Rd & Hill Rd	14
2.7.	Option 6: Mill Rd & Redoubt Rd	15
3.	Conclusion	16
4.	Recommendation	17

Appendices

No table of contents entries found.

1. Background

1.2. South IBC network

During the South Indicative Business Case (IBC), the proposed new Rangi Road viaduct and Popes Road arterial were seen as one link/ arterial project. Rangi Road was the preferred Frequent Transit Network (FTN) route and a key industrial connection and was recommended as a multi-modal corridor with regional significance in the future network. Popes Road was viewed as an extension of the Rangi Road project and provided a key east-west connection to the N-S Mill Road strategic arterial. Rangi Road was also initially part of the frequent transit network in Takaanini, providing frequent and efficient bus services in the area.

The South IBC also included Mill Road, a strategic arterial which extended from Redoubt Road (in the north), through to a new Drury South interchange (in the south). The intended strategic function of Mill Road is to provide for inter-regional suburban connectivity and to provide a sub-regional freight route, connecting SH1 at Manukau, Papakura, Drury East, Drury South and SH1 at Drury South.

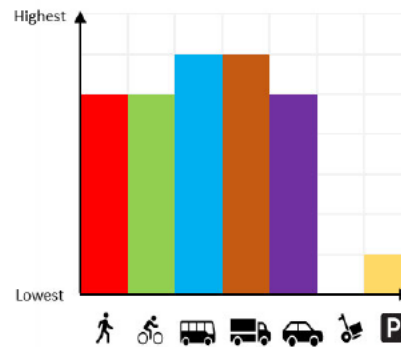
1.3. DBC optioneering

Since the South IBC, optioneering was undertaken to reconfirm the Takaanini Level Crossings network and the Takaanini FTN route. Rangi Road is no longer part of the Takaanini FTN route nor being recommended as a grade separated viaduct in the Takaanini Level Crossings DBC project. A new grade-separated connection, Manuia Road, will be the key industrial connection in the recommended network. The function of Manuia Road differs to the function which Rangi Road would have played, in the sense that Manuia Road is not part of the frequent transit network and has less regional significance. Manuia Road provides a connection between Great South Road (south of the Takaanini Interchange) and the Takaanini industrial area. Great South Road near the Takaanini interchange in the future is limited in terms of its role, as it is serving multiple functions which consist of providing for:

- Freight access to the local Takaanini industrial area
- Key primary arterial – high general traffic movement around the interchange
- FTN route – frequent buses routing along Great South Road
- Access across the NIMT – reducing severance in the Takaanini local network
- Key walking and cycling movement

Figure 1-1 shows the future modal priority for the section of Great South Road, south of the Takaanini Interchange. The future modal priority graph indicates that there are expected to be competing modes in the area with a lot of movement.

Figure 1-1: Future Modal Priority for GSR (Mahia Road - Manuroa Road)



The local environment on Great South Road is therefore limited in terms of being able to provide for a significant regional freight function and serve high freight movement. This will have an adverse impact on the surrounding community who live and travel in this area. This community is already significantly impacted by the national and regional transport infrastructure in this area.

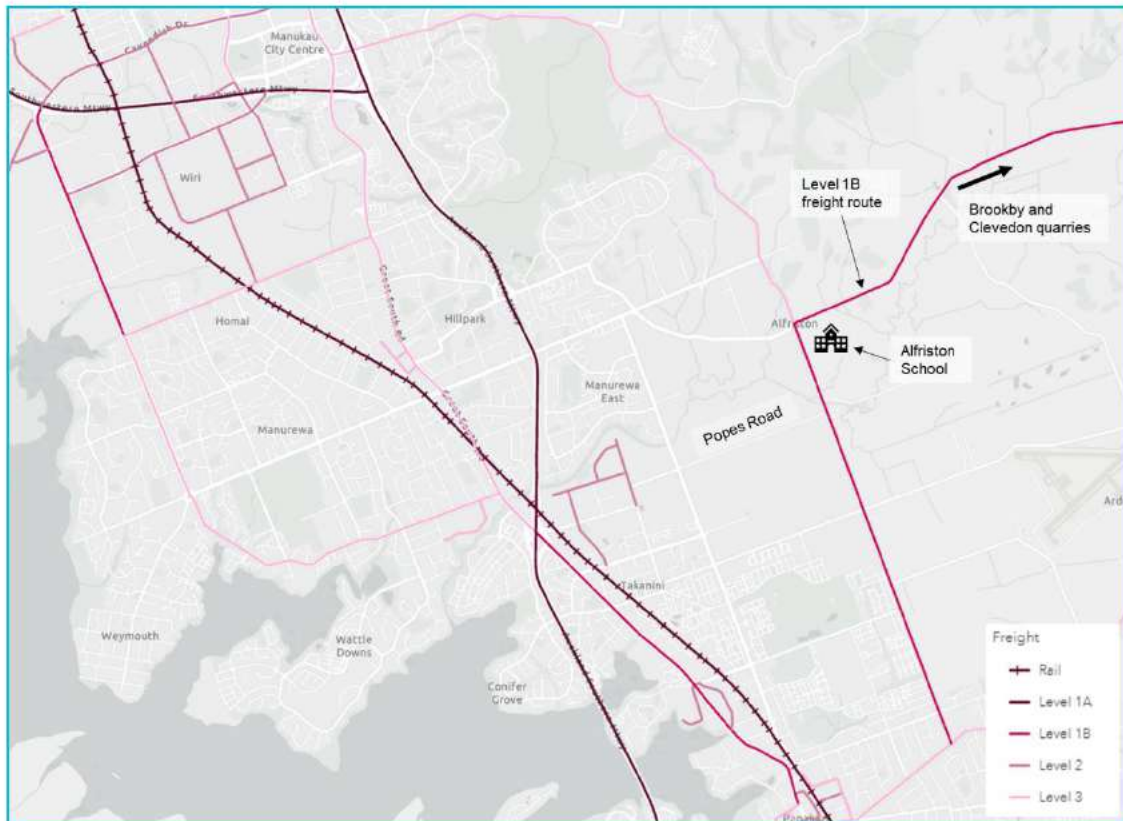
1.4. DBC gap analysis

Following the DBC optioneering and in light of the above proposed changes to the network, a gap analysis was undertaken to reconfirm the role, form and function of Popes Road. This gap analysis concluded Popes Road is expected to be a multi-modal corridor providing for walking and cycling, freight, connector PT services and general traffic. Popes Road is expected to provide a connection between Mill Road and the Takaanini industrial area, while serving the adjacent FUZ. The modelling concluded that Popes Road provides for a key east-west connection between the Takaanini industrial area and the strategic corridor, Mill Road. The assessment shows that Popes Road will not have a regional role in the transport network and mainly serves Mill Road, the adjacent FUZ and the Takaanini industrial area. Modelling showed limited number of trips along Popes Road which also uses Manuia Road, hence, a through movement connection from Mill Road, along Popes Road, and through the industrial area, to connect to GSR was not seen as a key connection in the future network.

1.5. Current freight network

Figure 1-2 shows the current freight network indicated by AT's future connect network. Currently, there is no strategic freight classification along Popes Road.

Figure 1-2: Current freight network (AT's Future Connect)

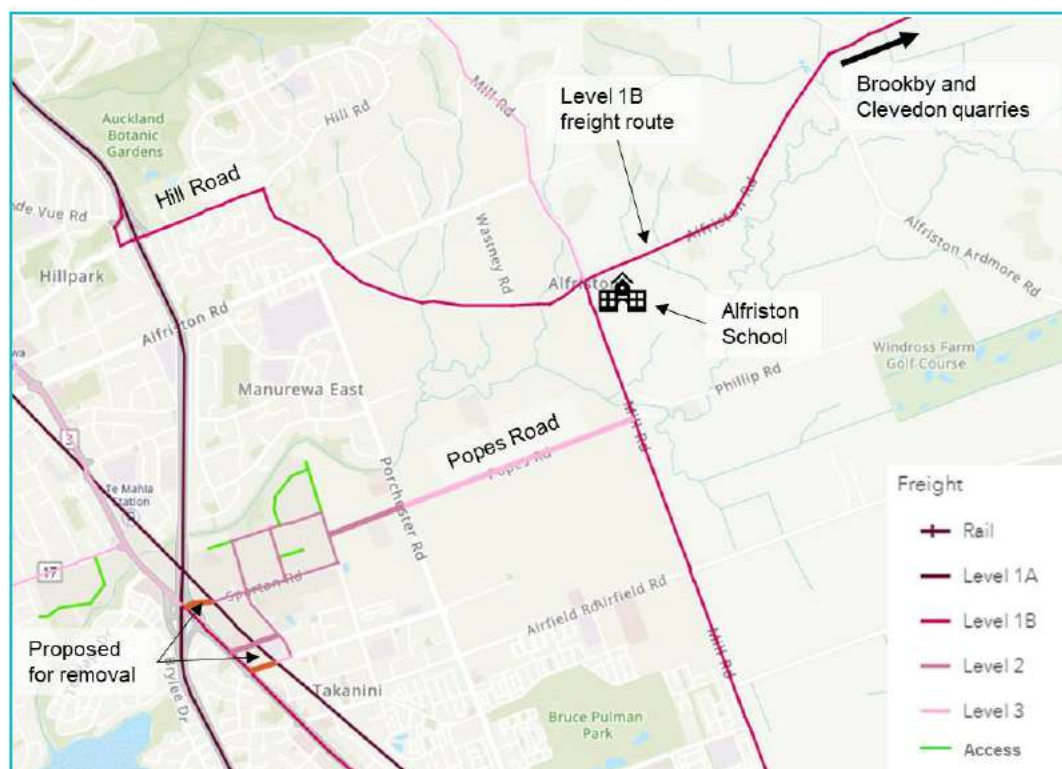


1.6. Long-term freight network

Te Tupu Ngātahi assessed Popes Road under the basis of the strategic long-term network provided by Auckland Transport for each mode. For freight in particular, it is expected that the industrial section of Popes Road will form part of the Level 2 strategic freight network. This classification indicates that the corridor is part of the local freight network within the Takaanini strategic freight area. The roads are primarily used for industrial purposes and are free from sensitive community/ residential impacts. Planning and design should consider the efficiency of freight movements. It is expected that the FUZ section of Popes Road will form part of the Level 3 freight strategic network. This classification indicates that the corridor connects between strategic freight areas, in this case the Mill Road (Level 1B freight network) and the Takaanini industrial area. Planning and design should consider efficient movement of freight, noting that adjacent land uses to the corridor are such that freight movements are not actively encouraged/ prioritised.

The wider long-term strategic freight network proposes a Level 1B freight connection between Brookby (out east) and the Hill Road SH1 access as shown in Figure 1-3. This route uses Alfriston Road to access Hill Road, providing access to the strategic state highway network. It should also be noted there is an existing school (Alfriston School) on the corner of Alfriston Road/ Mill Road. As heavy vehicle movement increases on this route overtime, there will be adverse safety risks on the adjacent sensitive land use.

Figure 1-3: Long-term strategic freight network



Strategic Network:

• **Rail Network and Level 1A**

Transport corridors of the highest strategic value to freight movement, including Railways, the Motorways and most of the State Highways (typically the Waka Kotahi, NZ Transport Agency road network), and Arterials where efficient freight movements must be actively supported to maintain Levels of Service through active planning and design

• **Level 1B**

Roads of the highest strategic value to freight movement being arterials where efficient freight movements must be actively supported to maintain Levels of Service, where competing modes and land uses require active management

• **Level 2**

Local freight networks within strategic freight areas where there are no competing land use demands i.e. the land adjacent to these roads are primarily used for industrial / commercial purposes and free from sensitive community or other residential impacts. Planning and design should consider the efficiency of freight movements

• **Level 3**

Freight networks connecting to / between strategic freight areas where planning and design should consider the efficient movement of freight, noting that land uses adjacent to the road are such that the impacts of freight movement requires active management

Supporting Network:

• **Other**

Overdimension, Overweight and Ferry routes

1.6.1. Freight movement

There are a number of quarries east of Takaanini such as the Brookby and Clevedon quarries. Freight aggregate suppliers are critical and strategically important. There is typically a low number of these passing by however, there is high impact from these vehicles due to noise effects on the receiving environment. It is expected that these quarries may expand in the future resulting in an increase of heavy vehicles traversing along the proposed future Level 1B freight route.

These quarry heavy vehicles will traverse from the east, along Alfriston Road to access the strategic highway network to either travel north (to SH1/ SH22), or south (to SH1). Freight wishing to travel north to access SH1 or SH20 are likely to use Hill Road or Mill Road/ Redoubt Road as these corridors provide direct connections to the strategic network in the north. Use of the Takaanini

Interchange (via Popes Road and Manuia Road) is expected to take longer and be less direct, adding up to 4km more distance compared to the other routes. Freight to/ from the north is therefore highly unlikely to use this longer route via Popes Road.

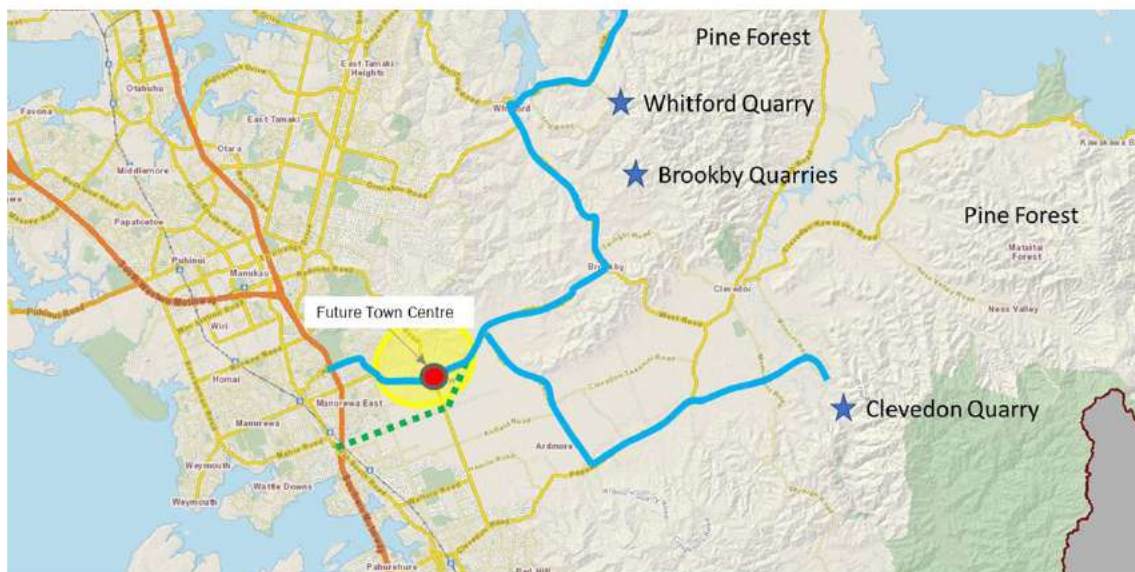
Freight wishing to travel south on SH1 from the east of Takaanini in the future network are likely to use Mill Road South, to access Drury South interchange. The intended function of these connections highlighted in the ISTN (Indicative South Transport Network) was to provide a sub-regional freight connection. [REDACTED] In the scenario where Mill Road South does not come into fruition, it is likely that freight may use Popes Road instead to travel east through the Takaanini industrial area to access the Takaanini interchange as this become the most direct route.

1.6.2. Uncertainties

Alfriston Road Plan Change in the area north of Popes Road:

This plan change looks to provide a town centre, Alfriston Village in the area where Mill Road and Alfriston Road intersect as shown on Figure 1-4. There are a number of quarries to the east which are expected to expand and grow in the future.

Figure 1-4: Potential Alfriston Village location



The Alfriston Village Plan Change is unconfirmed at this stage however, if this eventuates there is uncertainty around the future Level 1B freight route around the proposed Alfriston Village area. There is a potential that Popes Road may form part of the strategic/ regional freight network further elevating Popes Road's status in the freight network to Level 1B.

Notwithstanding the above, the uncertainties associated with the Plan Change and its implications for freight routing are such that we believe it has limited weight as a strategic consideration at this stage. In particular:

- The Plan Change is in its pre-application phase, so is yet to be lodged. The Plan Change is likely to be contentious in light of the draft FDS, the need to move the RUB (rural urban boundary) – and accordingly may face a lengthy hearing/ appeals process. Accordingly, the Plan Change is at least several months away from being operative (potentially much longer); and could conceivably be declined given recent precedent. Hence, there is no certainty at this stage that the Plan Change will materially change the context for freight network planning; and
- If made operative, it remains somewhat unclear that the Plan Change would automatically result in Popes Road replacing Alfriston Road as the freight route given that:
 - Further assessment is required to revisit the wider strategic freight network to confirm the long-term Level 1B freight network
 - Popes Road does not provide the most direct route for heavy vehicles wishing to access the northern strategic state highway network (see section 2 below) – several alternatives exist which may provide more direct connections between Brookby and SH1 in particular for those travelling to/from the north.
 - Each alternative freight route traverses some areas of sensitive adjoining land use. While it is acknowledged that the existing school and planned potential centre are land uses sensitive to heavy vehicle movements, it is unclear the extent to which these are any more or less sensitive than other areas traversed by alternative routes (noting the uncertainty of plan change status noted above).

2. Options

This section sets out possible strategic Level 1B freight connections in the wider network. Level 1B freight indicates a corridor with the highest strategic value to freight movement between arterials and where there is competing adjacent land use. Figure 2-1 shows six possible Level 1B freight routing options in the wider network. The following sub-sections show a high-level assessment of the advantages and limitations of each option.

Figure 2-1: Level 1B freight routing options

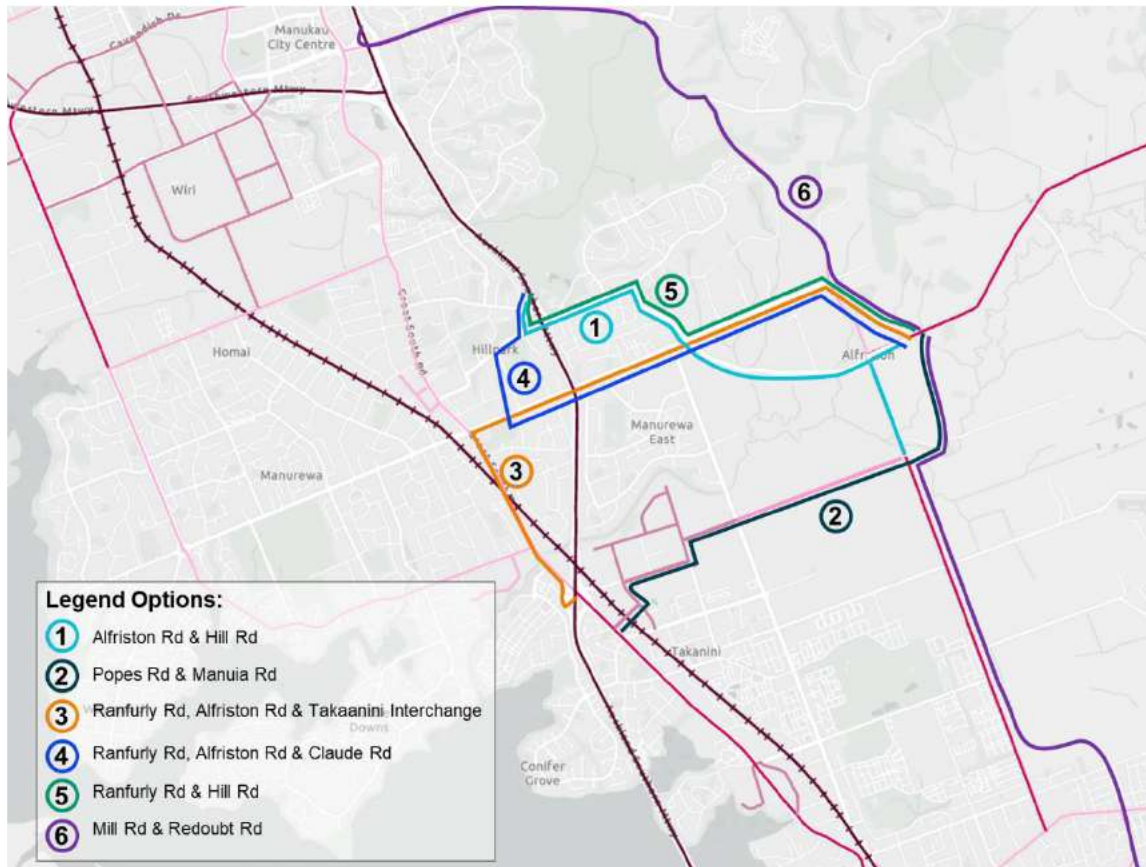
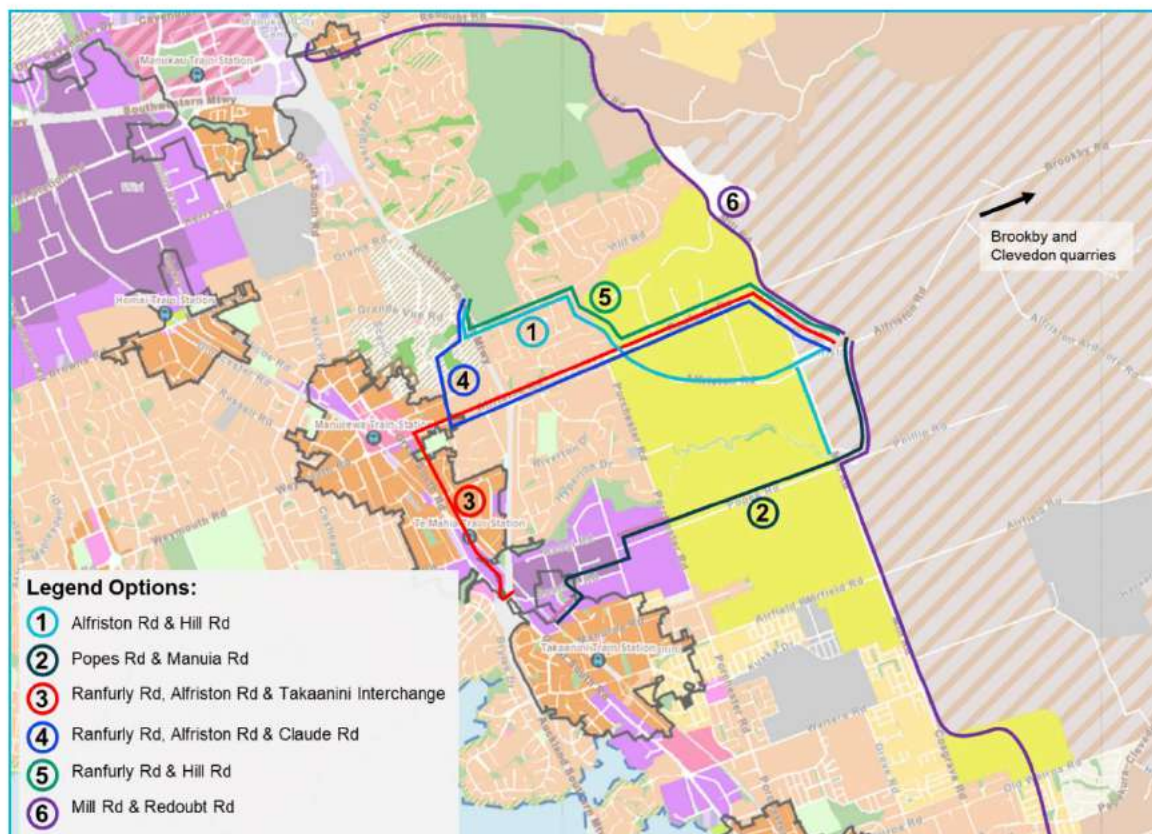


Figure 2-2 indicates the proposed land use expected in the area where each Level 1B freight route option sits in.

Figure 2-2: Land use (proposed land use)



2.2. Option 1: Alfriston Rd & Hill Rd

Option 1 shows the current proposed long-term freight network, with the Level 1B freight route traversing Alfriston Road and accessing SH1 via Hill Road.

Figure 2-3: Option 1 - Alfriston Rd & Hill Rd

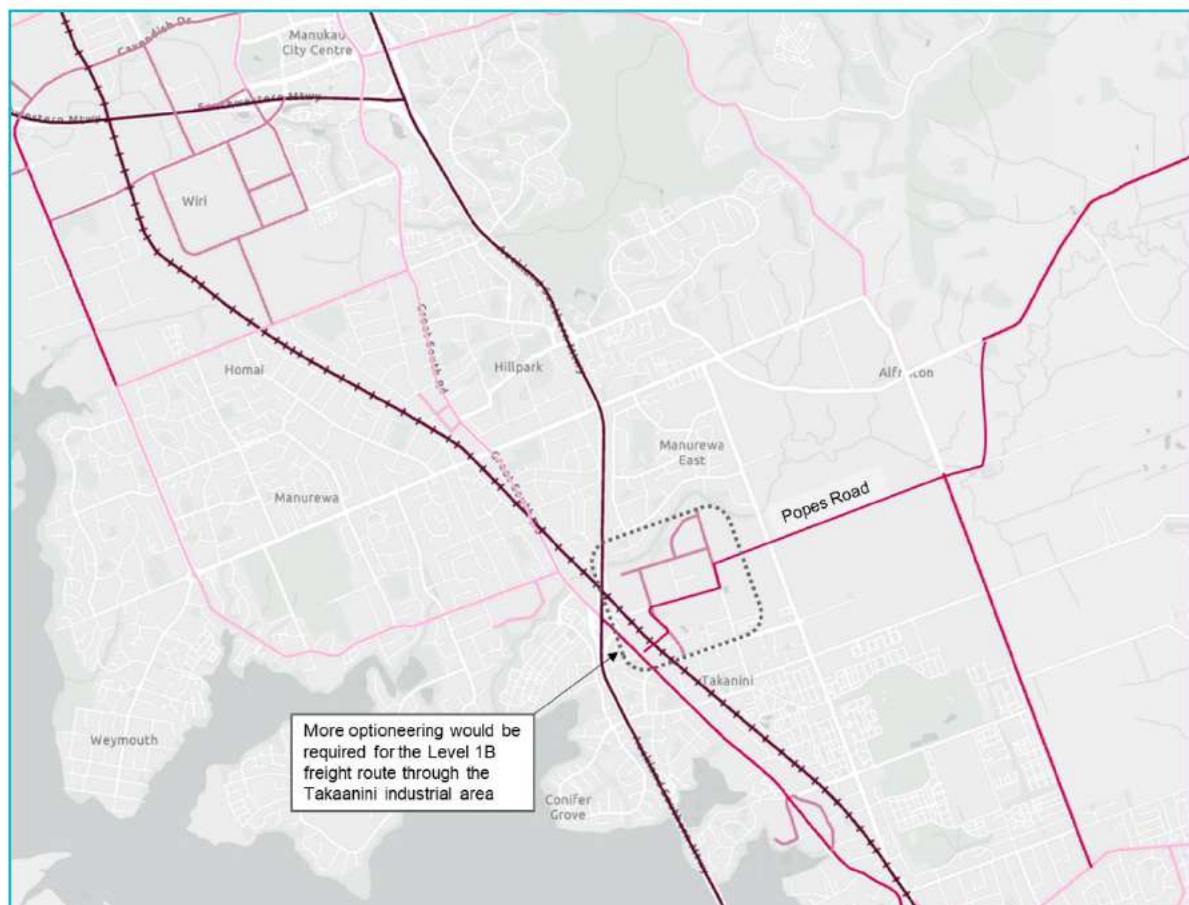


Advantages	Limitations
- Utilises existing corridors/ infrastructure - Provides a direct connection for heavy vehicles wishing to travel to/from the northern strategic state highway network.	- If the Alfriston Village Plan Change is confirmed, there will be undesirable safety outcomes for the surrounding sensitive area which will be impacted by a high proportion of heavy vehicle movement. - There is also the existing Alfriston School adjacent to the proposed Level 1B freight route. Hence, there will be undesirable safety outcomes for vulnerable road users and those accessing the school. - Hill Road is a secondary arterial with adjacent residential land use. Hence, there are safety risks on the receiving land use due to the expected increase of heavy vehicles traversing this corridor. - There is no clear route for freight wishing to travel south to access the strategic network. Southbound freight may use Popes Road/ Manuia Road and access Takaanini interchange, or may continue on Mill Road. If Mill Road through Drury South is implemented, this will provide a better route for freight to access the state highway network.

2.3. Option 2: Popes Rd & Manuia Rd

Option 2 consists of a new corridor/ infrastructure to allow for the Level 1B freight route to bypass the proposed/ potential Alfriston Village. This option proposes Popes Road and Manuia Road to form the Level 1B freight connection.

Figure 2-4: Option 2 - Popes Rd & Manuia Rd



Advantages	Limitations
– If the Takaanini FUZ does not eventuate, Popes Road will be a suitable Level 1B freight connection as there will be no adjacent sensitive land use. Surrounding land use would likely remain rural under this scenario. – This route provides a direct connection for freight wishing to access the southern strategic state highway network.	– If the Takaanini FUZ area develops, the land adjacent to Popes Road is expected to be urbanised and is assumed to be of residential nature. In this case, a Level 1B freight route on Popes Road will result in a high percentage of heavy vehicles traversing a sensitive area. This would result in safety issues similar to the risk posed by the current proposed Level 1B freight route (Option 1). – Additional corridors/ infrastructure is required to support the new route (bypass around the proposed Alfriston Village) – This is an indirect freight route for heavy vehicles (from the quarries) wishing to access the northern strategic state highway network. Heavy vehicles would need to divert south to travel north again. It is unlikely that freight will use this route for the

Advantages	Limitations
	purposes of this movement, hence may revert to using Hill Road or Mill Road/ Redoubt Road.
Notes: If this option is preferred, more detailed assessment/ optioneering would be required to identify the most efficient, safe, feasible freight route through the industrial area, along with any required intersection upgrades. If this option goes ahead, traffic management is required to restrict freight traffic movement on residential streets/ the receiving environment in Takaanini such as Manuroa Road and Takaanini School Road. Management/ discouraging of heavy vehicles is recommended through measures such as traffic calming, a heavy vehicle through movement bylaw. These measures can be achieved within the existing road reserve.	

2.4. Option 3: Ranfurly Rd, Alfriston Rd & Takaanini Interchange

Option 3 consists of a new corridor/ infrastructure to allow for the Level 1B freight route to bypass the proposed/ potential Alfriston Village. This route can use the bus lanes proposed on Alfriston Road as freight lanes. The Level 1B freight connection also utilises Great South Road and the Takaanini Interchange to access the SH1 network.

Figure 2-5: Option 3 - Ranfurly Rd, Alfriston Rd & Takaanini interchange



Advantages	Limitations
– Ability to utilise proposed bus lanes on Alfriston Road to access the motorway – Route largely does not traverse sensitive, residential areas	– Additional corridors/ infrastructure required to support the new route (bypass around the proposed Alfriston Village) – Indirect, long diversion route for heavy vehicles wishing to travel both north and south on SH1. Hence, this is not an efficient route and it is likely that heavy vehicles would use other residential streets to access the strategic state highway network.

2.5. Option 4: Ranfurly Rd, Alfriston Rd & Claude Rd

Option 4 consists of a new corridor/ infrastructure to allow for the Level 1B freight route to bypass the proposed/ potential Alfriston Village. This route can use the bus lanes proposed on Alfriston Road as freight lanes. Claude Road is proposed to provide access to the State highway network in this option.

Figure 2-6: Option 4 - Ranfurly Rd, Alfriston Rd & Claude Rd



Advantages	Limitations
– Ability to utilise proposed bus lanes on Alfriston Road to access the strategic state highway network.	– Additional corridors/ infrastructure required to support the new route (bypass around the proposed Alfriston Village) – Indirect, long diversion route for those heavy vehicles wishing to travel both north and south on SH1. Hence, this is not an efficient route and it is likely that heavy vehicles would use other residential streets to access the state highway network. – Surrounding land use on Claude Road is residential. This would result in undesirable safety outcomes for the surrounding sensitive area which will be impacted by a high proportion of heavy vehicle movement.

2.6. Option 5: Ranfurly Rd & Hill Rd

Option 5 consists of a new corridor/ infrastructure to allow for the Level 1B freight route to bypass the proposed/ potential Alfriston Village. This option utilises Ranfurly Road and Hill Road for freight to access the strategic state highway network.

Figure 2-7: Option 5 - Ranfurly Rd & Hill Rd



Advantages	Limitations
Provides a direct connection for heavy vehicles to access the northern strategic state highway network.	- Additional corridors/ infrastructure required to support the new route (bypass around the proposed Alfriston Village) - Hill Road is a secondary arterial with adjacent residential land use. Hence, there are safety risks with heavy vehicles traversing this corridor. There will be undesirable safety outcomes for the surrounding sensitive area which will be impacted by a high proportion of heavy vehicle movement. - There is no clear route for freight wishing to access the southern strategic state highway network. Southbound freight may use Popes Road/ Manuia Road and access Takaanini interchange, or may continue on Mill Road. If Mill Road through Drury South is implemented, this will provide a better route for freight to access the state highway network.

2.7. Option 6: Mill Rd & Redoubt Rd

Option 6 consists of a new corridor/ infrastructure to allow for the Level 1B freight route to bypass the proposed/ potential Alfriston Village. This option assumes Mill Road extends from Redoubt Road through to Drury South as intended in the ISTN.

Figure 2-8: Option 6 - Mill Rd & redoubt Rd



Advantages	Limitations
- Freight route lies predominantly on the urban fringe, reducing conflicts/ safety risks on sensitive land uses. - Provides a direct connection for heavy vehicles to access both the northern and southern strategic state highway network.	- Additional corridors/ infrastructure required to support the new route (bypass around the proposed Alfriston Village). [REDACTED] [REDACTED] [REDACTED]

3. Conclusion

Key conclusions from the above high-level assessment include:

- The Takaanini area is complex and already impacted by regional transport infrastructure such as the strategic state highway network and the NIMT.
- Local freight to/ from the Takaanini industrial area is expected to use Manuia Road and Popes Road to access the area from either the east or west.
- A sub-regional freight route connecting eastern areas such as Brookby and Clevedon to the strategic state highway network are regionally important.

- Mill Road from the IBC network is the preferred freight route that is expected to provide a sub-regional freight connection for heavy vehicles to access both the northern strategic state highway network.
- The Hill Road and Mill Road routes are the most direct for freight to access the northern strategic highway network. Hence, the route through Takaanini (Popes Road, Manuia Road) is not suitable for this northern freight movement.
- In the absence of a Mill Road South (connection through to Drury), there is a role for Popes Road and Manuia Road to provide a freight connection through Takaanini for freight accessing the southern strategic state highway network. However, this is not expected to be a significant amount of freight given the northern movement would be accommodated via Hill Road or Mill Road.

4. Recommendation

After consideration of the potential future freight movements in the area, and on the basis that the strategic freight network is expected to change, **Option 6** (Mill Road & Redoubt Road as per the ISTN) is proposed to form the Level 1B freight connection in the network for the following reasons:

- Mill Road provides a direction connection for heavy vehicles that wish to access the northern and southern strategic state highway network.
- This route lies predominantly on the urban fringe and reduces conflicts/ safety risks on sensitive land uses.

This option aligns with the South IBC and Mill Road will perform the intended function – providing a sub-regional freight connection in the wider network.

Figure 4-1: Recommended Level 1B freight option



In the case that Mill Road South does not eventuate, **Option 2** (Popes Road & Manuia Road) is recommended to adopt a regional freight role specifically for heavy vehicles wishing to access the southern strategic state highway network. In this scenario the freight connection through the Takaanini industrial area should be further explored to understand a freight connection which is suitable and any intersection upgrades required. Management and the discouragement of heavy vehicles potentially traversing on residential streets is recommended through measures such as traffic calming or/and a heavy vehicle through movement bylaw. These measures can be achieved within the existing road reserve. This work could be progressed through a fast response via SGA, or AT.

In summary, any new land use development should not compromise critical northern freight routes via Hill Road and Mill Road. It is recommended that this northern movement should not be redirected through Takaanini via Popes Road and Manuia Road. There is potential for the southern movement to be accommodated via Popes Road and Manuia Road, particularly in the case where Mill Road South is no longer in the future transport network.

Given the uncertainties, there is the potential for the strategic significance of the Popes Road route as part of an east-west route connecting to Great South Road and SH1 via the proposed Manuia Road rail crossing (proposed as part of the TLC Project) may increase. This in turn may mean that further work needs to be undertaken in future to determine any route protection requirements to provide a freight connection between Popes Road and Manuia Road. Given the above uncertainties, this work

has not been undertaken as a part of this business case. It is recommended that this is considered further in future work when the implications of the above uncertainties become clearer.

South FTN and Key Connections Appendix E - Engagement Summary

October 2023

Version 1.1

Document Status

Responsibility	Name
Author	██████████
Reviewer	██████████████████
Approver	████████████████████

Revision Status

Version	Date	Reason for Issue
0.1	01/06/2023	Issue for Te Tupu Ngātahi Review and Verification
1.0	23/06/2023	Issue for IQA Review
1.1	31/10/23	FINAL

1	Executive Summary	1
1.1	Introduction	1
1.2	What we heard.....	1
1.3	Next steps	2
2	Background.....	2
2.4	Strategic Transport Network – Frequent Transit Network.	4
3	Engagement Activity and Feedback	6
3.4	Engagement activity	6
3.4.1	Manawhenua engagement summary	8
3.4.2	Key stakeholder interactions.....	10
3.4.3	Community engagement strategy and feedback	13
3.5	Feedback	15
3.5.1	Overall feedback	16
3.6	Media coverage	21
3.7	Next Steps	22
	Sat 25 March, 10am-2pm, World of Cultures, Te Paataka Koorero o Takaanini	26

Appendices

1	Appendix 1
2	Appendix 2

1 Executive Summary

1.1 Introduction

Te Tupu Ngātahi Supporting Growth is a collaboration between Auckland Transport (AT) and Waka Kotahi NZ Transport Agency (Waka Kotahi). Te Tupu Ngātahi was formed to investigate, plan, and secure route protection for transport projects in the Auckland region to support the region's growth over the next 30 years.

Te Tupu Ngātahi Supporting Growth is working with Auckland Council to integrate transport planning with the land use aspirations of the Manurewa Takaanini Papakura Integrated Area Plan (2018). A plan that outlines an urban vision for these areas over the next 30 years. It sets out the key ideas, desired outcomes and supporting transformation activities to achieve the urban vision for the Great South Road corridor and Manurewa, Takaanini and Papakura. *The primary purpose of the Future Urban Land Supply Strategy is to identify the sequencing and timing of future urban land for development readiness. It sets out how and when new urban land will be supplied for development over the next 30 years.*

As part of this work, Frequent Transit Network (FTN) bus routes are proposed to improve transport networks on some of South Auckland's existing roads.

The two proposed FTN routes are:

- **The Great South Road FTN**
- **The Takaanini FTN**

With Key Connections at:

- Popes Road.
- Croskery Road.
- Great South Road between Waihoehoe Road and the Drury Interchange.

Engagement with partners, stakeholders, landowners, and the wider community is integral to the planning process. This report summarises engagement activities undertaken for South FTN (bus) routes between **8 March 2023 and 10 May 2023**. The primary purpose of this engagement was to gather feedback from stakeholders and the wider community on the proposed options for the South FTN (bus) routes.

1.2 What we heard

Overall, the feedback received during the public engagement period shows strong support for the proposed new South FTN (bus) routes.

Feedback also supported separated public transport, walking, and cycling routes to encourage more sustainable modes of transport and to remove traffic and congestion from the main arterial routes along Great South Road, providing alternative modes of transport in and around Takaanini.

Key themes from our engagement

- Support for the two FTN routes.
- Support for improved walking and cycling facilities.
- Support for walking and cycling facilities to be separated from general traffic and public transport lanes.
- Support for dedicated bus lanes.
- Support for planning now to prepare for future growth.
- Requests that the Strategic Freight Network (SFN) value be considered in the proposed options.
- General comments about public transport in South Auckland, and how it could be improved in Takaanini moving forward.
- Requests to consider how the Takaanini retail hub and Takaanini town centre can be integrated now into future transport planning.

The feedback gathered during the engagement period has been analysed, and community responses will contribute to decision-making as the project progresses. We will share feedback with the community, in the form of a two-page engagement summary, later in 2023.

1.3 Next steps

Stakeholder and public engagement will continue into 2023 and beyond. In particular, we will engage and communicate with landowners about potential impacts on their property with greater certainty and clarity. This engagement will inform the route refinement as part of determining the extent of the proposed designation boundaries.

Lodgement of Notice of Requirement documentation to support route protection of the preferred networks is anticipated to occur in late 2023.

2 Background

Future growth areas in South Auckland make up the largest proportion of growth in Tāmaki Makaurau, Auckland. Over the next 30 years, 120,000 more people will live and work in South Auckland. We are preparing for that growth by planning public transport, walking, cycling, freight, and general traffic improvements.

In 2018, Te Tupu Ngātahi investigated an indicative strategic transport network for South Auckland. Public feedback during the Indicative Business Case (IBC) stage strongly supported better transport networks across Tāmaki Makaurau, including South Auckland.

As part of the IBC process, the community told us they wanted to see:

- Increased transport choice (and to be able to separate shorter distance trips from longer ones).
- Improved north-south movements.
- Improved access to education.
- Better access to employment and recreation opportunities.

To meet these community priorities, planning is underway to improve transport networks on some of South Auckland's existing roads, including the planning for two new FTN routes.

The two proposed FTN routes are:

- **The Great South Road FTN** will connect the Papakura, Manukau and Takaanini town centres and Drury Central, Papakura, Te Mahia, Manurewa and Manukau rail station and bus stations.
- **The Takaanini FTN** is proposed between Drury (Drury West train station) and Manurewa train station. The route is being planned to provide bus services to give the community access to the Drury train stations, Papakura Train Station and Manurewa Train Station.

The two FTNs, totalling around 28km in length, will connect train stations with town centres in Manukau, Takaanini, Papakura and Drury.

The objectives of the Great South Road and Takaanini FTNs are to:

- Enable access to economic and social opportunities by providing high-quality public transport between Drury and Manukau that integrates with the rail network.
- Support planned growth by integrating with the existing transport system, land use and the planned public transport network.
- Support growth and mode share shift towards low-carbon transport modes.

In addition to the FTN routes, three key connections are included in the DBC. These are upgrades to existing corridors in the South to enable planned growth and encourage the uptake of active modes. These key connections are:

- Popes Road.
- Croskey Road.
- Great South Road between Waihoehoe Road and the Drury Interchange.

To support the DBC and alternatives assessment process, public engagement on the South FTNs was held to gather community feedback and sentiment about the proposed options.

The approach of Te Tupu Ngātahi for route protection is illustrated below in Figure 1.



Figure 1: Te Tupu Ngātahi Supporting Growth funnel diagram.

This report summarises engagement activities and the feedback we received between 8 March and 10 May 2023 – our public engagement period.

2.4 Strategic Transport Network – Frequent Transit Network.

The South FTN DBC forms part of the wider strategic South transport network. It is anticipated to be delivered in the next 30 years, subject to growth and funding.

The South FTN DBC package includes the Great South Road FTN and the Takaanini FTN.

The proposed FTN routes are being planned to provide improvements like dedicated bus lanes and bus priority at intersections to make travel times more reliable. Walking and cycling improvements are proposed along the full length of both routes to provide the required step change in transport choice and to improve access for the community.

The South FTN routes will use existing roads and some sections off road will require upgrading, including widening.

A map of the proposed options is shown in Figure 2.

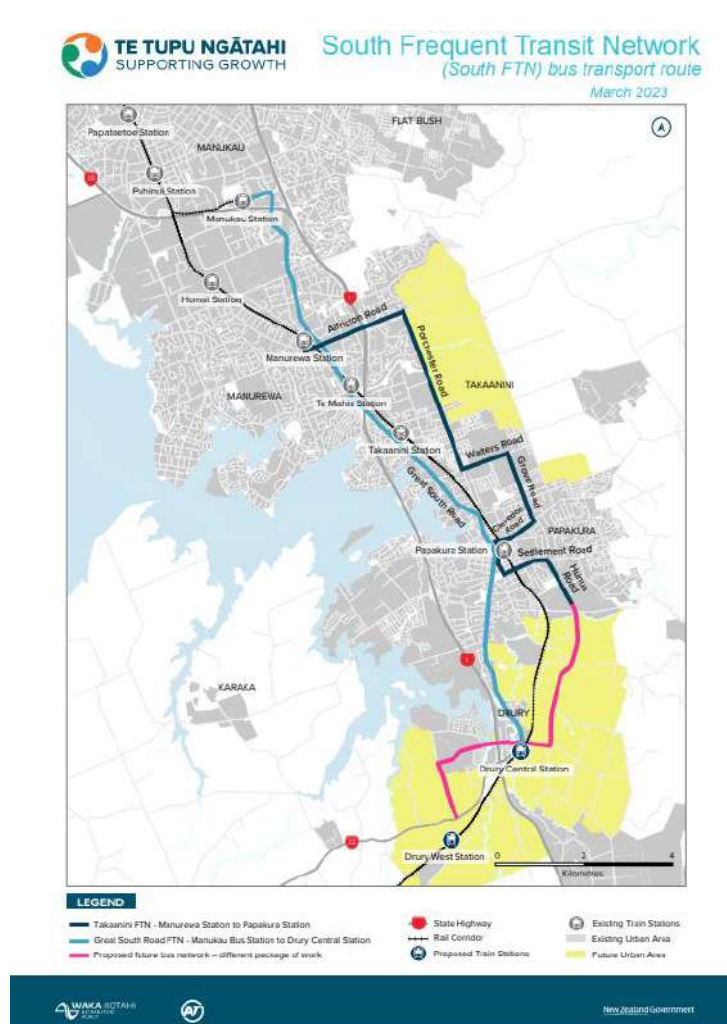


Figure 2. Proposed South FTN routes.

In addition to the two FTN routes, key connections were identified that facilitate growth and support active modes. These key connections are:

- Popes Road, Takaanini upgrade
- Croskery Road, Papakura upgrade
- Great South Road, Drury upgrade between Waihoehoe Road and Drury Interchange – upgrade to fill a gap in the network between the Great South Road FTN and the Drury Interchange.

These key connections were introduced during the public engagement period and to ensure public feedback on the whole network, including the key connections, we undertook:

- A further Hive email campaign
- Letter drop to targeted areas.
- Open events:
 - StreetFest Papakura Saturday 6 May 2023
 - P2D Community Information Event Saturday 17 June – Drury Hall
 - Supporting Growth Alliance community information event Saturday 24 June 2023 – Takaanini Library

A map of the proposed South FTN routes along with key connections is shown in Figure 3.

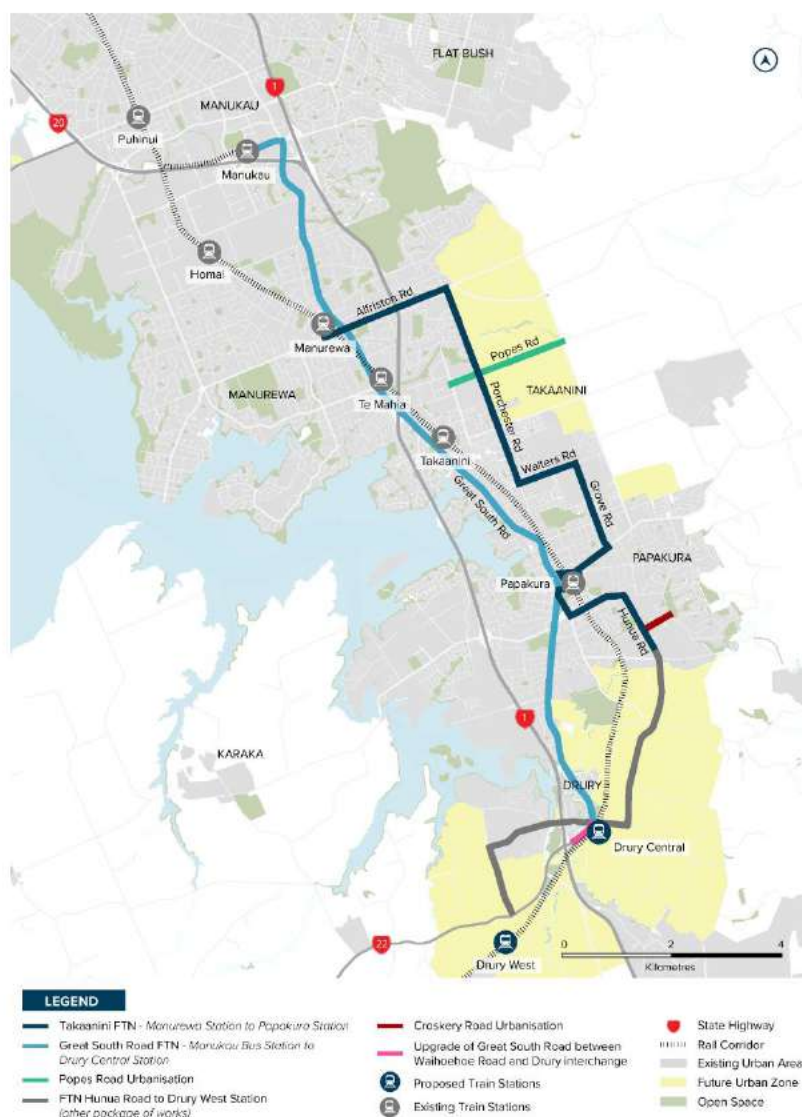


Figure 3 South FTN routes including Key Connections

3 Engagement Activity and Feedback

3.4 Engagement activity

Our engagement included communication and events with partners, elected members, the community, and other key stakeholders.

Table 1 summarises our engagement methods and the groups that we engaged with.

Table 1: Engagement activity by stakeholder group

Who we engaged	How we engaged
Partners	Southern Manawhenua table – ongoing twice monthly hui with Manawhenua and the project team.

Who we engaged	How we engaged
	• Auckland Council Partnership Forum – twice monthly meetings to update Council on Te Tupu Ngātahi projects (including the Takaanini project). • KiwiRail – Partnership Forums.
Elected Members Local Board areas: • Otara-Papatoetoe • Manurewa • Papakura • Franklin	• Memos – various memos distributed to elected members of the four applicable local board areas, the mayor, all applicable Ward Councillors and Local Members of Parliament to update them on the project and community engagement. • Presentations – in-person project updates to the Manurewa Local Board, Papakura Local Board and Otara-Papatoetoe Local Board. • Written updates - Franklin Local Board. • Email – interactions with elected members with informal email updates as community engagement progressed. In general, there was overall support from elected members. Papakura Local Board is particularly engaged, given elected members understanding of the importance of the Great South Road corridor and the Papakura Commercial Projects Group membership.
Business Associations • Manukau • Manurewa • Takaanini • Papakura • Pukekohe	• Direct communications – informative emails sharing full details of the proposed FTN routes. • 1:1 session interaction via email and phone calls updating the BID Manager about the project. Both Takaanini Business Association and Papakura Business Association sit on the Papakura Commercial Project Group - online presentation to the PCBG on Wednesday, 14 June 2023.
Papakura Commercial Projects Team	• Online presentation to the group providing updates regarding the project. The group is Chaired by [REDACTED] and its membership comprises local board members, Papakura and Takanini Business Association members and local business representatives.
Key stakeholders	• Schools – phone call and information email provided to all schools in the vicinity of both proposed routes requesting information be placed in school newsletters. • Direct communication – social clubs, recreational clubs, and places of worship were contacted as advocacy stakeholders. • 1:1 session – held with the Auckland Transport Freight Working Group on 3 April 2023. • Informative emails, Hive campaigns and direct communication with Kāinga Ora regarding the South FTN routes.

Who we engaged	How we engaged
Community	• Flyer – a community flyer drop to 8,000 households and businesses along the proposed routes to socialise the project and encourage feedback. (Attached Appendix 1). • Media advertising – comprehensive media campaign using different channels such as print, social and radio. Focussed on ethnic and community-based media • The Hive – Our online engagement platform with project information and a place to submit feedback through a place for the public to place online feedback, e.g. Have your say / Find out More Webpage / organisation email campaigns. • Email campaigns – numerous email campaigns sent out to let subscribers know of key dates across the formal consultation period. • Community open days – seven community information events from 2 March to 6 May 2023 across the three council ward areas (Attached Appendix 2) • School and tertiary engagement - a dedicated student survey to gather feedback regarding public transport in next 20-30 years. • Auckland Council People's Panel survey - a survey was conducted to collect feedback about transport in South Auckland. The participants of survey participants were residents who live in Local Boards: Mangere-Otahuhu Otara-Papatoetoe Manurewa, Papakura, and Franklin.
Developers	• Meetings – the project team met with several developers across 2022 and 2023 with respect to their proposed development and the FTN proposals.
Utilities	• Meetings - Te Tupu Ngātahi met with Vector, First Gas, Transpower, and Watercare to discuss the interface between projects and utilities on a programme wide basis throughout 2022. Conversations will continue in 2023.

3.4.1 Manawhenua engagement summary

AT and Waka Kotahi recognise and respect Te Tiriti o Waitangi as Te Tūāpapa (foundation). This underpins the way that AT and Waka Kotahi partner with Manawhenua, to build strong, meaningful, and enduring relationships. To this end, Ngā Manawhenua o Tāmaki Makaurau are partners in Te Tupu Ngātahi. Partnership is a commitment to ongoing and regular engagement with Manawhenua in a manner that is open and transparent and enables meaningful input into decision making. The partnership dates back to the Programme Business Case (PBC) and Indicative Business Case (IBC) of the programme.

In the context of the South FTN Project, engagement with Manawhenua has taken place through the regular Te Tupu Ngātahi Manawhenua Southern Hui. This Hui generally takes place twice monthly

and involves representatives from the iwi authorities with a direct interest in the Project area. These are:

- Te Ākitai Waiohūa;
- Ngāti Tamaoho;
- Ngāti Te Ata Waiohūa;
- Ngaati Whanaunga;
- Ngāi Tai ki Tamaki;
- Ngāti Maru;
- Ngāti Pāoa;
- Ngāti Tamaterā;
- Te Ahiwaru Waiohūa; and
- Te Patu Kirikiri.

The Project team has presented in fourteen of the Hui since the inception of the Project in September 2021, including three times during the public engagement period. The matters covered in each Hui and attendees are summarised in Table 2.

Table 2: Manawhenua representative attendance by hui

Date of hui	Matters covered	Iwi groups represented
2/9/2021	Project team introduction	Ngāti Tamaoho, Ngaati Whanaunga, Ngāti Tamaterā, Te Ākitai Waiohūa, Ngāti Pāoa, Ngāi Tai ki Tamaki, Te Ahiwaru, Ngāti Maru
2/12/2021	Inputs to MCA for FTN routes	Ngāti Tamaoho, Ngaati Whanaunga, Te Ākitai Waiohūa, Ngāti Te Ata Waiohūa, Ngāi Tai Ki Tamaki.
3/2/2022		Ngāti Tamaoho, Ngaati Whanaunga, Te Ākitai Waiohūa, Ngāti Te Ata Waiohūa, Ngāi Tai Ki Tamaki, Ngāti Maru, Te Patu Kirikiri.
7/7/2022	Update confirming need for route protection	Ngāti Tamaoho, Ngāti Pāoa, Ngāti Tamaterā, Te Ākitai Waiohūa, Ngāti Te Ata Waiohūa, Ngaati Whanaunga.
1/9/2022	Approach to corridor widening, design, and underlying principles	Ngāti Tamaoho, Te Ākitai Waiohūa, Ngāti Tamaterā, Ngāti Te Ata Waiohūa, Ngāti Pāoa, Ngaati Whanaunga.
27/9/2022		Te Ākitai Waiohūa, Ngaati Whanaunga, Ngāti Tamaterā, Ngāti Pāoa
3/11/2022		Te Ākitai Waiohūa, Ngāti Te Ata Waiohūa, Ngāti Tamaterā, Ngāti Maru, Ngāti Tamaoho, Te Ahiwaru
12/1/2022	Programme update, approach to stormwater design	Te Ākitai Waiohūa, Ngāti Tamaoho, Ngaati Whanaunga
2/3/2023	Update on public engagement and planning programme	Ngāi Tai Ki Tamaki, Ngāti Tamaterā, Ngāti Tamaoho, Ngaati Whanaunga, Ngāti Te Ata Waiohūa, Te Ākitai Waiohūa
21/3/2023	Updated design approach	Ngāi Tai Ki Tamaki, Ngāti Tamaterā, Ngāti Tamaoho, Ngaati Whanaunga, Ngāti Te Ata Waiohūa, Te Ākitai Waiohūa, Ngāti Pāoa
17/4/2023	Updated design approach	Ngāi Tai Ki Tamaki, Ngāti Tamaterā, Ngāti Tamaoho, Ngaati Whanaunga, Ngāti Te Ata Waiohūa, Te Ākitai Waiohūa

Date of hui	Matters covered	Iwi groups represented
4/5/2023	Emerging preferred option and route protection strategy	Ngāi Tai Ki Tamaki, Ngāti Tamatera, Ngāti Tamaoho, Ngaati Whanaunga, Ngāti Te Ata Waiohua, Te Ākitai Waiohua

Key feedback received from Manawhenua representatives over the course of the above engagement was as follows:

- General support for the Project, in particular the prospect of faster and more frequent public transport on the routes proposed, an extended reach for frequent public transport, the idea of buses feeding and extending the spatial reach of the rail network, and in general greater accessibility for future generations.
- Notwithstanding the above, some iwi representatives queried the extent to which the Great South Road FTN in particular functionally duplicated rail services, and whether the effects and costs of the FTN were appropriate given the concurrent planning and investment in the rail network.
- There was a level of concern with the potential level of property impacts for the Project, and efforts to reduce the level of impact from the Project were supported.
- There was a clear expectation that the Project would deliver environmental gains when implemented, in particular for stormwater treatment.
- There was a clear expectation that existing features of cultural and environmental value in the context of the cultural landscape would be protected and enhanced by the Project, particularly waterbodies such as Otūwairoa/Slippery Creek, and the Papakura Stream; and
- There was a clear expectation that Manawhenua would continue to be involved as partners through future consenting, detailed design, and implementation phases of the Project; to be provided for through the designation conditions.

This feedback has been well understood by the Project team. Engagement through the bimonthly Hui will continue as the concept design and planning processes progress.

3.4.2 Key stakeholder interactions

Table 3 summarises feedback from key stakeholders. Written feedback (where received) is noted.

Table 3: Key stakeholder interactions.

Who we engaged	Feedback
Schools and Tertiary facilities	Direct communications via informative emails and online surveys to 28 local education facilities and The Manukau Institute of Technology (MIT). Overwhelming support for the FTN routes, active modes and planning now for future growth.
Heavy Haulage	The New Zealand Heavy Haulage Association (NZHHA) form part of the AT Freight Working Group (FWG).

Who we engaged	Feedback
	The NZHHA provided individual written feedback during the consultation period. NZHHA highlighted the requirements of their operators along certain areas of the proposed FTN routes and the requirement to retain the strategic nature of these routes, particularly Great South Road, which is the main route for oversized loads through Auckland.
AT Freight Working Group (FWG)	We presented to the AT Freight Working Group (FWG) on Monday 3 April 2023. The group was interested in whether the FTN was on greenfield land. The project team explained that FTN routes would use brownfield land and the existing roading network and is being planned in anticipation of planned growth. The FWG asked whether the FTN routes linked in with other Strategic Growth areas across South Auckland. The project team explained that the routes were linked to wider Council growth plans, with the FTN routes being part of the wider Southern package for road upgrades. The FWG was interested in the design of the network. The project team explained that our role is to route protection and that our design is to the concept plan level. The team outlined the plan for separated active mode facilities along the corridor and confirmed that the current design provides a buffer (there was concern around safety). The group was pleased to hear that separation was being provided in the plans. The FWG fed back to the project team that there is support for the bus routes to include T2/T3 lanes. The project team explained that by route protecting at this stage, the designation would provide the opportunity to implement this during the design phase if needed.
Wallace Group	Feedback received from The Wallace Group centred around a need for a better connection (now) for the community to utilise the Takaanini retail hub and town centre area.
Residents Assoc and Community Advocacy Groups • TRAG • Addison Society • Conifer Grove R&R	Limited feedback was received from the advocacy groups and their members regarding the FTN routes. However, a general theme centred around a need for a better connection (now) for the community to utilise the Takaanini retail hub and town centre area.
Campaign for Better Transport (CBT) ██████████	The CBT provided the following general comments in relation to the proposals: 1. We would like to see the routes running at a 15-minute frequency between 7am and midnight as opposed to the standard 7am to 7pm for an FTN route. 2. Given many airport workers reside in suburbs such as Manurewa and Papakura and that the current public transport option is a bus, we would like to see consideration of having expanded services both before 7am and after

Who we engaged	Feedback
	midnight, connected with the Airport Link service to improve the catchment of that service. 3. The timetables must be well designed to enable integration with the train services at Drury, Papakura, Manurewa and Manukau. One of the problems with bus services in this part of Auckland at the moment is that with late-running train services, the bus services often leave before the trains arrive. Minor Improvements The CBT would like to see the following route adjustment made: From the Walters Road/Porchester Road roundabout, instead of the bus route turning from Walters Road to Porchester Road, we would like to see the bus route continuing along Walters Road and then turning into Arion Road, then turning into Kauri Heart Avenue and then turning into Porchester Road. For the avoidance of doubt, we would like this diversion to be both directions. The presence of a considerable retail and community centre (the Takanini Town Centre) at the corner of Walters Road and Arion Road means it would be a considerable trip attractor for any bus service and provide greater amenity for the community.
Peoples Panel	Auckland Councils People's Panel Survey was distributed to over 6,500 Peoples Panel members, with 1,133 responses, that is a response rate of 17%. (Note normal response rate is 10-12%). The participants of survey were residents who live in Local Boards: Mangere-Otahuhu Otara-Papatoetoe Manurewa, Papakura, and Franklin. Overall feedback supports the FTN routes, active modes and planning now for future growth.
Pukekohe Business Association	Pukekohe Business Association (PBA) PBA shared information provided by Te Tupu Ngātahi Supporting Growth with the association committee and members. PBA did not place feedback to SGA.
Manurewa BA	Manurewa Business Association (MBA) Overall, Manurewa Business Association is supportive of the concept of the Frequent Transit Network
Papakura BA	Papakura Business Association (PBA) The PBA shared information regarding the proposed FTN routes with the association committee and business members. Te Tupu Ngātahi Supporting Growth presented to the PBA via the Papakura Commercial Projects Group on Wednesday, 15 June 2023. No specific feedback from PBA.

Who we engaged	Feedback
Manukau BA	Manukau Business Association (MBA) MBA shared information regarding the proposed FTN routes with association committee and members. MBA supported the FTN routes.
Takanini BA	Takaanini Business Association The TBA shared information regarding the proposed FTN routes with the association committee and business members. Te Tupu Ngātahi Supporting Growth presented to the PBA via the Papakura Commercial Projects Group on Wednesday, 15 June 2023. Feedback focussed on third party land acquisition and landowner engagement around the proposed designation. TBA was keen that landowner engagement occur earlier than in the case of the TLC project. TBA was keen to understand how the FTN and TLC integrated. Detail provided during the presentation to Papakura Commercial Projects Group.

3.4.3 Community engagement strategy and feedback

To ensure that public engagement captured the diverse nature of those residing along the proposed FTN routes, we used the following engagement strategy:

- Targeted engagement strategies for each community - Manurewa, Takaanini and Papakura
- Work closely with elected members so they can support the process and have accurate and up-to-date information to support their community conversations.
- Ensure messaging is highly visual.
- Collateral to be produced in different languages (based on area demographics)
- Use partner organisations and key Local stakeholders to help share the messaging.
- Identify community groups that we can partner with to help develop and deliver the “boots on the ground” engagement activities.

We note that three weeks of the six-week public engagement phases were during school and public holidays and coincided with Auckland Council’s Annual Plan engagement. With this in mind and to give the community and key stakeholders more time to respond, the engagement period was extended by three weeks and finished on 10 May 2023.

Public engagement was open between **8 March and 10 May 2023**; the community was invited to provide feedback on the preferred options for the network. Survey questions presented during engagement included:

- 1) New frequent bus networks with dedicated bus lanes will be a good transport option because buses won't get caught up in as much congestion, and people will get where they want to go faster and more efficiently.**

Strongly agree -----Strongly disagree.

- 2) New frequent bus networks will help support the economy and improve social well-being in South Auckland.**

Strongly agree -----Strongly disagree.

- 3) I would like future generations of South Aucklanders to have:**

- **Safer, more accessible, and sustainable transport choices**
- **Dedicated Bus Lanes**
- **Safe walking and cycling paths.**

Strongly agree -----Strongly disagree.

- 4) I support planning being done now so there will be better transport options as more and more people live, work, and play in South Auckland.**

Strongly agree -----Strongly disagree.

To garner feedback, the following engagement activities were undertaken:

- Have your say / Find out More Webpage
- Elected member presentations, memorandums and informative emails.
- Supporting Growth hosted community information events across the three ward areas
- Joint engagement events with partner organisations
- Auckland Council People's Panel survey
- Media advertising (focus on ethnic and community-based media) – print, social and radio
- School and tertiary engagement
- Engagement with advocacy groups such as the AT Freight Working Group, the five business associations across the three council ward areas and local community advocacy groups.
- Multiple online email campaigns to Supporting Growth's southern distribution stakeholder database (over 2000 stakeholders) – updating extended feedback dates, advertising online feedback opportunities and open invitations to community information events across the three local board areas.
- Targeted engagement with key stakeholders and local community advocacy groups such as Takanini Residents Action Group (TRAG) and the Addison Community Society.

3.5 Feedback

Overall, there was a high level of feedback. The project team spoke directly with over 200 community members at public events held within the community, including:

- NZUP P2D community information event at Papakura Library,
- Takaanini World of Cultures Day
- Sunday worship at the Gurdwara Sikh Temple, Takaanini
- Papakura Streetfest and
- Three Te Tupu Ngatahi Supporting Growth hosted events across the three council ward areas of Manurewa, Takaanini and Papakura

The events generated direct conversation and immediate feedback from the community, with the overall response supporting the proposed South FTN routes, including walking and cycling facilities. Community feedback at these events indicated strong support for the project.

In addition, we ran three targeted online surveys across the three local board areas using:

- the Auckland Councils Peoples Panel,
- 28 local Schools, and
- the Manukau Institute of Technology (MIT).

And received over 1300 responses to the survey questions.

Concurrently, we surveyed the public through Supporting Growths online platform, the Hive. We received the following:

- 561 page views
- 450 visitors
- 205 responses.

In addition, we received:

- 2984 online page views of the project and 1788 visitors to the website
- 17 people completed the online survey.
- 11 people dropped a pin on our social map.
- 1 person emailed feedback to us.
- 19 people signed up for project updates.

Figure 4: Hive social map with pin drops, by location

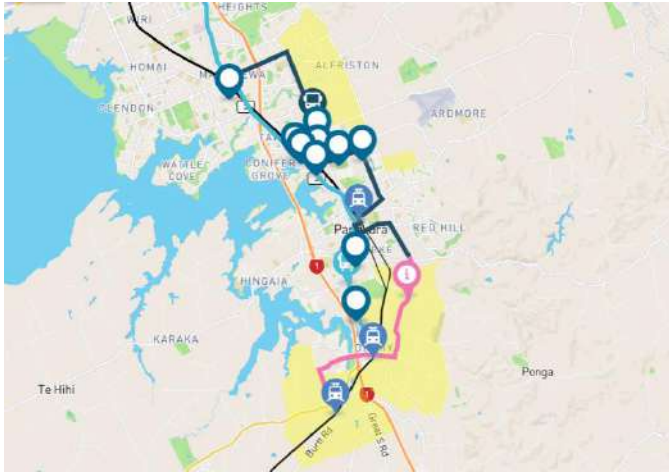
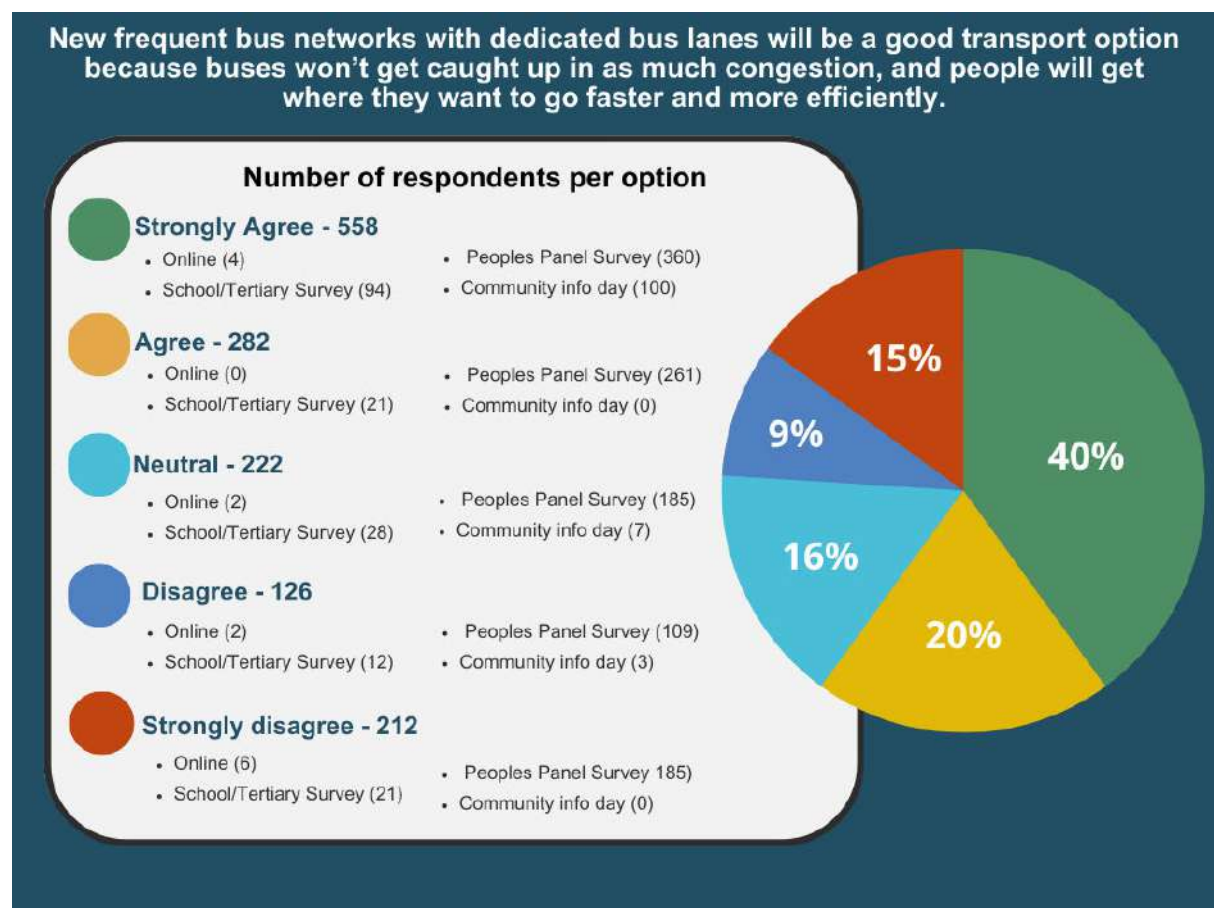


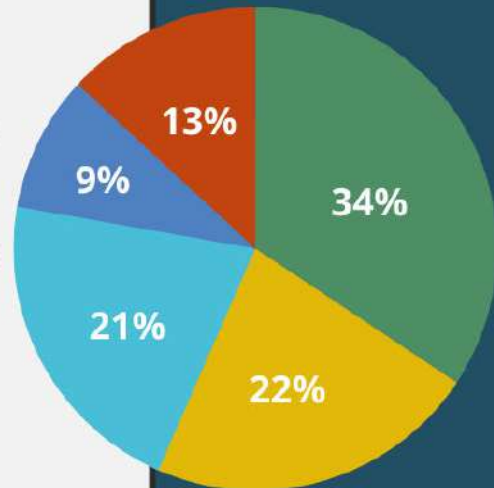
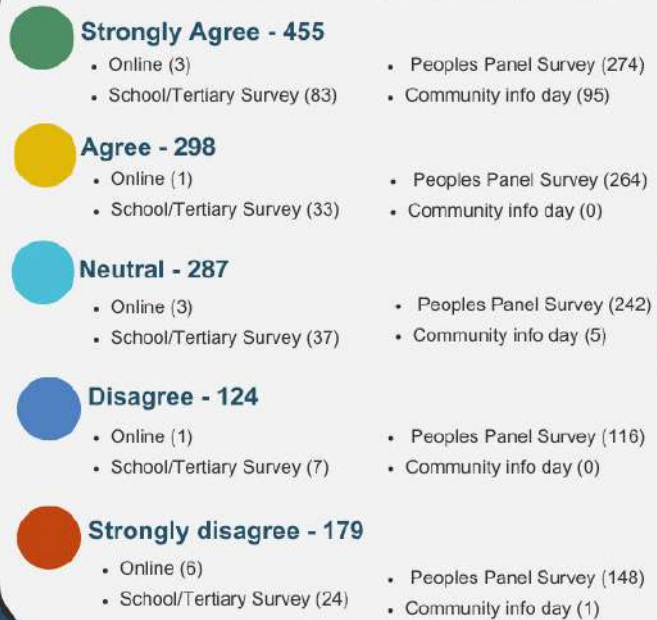
Figure 4: Hive social map with pin drops, by location

3.5.1 Overall feedback

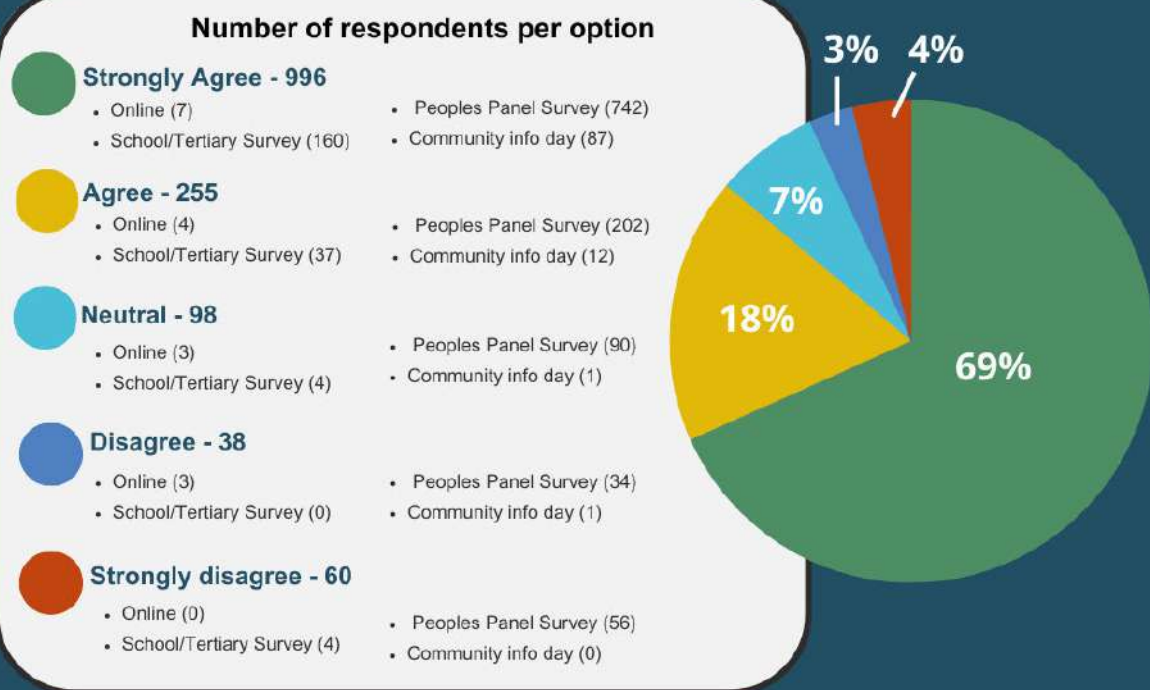


New frequent bus networks will help support the economy and improve social well-being in South Auckland.

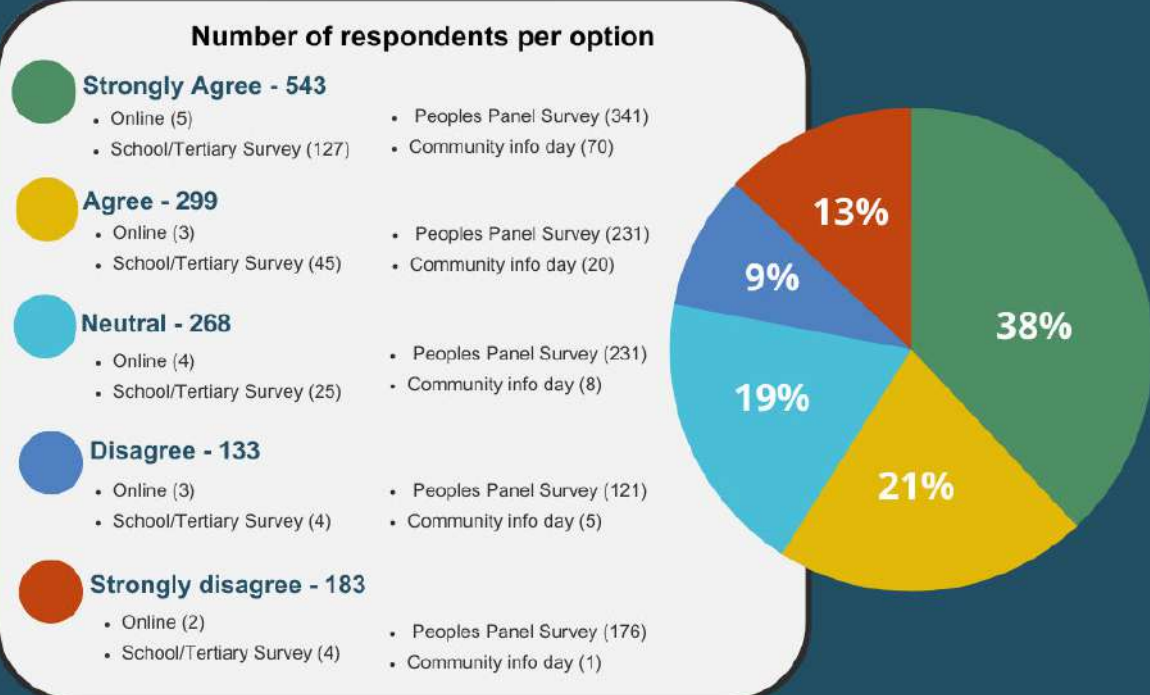
Number of respondents per option



I would like future generations of South Aucklanders to have safer, more accessible, and sustainable transport choices

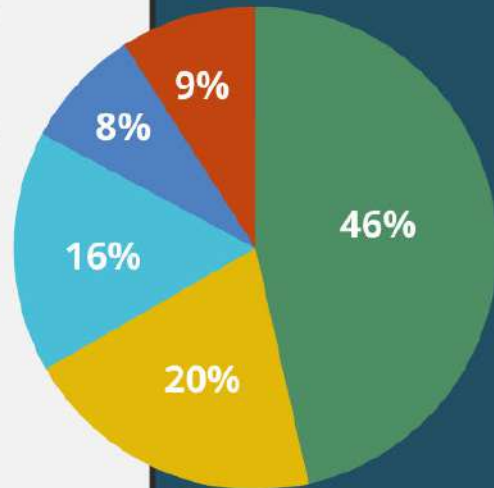
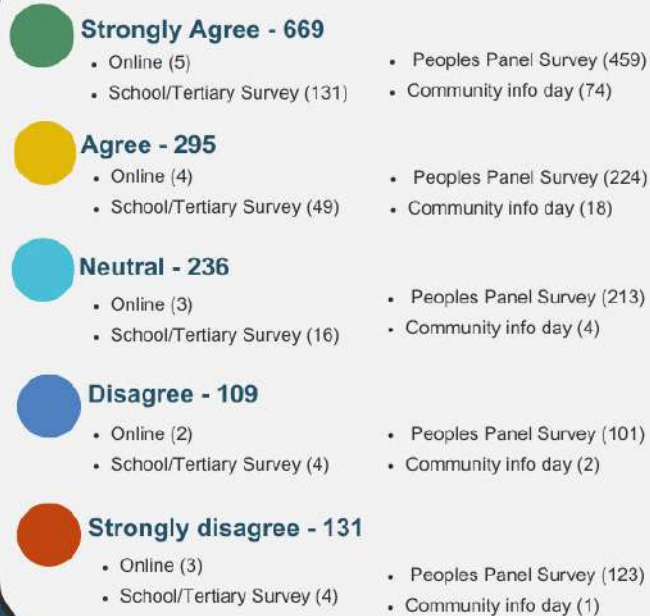


I would like future generations of South Aucklanders to have dedicated bus lanes



I would like future generations of South Aucklanders to have safe walking and cycling paths

Number of respondents per option



I support planning being done now so there will be better transport options as more and more people live, work and play in South Auckland

Number of respondents per option

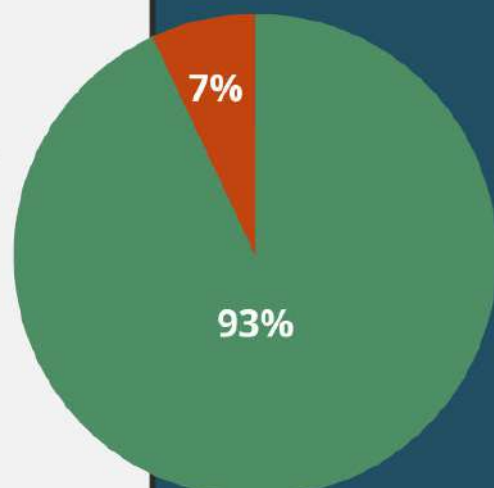


Table 4 summarises the key themes drawn from public feedback and our responses to the feedback we received.

Table 4: Summary of key themes and responses

Key theme	Comments	What we have done
Strong support for the two FTN routes	- Majority of people supported the FTNs as they provide connectivity to major parts of the city. - People supported having multi-choice public transport options on these routes. - They will encourage more people to use buses and make public transport more appealing - They will reduce traffic and congestion on the roads - Dedicated bus lanes will help people get where they want to go faster and save them time - It would make travelling in bus safer.	- We note the support and will continue planning to support future growth by working to protect the land required for future transport networks. - We will continue our work to help ensure improved and more sustainable transport mode choice for Aucklanders.
Safe and dedicated walking and cycling infrastructure	- Feedback supports dedicated facilities for walking and cycling - It would be safer for people who cycle to work/school/university - The idea of a walkable city is supported. - FWG supported separated walking and cycling modes. - People raised concerns about how the roads are not safe for cyclists, dedicated cycle lanes would be safer for people who prefer cycling as a mode of transport	- We will continue our work planning for dedicated active mode infrastructure to make Tāmaki Makaurau safer and more accessible for people travelling on foot and on bikes. - Our planning provides dedicated active mode facilities separated from public transport and general traffic, including freight.
The Takaanini rail station and the Takaanini retail and shopping town centre need to be integrated into the proposed FTN route using Arion Road.	Several stakeholders commented that: - Takaanini train station needs to be near the major economic hub, not the residential area. - People commented that there is no transport hub in Takaanini. The buses need to stop at the main shopping area in Takaanini. - By using Arion Road in the proposed FTN route would help with economic growth	- We acknowledged the feedback and provided more specific details about the strategic nature of the FTN route. - We are working with Auckland Transport's Metro team to connect them with the stakeholders who provided feedback.
That the networks need to integrate with the Strategic Freight Network (SFN).	Feedback from the Freight Working Group (FWG) and NZ heavy Haulage Association that the new networks, specifically the Great South Road FTN, is an important strategic network for freight.	- We acknowledged the feedback and provided more specific details about the strategic nature of the FTN route and the importance of the Great South Road corridor as a Strategic Freight Network. - We presented to the FWG on 3 April 2023 outlining the proposed FTN routes and how the routes integrated into the Strategic Freight Network.

Key theme	Comments	What we have done
Parking	There were two pieces of differing feedback regarding parking. One theme was in support of the removal of parking in favour of a more efficient public transport network. Another theme is that removing parking for businesses would have a detrimental effect on the accessibility to businesses along Great South Road, and, therefore, a detrimental effect on the economy.	- We acknowledged the feedback, provided more project details, and explained how the bus routes would help improve connectivity. - We explained how the project is planned to make Auckland future-proof with different transport options like dedicated walkways, cycleways, and connectivity to major train stations and bus stops.
Reliable and increased frequency of public transport	- People expressed that public transport needs to be reliable and buses need run to timetable. - Need to increase the frequency of bus service so that buses are on time	- We explained that FTNs operate on a schedule of at least every 15 minutes, in both directions, from 7am to 7pm, seven days a week. - We are planning improvements, like dedicated bus lanes, that mean buses won't get caught up in the same congestion as general traffic. - We will continue to work to protect the land required to operate the proposed FTNs in the future.
No need for dedicated bus lanes	- Dedicated bus lanes create more traffic because there will be fewer lanes for general traffic. - Not many people use buses, so there is no need for dedicated bus lanes. - Creating one more lane for buses will make the walkway skinnier, and it is dangerous	- We explained that FTNs would encourage more people to use public transport because they will get people where they want to go faster and more efficiently. - We showed the proposed cross-section and explained that footpaths and cycle facilities will be dedicated and separated from public transport, freight and general traffic.
Affordable and cheap public transport	People supported the idea of continuing subsidised public transport, making it affordable for more people to use buses and trains	We have passed comments regarding the cost of public transport to Auckland Transport.
Better connectivity	- Some people said that public transport doesn't provide great connectivity. Some people need to take multiple buses to reach one destination. - There is should better connectivity between bus and train stations	We explained how the proposed FTNs would improve connectivity by integrating and connecting with town centres and rail stations, providing commuters with a choice of travel options.

3.6 Media coverage

To ensure that we engaged with the three separate and diversely different communities along the proposed FTN route, we undertook a comprehensive media strategy focusing on ethnic and community-based media.

The media plan advertised events where the community could come and talk with project team members as well as directing the community to platforms where they could provide their feedback online (the Hive, Q codes, website).

Proactive media coverage was closely monitored during the engagement period. Apart from Te Tupu Ngātahi Supporting Growths' proactive media advertising, there was no media pickup during the public engagement phase.

3.7 Next Steps

Feedback gathered during the formal consultation period has been reviewed and analysed. It has been used to help understand issues and opportunities with proposals for the South FTNs and contribute to project decision-making. Engagement will continue with partners, key stakeholders, developers, landowners, and the wider community beyond the consultation period.

An important part of developing a NoR is consulting with potentially affected people, Manawhenua, the community, landowners, businesses, government and community organisations. We will be able to outline potential property impacts with landowners by mid-late 2023.

We are working towards lodging our Notice of Requirement (NoR) documentation to protect the land we need in late 2023. Once this is finalised, it will be lodged with Auckland Transport as the requiring authority.

The project is currently without funding for detailed design and construction. Construction is not anticipated for another 20-30 years and will be in line with the release of land by Auckland Council.



1 Appendix 1

South Frequent Transit Network Routes



Planning now to improve transport network routes along some of South Auckland's existing major roads

Over the next 30 years, there will be 120,000 more people living, working, and schooling in South Auckland.

We are preparing Tāmaki Makaurau for that growth by planning solutions for improved public transport, better and safer walking and cycling options, and new and upgraded roads. We want future generations of South Aucklanders to have more choice about how they get around.

Public
engagement
extended to
8 May
**Tell us what
you think now**

To help achieve this, we're planning two new bus routes, known as a Frequent Transit Network Routes (FTN).

The new bus networks, totalling around 28 kilometres in length, will connect train stations with town centres in Manukau, Puhinui, Takaanini, Papakura and Drury.

Typically, FTN bus routes operate at least every 15 minutes making them efficient, direct, and attractive to users. The bus network will connect with the rail network to give people greater access to the places they want to go – like home, school, work and recreational activities



**Find out more and tell us what
you think**

Scan the QR Code or visit our
website using the URL below.

**findoutmore-
supportinggrowth.nz**

2 Appendix 2

Community information events – South Frequent Transit Network

During the public engagement phase Te Tupu Ngatahi hosted and participated in a total of seven information days, organised to approach the wider community to collect their feedback on South Frequent Transit Network Routes (FTN). The information days were planned to use two strategies: partnering at public events like World of Cultures, P2D open event, and StreetFest Papakura. We also engaged with the public at community venues, such as Manurewa Library and Gurudwara Sri Kalgidhar Sahib (Sikh Temple). Takanini. We used an onsite survey as a tool to collect feedback from the public. The participants in the survey were to paste a sticky dot on a board to answer the question. Most people agreed to take part in the survey. Our survey questions were:

1. **New frequent bus networks with dedicated bus lanes will be a good transport option because buses won't get caught up in as much congestion, and people will get where they want to go faster and more efficiently.**

Strongly agree -----Strongly disagree.

2. **New frequent bus networks will help support the economy and improve social well-being in South Auckland.**

Strongly agree -----Strongly disagree.

3. **I would like future generations of South Aucklanders to have:**

- Safer, more accessible, and sustainable transport choices
- Dedicated Bus Lanes
- Safe walking and cycling paths.

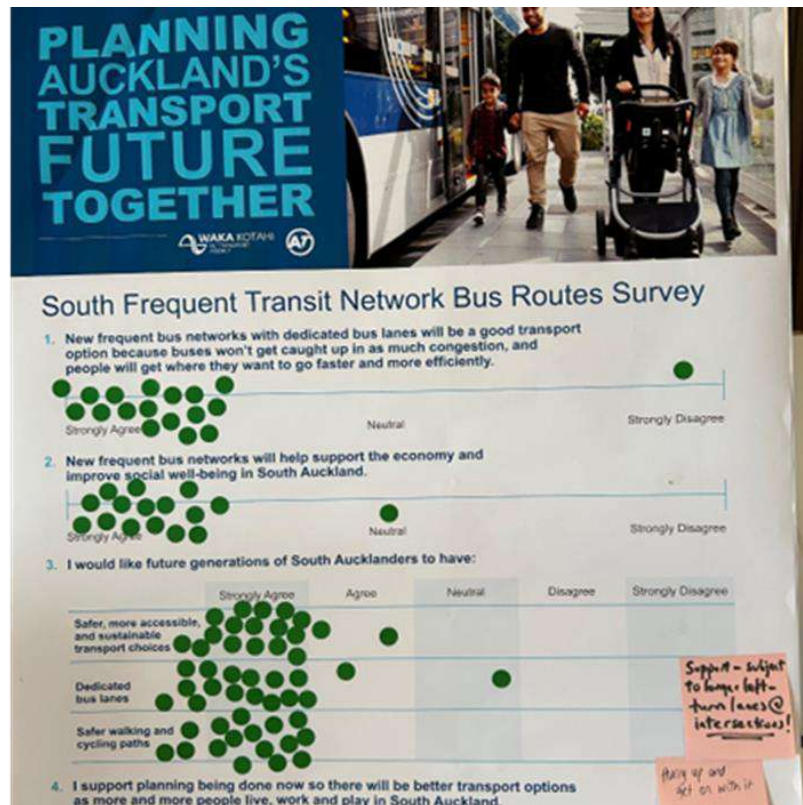
Strongly agree -----Strongly disagree.

4. **I support planning being done now so there will be better transport options as more and more people live, work, and play in South Auckland.**

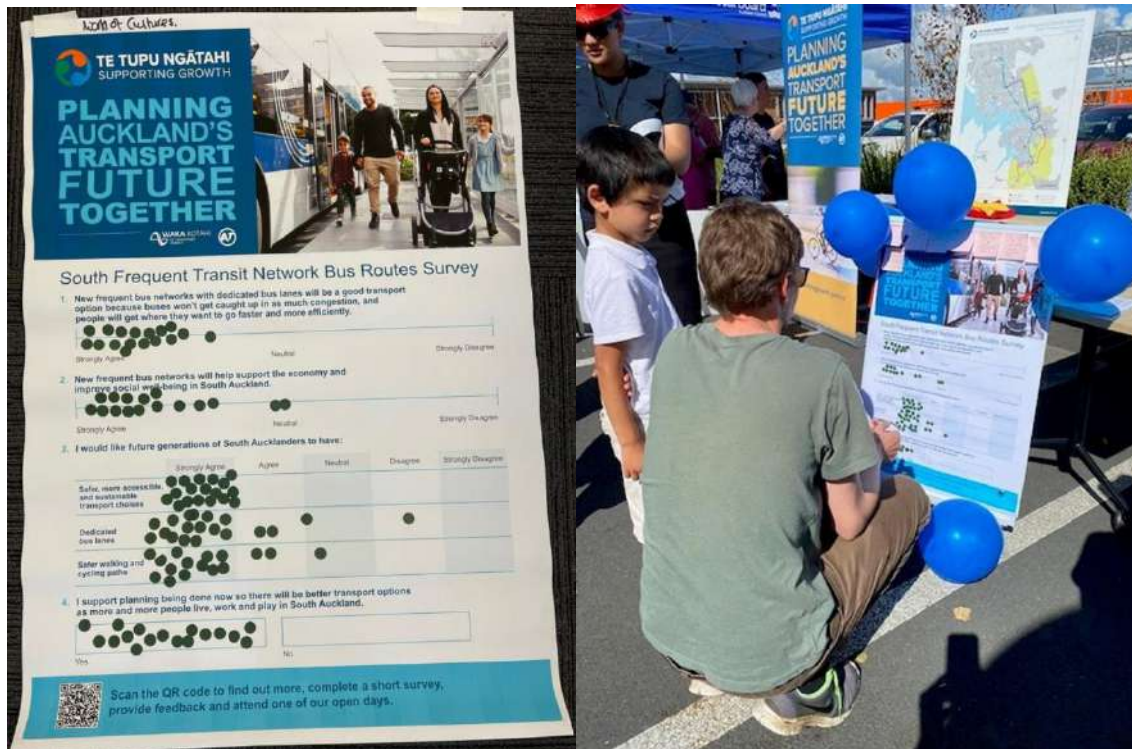
Strongly agree -----Strongly disagree.

Sat 25 March, 10.30am - 1pm, Community Open Day, Manurewa Library

In general, the people who stopped and spoke with the team were happy to provide verbal feedback, especially about public transport provision in South Auckland. People were happy and keen to participate in an onsite survey. As a general sentiment, people who stopped and spoke with the team were supportive of dedicated bus lanes. There was also a clear support for improved cycle facilities that are continuous and separated from other traffic.



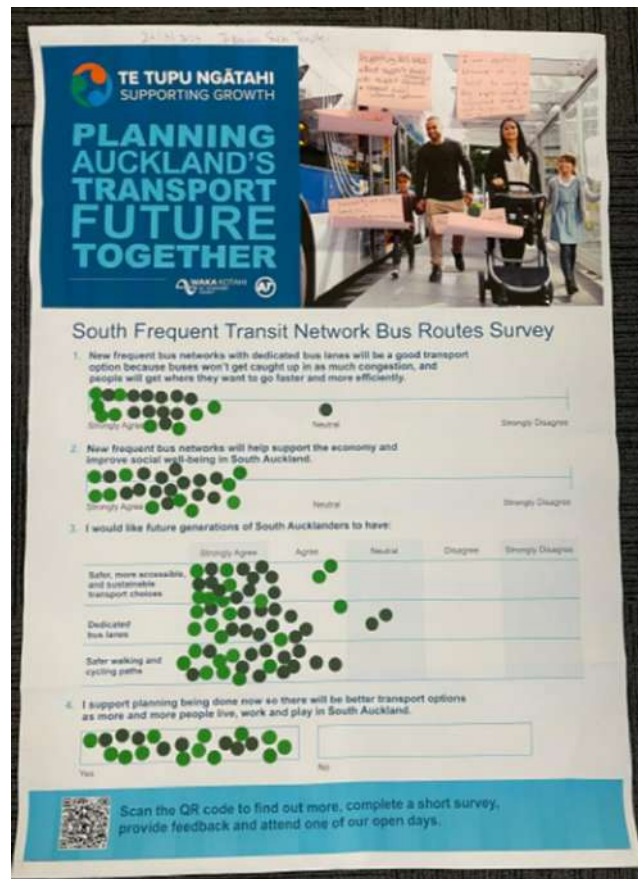
Sat 25 March, 10am-2pm, World of Cultures, Te Paataka Koorero o Takaanini



At World of Cultures event, the team addressed people who came to attend the event. The people expressed interest to know about the FTN project in South Auckland. The large maps attracted attention and people stopped to look at them wanting to know more about the proposed bus networks. Most people we spoke with were happy to take part in the survey and provide verbal feedback. The public supported the proposed new FTN networks and agreed that public transport in South Auckland needs to be improved.

Sunday 26 March, 11am-1pm, Gurdwara Sri Kalgidhar Sahib (Sikh Temple)

We spoke to around 50-55 worshipers who came to visit the Gurudwara (Sikh Temple). The team planned to speak to the worshipers on their way out after they had finished the prayer. People were curious and wanted to know more about the proposed bus networks. Most people who stopped and spoke with us were happy to take part in the survey and provide verbal feedback. However, many people were hesitant to provide their contact details for various reasons such as *I don't use public transport, I don't live in South Auckland, I don't want too many emails, and I don't use email*. Apart from taking part in the survey, people provide verbal feedback. General statement was people want public transport to be reliable with better frequency. Safety was also raised as a factor, it needs to be safer to use the public transport as some people do not find it safe to take the train at late hours.



TE TUPU NGĀTAHI
SUPPORTING GROWTH

PLANNING AUCKLAND'S TRANSPORT FUTURE TOGETHER

South Frequent Transit Network Bus Routes Survey

- New frequent bus networks with dedicated bus lanes will be a good transport option because buses won't get caught up in as much congestion, and people will get where they want to go faster and more efficiently.
- New frequent bus networks will help support the economy and improve social well-being in South Auckland.
- I would like future generations of South Aucklanders to have:
 - Safer, more accessible, and sustainable transport choices
 - Dedicated bus lanes
 - Safer walking and cycling paths
- I support planning being done now so there will be better transport options as more and more people live, work and play in South Auckland.

Scan the QR code to find out more, complete a short survey, provide feedback and attend one of our open days.



Saturday, 1 April, 2pm – 4.30pm, Community Open Day, Takaanini Hall

This open day was not well attended with only three people coming to the open afternoon. The location and weather are considered to have potentially contributed to this. The three participants were part of the same group and were primarily interested in the future of Mill Road but were open to providing their feedback on the survey. One respondent provided their name and contact email to be kept informed about the FTN project and to receive information on Mill Road when/if it was available. The people who stopped and spoke with us were very supportive of dedicated bus lanes and strongly support planning now for future generations.

TE TUKU NGĀTAHI
SUPPORTING GROWTH

PLANNING AUCKLAND'S TRANSPORT FUTURE TOGETHER

South Frequent Transit Network Bus Routes Survey

1. New frequent bus networks with dedicated bus lanes will be a good transport option because buses won't get caught up in as much congestion, and people will get where they want to go faster and more efficiently.

Strongly Agree Neutral Strongly Disagree

2. New frequent bus networks will help support the economy and improve social well-being in South Auckland.

Strongly Agree Neutral Strongly Disagree

3. I would like future generations of South Aucklanders to have:

Strongly Agree Agree Neutral Disagree Strongly Disagree

Safer, more accessible, and sustainable transport choices

Dedicated bus lanes

Safer walking and cycling paths

4. I support planning being done now so there will be better transport options as more and more people live, work and play in South Auckland.

Yes No

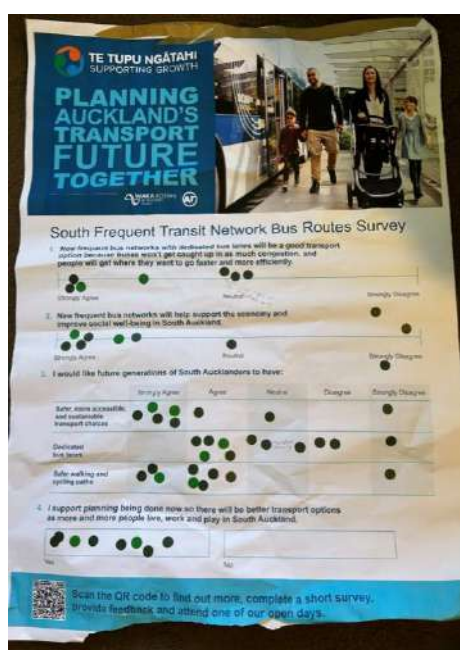
Scan the QR code or go to www.aucklandcouncil.govt.nz/transport/consultation to complete a short survey, provide feedback and attend one of our open days.



Tuesday, 4 April, 5 – 7pm, Community Open Day, Massey Park Grandstand

We did not have anyone attend who had seen information about the event and were attending as a result. Rather, the people we spoke with were either passing by (including commuters from the train station) or people wanting to enter the stadium by going past us. We did not collect any contact details despite asking if people wanted to sign up to receive more information on our projects.

We received mixed responses to the South FTN proposals noting that one person who 'strongly disagreed' with the options under statement 2 and options under statement 3 did so because "if I get caught up in congestion driving, everyone else should too." Another person 'strongly disagreed' with statements 1 and 2 because he felt that investment should be in rail infrastructure and services and not buses. Neutral feedback was generally related to supporting the concept of dedicated bus lanes, but noting concern about the impact on people's homes and businesses to widen roads as well as the costs involved.



Saturday 6 May 2023 Great South Road Papakura 10am- 2pm

The engagement team attended Live Papakura StreetFest, annual event organized by Papakura Business Association and local businesses. On this busy day the team spoke to around 40 people who came to attend the StreetFest. Most people were happy to take part in the survey and provide verbal feedback. The large maps attracted attention and people stopped to know more about the proposed South FTN bus routes. As a general sentiment people who stopped and spoke with the team were supportive of dedicated bus lanes, walking and cycling routes (active modes) and strongly supported to reduce congestion and planning now for future generations and future urban zones. Only a few people offered to share their details to receive updates and information in future. The team also met residents who were already receiving emails from Te Tupu Ngātahi Supporting Growth.



South FTN and Key Connections

Appendix F – Urban Design Evaluation

November 2023

Version 1.1

Document Status

Responsibility	Name
Author	[REDACTED]
Reviewer	[REDACTED] [REDACTED]
Approver	[REDACTED]

Revision Status

Version	Date	Reason for Issue
0.1	06/05/2023	Draft for internal review
1.0	23/06/2023	Issue for IQA review
1.1	9/11/2023	Final

Table of Contents

1	Introduction.....	2
2	Existing Environmental Context.....	5
3	Great South Road 1.....	7
4	Great South Road 2.....	10
5	Great South Road 3.....	14
6	Alfriston Road.....	17
7	Porchester – Popes Road.....	20
8	Wider Papakura	23
9	Central Papakura.....	26

1 Introduction

This urban design evaluation has been prepared for the South FTN and Key Connections Detailed Business Case (DBC) based on the guidance and principles established in the programme wide document - Te Tupu Ngātahi Design Framework (Design Framework).

The Design Framework takes a systems-based approach as the basis on which urban areas are organised and understood and pulls these apart as a series of layers; environment, social, built form, movement and land use, with cultural and sustainability values underpinning and spanning across these. In this way transport networks are not seen in isolation rather in terms of how they can contribute to the urban system as a whole.

The Design Framework provides measurable guidance for outcomes-based decisions throughout each phase of the programme delivery including:

- Option development
- Option evaluation
- Detailed business case preparation, and
- The corridor protection and consenting process.

There are 20 design principles that have been established within these layers to provide high level guidance on the attributes of responsive, resilient, sustainable and high-quality urban environments. Each preferred option has been evaluated against these 20 programme wide design principles based on the current design detail (Rev A). The record notes where an option is supportive of each of the design principles. Where the option was assessed as being neutral or as an opportunity for development, this has been elaborated on as urban design recommendations that should be considered and developed in future design stages.

The intention of this evaluation is to provide a high level urban design overview that considers the following projects (as named at the time of this evaluation):

- Great South Road Frequent Transit Network (FTN)
- Great South Road upgrade between Waihoehoe Road and State Highway 22 interchange
- Takaanini FTN
- Popes Road urbanisation
- Croskery Road urbanisation

The urban design commentary will also identify design opportunities and refinements that should be considered at subsequent stages of the design and help to form the basis of future urban design specific consent conditions.

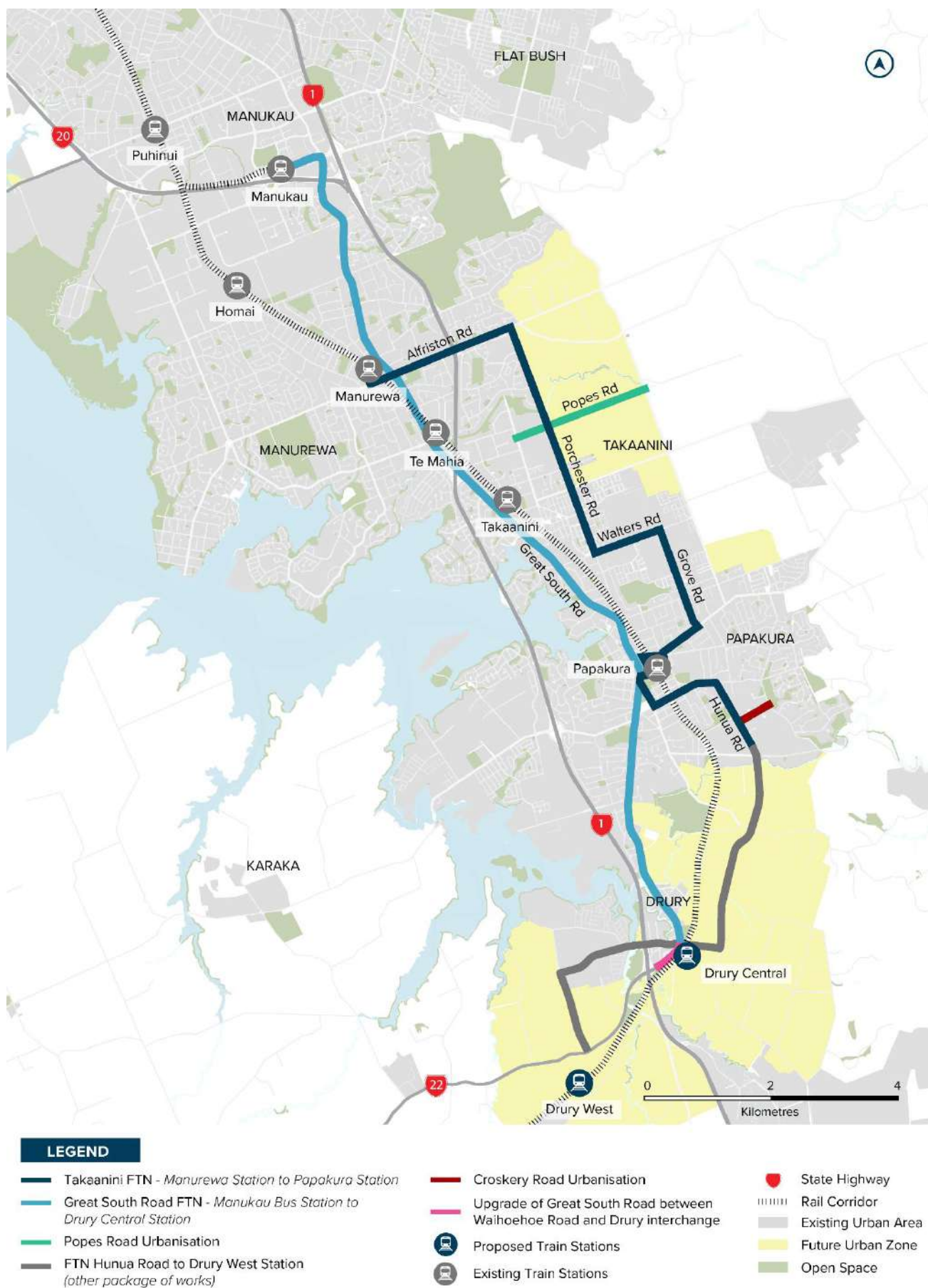


Figure 1 – South FTN and Key Connections Business Case

2 Existing Environmental Context

The proposed South FTN and Key Connections alignment traverses a highly urbanised and varied urban morphology in southern Auckland. This stretches from Manukau to Drury and connects with the town centres of Manurewa, Takaanini and Papakura. As shown in Figure 1, the DBC defines five independent projects overall, however the majority of the project scope is included within the GSR and Takaanini FTN routes.

In response to this the sections evaluated have been redefined to better reflect the urban morphology and create a more balanced view of the project under an urban design lens. Also considered is where the project is proposing road widening through designation or to stay within the road reserve. This affects the corridor's scale of impact on the surrounding area but also its ability to support or enable positive urban outcomes. The following seven sections are proposed for evaluation:

- Great South Road 1 – Manukau Station Road and the northern end of GSR to the Orams Road intersection. This section of the corridor utilises the existing 30m wide road reserve where a designation hasn't been proposed. It has a varied urban morphology including the Manukau centre.
- Great South 2 – GSR from Orams Road to Coles Crescent. This section of the corridor is highly constrained in places with an existing road reserve of 20m but varies up to 30m. Road widening through designation is proposed only at intersections and just south of Manurewa centre. The urban morphology is highly variable shifting between residential, industrial and centre zones. This section directly interfaces with the Manurewa and Takaanini town centres and includes the major Takaanini State Highway 1 interchange.
- Great South Road 3 – GSR from the intersection with Beach Road/Settlement Road to the Drury interchange. This section interfaces with mostly residential land use and is also predominately constrained to a 20m existing road reserve. Road widening through designation is proposed only at intersections.
- Afriston Road – Weymouth Road and Afriston Road from the intersections with Selwyn Road to Porchester Road. Road widening through designation is proposed for the majority for this section up to Magic Way, which will significantly impact the adjacent residential land use. This section also ties directly into Manurewa centre and train station.
- Porchester-Popes – Porchester Road, Popes Road and Walters Road, along Bruce Pulman Park. This section largely services the residential areas of Manurewa, Takaanini and the northern end of Papakura. There is a long section that interfaces with the Takaanini Future Urban Zone (FUZ). A designation is proposed for all three roads.
- Wider Papakura – This covers two sections of the Takaanini FTN including Grove Road to Clevedon Road, Settlement Road to Hunua Road, as well as Croskery Road. These sections cover the wider residential and industrial area outside of the Papakura centre where a designation is only proposed at intersections.
- Papakura Central – This Section covers both GSR FTN and Takaanini FTN including portions of GSR, Clevedon Road, Railway Street West, Wood Street, Ōpāheke Road and Settlement Road. This section includes the town centre and high density residential zoning of Papakura, and also directly interfaces with the Papakura train station/bus interchange. A designation is only proposed at intersections.

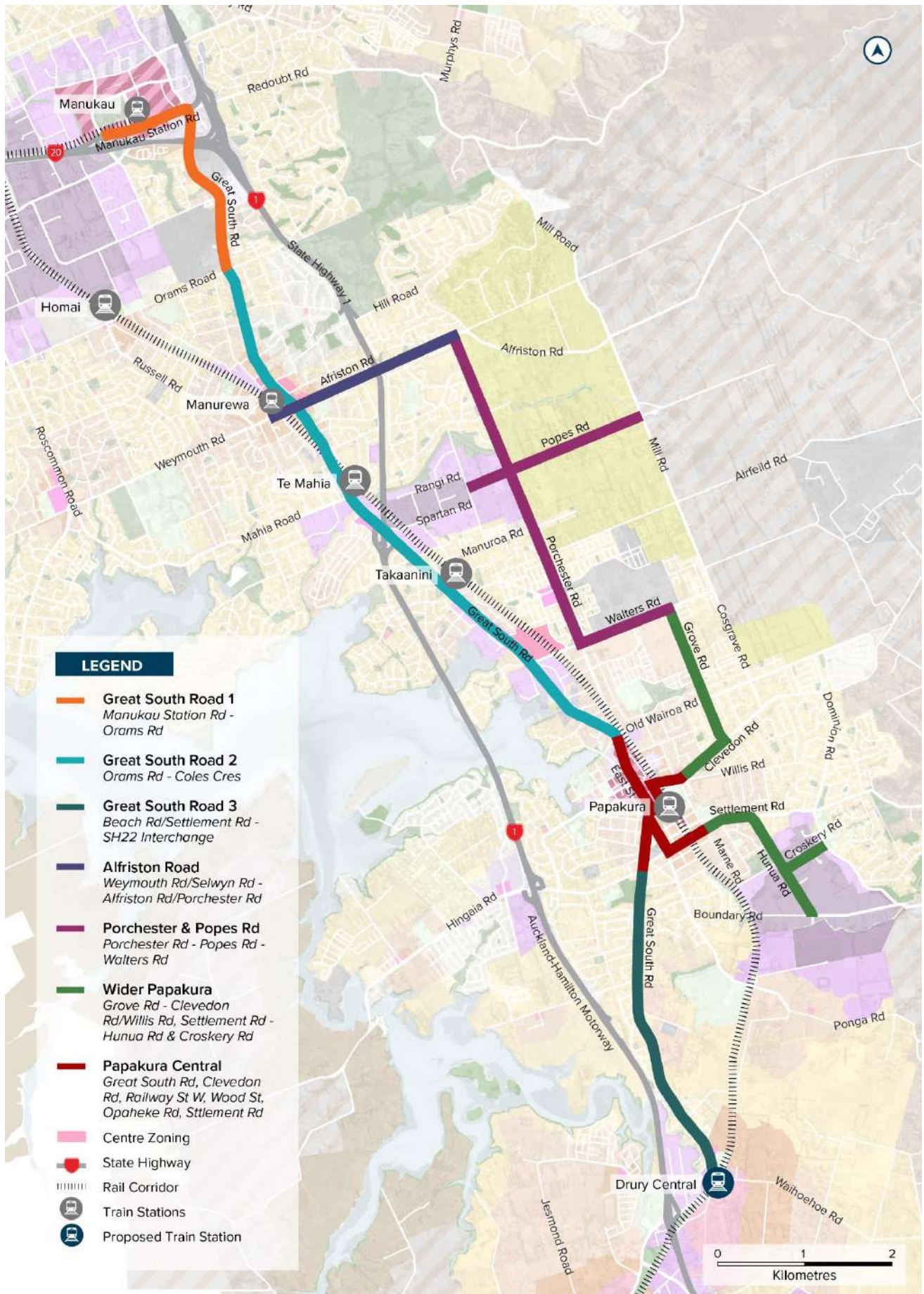


Figure 2 – Urban Design Evaluation Sections

3 Great South Road 1

		Supports	Neutral	Opportunity for Development	Not relevant
System layers	Design Principles				
Environment	1.1 Support and enhance ecological corridors and biodiversity		●		
	1.2 Support water conservation and enhance water quality in a watershed			●	
	1.3 Minimise land disturbance, conserve resources and materials	●			
	1.4 Adapt to a changing climate and respond to the microclimatic factors of each area		●		
Social	2.1 Identity and place		●		
	2.2 Respect culturally significant sites and landscapes		●		
	2.3 Adaptive corridors	●			
	2.4 Social cohesion	●			
	2.5 Safe corridors		●		
Built form	3.1 Align corridors with density	●			
	3.2 Corridor scaled to the surrounding context and urban structure	●			
	3.3 Facilitate an appropriate interface between place and movement			●	
Movement	4.1 Connect nodes	●			
	4.2 Connect modes	●			
	4.3 Support access to employment and industry	●			
	4.4 Prioritise active modes and public transport		●		
	4.5 Support inter-regional connections and strategic infrastructure	●			
	4.6 Support legible corridor function	●			
Landuse	5.1 Public transport directed and integrated into centres	●			
	5.2 Strategic corridors as urban edges				●

Figure 3 – Great South Road 1 Urban Design Evaluation

The proposed corridor is supportive of the following Design Framework principles:

Environment

- Minimise land disturbance, conserve resources and materials

Social

- Adaptive corridors
- Social cohesion

Built Form

- Align corridors with density
- Corridor scaled to the surrounding context and urban structure

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Support inter-regional connections and strategic infrastructure
- Support legible corridor function

Those principles that scored neutral in their support include:

- **Support and enhance ecological corridors and biodiversity**

The corridor proposes to maintain the existing road configuration which limits the potential to support positive ecological outcomes. However, while this is limited there is some contiguous space within berms to accommodate planting.

- **Adapt to a changing climate and respond to the microclimatic factors of each area**

The corridor supports the reduction of climate change impact with modal shift through the provision of active modes and public transport options. However, the proposed corridor configuration demonstrates a potentially constrained provision of space for amenity planting and water sensitive design elements that would contribute towards mitigating urban heat island effects or micro climatic conditions.

- **Identity and place**

The future design response should consider opportunities to incorporate underlying identity drivers of the surrounding context. This includes cultural values and narrative expressions in partnership with Manawhenua. Incorporation of design narratives could be considered in the arrangement of the corridor. For instance through wayfinding and signage, natural landscape, bridges and structural elements or where the corridor intersects with sites of cultural significance.

- **Respect culturally significant sites and landscapes**

There are no specific sites of significance under the Auckland Unitary Plan: Operative in Part (AUP:OIP) that have been identified in this section. Manawhenua have indicated the area and corridor in general holds deep historical and cultural significance with a challenging history and a high level of sensitivity. In future design stages, Manawhenua will be invited to provide input into relevant cultural landscape and design matters.

- **Safe corridors**

The corridor in this section has enough width within the road reserve to accommodate a configuration that supports a safe corridor environment for all modes. However, by maintaining the existing road configuration as proposed, there is a lack of accommodation for appropriately sized berms / buffers to support pedestrian and cyclist safety. Further detail and refinement is also needed to demonstrate a safe pedestrian environment within intersection arrangement, mid-block crossings or tie in into the surrounding network.

- **Prioritise active modes and public transport**

This section of the corridor is identified as part of the regional active mode network. This is the highest strategic ranking, refer Auckland Transport's Future Connect¹ and has the most significant strategic importance of the corridor due to this. The section widely accommodates separated active mode facilities within the existing road reserve. However, there are some space constrained points, including the bridges over State Highway 20 and Puhinui Creek, where a lower level of service i.e. shared use path, may need to be provided. Future design stages should address the appropriate and safe tie in of active mode facilities in these locations.

The following principles were identified as an opportunity for development to this section of the corridor:

- **Support water conservation and enhance water quality in a watershed**

The proposed corridor allows no allocation of land area to provide any form of water quality treatment, including swales, rain gardens, bioswales or wetlands.

- **Facilitate an appropriate interface between place and movement**

By maintaining the existing road configuration this section of corridor does not directly address the poor existing public private interface between the corridor and residential frontage dwellings. Currently there is a lack of privacy and dwellings are exposed to high noise levels generated by corridor function, issues which could be exacerbated as the corridor densifies.

The following principles were identified as not relevant:

- Strategic corridors as urban edges

¹Auckland Transport. Future Connect - Auckland Transport's Network Plan. <https://at.govt.nz/about-us/transport-plans-strategies/future-connect-auckland-transport-network-plan/>

4 Great South Road 2

		Supports	Neutral	Opportunity for Development	Not relevant
System layers	Design Principles				
Environment	1.1 Support and enhance ecological corridors and biodiversity			●	
	1.2 Support water conservation and enhance water quality in a watershed			●	
	1.3 Minimise land disturbance, conserve resources and materials	●			
	1.4 Adapt to a changing climate and respond to the microclimatic factors of each area		●		
Social	2.1 Identity and place		●		
	2.2 Respect culturally significant sites and landscapes		●		
	2.3 Adaptive corridors		●		
	2.4 Social cohesion		●		
	2.5 Safe corridors			●	
Built form	3.1 Align corridors with density	●			
	3.2 Corridor scaled to the surrounding context and urban structure	●			
	3.3 Facilitate an appropriate interface between place and movement			●	
Movement	4.1 Connect nodes	●			
	4.2 Connect modes		●		
	4.3 Support access to employment and industry	●			
	4.4 Prioritise active modes and public transport		●		
	4.5 Support inter-regional connections and strategic infrastructure	●			
	4.6 Support legible corridor function	●			
Landuse	5.1 Public transport directed and integrated into centres	●			
	5.2 Strategic corridors as urban edges				●

Figure 4 – Great South Road 2 Urban Design Evaluation

The proposed corridor is supportive of the following Design Framework principles:

Environment

- Minimise land disturbance, conserve resources and materials

Built Form

- Align corridors with density
- Corridor scaled to the surrounding context and urban structure

Movement

- Connect nodes
- Support access to employment and industry
- Support inter-regional connections and strategic infrastructure
- Support legible corridor function

Land use

- Public transport directed and integrated into centres

Those principles that scored neutral in their support include:

- **Adapt to a changing climate and respond to the microclimatic factors of each area**

Refer to text written in Great South Road 1

- **Identity and place**

Refer to text written in Great South Road 1

- **Respect culturally significant sites and landscapes**

Refer to text written in Great South Road 1

- **Adaptive corridors**

The proposed design utilises and enhances an existing corridor, minimising significant engineering solutions and social disruption. However, the space constrained corridor limits its flexibility to accommodate future change in function or appropriately respond to physical interface as the corridor densifies. This is especially pertinent as this section of corridor is within a walkable catchment of three train stations (Manurewa, Te Mahia, and Takaanini), which could see adjacent residential zoning with a minimum of six story's under Auckland Council Plan Change 78. This also limits its accommodation for variations in noise levels and there is no space provision for non-transport functions such as ecological diversity, water management or recreation.

- **Social cohesion**

The corridor supports modal shift and providing connectivity between three centres and local amenities. However network resilience and efficiency will be negatively affected as corridor functions like a southbound bus lane or separated active mode facilities are not accommodated through some sections. This is especially important where the corridor connects to the three train stations.

- **Connect modes**

The corridor provides multi model travel options and aims to reduce car dependency. However, where the corridor is space constrained within the existing road reserve there is limited space for appropriate transition between modes i.e. bus stops/shelters off the pathway. Connection of modes through interchanges and tie in into the three train stations is currently undefined and will need to be addressed in future design stages.

- **Prioritise active modes and public transport**

The corridor accommodates active modes and prioritised bus lanes. However, the corridor width does not allow for a bidirectional facility for both of these functions which potentially results in a poorer outcome in terms of modal level of service, i.e., shared use paths and only northbound bus lanes in some places. The Papakura Stream bridge proposed to be retained does not support an appropriate active mode environment and disrupts the continuity and completeness of the network.

The following principles were identified as an opportunity for development to this section of the corridor:

- **Support and enhance ecological corridors and biodiversity**

The corridor is likely to impact or require the removal of existing mature trees with limited space or flexibility to avoid these when they are within the road reserve. Future design stages should demonstrate how these impacts will be mitigated and how ecological impacts will be supported without contiguous space in the corridor for planting. There are also approximately a dozen notable trees identified under the AUP that directly interface with this section of corridor. Further detail is required to assess and mitigate any impact to these.

- **Support water conservation and enhance water quality in a watershed**

This proposed section of corridor allows no allocation of land area to provide any form of water quality treatment, including swales, rain gardens, bioswales or wetlands. Because of this the corridor also doesn't contribute to stormwater or flooding resilience.

- **Safe corridors**

The proposed corridor configuration presents clear limitations in its support for safe corridor outcomes. This includes limited allocation of berm or median space in sections resulting in a lack of separation between modes and refuge for pedestrians. The Papakura Stream bridge and the Walters Road roundabout are both proposed to be retained and also present challenges to support a safe active mode environment. Takaanini interchange is a point for CPTED concern, isolation, and an undesirable pedestrian environment. Further detail and refinement is needed to demonstrate a safe pedestrian environment within intersection arrangement, mid-block crossings or tie in into the surrounding network.

- **Facilitate an appropriate interface between place and movement**

The potential corridor cross section presents a challenging environment throughout this section to enabling or supporting appropriate interfaces. This includes public private interfaces along the corridor boundary and between competing modal uses with a lack of buffer or separation. There is a lack of space in some locations to support people orientated streets or streets as public spaces through active interfaces and pedestrianised areas. Further detail is required to demonstrate how the corridor will appropriately interface and respond to the Manurewa and Takaanini town centres.

The following principles were identified as not relevant:

- Strategic corridors as urban edges

5 Great South Road 3

		Supports	Neutral	Opportunity for Development	Not relevant
System layers	Design Principles				
Environment	1.1 Support and enhance ecological corridors and biodiversity			●	
	1.2 Support water conservation and enhance water quality in a watershed			●	
	1.3 Minimise land disturbance, conserve resources and materials	●			
	1.4 Adapt to a changing climate and respond to the microclimatic factors of each area		●		
Social	2.1 Identity and place		●		
	2.2 Respect culturally significant sites and landscapes		●		
	2.3 Adaptive corridors		●		
	2.4 Social cohesion		●		
	2.5 Safe corridors			●	
Built form	3.1 Align corridors with density	●			
	3.2 Corridor scaled to the surrounding context and urban structure	●			
	3.3 Facilitate an appropriate interface between place and movement			●	
Movement	4.1 Connect nodes	●			
	4.2 Connect modes		●		
	4.3 Support access to employment and industry	●			
	4.4 Prioritise active modes and public transport		●		
	4.5 Support inter-regional connections and strategic infrastructure	●			
	4.6 Support legible corridor function	●			
Landuse	5.1 Public transport directed and integrated into centres	●			
	5.2 Strategic corridors as urban edges				●

Figure 5 – Great South Road 3 Urban Design Evaluation

The proposed corridor is supportive of the following Design Framework principles:

Environment

- Minimise land disturbance, conserve resources and materials

Built Form

- Align corridors with density
- Corridor scaled to the surrounding context and urban structure

Movement

- Connect nodes
- Support access to employment and industry
- Support inter-regional connections and strategic infrastructure
- Support legible corridor function

Land use

- Public transport directed and integrated into centres

Those principles that scored neutral in their support include:

- **Adapt to a changing climate and respond to the microclimatic factors of each area**

Refer to text written in Great South Road 1

- **Identity and place**

Refer to text written in Great South Road 1

- **Respect culturally significant sites and landscapes**

Refer to text written in Great South Road 1

- **Adaptive corridors**

The proposed design utilises and enhances an existing corridor, minimising any significant engineering solutions and social disruption. However, the space constrained corridor limits its flexibility to accommodate future change in function or appropriately respond to physical interface as the corridor densifies. This also limits its accommodation for variations in noise levels and there is no space for non-transport functions such as ecological diversity, water management or recreation.

- **Social cohesion**

The corridor supports modal shift and providing connectivity between centres and local amenities. However, network resilience and efficiency will be negatively affected as the proposed corridor doesn't accommodate a southbound bus lane.

- **Connect modes**

The corridor provides multi model travel options and aims to reduce car dependency. However, where the corridor is space constrained within the existing road reserve there is limited space for appropriate transition between modes i.e. bus stops/shelters off the pathway. There is limited detail on connection of modes through interchanges.

- **Prioritise active modes and public transport**

The corridor accommodates fully separated active mode pathways. However, due to a constrained corridor width a southbound bus lane has not been accommodated. Further detail is required to further demonstrate how public transport facilities will be accommodated within the corridor.

The following principles were identified as an opportunity for development to this section of the corridor:

- **Support and enhance ecological corridors and biodiversity**

The corridor is likely to impact or require the removal of existing mature trees with limited space or flexibility to avoid these when they are within the road reserve. Future design stages should demonstrate how these impacts will be mitigated and how ecological impacts will be supported with limited contiguous space in the corridor for planting. This section of corridor also directly interfaces with several notable trees/notable group of trees and one significant ecological area (SEA) at Kirks Bush identified under the AUP. Further detail is required to assess and mitigate the impact to these. Where a new bridge is proposed at Otūwaioa Stream, there is opportunity for enhanced ecological outcomes and planting.

- **Support water conservation and enhance water quality in a watershed**

This proposed section of corridor allows no allocation of land area to provide any form of water quality treatment, including swales, rain gardens, bioswales or wetlands. Because of this the corridor also doesn't contribute to stormwater or flooding resilience.

- **Safe corridors**

The proposed corridor configuration presents clear limitations in its support for safe corridor outcomes. There is limited allocation of berm or median space resulting in a lack of separation between modes and refuge for pedestrians. Further detail and refinement is also needed to demonstrate a safe pedestrian environment within intersection arrangement, mid-block crossings or tie in into the surrounding network.

- **Facilitate an appropriate interface between place and movement**

The potential corridor cross section presents a challenging environment throughout this section to enabling or supporting appropriate interfaces. This includes public private interfaces along the corridor boundary and between competing modal uses with a lack of buffer or separation.

The following principles were identified as not relevant to the crossing:

- Strategic corridors as urban edges

6 Alfriston Road

		Supports	Neutral	Opportunity for Development	Not relevant
System layers	Design Principles				
Environment	1.1 Support and enhance ecological corridors and biodiversity	●			
	1.2 Support water conservation and enhance water quality in a watershed	●			
	1.3 Minimise land disturbance, conserve resources and materials		●		
	1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	●			
Social	2.1 Identity and place		●		
	2.2 Respect culturally significant sites and landscapes		●		
	2.3 Adaptive corridors		●		
	2.4 Social cohesion			●	
	2.5 Safe corridors	●			
Built form	3.1 Align corridors with density	●			
	3.2 Corridor scaled to the surrounding context and urban structure	●			
	3.3 Facilitate an appropriate interface between place and movement		●		
Movement	4.1 Connect nodes	●			
	4.2 Connect modes	●			
	4.3 Support access to employment and industry	●			
	4.4 Prioritise active modes and public transport	●			
	4.5 Support inter-regional connections and strategic infrastructure				●
	4.6 Support legible corridor function	●			
Landuse	5.1 Public transport directed and integrated into centres	●			
	5.2 Strategic corridors as urban edges				●

Figure 6 – Alfriston Road Urban Design Evaluation

The proposed corridor is supportive of the following Design Framework principles:

Environment

- Support and enhance ecological corridors and biodiversity
- Support water conservation and enhance water quality in a watershed
- Adapt to a changing climate and respond to the microclimatic factors of each area

Social

- Safe corridors

Built Form

- Align corridors with density
- Corridor scaled to the surrounding context and urban structure

Movement

- Connect nodes
- Connect modes
- Support access to employment and industry
- Prioritise active modes and public transport
- Support legible corridor function

Land use

- Public transport directed and integrated into centres

Those principles that scored neutral in their support include:

- **Minimise land disturbance, conserve resources and materials**

This portion of the corridor utilises an existing corridor which limits earthworks. However, the proposed designation has the potential to have impacts on existing urban built form and therefore drive future demand for hard engineering materials.

- **Identity and place**

Refer to text written in Great South Road 1

- **Respect culturally significant sites and landscapes**

Refer to text written in Great South Road 1

- **Facilitate an appropriate interface between place and movement**

There is enough width within the corridor to support clear allocation of street space and interface between modes. However, refinement and definition is required at future design stages to demonstrate an appropriate public private interface with existing built form that is in close proximity to the widened corridor. Further detail is also required to demonstrate a positive interface with adjacent open space and parks.

- **Adaptive corridors**

The proposed design utilises and enhances an existing corridor providing a key east west link supporting whole of life beneficial use. There is also flexibility within the corridor to appropriately

respond to future changes in function or surrounding land use, for example, as the corridor densifies. It also provides space for non-transport functions such as ecological diversity and water management. However, the proposed designation is likely to result in a significant physical intervention in the local area, with resultant social disruption.

The following principles were identified as an opportunity for development to this section of the corridor:

- **Social cohesion**

The proposed designation is likely to impact community resilience through the significant effect to property as well as impacting the grain of development in the area. Cross corridor connectivity is currently undefined, and will need to be addressed in future design stages to address cross corridor access to community facilities and open spaces.

The following principles were identified as not relevant:

- Support inter-regional connection and strategic infrastructure
- Strategic corridors as urban edges

7 Porchester – Popes Road

		Supports	Neutral	Opportunity for Development	Not relevant
System layers	Design Principles				
Environment	1.1 Support and enhance ecological corridors and biodiversity		●		
	1.2 Support water conservation and enhance water quality in a watershed		●		
	1.3 Minimise land disturbance, conserve resources and materials	●			
	1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	●			
Social	2.1 Identity and place		●		
	2.2 Respect culturally significant sites and landscapes		●		
	2.3 Adaptive corridors	●			
	2.4 Social cohesion		●		
	2.5 Safe corridors			●	
Built form	3.1 Align corridors with density				●
	3.2 Corridor scaled to the surrounding context and urban structure	●			
	3.3 Facilitate an appropriate interface between place and movement	●			
Movement	4.1 Connect nodes	●			
	4.2 Connect modes		●		
	4.3 Support access to employment and industry	●			
	4.4 Prioritise active modes and public transport			●	
	4.5 Support inter-regional connections and strategic infrastructure				●
	4.6 Support legible corridor function	●			
Landuse	5.1 Public transport directed and integrated into centres				●
	5.2 Strategic corridors as urban edges				●

Figure 7 – Porchester – Popes Urban Design Evaluation

The proposed corridor is supportive of the following Design Framework principles:

Environment

- Minimise land disturbance, conserve resources and materials
- Adapt to a changing climate and respond to the microclimatic factors of each area

Social

- Adaptive corridors

Built Form

- Corridor scaled to the surrounding context and urban structure
- Facilitate an appropriate interface between place and movement

Movement

- Connect nodes
- Support access to employment and industry
- Support legible corridor function

Those principles that scored neutral in their support include:

- **Support and enhance ecological corridors and biodiversity**

The proposed corridor is likely to impact existing mature tree line in varied locations along the corridor. However, there is potential to support ecological enhancement and biodiversity in the local environment by providing contiguous space for diverse planting responses, particularly at Papakura Stream or within the allocated berm space.

- **Support water conservation and enhance water quality in a watershed**

Water quality treatment systems have been proposed, including potential treatment ponds near Papakura Stream and swales along Popes Road to enhance and support water quality. However, elsewhere in the corridor this is not accommodated, and additional land has not been allocated to enhance water quality.

- **Identity and place**

Refer to text written in Great South Road 1

- **Respect culturally significant sites and landscapes**

Refer to text written in Great South Road 1

- **Social cohesion**

Cross corridor connectivity is currently undefined, and will need to be addressed in future design stages to address cross corridor access to community facilities and open spaces, in particular into Bruce Pulman Park.

- **Connect modes**

Further detail and refinement is needed to demonstrate appropriate modal connections, for example the accommodation of bus stops / shelters along the FTN or connectivity into surrounding active modes network.

The following principles were identified as an opportunity for development to this section of the corridor:

- **Safe corridors**

Further detail and refinement is required for intersection arrangements to demonstrate safe crossings for active modes. This includes intersections, in particular the dual lane roundabout between Porchester Road and Popes Road or mid-block crossing points to support safe pedestrian environments. This also includes the Papakura Stream bridge which has no proposal for upgrade and only includes a shared use path on the western side. Further detail and refinement is required to address safe active mode cross corridor connectivity to access the bridge pathway.

- **Prioritise active modes and public transport**

The corridor accommodates fully separated active mode pathways, except for Papakura Stream bridge as mentioned under safe corridors. This disrupts the continuity of the pathway and ability to support the future urban zone on the eastern side. Further detail and refinement is needed to demonstrate appropriate tie in of separated into shared use facilities and efficient cross corridor connectivity. Public transport is also not prioritised and is proposed to use existing vehicular lanes. Further detail is required to further demonstrate how public transport facilities will be accommodated within the corridor.

The following principles were identified as not relevant:

- Align corridors with density
- Support inter-regional connections and strategic infrastructure
- Public transport directed and integrated into centres
- Strategic corridors as urban edges

8 Wider Papakura

		Supports	Neutral	Opportunity for Development	Not relevant
System layers	Design Principles				
Environment	1.1 Support and enhance ecological corridors and biodiversity		●		
	1.2 Support water conservation and enhance water quality in a watershed			●	
	1.3 Minimise land disturbance, conserve resources and materials	●			
	1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	●			
Social	2.1 Identity and place		●		
	2.2 Respect culturally significant sites and landscapes		●		
	2.3 Adaptive corridors	●			
	2.4 Social cohesion		●		
	2.5 Safe corridors		●		
Built form	3.1 Align corridors with density	●			
	3.2 Corridor scaled to the surrounding context and urban structure	●			
	3.3 Facilitate an appropriate interface between place and movement	●			
Movement	4.1 Connect nodes	●			
	4.2 Connect modes		●		
	4.3 Support access to employment and industry	●			
	4.4 Prioritise active modes and public transport		●		
	4.5 Support inter-regional connections and strategic infrastructure				●
	4.6 Support legible corridor function	●			
Landuse	5.1 Public transport directed and integrated into centres	●			
	5.2 Strategic corridors as urban edges				●

Figure 8 – Wider Papakura Urban Design Evaluation

The proposed corridor is supportive of the following Design Framework principles:

Environment

- Minimise land disturbance, conserve resources and materials
- Adapt to a changing climate and respond to the microclimatic factors of each area

Social

- Adaptive corridors

Built Form

- Align corridors with density
- Corridor scaled to the surrounding context and urban structure
- Facilitate an appropriate interface between place and movement

Movement

- Connect nodes
- Support access to employment and industry
- Support legible corridor function

Land use

- Public transport directed and integrated into centres

Those principles that scored neutral in their support include:

- **Support and enhance ecological corridors and biodiversity**

The proposed corridor is likely to impact existing mature tree lines in various locations along the corridor. However, there is potential to support ecological enhancement and biodiversity in the local environment by providing contiguous space for diverse planting responses for instance within the allocated berm space.

- **Identity and place**

Refer to text written in Great South Road 1

- **Respect culturally significant sites and landscapes –**

Refer to text written in Great South Road 1

- **Social cohesion**

Cross corridor connectivity is currently undefined and will need to be addressed in future design stages to address cross corridor access to community facilities and open spaces.

- **Safe corridors**

Further detail and refinement is required for intersection arrangements to demonstrate safe crossings for active modes, particularly at proposed roundabouts or mid-block crossing points to support safe pedestrian environments.

- **Connect modes**

Further detail and refinement is needed to demonstrate appropriate modal connections, for example the accommodation of bus stops / shelters along the FTN or connectivity into surrounding active modes network.

- **Prioritise active modes and public transport**

The corridor accommodates fully separated active mode pathways. However, public transport is not prioritised and is proposed to use existing vehicular lanes. Further detail is required to further demonstrate how public transport facilities will be accommodated within the corridor.

The following principles were identified as an opportunity for development to this section of the corridor:

- **Support water conservation and enhance water quality in a watershed**

The corridor demonstrates a water detention based approach and does not support water conservation or quality in a known flood zone. There is no allocation of any additional land or flexibility within the designation to suggest a treatment system that supports or enhances water quality.

The following principles were identified as not relevant:

- Support inter-regional connections and strategic infrastructure
- Strategic corridors as urban edges

9 Central Papakura

		Supports	Neutral	Opportunity for Development	Not relevant
System layers	Design Principles				
Environment	1.1 Support and enhance ecological corridors and biodiversity		●		
	1.2 Support water conservation and enhance water quality in a watershed			●	
	1.3 Minimise land disturbance, conserve resources and materials		●		
	1.4 Adapt to a changing climate and respond to the microclimatic factors of each area	●			
Social	2.1 Identity and place		●		
	2.2 Respect culturally significant sites and landscapes		●		
	2.3 Adaptive corridors		●		
	2.4 Social cohesion		●		
	2.5 Safe corridors			●	
Built form	3.1 Align corridors with density	●			
	3.2 Corridor scaled to the surrounding context and urban structure	●			
	3.3 Facilitate an appropriate interface between place and movement		●		
Movement	4.1 Connect nodes	●			
	4.2 Connect modes		●		
	4.3 Support access to employment and industry	●			
	4.4 Prioritise active modes and public transport			●	
	4.5 Support inter-regional connections and strategic infrastructure				●
	4.6 Support legible corridor function	●			
Landuse	5.1 Public transport directed and integrated into centres	●			
	5.2 Strategic corridors as urban edges				●

Figure 9 – Central Papakura Urban Design Evaluation

The proposed corridor is supportive of the following Design Framework principles:

Environment

- Adapt to a changing climate and respond to the microclimatic factors of each area

Built Form

- Align corridors with density
- Corridor scaled to the surrounding context and urban structure

Movement

- Connect nodes
- Support access to employment and industry
- Support legible corridor function

Land use

- Public transport directed and integrated into centres

Those principles that scored neutral in their support include:

- **Support and enhance ecological corridors and biodiversity**

The proposed corridor is likely to impact existing mature tree lines in various locations along the corridor. However, there is potential to support ecological enhancement and biodiversity in the local environment by providing contiguous space for diverse planting responses for instance within the allocated berm space.

- **Minimise land disturbance, conserve resources and materials**

This portion of the FTN utilises an existing corridor which limits earthworks. However, further design detail on the extent of earthworks and retaining structures is required in the approaches to the rail crossing bridges at Clevedon Road and Settlement Road to address their impact and mitigate adverse effects.

- **Identity and place**

Refer to text written in Great South Road 1

This section of the corridor also directly interfaces with several sites of historical heritage as identified under the AUP:OIP. The proposed designation overlaps the Papakura Old Central School site. Further detail is required to demonstrate how the corridor can respect and preserve the value of these sites.

- **Respect culturally significant sites and landscapes**

Refer to text written in Great South Road 1

- **Adaptive corridors**

The proposed design demonstrates the utilisation and enhancement of existing corridors. This is with enough space in the existing road reserve and at intersections through designation to provide for an adaptive and flexible space function. However, the two bridges across the rail line at Clevedon Road and Settlement Road do not form part of the proposal for upgrade. These do not provide any flexibility to change in function, adequately accommodate active modes or public transport, or respond to future land use.

- **Social cohesion**

Cross corridor connectivity is currently undefined and will need to be addressed in future design stages to address cross corridor access to community facilities and open spaces.

- **Facilitate an appropriate interface between place and movement**

There is space within the corridor to support clear allocation of street space and interface between modes, however, this excludes the existing Clevedon Road and Settlement Road bridges. Further detail will need to demonstrate an appropriate interface, connectivity at a fine grain pedestrian level and ability to support a people orientated street within the Papakura town centre. Particularly important is the interface and connectivity into the Papakura Train Station and grade separated pedestrian accessway.

- **Connect modes**

Further detail and refinement is needed to demonstrate appropriate modal connections. For example the accommodation of bus stops / shelters along the FTN or the existing bus layover on Ōpāheke Road, and connectivity into surrounding active modes network and into Papakura Train Station. Further consideration and refinement is needed to demonstrate how buses will efficiently access the station and bus interchange.

The following principles were identified as an opportunity for development to this section of the corridor:

- **Support water conservation and enhance water quality in a watershed**

The corridor demonstrates a water detention based approach and does not support water conservation or quality in a known flood zone. There is no allocation of any additional land or flexibility within the designation to suggest a treatment system that supports or enhances water quality.

- **Safe corridors**

The corridor does not adequately support a safe active modes environment in several locations, particularly at the existing Clevedon Road and Settlement Road bridges. This includes no accommodation for cycle paths, no buffer between modes on Clevedon Road, and no pathway on the southern side of the Settlement Road bridge. There is also a lack of detail for intersection arrangement to demonstrate safe cross corridor connectivity. This is , particularly at the Settlement Road bridge where there is no crossing point before the bridge, and the existing environment fails to address universal accessibility.

- **Prioritise active modes and public transport**

The corridor does not accommodate separated active mode pathways in the bridge sections mentioned above or along Great South Road through the Papakura town centre, which disrupts the continuity and completeness of the network. This is particularly an issue where separated active mode paths terminate into no footpath on the Settlement Road bridge. Public transport is also not prioritised and is proposed to use existing vehicular lanes. Detail is unclear on how public transport will be accommodated within the corridor.

The following principles were identified as not relevant:

- **Support inter-regional connections and strategic infrastructure**

- Strategic corridors as urban edges

South FTN and Key Connections

Appendix G – Transport Outcomes Report

October 2023

Version 1.1

Document Status

Responsibility	Name
Author	
Reviewer	
Approver	

Revision Status

Version	Date	Reason for Issue
0.1	10/05/2023	Draft for internal review
0.2	01/06/2023	Interim issue for SME review
1.0	23/06/2023	Issue for IQA
1.1	31/10/23	Final Issue

Table of Contents

1	Introduction.....	1
1.1	Purpose and scope of the report	1
1.2	Report Structure	1
2	Strategic Context.....	1
2.1	Strategic Transport Context	1
1.1	Strategic Land Use Context.....	2
3	Recommended network.....	6
3.1	Great South Road FTN	8
3.2	Takaanini FTN	10
3.3	Corridor Upgrade Project:	11
3.4	Corridor Urbanisation Projects:	11
4	Investment Objectives and KPIs for the South FTN Recommended Option	12
4.1	Overall South FTN Outcomes.....	13
5	Transport Analysis.....	21
5.1	Land Use Scenarios	21
5.1.1	Land Use Assumptions	21
5.1.2	Land Use Sensitivity Tests	23
5.1.3	Assessment Years	25
5.2	Transport Network Analysis	26
5.2.1	Transport Modelling	26
5.2.2	Interdependencies with other key north-south routes	27
5.2.3	Roads and Streets Framework (RASf).....	31
5.2.4	Corridor Form Assessment Framework (CFAF).....	31
5.2.5	RASf and CFAF Summary	33
5.2.6	Intersection Form and Function	52

Appendices

Appendix 1	Form & Function for South FTN
Appendix 2	Intersection Methodology and Performance Summary
Appendix 3	KPI Development Methodology
Appendix 4	Modelling Specifications

Table of Figures

Figure 2-1: Transport network context (key N-S routes)	1
--	---

Figure 2-2: Existing Land Use and Proposed Land Use	3
Figure 3-1: Recommended South FTN Option	7
Figure 3-2: Strategic hierarchy of services (Regional Public Transport Plan 2018 - 2028)	8
Figure 5-1: South Area Planned Growth Map	23
Figure 5-2: South FTN indicative proposed intersection forms	54

Table of Tables

Table 4-1: Te Tupu Ngātahi DBC Packages in the South	12
Table 4-2: South FTN Outcomes	14
Table 5-1: Summary of South Planned Growth and Timing	21
Table 5-2: Percentage of Takaanini FUZ-related traffic using surrounding corridors	25
Table 5-3: Percentage of Ōpaheke-Drury FUZ-related traffic using surrounding corridors	25
Table 5-4: Summary of Land Use Assessment Years	26
Table 5-5: Key N-S routes in the long-term southern network	27
Table 5-6: Inputs and Outputs of the CFAF Tool	32
Table 5-7: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	33
Table 5-8: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	34
Table 5-9: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	35
Table 5-10: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	36
Table 5-11: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	37
Table 5-12: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	38
Table 5-13: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	39
Table 5-14: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)	40
Table 5-15: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)	41
Table 5-16: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)	42
Table 5-17: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)	44
Table 5-18: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)	45
Table 5-19: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)	46

Table 5-20: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections).....	47
Table 5-21: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections).....	48
Table 5-22: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections).....	49
Table 5-23: RASF and CFAF Mandates Summary – Popes Road urbanisation (multi-modal connections).....	50
Table 5-24: RASF and CFAF Mandates Summary – Croskery Road urbanisation (multi-modal connections).....	51
Table 5-25: Intersection summary	56

Acronyms

Acronym/Term	Description
ADT	Average Daily Traffic (number of vehicles per day)
ALT	Alliance Leadership Team
AMP	Alliance Management Plan
AMT	Alliance Management Team
AT	Auckland Transport
AUP	Auckland Unitary Plan
DBC	Detailed Business Case
Do min	Do Minimum Option
FDS	Future Development Strategy
FUZ	Future Urban Zone
FULSS	Future Urban Land Supply Strategy
FTN	Frequent Transit Network
GIS	Geographic Information System
GSR	Great South Road
IBC	South Indicative Business Case
KPI	Key Performance Indicator
LOS	Level of Service
MCA	Multi-Criteria Assessment
MSM	Macro Strategic Model
NIMT	North Island Main Trunk
NOP	Non-Owner Participant (AECOM, Beca, Bell Gully, Buddle Findlay)
OP	Owner Participant
PAA	Programme Alliance Agreement
PAB	Programme Alliance Board
PCG	Project Control Group
PMO	Programme Management Office
PT	Public Transport

Acronym/Term	Description
QoS 1	Quality of Service 1
RAMC	Regional Active Mode Corridor
RT	Rapid Transit
RTC	Rapid Transit Corridor
RTN	Rapid Transit Network
SATURN	Meso-simulation modelling software package used for transport assessment – Simulation and Assignment of Traffic to Urban Road Network
SH1	State Highway 1
SIDRA	Signalised Intersection Design and Research Aid
Te Tupu Ngātahi	Supporting Growth Alliance
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

1 Introduction

1.1 Purpose and scope of the report

This Transport Outcomes report has been prepared by Te Tupu Ngātahi for the South Frequent Transit Network (FTN) Detailed Business Case (DBC). Te Tupu Ngātahi (the Supporting Growth Alliance) is a collaboration between Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) to carry out the planning phase of the Te Tupu Ngātahi Programme (the Programme) (formerly known as the Transport for Future Urban Growth (TFUG) Programme).

The South Frequent Transit Network DBC includes the following project elements:

- **Great South Road FTN** between Drury Central Station and Manukau
- **Takaanini FTN** between Drury West Station and Manukau Station
- **Popes Road** and **Croskery Road** urbanisation
- **Upgrade** of Great South Road between Waihoehoe Road and Drury interchange

The South FTN DBC is largely focused on developing the strategic FTN routes between Drury and Manukau. This DBC is part of the wider Takaanini DBC package.

This Transport Outcomes report:

- Details the transport outcomes including Key Performance Indicators (KPIs) of the recommended network for the South FTN.
- Provides an overview of the key transport assessments undertaken to support the optioneering process for the South FTN recommended network including:
 - Corridor Form and Function assessments, and
 - Intersection Form and Function assessments.

As identified, the focus of this report is the transportation outcomes of the recommended network for South FTN only, with a more detailed description of the option development and assessment process provided within Appendix C - Options Assessment Report.

1.2 Report Structure

The report has been split into several sections, covering the following:

- **Section 2** provides some wider strategic context for this project.
- **Section 3** summarises the recommended network for the South FTN corridors.
- **Section 4** summarises the investment objectives identified for the South FTN corridors and the associated Key Performance Indicators (KPIs) set for each of these objectives. These KPIs subsequently measure how well the recommended network performs against the investment objectives.
- **Section 5** summarises the transport assessment undertaken to reach the recommended network.

There are several appendices to this report that provide further detail, specifically:

- Appendix 1: Form and Function South FTN Corridors

- Appendix 2: Intersection Methodology and Performance Summary
- Appendix 3: KPI Development and Methodology
- Appendix 4: Modelling Specifications

2 Strategic Context

2.1 Strategic Transport Context

High growth is planned in both the southern Auckland and northern Waikato regions. Significant uplift in travel (of over 450% in the region of the Takaanini) by public transport predicted with the rail upgrades in place, the majority of which would be carried by the rail system.

Passenger rail is planned to provide the core rapid transit functionality for southern Auckland to drive significant mode shift away from reliance on passenger cars. Various existing and planned projects such as the City Rail Link (CRL) project and additional track capacity (4-track planned from Pukekohe to Wiri) are progressing the expansion of the southern rail line capacity and attractiveness. These rail upgrades are estimated to result in a significant mode shift to public transport, to address both existing needs and accommodate the high growth planned in both southern Auckland and northern Waikato regions. The rail in the southern network will provide the backbone of the transport network, connecting centres and regions, providing more efficient services and carrying higher volume of passengers.

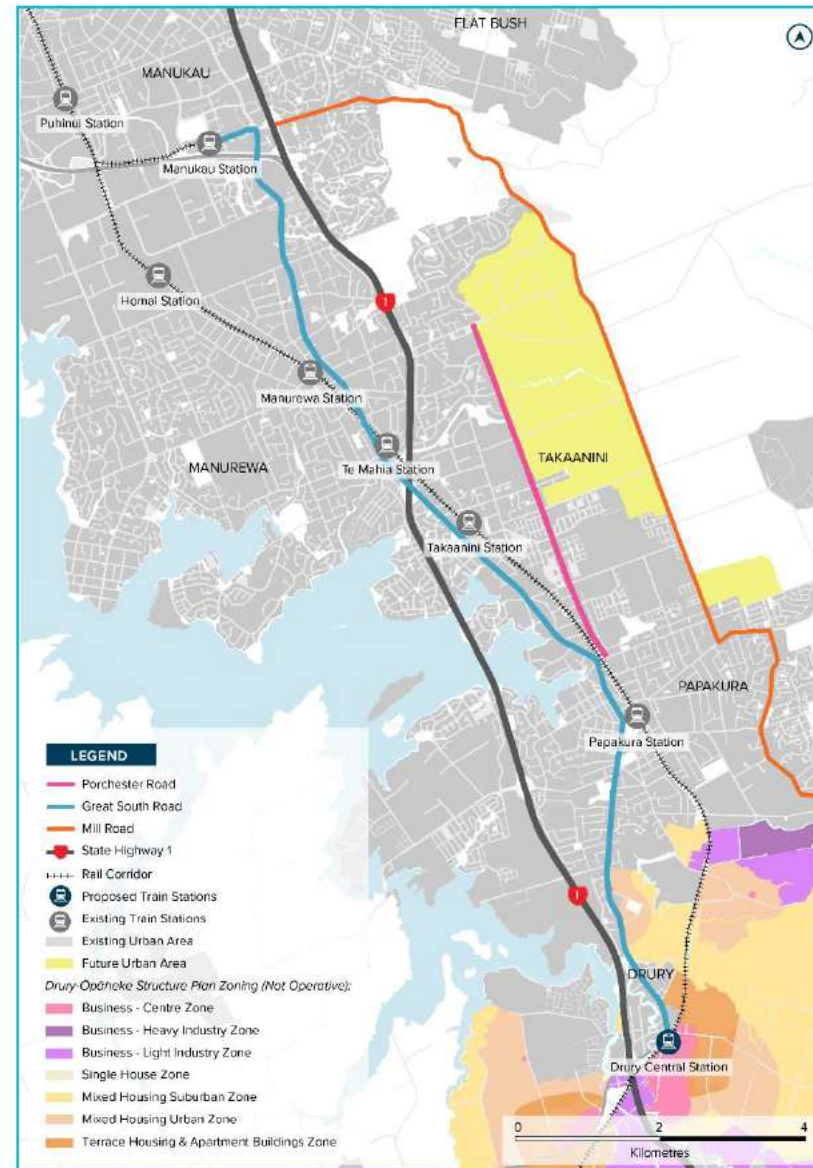
Rail/ RTN typically consists of lower frequency of stops/ stations to enable more efficient movement between centres/ regions. The lower number of stops and fixed rail corridor results in limited coverage and accessibility for some parts of the South Auckland catchment. The southern rail line also does not provide a direct connection to Manukau from the south (i.e. Papakura) and commuters have to transfer at Puhinui Station between the Southern and the Eastern rail lines, to access Manukau train station.

This part of urban Auckland is also highly constrained, bounded to the west by the Pahurehure inlet and the east by the Hunua Ranges. This results in a relatively narrow corridor (<4km), dominated by north-south regional and national-level strategic transport corridors. The narrow overall corridor and dominance of the strategic transport infrastructure also results in constrained east-west local movement, with resulting community severance and poor transport choices and accessibility.

Figure 2-1 shows the key north-south corridors and their expected role in the future transport network.

Figure 2-1: Transport network context (key N-S routes)

Key N-S Route	Role in the future network
Rail corridor	Main rapid transit spine & freight movement
State highway 1 (SH1)	Inter-regional general traffic & freight
Mill Road	Long-term suburban connectivity & active modes
Porchester Road	Public transport, local access & active modes
Great South Road	Public transport, local access, freight & active modes



State Highway 1 is the main strategic north-south route which connects the Auckland region to other parts of the country. SH1 also provides access to the Auckland CBD, providing access to the city's major commercial, retail and cultural hub. SH1 plays a critical role in the wider Auckland network as it supports the movement of people and goods both within the city and throughout the wider region. Currently, SH1 widening is underway through the Southern corridor improvements and SH1 Papakura to Bombay 6 laning projects. SH1 is expected to have 6-8 lanes through the southern area in the future network.

Great South Road is a key north-south arterial that connects between Drury and Manukau. This corridor supports local and regional commuting as it connects South Auckland suburbs with the wider Auckland region. Great South Road connects residential areas to employment centres, commercial districts and other key destination within South Auckland. This route is an alternative north-south connection that is typically used as a diversion route for when State Highway 1 is at capacity due to congestion or a crash incident. Great South Road connects a number of major transport hubs such as the Manukau bus station, Manurewa bus/train station, Te Mahia train station, Takaanini train station, Papakura train station and the future Drury Central station.

Mill Road is an eastern strategic connection which is intended to connect growth areas in the South, providing suburban connectivity in the long-term. Mill Road is expected to relieve traffic pressure on Great South Road by providing an alternative strategic local access and to also, relieve SH1 of supporting local trips. In recent policy context, there is uncertainty around the form of Mill Road in the future transport context. If capacity on Mill Road is not increased in the future, the role of Great South Road in the transport network will be more prominent, serving as the primary north-south public transport alternative to the rail and major route for traffic. There will also be added pressure on other north-south routes including Great South Road and Porchester Road.

Porchester Road is expected to be a two-lane secondary arterial which serves Takaanini on the eastern side of the rail line. It is also adjacent to the Takaanini future urban zone. Porchester Road will connect to the Papakura area and through to Ōpaheke North-South arterial in the future network. Ōpaheke North-South arterial will connect further south to the Ōpaheke/ Drury area.

The transport network in the South is operating under the shadow of a highly congested SH1 corridor. The purpose of the South frequent transit network is to support access to the rail system in the southern network and provide more flexible and accessible transport options to areas that are not well serviced by the rail network. Additionally, the frequent transit network provides feeder services to the rail stations and assists in the first/ last mile of their transportation journey. Effective integration between the rail and the frequent transit network improves the overall accessibility and convenience of the rail network, making it more attractive for people to use public transport rather than relying on private vehicles. Overall, the frequent transit network complements the rail network by providing a more comprehensive and integrated transport system that meets the diverse needs of different communities in the South.

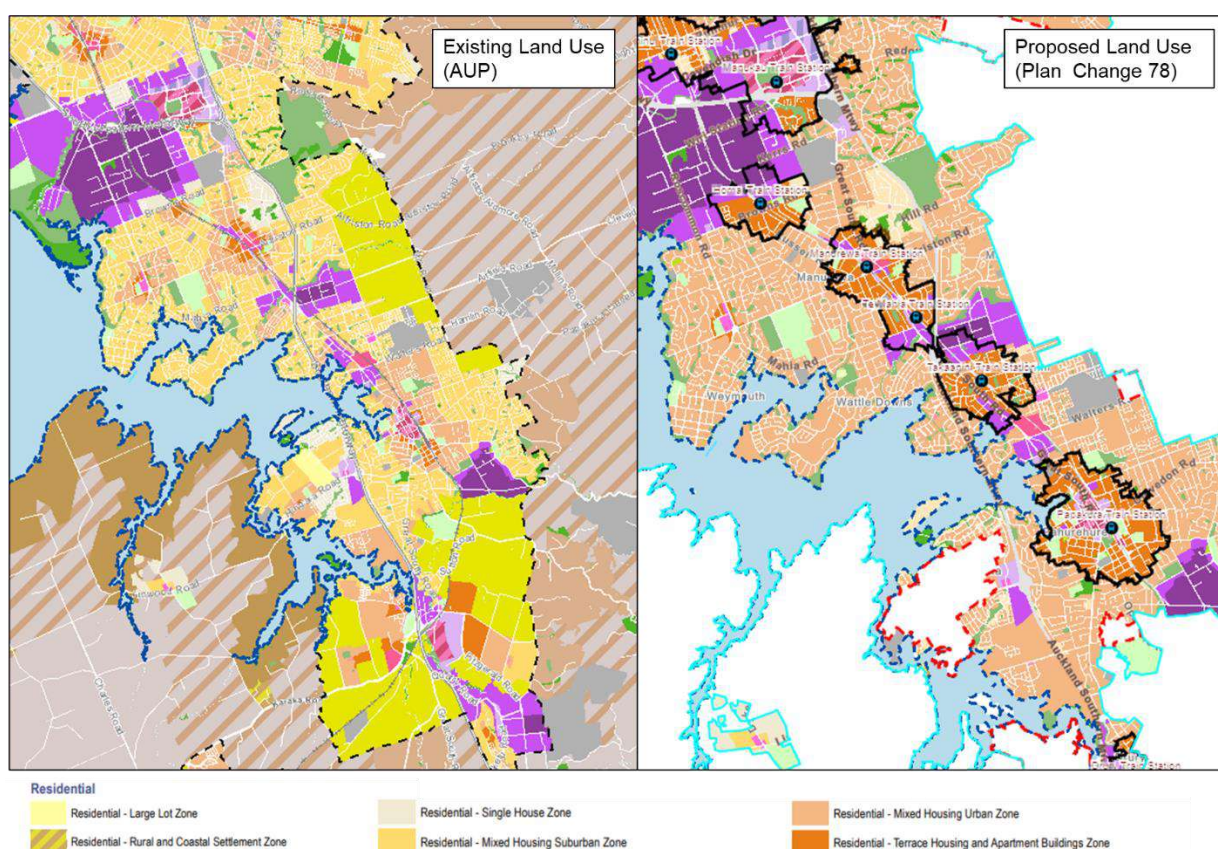
1.1 Strategic Land Use Context

The existing land use along the extent of Great South Road is ribbon mixed-use development, referring to mixed land uses such as residential, commercial and industrial, along the fringe of the major transport route. This results in a linear pattern of intensified development with key town centres, businesses, shops and new developments providing the urban fringe of the corridor.

Figure 2-2 shows the proposed land use changes in the South, which are being progressed as part of Plan Change 78 (PC78). As shown, PC78 will enable greater densities within the existing urban areas especially around the train stations where apartments of up to six storeys will be allowed. This will support walking and cycling catchments to the existing town centres and increase public transport uptake. At this point, it is still uncertain when and to what extent there will be an increase in density, but it is possible that this could occur in the near future.

Since the southern rail line is generally parallel and close to Great South Road, the train station catchments in the south generally overlap with parts of the Great South Road corridor. This indicates that the greater densities of development are enabled along Great South Road, allowing intensification along this 'urban fringe'.

Figure 2-2: Existing Land Use and Proposed Land Use



Recent policy changes also include the Medium Density Residential Standards (MDRS). This will enable housing choice in main urban areas through development of three homes up to three storeys on each site, without the need for resource consent. To enable this, the Resource Management (Enabling Housing Supply and Other Matters) Amendment Act 2021 (RMA-EHS) requires Tier 1 territorial authorities in the likes of Auckland to incorporate the MDRS into every relevant residential zone in their district plan. This is being progressed through Plan Change 78.

Porchester Road is adjacent to the Takaanini Future Urban Zone (FUZ). The eastern part of the Great South Road FTN, between Park Estate Road and Drury, is also adjacent to FUZ.

There are a number of metropolitan and town centres along Great South Road which indicates the corridor has a key role as place for business and provides a spine in the south for an integrated regional transport hub.

The **Manukau Metropolitan Centre** has a large variety of land uses enabled with a Westfield shopping centre, Manukau Plaza, Manukau Institute of Technology (MIT), Hayman Park, Manukau District Court, Rainbows End theme park and the nearby Vodafone Events Centre. There is a key transport hub nearby which consists of the Manukau Bus Station and Train Station. Eke Panuku (Auckland Council urban regeneration agency) has a Framework Plan (2016)¹ for this area which looks at transforming the Manukau area, increasing the residential population from 6,000 to 20,000. The vision for this transformation is to enable Manukau to be the gateway to affordable and sustainable urban living, a meeting place and a hub for learning, leisure, cultural experiences; surrounded by healthy neighbourhoods. This plan focuses on people-oriented design such as key spatial projects, movement networks, amenities, attractors, place-making and walkability. The plan also focuses on other strategies such as community benefits, housing supply and choice, repositioning and creating a complementary role to other centres including the airport, Highbrook, Ormiston and Sylvia Park.

The Manurewa, Takaanini, Papakura Integrated Area Plan (2018)² outlines the land use aspirations for the three areas, specifically focusing on revitalisation of Manurewa and Papakura centres and creating a clear identity for the Takaanini Town Centre. The plan outlines an urban vision for the three areas over the next 30 years and sets out the key ideas, desired outcomes and supporting transformation activities that will achieve the urban vision for the Great South Road corridor and Manurewa, Takaanini and Papakura centres.

Manurewa Town Centre features a mix of small to medium sized retail outlets including the Southmall and provides a range of community facilities including the Manurewa Library and the Manurewa Community Centre. Manurewa Town centre also consists of a transport hub which includes both a bus and train station. The town centre is in close proximity to State Highway 1 via the Hill Road access. In recent years, there have been efforts to improve and revitalize Manurewa Town Centre, with a particular focus on enhancing the public realm and supporting local businesses. This has included the development of new public spaces, such as the Manurewa Town Centre Plaza, and the implementation of a streetscape upgrade program, which aims to improve the appearance and functionality of the town centre's streets and footpaths. The Integrated Area Plan builds on the town centre revitalisation work already underway in Manurewa and identifies key redevelopment opportunities by improving pedestrian connections between the library, Great South Road, Southmall and the train station. There are funded short-term projects which look to strengthen links between the town centre, Nathan Homestead (arts centre) and Botanic Gardens through safer intersections and new crossing points. Other safety improvements around the town centre and Manurewa train station are also funded with high priority.

The **Takaanini Town Centre** offers strong retail opportunities via the Southgate shopping centre and the town centre on the eastern side of the rail line. There are also community spaces such as the Takaanini Library/ community hub and Bruce Pulman Park. The Integrated Area Plan acknowledges the residential population will grow significantly, increasing the demand for the town centre to meet local needs. The short-medium term projects for the area consist of improvements at Takaanini Station, grade-separation of road/rail connections in Takaanini (Te Tupu Ngātahi Takaanini Level Crossings Project), streetscape and safety improvements.

The emerging **Papakura Metropolitan Centre** is an existing centre which is zoned as a 'metropolitan centre', however, may not currently perform as this. Papakura has an established community/ civic

¹ Transform Manukau – Renewal of Manukau Central, High Level Project Plan, Panuku Development Auckland (April 2016)

² Manurewa, Takaanini, Papakura Integrated Area Plan, Auckland Council (2018)

services base and forms the gateway to the Hunua Ranges and the leisure and recreation spaces/ activities. The Integrated Area Plan sets an outcome for Papakura to transition into a metropolitan centre that can accommodate intensified development, growth and activities. The high priority projects set out in the plan consists of activating the water's edge through pedestrian and cycle connections, parking management through the metropolitan centre and activating key development sites with quality residential intensification.

The **Drury centre** is now live zoned to become a metropolitan centre through the approval of Plan Change 48 which enables intensive development within the Drury area. The proposed Drury Central Station is also expected to support the significance of the metropolitan centre. The vision for the surrounding area around the station is expected to be in the form of transit-orientated development.

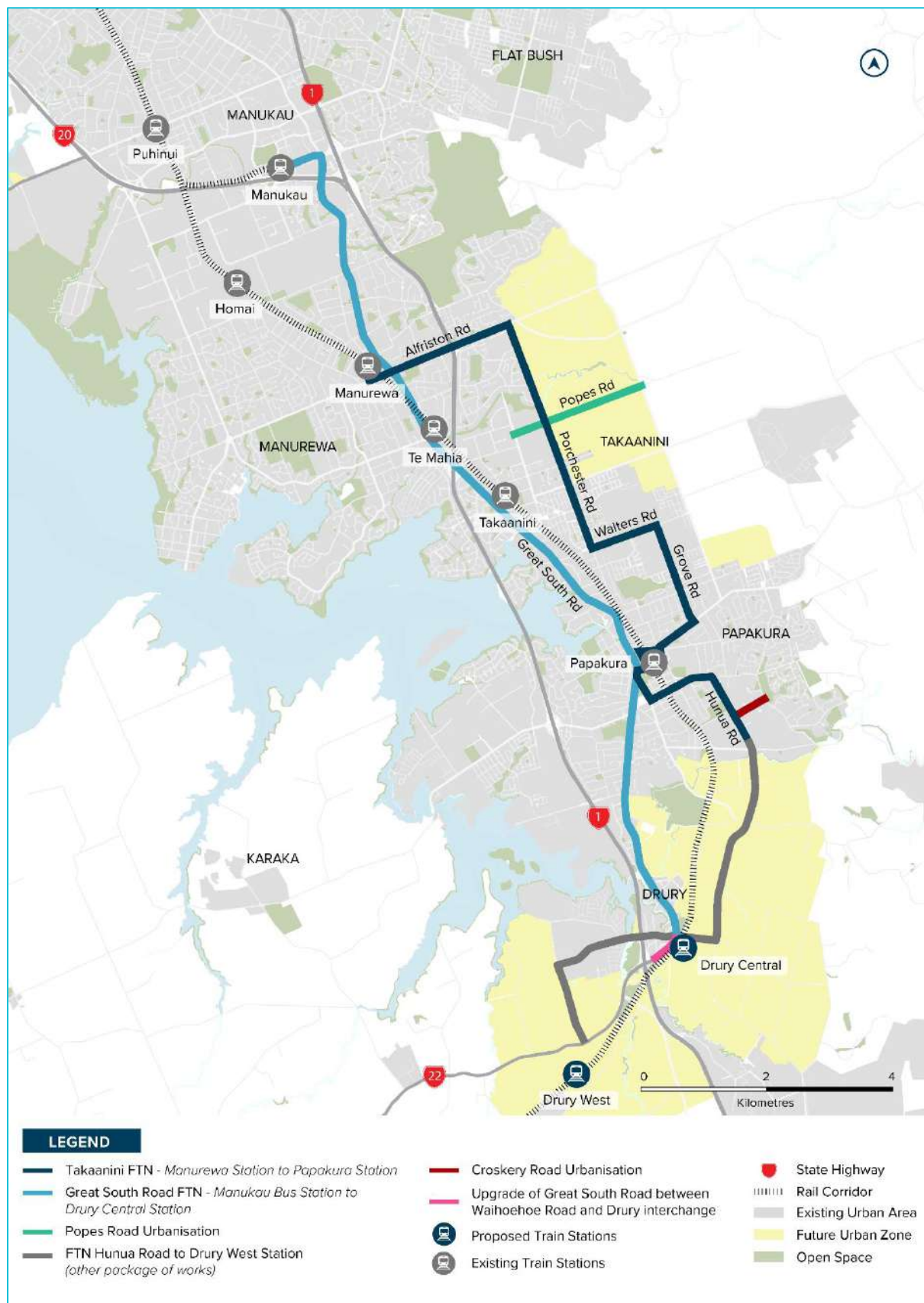
3 Recommended network

The following section outlines the recommended option for the South FTN DBC. The recommended network for the South FTN DBC consists of two FTN routes and two urbanisation projects. Further detail on the specific features of these interventions are provided in the following section. The recommended network has been developed through careful assessment of both the effectiveness and impacts of various treatments, acknowledging the existing urban development in much of the corridor. The development of the preferred treatment is documented in the main business case, with only the recommended option documented here.

Figure 3-1 shows the overall South FTN emerging recommended network. The figure shows the two FTN routes and two urbanisation project elements.

Overall, it is considered that the South FTN recommended network contributes to an integrated PT network, which is reliable, supports growth, and offers sustainable travel choice and access to economic and social opportunities.

Figure 3-1: Recommended South FTN Option



The South FTN recommended network is summarised below:

South FTN routes:

- Great South Road FTN between Drury Central Station and Manukau city centre
- Takaanini FTN between Drury West Station and Manurewa Station

Corridor upgrade Project:

- Upgrade of Great South Road between Waihoehoe Road and Drury interchange

Urbanisation Projects:

- Popes Road
- Croskery Road

Frequent transit network typically consists of routes with a 15 minute or greater bus frequency that can be efficient, direct and attractive. Services along these routes typically operate between 7am to 7pm, 7 days a week. Outside of these times, the buses are expected to operate every 30 minutes. It is expected that the CATR funding will enable the Great South Road FTN to operate at a 15-minute frequency up until midnight in the future network.

Figure 3-2: Strategic hierarchy of services (Regional Public Transport Plan 2018 - 2028)

2018				
SERVICES LAYER	RAPID 	FREQUENT 	CONNECTOR 	OTHER SERVICES (Local, rural-township, peak only, school, Total Mobility, on-demand services)
Defining feature	CORE – ALL DAY NETWORK			SUPPORTING NETWORK
Minimum hours of operation	6am – 11pm			No minimum
City Centre Services	15 minutes			30 minutes
Minimum Headway	15 minutes			30 minutes
Non-City Centre services	7am-7pm, 7 days	15 minutes		
Minimum Headway	Outside those times	30 minutes		
Achieving Efficiency and Reliability	Dedicated Right of Way			Priority measures
				Limited priority measures

The key corridors that are recommended as part of the South FTN network are summarised in the following sub-sections.

3.1 Great South Road FTN

The Great South Road FTN is a key north-south route which provides a key frequent public transport link between Drury and Manukau. This FTN route is parallel to the Southern rail line and provides resilience in the public transport network. The key strategic corridors included in the Great South Road FTN recommended route are summarised below:

- **Manukau Station Road:** A four lane multi-modal secondary arterial connection with separated walking and cycling facilities. This corridor provides a key frequent public transport link to the Manukau Bus Station. This connection will continue to provide access to the Manukau Metropolitan Centre, Manukau bus/ rail station, adjacent retail and nearby recreational activities. Manukau Station Road connects to SH1, SH20 and to Great South Road which is a key arterial.
- **Great South Road:**
 - **Section between Manukau Station Road and Browns Road:** A four lane multi-modal primary arterial connection with separated walking and cycling facilities. This corridor provides a key frequent public transport link between Manukau and Drury. This connection will continue to provide access to key destinations including Rainbows End, Due Drop Events Centre and the Manukau Superclinic.
 - **Section between Browns Road and Manurewa Town Centre:** A three lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There is a northbound³ bus lane within the recommended cross-section. This corridor provides a key frequent public transport link between Manukau and Drury. This section will continue to provide access to the surrounding residential area and the Manurewa Town Centre.
 - **Manurewa Town Centre:** This connection will continue to provide access to the Manurewa bus interchange, train station, adjacent retail and nearby recreational activities. Bus routes divert behind the town centre to tie into the bus interchange. Walking and cycling are expected to be prioritised through the town centre.
 - **Section between Manurewa Town Centre and Takaanini Interchange:** A three lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There is a northbound⁴ bus lane within the recommended cross-section. This corridor provides a key frequent public transport link between Manukau and Drury. This section will continue to provide access to the surrounding residential area, Manurewa Town Centre and the Takaanini Interchange.
 - **Takaanini Interchange:** Four to six general traffic lanes (no change from current arrangement). The Takaanini Interchange is the intersection of SH1 and the Great South Road and this interchange provides access to the strategic network. Both SH1 on-ramps are situated on the western side of Great South Road.
 - **Section between Takaanini interchange and Manuroa Road:** A four lane multi-modal primary arterial connection with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link between Manukau and Drury. Provides access to the Takaanini industrial area via Manuia Road.
 - **Section between Manuroa Road and Papakura Metropolitan Centre:** A three to four lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There bi-directional bus lanes This corridor provides a key frequent public transport link between Manukau and Drury.
 - **Papakura Metropolitan Centre:** This connection will continue to provide access to the Papakura metropolitan centre facilities, Papakura train station, adjacent retail and nearby recreational activities. There is no bus priority such as dedicated bus lanes recommended through the Metropolitan Centre. The bus routes divert behind the metropolitan centre to tie in at the

³ Recommended cross-section shows a northbound bus lane, however, an alternative cross section (i.e. southbound bus lane) can be selected at implementation.

⁴ Recommended cross-section shows a northbound bus lane, however, an alternative cross section (i.e. southbound bus lane) can be selected at implementation.

Papakura bus interchange. There is a vision to reduce the vehicular (freight and general traffic) through movement along Great South Road through the Metropolitan Centre. The alternative route for freight and general traffic is via Queen Street, East Street and back onto Great South Road via Wellington Street. The speed limit through the metropolitan centre is expected to be reduced in the future network. It is expected that this section of Great South Road will primarily serve pedestrians, cyclists and public transport. Hence, traffic calming is recommended through the metropolitan centre to discourage vehicles through this route.

- **Section between Papakura Metropolitan Centre and Waihoehoe Road:** A three lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There is a northbound⁵ bus lane within the recommended cross-section. This corridor provides a key frequent public transport link between Manukau and Drury.

3.2 Takaanini FTN

The Takaanini FTN provides key frequent public transport link between Manurewa, Takaanini, Papakura and Drury Central Stations. This FTN provides for 'C-shaped' bus services between the stations. The Takaanini FTN integrates with the southern rail network and it connects with the proposed Drury FTN to the south. The key strategic corridors included in the Takaanini FTN recommended route are summarised below:

- **Weymouth Road (between Manurewa bus Interchange and Great South Road):** A four lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This corridor provides access to the Manurewa bus interchange and is a key east-west connection which crosses the southern rail line.
- **Alfriston Road (between Great South Road and Magic Way):** A four lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link to the Manurewa Bus Station and train station. This connection will continue to provide access to the Manurewa Town Centre, adjacent retail and nearby recreational activities. Alfriston Road is a key east-west link which provides access over the motorway
- **Alfriston Road (between Magic Way and Porchester Road):** A three lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. There is an eastbound⁶ bus lane within the recommended cross-section along this extent. This corridor provides a key frequent public transport link between Manurewa and Takaanini.
- **Porchester Road:** A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link between Manurewa, Takaanini and Papakura. It will serve the adjacent Takaanini FUZ, Takaanini industrial area and the surrounding residential catchment.
- **Walters Road:** A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This connection will provide access to adjacent retail and nearby recreational activities consisting of the Takaanini Town Centre and Bruce Pulman Park. Walters Road has a wider function of providing an east-west link between Great South Road and the N-S Mill Road strategic arterial.

⁵ Recommended cross-section shows a northbound bus lane, however, an alternative cross section (i.e. southbound bus lane) can be selected at implementation.

⁶ Recommended cross-section shows an eastbound bus lane, however, an alternative cross section (i.e. westbound bus lane) can be selected at implementation.

- **Grove Road:** A two lane multi-modal collector with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link between Takaanini and Papakura.
- **Clevedon Road:** A two lane multi-modal primary arterial connection with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link between Takaanini and Papakura.
- **Railway Street West and Wood Street:** A two lane multi-modal collector with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link to the Papakura Train Station and the Papakura Metropolitan Centre.
- **Ōpaheke Road:** A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link between Papakura and Drury.
- **Settlement Road:** A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link between Papakura and Drury. This corridor has a strategic freight function, providing a connection between the Papakura Interchange and the Papakura industrial area to the east.
- **Hunua Road:** A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This corridor provides a key frequent public transport link between Papakura and Drury. This connection links to the Drury FTN, further connecting with the Drury Central Station in the South. Hunua Road also provides access to the adjacent industrial area.

3.3 Corridor Upgrade Project:

The scope of this DBC includes a corridor upgrade project of the section of Great South Road in Drury between Waihoehoe Road and Firth Street. This corridor is currently two lanes and is expected to be a pinchpoint in the network.

- **Great South Road (between Waihoehoe Road and Firth Street):** A four lane multi-modal primary arterial connection with dedicated walking and cycling facilities. This corridor provides a connection to the Drury Interchange and the strategic state highway network. This connection is adjacent to Drury Central Station and hence provides access to the station.

3.4 Corridor Urbanisation Projects:

The corridor urbanisation projects involve upgrades to existing corridors to enable the surrounding urban environment in the future. These projects complement the Takaanini FTN route and include the following corridors:

- **Popes Road:** A two lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. This corridor is a key east-west connection, connecting between Takaanini School Road, Porchester Road and the N-S Mill Road strategic arterial.
- **Croskery Road:** A two lane multi-modal collector with dedicated walking and cycling facilities. This corridor is a key east-west connection between Hunua Road and the N-S Mill Road strategic arterial. This connection provides access to the Papakura industrial area.

4 Investment Objectives and KPIs for the South FTN Recommended Option

The following section provides a breakdown of the performance of the South FTN recommended option against the Investment Objectives and subsequent KPIs.

The KPI measures compares the 'Do Minimum' transport network against the proposed Te Tupu Ngātahi projects in the recommended South FTN DBC network, using a full build-out 2048+ scenario.

The 2048+ land use scenario was agreed with Auckland Council to be the most appropriate scenario for route protection purposes. This is not a specified date but reflects the full build-out (post 2048) of the currently planned development, which then informs the long-term infrastructure needs.

The South FTN is a part of a broader package (South package) of improvements identified to support growth in the South and unlock the future land use. These DBC projects under the South package are shown in Table 4-1, with the present South FTN DBC highlighted in bold.

Table 4-1: Te Tupu Ngātahi DBC Packages in the South

DBC Package	DBC	Projects / Elements
Takaanini DBC Package	South Frequent Transit Network (FTN) (this DBC)	• Great South Road FTN between Drury Central Station and Manukau Station • Takaanini FTN between Drury West Station and Manukau Station • Popes Road and Croskery Road urbanisation • Upgrade of Great South Road between Waihoehoe Road and Drury interchange
	Level Crossings DBC assessed for removal and/or replacement (being prepared in parallel with this DBC)	• Spartan Road • Manuia Road • Manuroa Road • Taka Street • Walters Road
Rail DBC Package	Rail DBC	• New Drury West Station • New Drury Central Station • New Paerata Station • Additional rail capacity (four tracks between Wiri and Pukekohe)
South Strategic DBC Package	Mill Road and Drury DBC	• Mill Road Corridor upgrades • Upgrades in Drury
	Pukekohe DBC	• Alternative route to SH22 between SH1 and Pukekohe • New arterial connections to the proposed Pukekohe
Drury Local	Drury Local Arterials DBC	• New Drury arterial network

It is the combination of the proposed Te Tupu Ngātahi projects and this South FTN DBC projects that will enable the key transport and land use integration outcomes for the South community.

The recommended network will enable better connections between the train stations and through the metropolitan/ town centres in the South network, enabling improved travel choices to access the strategic projects assumed in the wider South network.

The key difference in the strategic network between the Do minimum and South FTN recommended network is the two FTN routes, two corridor urbanisation projects and the upgrade of Great South Road between Waihoehoe Road and Drury interchange.

4.1 Overall South FTN Outcomes

As detailed above, the South FTN recommended option has been developed within the context of a wider network, Table 4-2 reports on the overall outcomes of the entire system. The reported measures are based on the complete network, with the complete buildout of projected growth in the South.

Table 4-2: South FTN Outcomes

Key Performance Indicator	Measure	Outcome	Commentary
Investment Objective 1: Access			
Enable access to economic and social opportunities by providing high quality public transport between Drury and Manukau that integrates with the rail network			
Job Access	Proportion of employment accessible within 15, 30, and 45 minutes accessible by public transport	In 2048+: - In the recommended network, 84,200 jobs can be accessible within 30 mins by PT from Manurewa (compared to 81,100 in the Do-min option). - In the recommended network, 40,900 jobs can be accessible within 30 mins by PT from Takaanini (compared to 36,500 in the Do-min option). - In the recommended network, 40,900 jobs can be accessible within 30 mins by PT from Takaanini east (compared to 34,600 in the Do-min option). This is largely due to the Takaanini FTN. - In the recommended network, 49,600 jobs can be accessible within 30 mins by PT from Papakura (compared to 49,000 in the Do-min option). - In the recommended network, 29,800 jobs can be accessible within 30 mins by PT from Drury (consistent with the Do-min option).	In 2048+: - There is a 4% increase in jobs accessible by PT within a 30-minute catchment of Manurewa. - There is a 12% increase in jobs accessible by PT within a 30-minute catchment of Takaanini. - There is a 18% increase in jobs accessible by PT within a 30-minute catchment of Takaanini East. This increase is largely due to the Takaanini FTN. - There is a 1% increase in jobs accessible by PT within a 30-minute catchment of Papakura. - There is expected to be no change in the number of jobs accessible by PT within a 30-minute catchment of Drury⁷. The FTN routes enable access to jobs. Without bus priority, bus service reliability and the portion of jobs accessible by PT are affected. There would be an increase in delays resulting in an increase in travel time and trip time variability. This impacts the portion of employment accessible.
Job Access	Proportion of employment accessible within 15, 30, and 45 minutes accessible	In the recommended network in 2048+, 126,500 jobs can be accessible within 15 mins of the South area by active modes.	The recommended network improves safety for vulnerable road users to access jobs due to the improved facilities. The walking and cycling facilities contribute to the number of jobs accessible by active modes for the South area.

⁷ Analysis showed journeys switch between rail to bus from the Do-min to the Option. This is due to the improved generalised costs. The rail has slightly slower actual time, however has improved perceived travel time.

Key Performance Indicator	Measure	Outcome	Commentary
	by active modes (walking and cycling)	In the recommended network in 2048+, 177,000 jobs can be accessible within 30 mins of the South area by active modes. In the recommended network in 2048+, 264,200 jobs can be accessible within 45 mins of the South area by active modes.	
Key destination access	Reduction in travel time between key social and employment destinations along each FTN route (PT)	The FTN connects people between stations/ centres along the extents of the route. Travel time was measured along the extent of each FTN route. GSR FTN: Up to 11 minutes travel time savings in the northbound direction on Great South Road (Drury to Manukau) in 2048+. Up to 9 minutes travel time savings in the southbound direction on Great South Road (Manukau to Drury) in 2048+. Takaanini FTN: Up to 2 minutes travel time savings in the northbound/ westbound direction along the Takaanini FTN route (Hunua Rd to Manurewa Bus Interchange) in 2048+. Up to 8 minutes travel time savings in the southbound/ eastbound direction along the Takaanini FTN route (Manurewa Bus Interchange to Hunua Rd) in 2048+.	Travel time from Drury to Manukau reduces by 11 minutes along Great South Road in the Recommended Network in 2048+. Travel time from Manukau to Drury reduces by 9 minutes along Great South Road in the Recommended Network in 2048+. Travel time from Hunua Road to Manurewa bus interchange reduces by 2 minutes along the Takaanini FTN route in the Recommended Network in 2048+. Travel time from the Manurewa bus interchange to Hunua Road reduces by 8 minutes along the Takaanini FTN route in the Recommended Network in 2048+.
Travel time	Travel time variability (public transport)	Travel time is measured for all vehicles travelling along the GSR FTN route between Manukau and Drury. The travel time varies less in the recommended network compared to	The models indicate that the travel time spread between Manukau and Drury (across the day) reduces from 24 minutes to 18 minutes for the GSR FTN route in 2048+. This results in improved

Key Performance Indicator	Measure	Outcome	Commentary
		the Do Minimum scenario. Travel time spread across the day (comparing three modelled peaks and each direction of travel) is 19 minutes (NB) and 18 minutes (SB) in the Recommended Option, while the travel time spread in the Do Minimum scenario is 21 minutes (NB) and 24 minutes (SB) in 2048+. Travel time for the Takaanini FTN is measured for all vehicles travelling between Manurewa bus interchange and Hunua Road. The travel time varies less in the recommended network compared to the Do Minimum scenario. Travel time spread across the day (comparing three modelled peaks and each direction of travel) is 19 minutes (NB) and 12 minutes (SB) in the Recommended Option, while the travel time spread in the Do Minimum scenario is 20 minutes (NB) and 18 minutes (SB) in 2048+.	consistency of travel time for those travelling via PT on the GSR FTN route. For the Takaanini FTN, the models indicate that the travel time spread between Manurewa bus interchange and Hunua Road (across the day) reduces from 20 minutes to 12 minutes for the Takaanini FTN route in 2048+. This results in improved consistency of travel time for those travelling via PT on the Takaanini FTN route.
Investment Objective 2: Integration Support planned growth by integrating high quality public transport corridors with the current and planned transport system and land use.			
Proximity to PT network	No. of households with access to high quality PT (within 800m of the FTN corridor)	Approximately 72,700 households are within an 800m catchment of the PT routes.	72,700 households are in proximity to PT upgrades such as bus lanes, or locations with proposed intersection upgrades.
Provision of Bus Lanes on network	% / KMs of new bus lanes	19 km of new bus lanes across both FTN routes. Increase in improved PT network by an overall 34%. 54% of the GSR FTN route has bus lanes 15% of the Takaanini FTN route has bus lanes	15.1 km of new bus lanes on GSR FTN (total of 16.8 km of bus lanes) 3.8 km of new bus lanes on Takaanini FTN (Alfriston Road) Measured one-way over each of the corridor lengths.

Key Performance Indicator	Measure	Outcome	Commentary
Amenity of the street	KMs of new and improved transport network with enough space for street furniture/ lighting and tree planting appropriate to the known place function and built form	• 26.4 km on GSR FTN and Takaanini FTN corridors • 2.6 km on the South key connections (Popes Road and Croskery Road)	• 13.2 km on GSR FTN route • 13.2 km on Takaanini FTN route • 2.1 km on Popes Road • 0.5 km on Croskery Road Measured one-way over each of the corridor lengths.
Investment Objective 3: Travel Choice Support growth and mode share shift towards low carbon transport modes			
Patronage uplift	% patronage uplift expected on the FTN routes	Average hourly PT patronage uplift on GSR FTN route (NB in AM peak hour): • Manurewa to Manukau: 215 (51% uplift) • Papakura to Manurewa: 82 (257% uplift) • Drury to Papakura: 123 (242% uplift) Average hourly PT patronage uplift on Takaanini FTN route (NB in AM peak hour): • Alfriston Rd/ Weymouth Rd: 112 (59%) • Alfriston Rd to Airfield Rd: 41 (90%) • Airfield Rd to Papakura: 23 (42%) • Papakura to Hunua Rd: 26 (34%) • Hunua Rd to Drury: 3 (7%) Average hourly PT patronage uplift on GSR FTN route (SB in PM peak hour):	Average daily patronage increase of 2,800 passengers across both FTN routes. Average annual patronage increase of 674,800 passengers across both FTN routes.

Key Performance Indicator	Measure	Outcome	Commentary
		- Manurewa to Manukau: 198 (82% uplift) - Papakura to Manurewa: 30 (130% uplift) - Drury to Papakura: 23 (64% uplift) Average hourly PT patronage uplift on Takaanini FTN route (SB in PM peak hour): - Alfriston Rd/ Weymouth Rd: 168 (141%) - Alfriston Rd to Airfield Rd: 72 (166%) - Airfield Rd to Papakura: 24 (57%) - Papakura to Hunua Rd: 7 (11%) - Hunua Rd to Drury: 8 (33%)	
Mode Share	% PT and active mode share in the AM peak.	31% of trips from the South travelling north (i.e. CBD) in the AM peak in the recommended network are PT trips (20,300 trips) in 2048+. 23% of trips of South local (shorter) trips in the AM peak in the recommended network are active mode trips (21,700 trips) in 2048+. The mode share in the recommended network is largely consistent with the Do minimum.	The overall mode share in the recommended network does not materially change from the Do-min. This is due to the wider PT network assumed in both the Do-min and the recommended network. - Rail 4-tracking (additional track capacity from Pukekohe to Wiri) - City Rail Link - Level crossings grade separation Passenger rail is planned to provide core rapid transit functionality in southern Auckland, providing significant mode share benefits which are captured in the Do-min. The South FTN network is less transformational however, provides for the local connectivity/ accessibility in the South network. The South area is deprived in terms of PT accessibility and travel choice. Hence the FTN network provides for the shorter trips and access to key centres and stations. These benefits are not captured or made evident in

Key Performance Indicator	Measure	Outcome	Commentary
			the models due to the nature of the models which largely focus on the benefits gained by passenger rail.
Daily active mode-km uplift	Walk-km and cycle-km uplift	2,910 walk-km uplift in 2048+ 1,440 cycle-km uplift in 2048+	There is expected to be a daily increase of walk-km and cycle-km in the recommended network compared to the Do-min.
Provision of high-quality active modes network / Perceived safety (active modes)	% / KMs of new and improved cycle network achieving required QoS (from AT Statement of Intent 2018-21)	27 km of new and improved cycle network	14.5 km of new and improved cycle network on GSR FTN 12 km of new and improved cycle network on Takaanini FTN Measured one-way over each of the corridor lengths.
DSI (active modes)	No. of active mode incidents resulting in serious injury and deaths (2013-2022).	Active Mode previous recorded DSIs: Great South Road FTN: 20 serious injury and 2 fatalities. Takaanini FTN: 11 serious injury and 2 fatalities. Croskery Road: 0 serious injury and 0 fatalities. Popes Road: 1 serious injury and 2 fatalities. Great South Road, Drury (Waihoehoe Road – Drury Interchange): 0 serious injury and 0 fatalities.	38 active mode DSIs were recorded in the last 10-year period (2013-2022). However, with the expected growth in the area exposure to risks for active mode users is expected to increase. To accommodate for this increased safety risk, safe and connected walking and cycling facilities will be provided on the majority of corridors in South FTN network. While the number of previous active mode DSIs are notable, the conflict risk for these users may increase in the future as there are more vehicles and active mode users on the network. This risk can be reduced by providing dedicated facilities separated from traffic.
Overall DSI (all modes)	No. of overall incidents resulting in serious injury and deaths (2013-2022).	\$3.02 million crash benefits in 2048+ (single year). 80 DSIs estimated to be saved over 40 years Overall previous recorded DSIs: Great South Road FTN: 65 serious injury and 7 fatalities.	139 DSIs were recorded in the last 10-year period (2013-2022). However, with the expected growth in the area exposure to risks for all mode users is expected to increase.

Key Performance Indicator	Measure	Outcome	Commentary
		• Takaanini FTN: 45 serious injury and 6 fatalities. • Croskery Road: 0 serious injury and 0 fatalities. • Popes Road: 11 serious injury and 2 fatalities. • Great South Road, Drury (Waihoehoe Road – Drury Interchange): 3 serious injury and 0 fatalities	This risk can be reduced by the intersection upgrades, active mode facilities, corridor upgrades on the corridors across the South FTN network.
Emissions	CO ₂ emissions – tonnes of CO ₂ equivalents emitted	Recommended network reduces 2,250 yearly tonnes of CO₂ in 2048+ compared to the Do Minimum. Recommended network reduces 89,800 tonnes of CO₂ over 40 years	These reductions in CO ₂ in 2048+ is due to the reduced VKT and mode shift.
Vehicle Kilometres Travelled (VKT)	Reduction in vehicle kilometres travelled in the network	The average car user in NZ travels approximately 28 vehicle kilometres daily⁸. Recommended network reduces 54,800 vehicle kilometres travelled daily compared to the Do Minimum in 2048+. Recommended network reduces 18 million vehicle kilometres travelled annually compared to the Do Minimum in 2048+.	This VKT reduction is due to the PT priority and reduction of traffic capacity along Great South Road.

⁸ Based on 2020 VKT per capita from the Ministry of Transport, assuming 329 operational days in a year (<https://www.transport.govt.nz/statistics-and-insights/road-transport/sheet/vehicle-kms-travelled-vkt>).

5 Transport Analysis

The transport analysis sets out the transport network planning undertaken to determine the recommended corridors and intersections.

5.1 Land Use Scenarios

This summary provides an overview of the land use scenarios and assumptions used to assess the transport network.

5.1.1 Land Use Assumptions

Land use data was the main input used to inform the expected growth in transport demand, which then informed the network planning. For network planning purposes, a 2048+ (full build-out of planned development) land use scenario was used to develop the recommended network, which reflects the needs for long-term transport infrastructure.

5.1.1.1 Land Use Inputs & Scenarios

The development of the land use scenarios includes inputs from future land use plans, forecasts, and policies, which includes:

- Future Urban Land Supply Strategy
- Unitary Plan Zoning
- Precinct Plans

A summary of planned growth and timing for each growth area in the South is set out below.

Table 5-1: Summary of South Planned Growth and Timing

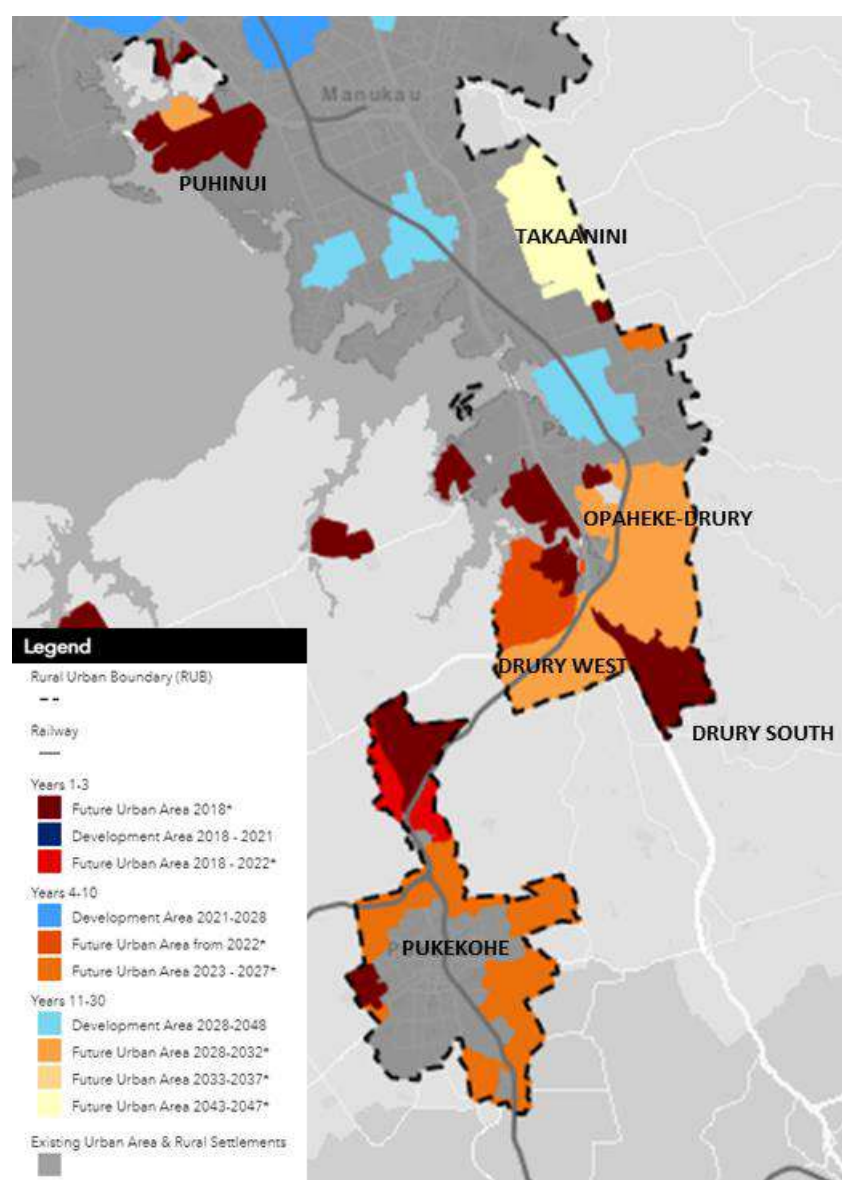
Area	Growth Summary	Proposed Timing ⁹ – Development Ready (Large Future Urban Areas)
Puhinui	480 hectares (business)	2012 – 2017
Hingaia	260 hectares Approx. 3,070 dwellings	2012 – 2017
Drury South	370 hectares (including business) 1,000 dwellings	2012 – 2017
Drury West (Stage 1)	Approx. 390 hectares 4,200 dwellings	2018 – 2022
Cosgrave Rd, Takaanini	Approx. 60 hectares 500 dwellings	2023 – 2027

⁹ Based on Auckland Council Future Urban Land Supply Strategy

Area	Growth Summary	Proposed Timing ⁹ – Development Ready (Large Future Urban Areas)
	1 local centre	
Pukekohe	Approx. 1,100 hectares 7,200 dwellings	2023 – 2027
Ōpaheke - Drury	7,900 dwellings 1 town and 2 local centres	2028 – 2032
Drury West (Stage 2)	Approx. 550 hectares 5,650 dwellings 1 town and 2 local centres	2028 – 2032
Takaanini	Approx. 590 hectares 4,500 dwellings	2043 – 2047

Development areas in Clendon, Manurewa and Papakura are also expected from 2028 to 2048 and are also shown in Figure 5-1 below (light blue areas).

Figure 5-1: South Area Planned Growth Map



5.1.2 Land Use Sensitivity Tests

5.1.2.1 Future Development Strategy (FDS): NPS-UD and MDRS

Policy direction has changed since the IBC and now consists of documents such as the Emissions Reduction Plan, Arataki, Waka Kotahi Sustainability Action Plan and Te Taruke a Tawhiri: Auckland's Climate Plan. The policy context includes drivers such as reallocating road space and providing for reliable rapid and frequent transit services.

The timing of growth within the South is based on the FULSS which remains the current forecast for land release in the Auckland Region. Within the greater Auckland area, growth is staged across 30+ years, with Takaanini staged to be development ready in the second half of decade three (2043 - 2047). The FULSS has identified this area as having 'significant flooding and geotech constraints' and signals the need to identify comprehensive solutions to these geotechnical and stormwater issues before development can commence. These technical investigations may alter the projected yields or

timing of growth rather than whether the area will be “developed as planned” especially given its long-term horizon.

Auckland Council released a draft Future Development Strategy 2023-2053, which is currently under consultation. This document will supersede the existing Auckland Plan 2050 Development Strategy (2018) and the FULSS (2017). The FDS has three emerging direct impacts on the Takaanini Level Crossings Project which are:

- Recommended removal of Takaanini FUZ
- Recommended removal of Ōpaheke-Drury FUZ
- Slower anticipated overall population growth

While this document is yet to be approved, it has been reviewed internally and identified that any amendments to development timing/ removal of Takaanini and the Ōpaheke-Drury FUZ may have an impact on parts of the FTNs. Particular sections of the FTN that are dependent on the outcomes of the FDS are at risk. However, the South FTN DBC has noted the uncertainty of these future urban areas from the onset of the DBC stage and has taken this into consideration through the optioneering phase as well as the Notice of Requirement (NoR) phase with the packaging of the FTNs.

The FDS consists of two policies: National Policy Statement-Urban Development (NPS-UD) and Medium Density Residential Strategy (MDRS). MDRS enables development of at-least six-storey high residential buildings which are within an 800m walkable catchment of an RTN stop/station and 800m from the edge of large metropolitan centre zones such as Papakura and Manukau. The MDRS refers to three dwellings permitted at any residential site resulting in terrace housing apartment building (THAB).

Auckland Council is currently considering how the NPS-UD and the MDRS will impact the timing of growth in existing urban and future urban areas in Auckland. These policies feed into the Intensification Planning Instrument (IPI) Proposed Plan Change 78 which is currently on hold as regional flood modelling is being undertaken.

Te Tupu Ngātahi is liaising with Auckland Council and the Auckland Forecasting Centre to understand if new growth forecasts will be released. Te Tupu Ngātahi will continue to assume current land use yields, forecasts and FULSS timing, however, will assess the implications of this land use uncertainty and undertake sensitivity tests where required. Although the future urban zone growth areas have an influence on this Project, it significantly addresses accessibility for existing areas, and as such the outcomes are considered less sensitive to growth estimates than other greenfield growth areas.

5.1.2.2 Impact of FUZ changes on recommended network

The FDS has proposed that the Takaanini FUZ land in the north-east, bounded by Porchester Road and Mill Road, is an indicative proposed area for removal. “Proposed area for removal” indicates Council is signalling rezoning of this area to an appropriate non-urban zoning. As the FTN routes are predominantly situated in existing live zoned areas, it is expected that downsizing or delaying of the Takaanini FUZ will not have a significant impact on the decisions made around the FTN routes. Table 5-2 shows the proportion of Takaanini FUZ-related traffic (traffic to or from the Takaanini FUZ) using the FTN links nearby. Only 6% to 16% of the Takaanini FUZ-related traffic traverse on Alfriston Road and the northern end of Porchester Road. The majority of the trips to or from the Takaanini FUZ are using Stratford Road, further north to access SH1. Around 31% to 35% of the Takaanini FUZ traffic traverse on Popes Road (FUZ section) while around 8% of the traffic from the FUZ traverse on the industrial live-zoned section of Popes Road.

Table 5-2: Percentage of Takaanini FUZ-related traffic using surrounding corridors

Takaanini FUZ-related traffic % on surrounding corridors		
Corridor	AM peak (veh/hr)	PM peak (veh/hr)
Stratford Road	20%	16%
Alfriston Road	10%	6%
Porchester Road (between Alfriston Rd & Airfield Road)	16%	12%
Popes Road (FUZ section)	31%	34%
Popes Road (industrial live-zoned section)	8%	7%

The draft FDS has also proposed that the Ōpaheke FUZ land by Slippery Creek, is an indicative proposed area for removal. Other parts of the Ōpaheke FUZ has a proposed new timing of 2050+, hence have been deferred. A small portion of the southern section of the GSR FTN is adjacent to the Slippery Creek Ōpaheke FUZ which is proposed to be removed. The southern section of the Takaanini FTN, at Hunua Road is expected to tie into the Drury FTN corridor to the south via Ōpaheke N-S arterial. Table 5-3 shows the proportion of the Ōpaheke FUZ-related traffic (traffic to or from the Ōpaheke FUZ) using the FTN links nearby. It should be noted that a proportion of the Ōpaheke FUZ area selected is already live zoned and another portion is proposed to be deferred. Hence, the proportion of FUZ-related traffic in the table below reflects traffic that is originating from the live-zoned area, the area proposed to be deferred and the area proposed for removal.

Table 5-3: Percentage of Ōpaheke-Drury FUZ-related traffic using surrounding corridors

Ōpaheke-Drury FUZ-related traffic % on east-west corridor		
Corridor	AM peak (veh/hr)	PM peak (veh/hr)
Hunua Road	44%	42%
Great South Road (southern section south of Park Estate Road)	50%	56%

It should be noted that the original yield for the Ōpaheke FUZ area from council was reduced due to the flood plains, hence, it is unclear how much of the area will be downzoned and the subsequent traffic proportion.

5.1.3 Assessment Years

The development of land use scenarios includes different analytical years to inform staging, economic assessments, and the development of the recommended network. The different assessment years and their intended use are summarised below in Table 5-4.

Table 5-4: Summary of Land Use Assessment Years

Assessment Year	Network Planning and Staging	Economic Assessments	Recommended Footprint
2018*	✓		
2038 & 2048 (interim years)	✓✓✓	✓✓✓	✓
2048+ (full build-out)	✓✓✓	✓✓✓	✓✓✓

relative significance low (✓), relative significance high (✓✓✓) and base year reference (*)

The I-11 land use forecast series was agreed by Waka Kotahi, AT, and Auckland Council as the most appropriate land use scenarios to use. This also includes the interpretation of the Future Urban Land Supply Strategy (FULSS). The inputs include Stats NZ medium growth population forecasts and detailed demographic trends, via 64 person categories, 6 employment types and 3 educational role categories.

Based on the I-11 land use forecast series, the Auckland Forecasting Centre (AFC¹⁰) created each forecast scenario used by Te Tupu Ngātahi for the interim and full build-out scenarios.

AFC created the forecasts for the South IBC and South FTN DBC. These include the 2046+ (used in the IBC) and 2048+ (used in the DBC) datasets that include the full build-out in growth areas.

5.2 Transport Network Analysis

The following section describes the transport analysis undertaken to reach the recommended option for the South FTN DBC. This includes the network, corridor and intersection assessments undertaken, including:

- Auckland Transports' Roads and Streets Framework (RASf)
- The Corridor Form Assessment Framework (CFAF)
- Cross-Section design
- Intersection form and function
- Intersection design

5.2.1 Transport Modelling

Throughout the transport network analysis process, a range of different transport modelling tools have been used to undertake quantitative assessments of the transport system. These then inform decisions about planning transport network, corridors, and intersections.

The modelling methodology undertaken for the South FTN DBC options follow a typical hierarchical modelling structure and utilises a range of models as detailed below.

Strategic Multi-Modal Model

¹⁰ Auckland Forecasting Centre is a collaboration between Auckland Council, Auckland Transport, and the NZ Transport Agency.

- **MSM** is a regional multimodal model for Auckland, which translated land use (such as population and employment) to travel patterns (which creates estimates of car, truck, and public transport movements) at a strategic and regionwide level.

SATURN Model

- The SATURN model is a mesoscopic traffic model, which loads the forecasted vehicle trip patterns from MSM onto the road network to investigate the traffic effects at a more detailed level.

Active Modes Model

- The AFC Strategic Active Modes Model (SAMM) provides strategic-level estimates of walking and cycling demands.
- Te Tupu Ngātahi active modes station access model, this tool is only used to provide estimates of walking and cycling to major stations.

Intersection Modelling

- SIDRA modelling has been undertaken to assess the operational performance of key intersections along the project corridors. The demand was informed by the SATURN models.

Appendix 4 provides more model specifications and details for each respective model package used.

5.2.1.1 Design philosophy

It is important to note that the transport modelling is used to inform, rather than as a pure basis for, decisions on the design and planning of the transport network, corridors, and intersections. While the Project improves local connectivity in the network, the purpose is not to be able to accommodate all traffic demand in the network as to avoid a 'predict and provide' approach. Given that the Project has a key focus on public transport, the approach to design has centred around providing priority for PT along the routes.

5.2.2 Interdependencies with other key north-south routes

Along with Great South Road and Porchester Road, there are a number of other key N-S routes in the future Southern network. These include the following:

- Rail corridor
- State Highway 1
- Mill Road
- Ōpaheke N-S arterial

Table 5-5: Key N-S routes in the long-term southern network

Key N-S Route	Current form	Future form & status	Role in the future network
Rail corridor	2 tracks	4 tracks (business case stage)	Main rapid transit spine & freight movement

Key N-S Route	Current form	Future form & status	Role in the future network
State Highway 1	6-8 lanes	6-8 lanes (likely to remain as existing)	Inter-regional general traffic & freight
Mill Road	2 lanes	Potentially 4 lanes (proposed in previous IBC). Future form and timing are uncertain.	Long-term suburban connectivity & active modes
Ōpaheke N-S arterial	N/A	2 lanes and bus lanes (consented)	FTN route & active modes

Table 5-5 includes the expected future form of each north-south route in the southern network and the current status of the projects. There is a level of uncertainty around the future form and timing of a number of N-S corridors in the southern network, specifically around the rail corridor, Mill Road and the Ōpaheke N-S arterial.

Modelling of various scenarios were undertaken to understand the interdependency of the N-S routes in the network and to assess the effect on the FTN corridors (GSR and Porchester Road). The modelled year of the scenarios are based in 2048+.

Scenario 1: Mill Road remains in current form (2 lanes and no connection to Drury) and there is no Ōpaheke N-S arterial in the long-term network¹¹

This scenario tests the effect of both Ōpaheke N-S arterial and Mill Road (4-lanes) being removed from the long-term network. This essentially indicates GSR, SH1 and the rail corridor are the only key north-south routes in the network between Drury and Papakura. Please note this scenario has not been tested formally.

Impact on Great South Road:

Modelling showed that if Mill Road remained in the current form (2 lanes), and there is no Ōpaheke N-S arterial there is expected to be:

- An increase of approximately 500 veh/day on Great South Road between Manukau and Manurewa. This results in an increase to approximately 17,000 veh/day on this stretch of corridor.
- An increase of approximately 1,500 veh/day on Great South Road through the Takaanini area. This results in an increase to approximately 24,300 veh/day on this stretch of corridor.
- An increase of approximately 7,300 veh/day on Great South Road between Papakura and Drury. This results in an increase to approximately 18,200 veh/day on this stretch of corridor.

The form and timing of the combination of Mill Road and Ōpaheke N-S arterial have a significant impact on the traffic pressure on the section of Great South Road between Papakura and Drury. There is negligible impact on the northern section of Great South Road. There would be an overall impact on the accessibility in the network.

Impact on Takaanini FTN corridors:

¹¹ Please note this scenario has not been tested formally.

- An increase of approximately 2,700 veh/day on Porchester Road between Alfriston Road and Popes Road. This results in an increase to approximately 15,800 veh/day on this stretch of corridor.
- An increase of approximately 2,300 veh/day on Porchester Road between Popes Road and Airfield Road. This results in an increase to approximately 16,800 veh/day on this stretch of corridor.
- An increase of approximately 900 veh/day on Porchester Road between Airfield Road and Walters Road. This results in an increase to approximately 17,000 veh/day on this stretch of corridor. This results in an increase to approximately 20,000 veh/day on this stretch of corridor.

There is a moderate effect on the Takaanini FTN as there is a slight uplift in traffic on parts of Porchester Road. Intersection may struggle under this additional traffic pressure. It should be noted that if there is no Ōpaheke N-S arterial in the network then the southern section of the Takaanini FTN i.e. the Hunua Road becomes redundant for PT unless an alternative FTN route is provided.

Scenario 2: No Ōpaheke N-S arterial in the 2048+ network, 4-lane Mill Road is in the long-term network

This scenario tests the effect of Ōpaheke N-S arterial being removed from the long-term network while Mill Road (4-lanes) remains in the network.

Impact on Great South Road FTN:

Ōpaheke N-S arterial does not have a significant impact on the northern sections of Great South Road. The material impact is on the southern section of Great South Road, between Papakura to Drury.

- There is expected to be an increase of approximately 2,200 veh/day on Great South Road South between Papakura and Drury. This results in an expected increase to approximately 14,000 veh/day on this stretch of corridor.

Impact on Mill Road (4-lanes):

- More traffic is diverted to the southern section of Mill Road South (approx. 6,000 veh/day). This results in an increase to approximately 32,500 veh/day on this stretch of corridor.

The timing and implementation of Ōpaheke N-S arterial has a material impact on the N-S routes between Papakura and Drury. Traffic pressure increases on the remaining corridors, Great South Road and Mill Road South. This will trigger the need for four-lanes on Mill Road.

Impact on Takaanini FTN corridors:

- There is minimal impact on Porchester Road if Ōpaheke N-S arterial is not in the network.
- There is expected to be 3,700 less traffic on Hunua Road if Ōpaheke N-S arterial is not in the network. This results in an increase to approximately 3,600 veh/day on this stretch of corridor.

The timing and implementation of Ōpaheke N-S arterial has less material impact on corridors along the Takaanini FTN route. There would be less traffic on Hunua Road which would have connected to Ōpaheke N-S arterial.

Scenario 3: Mill Road remains in current form (2 lanes and no connection to Drury) and Ōpaheke N-S arterial is in the long-term network¹²

This scenario tests the effect of Mill Road remaining in the current form (no upgrades) while the Ōpaheke N-S arterial remains in the long-term network.

Please note this scenario has not been tested formally. Internal tests were undertaken with the models which indicated that if Mill Road is not upgraded in the future, there would be a slight increase in traffic on Great South Road specifically along the southern extent (Papakura to Drury). However, there is a greater impact of traffic pressure on Ōpaheke N-S arterial.

If the southern section of Mill Road in Drury is not in the long-term network then, it is expected that Ōpaheke N-S arterial will take on the role of what Mill Road was intended to perform. Ōpaheke N-S arterial will be expected to provide long-term suburban connectivity from Drury to the north through Papakura and will have a more strategic function. Traffic will divert off SH1 and add pressure to Ōpaheke N-S arterial, essentially adding traffic onto the FTN route. Traffic will also be shifted onto the Takaanini FTN network such as Porchester Road and Hunua Road, however, to a lesser extent.

The significant shift of traffic to Ōpaheke N-S arterial will result in an unplanned undesirable outcome for this corridor. The Takaanini FTN route may need to be revisited under this scenario as continuous bus lanes are not provided throughout the route, hence PT may be adversely impacted under this scenario. It is not recommended to route protect for additional bus lanes on the Takaanini FTN under this potential scenario due to the brownfields context (constrained environment) in which the Takaanini FTN sits in.

Scenario 4: Two-tracking along rail corridor in 2048+

Currently 4-tracking is assumed in 2048 and 2048+ (full build-out) models. The timing of 4-tracking of the rail corridor is uncertain. Hence, retaining 2-tracks in the long-term network was tested to understand the traffic increase on the wider network. This scenario assumes that all other N-S routes are in the network including the 4-lane Mill Road upgrade and Ōpaheke N-S arterial.

There is expected to be:

- an increase of 800 veh/day on Ōpaheke N-S arterial;
- an increase of 800 veh/day on Mill Road South
- an increase of 300 veh/day on Great South Road South.

It should be noted that in this 2-tracking scenario, there is a reduction in accessibility as there is a lot of latent demand in the network which are not picked up by the traffic difference in the network. The models indicate that PT trips on the rail corridor reduce by 3,100 trips in the morning peak period if there are only 2-tracks as opposed to 4-tracks.

Timing of the FTN and the 4-tracking of the rail corridor should be managed in a way that works for the two projects do not occur simultaneously. Adverse construction impacts of one project can be reduced if the other project is in the network. For example the FTN could provide for rail-bus replacement when four-tracking takes place.

¹² Please note this scenario has not been tested formally.

5.2.3 Roads and Streets Framework (RASf)

The development of the corridor design has included the use of AT's Road and Streets Framework (RASf), which qualitatively assesses the typology (movement and place value) and modal priority.

The intent of that framework is to classify the expected movement and place functions from a consistent regional context and identify the likely priority applied to each mode.

Each corridor within the South FTN DBC was assessed based on the following:

- **Place function** – for existing and long term 2048+
- **Movement function** – for existing and long term 2048+
- **Modal priority** – that reflect a 2048+ environment

The framework itself does not directly dictate a specific corridor design but provides context and guidance regarding the intended function of the corridor. This in turn will be used to inform future development and operation of the corridor. A 'mandate' for each road corridor has been developed by Te Tupu Ngātahi and approved by the RASf Steering Group, comprising senior officers from AT and Auckland Council.

RASf mandates were completed for corridors that fall under the jurisdiction of AT.

5.2.4 Corridor Form Assessment Framework (CFAF)

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 CFAF assessments were completed for all multi-modal corridors along the Great South Road FTN, Takaanini FTN, Popes Road, Croskery Road and the section of Great South Road between Waihoehoe Road and Drury Interchange.

Following the multi-disciplinary optioneering process of determining the FTN routes, the CFAF was applied to the corridors along the two FTN routes. Hence, the RASf and the principles for modal space allocation were used in the development of cross sections for these 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-sections 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 (PT 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.

Table 5-6 provides a summary of the inputs and outputs of the CFAF tool used during the assessment.

Table 5-6: Inputs and Outputs of the CFAF Tool

Inputs	Modelling inputs required?	Parameters	Outputs	Impact on Modelling
Place and Corridor Function	No	Qualitative assessment based on the Roads and Streets Framework (RASf)	Determines the purpose of the route and feeds into wider modal priority assessment	N/A
Public Transport	No	AT Remix file ¹³	Public transport priority	No
Walking and Cycling	No	Te Tupu Ngātahi primary and secondary walking and cycling network used, based on urban design framework	Helps with geometric design, determining suitable paths and which sides to include the facility	Chosen facility type for different corridors coded into SAMM
General Traffic	Yes	ADT volumes used, extracted from SATURN.	If PT priority needed, helps determine whether corridor is route protected for 2 or 4 lanes	Number of lanes included in MSM, used for SATURN outputs
Freight	Yes	User class 3 (heavy vehicles) divided by total of all user classes (all vehicles) to determine the percentage of freight. Data extracted from SATURN.	Informs role within wider freight network and whether specific freight measures are needed along corridor	Yes
Speed Environment	No	Assumption based on RASf and future land use. Parameters for high and low speed based on the IBC design philosophy.	High level assessment concludes a low speed of 50km/h or 60km/h or a high speed of 80km/h. These are the base assumptions for the speed, subject to vary through the DBC Optioneering process.	Speed along each network included in MSM, used for SATURN outputs

¹³ Te Tupu Ngātahi Remix File refers to the Auckland Transport vision of the 2048+ bus network. Data and routes are subject to change.

5.2.5 RASF and CFAF Summary

The following table provides a summary of the RASF mandates and CFAF results for the South FTN corridors. The future typology (movement and place value) and future modal priority for each corridor is summarised below, along with the proposed future cross-section from the CFAF process. A fuller description of the CFAF summary can be found in Appendix 1.

Table 5-7: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

Manukau Station Road	Future Modal Priority	CFAF Cross-Section																
Future Typology: P3/M3																		
Place Assessment: The supporting rationale is that that Manukau Metropolitan centre will be further intensified in 25 years making it regionally significant and will attract people across the region and even across the country.	<table><caption>Future Modal Priority Data</caption><thead><tr><th>Mode</th><th>Priority Level</th></tr></thead><tbody><tr><td>Pedestrian</td><td>Highest</td></tr><tr><td>Bicycle</td><td>High</td></tr><tr><td>Bus</td><td>Medium-High</td></tr><tr><td>Truck</td><td>Medium</td></tr><tr><td>Car</td><td>Medium-Low</td></tr><tr><td>Scooter</td><td>Low</td></tr><tr><td>Parking</td><td>Lowest</td></tr></tbody></table>	Mode	Priority Level	Pedestrian	Highest	Bicycle	High	Bus	Medium-High	Truck	Medium	Car	Medium-Low	Scooter	Low	Parking	Lowest	
Mode	Priority Level																	
Pedestrian	Highest																	
Bicycle	High																	
Bus	Medium-High																	
Truck	Medium																	
Car	Medium-Low																	
Scooter	Low																	
Parking	Lowest																	
Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to have high traffic volumes, be a regional cycling route and an OD/OW freight route. Manukau Station/ Metropolitan Centre is expected to attract a high volume of users here.		FOUR LANE FTN ARTERIAL																

Table 5-8: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

Great South Road (Manukau Station Road – Kerrs Road)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that it has key commercial activities which attract people across the region and even across the country. Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to see an increase in the number of cyclists and pedestrians accessing the Manukau City Centre.		FOUR LANE FTN ARTERIAL
Great South Road (Kerrs Road – Browns Road)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the presence of the local centre and the town centre in the area will attract activity across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that the corridor is expected to have high traffic volumes and high multimodal demands which have high strategic function. It also serves as a key north-south route providing access between the south and Manukau.		FOUR LANE FTN ARTERIAL

Table 5-9: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

Great South Road (Browns Road – Northcrest Way)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M3 Place Assessment: The supporting rationale is that the future land use is low density and is likely that this section is visited by people who live in/near the area or by people who are visiting those who live there. Movement Assessment: The rationale for the M3 assessment is that the corridor is expected to have high traffic volumes and high multimodal demands which have high strategic function. It also serves as a key north-south route for general traffic.		THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)
Great South Road (Northcrest Way – Mcannalley St)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the presence of the Manurewa town centre in the area will attract activity across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to have high traffic volumes in the future and high multi-modal demands and will continue to be used as a primary walking and major cycle route. It also serves as a key north-south route for general traffic and provides access to the motorway via Hill Road.		TOWN CENTRE – works within the existing road reserve/ no route protection ALFRISTON ROAD – MCANNALLEY ST: THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)

Table 5-10: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

Great South Road (Mcannalley St – Mahia Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that Te Mahia Station and the industrial businesses in the area will attract activity from across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M2 assessment is that a high volume of road users are expected along this section of road due to proximity to Te Mahia Train Station and the Takaanini interchange.		THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)
Great South Road (Mahia Rd – Manuroa Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the area offers a variety of land use activities which attracts activity from across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that the Takaanini Interchange provides access to the wider strategic network. This section of corridor will likely have high strategic significance and will attract high volumes of users including high multi-modal demands and will continue to be used as a primary walking and major cycle route. This section of corridor provides access to the Southern Path. This corridor will also provide key access to the Takaanini industrial area.		TAKAANINI INTERCHANGE – no change to lane arrangement FOUR LANE FTN ARTERIAL

Table 5-11: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

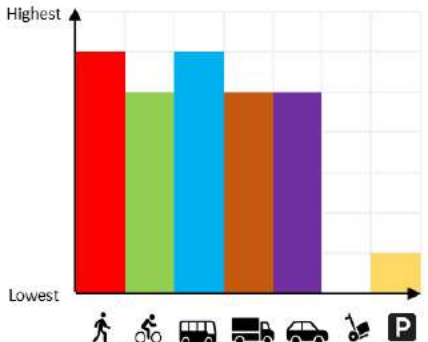
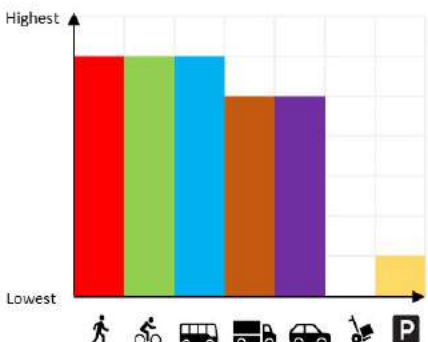
Great South Road (Manuroa Rd – Taka St)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that Takaanini Station will have a sub-regional catchment, attracting activity from across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to have high traffic volumes in the future and high multi-modal demands as it will continue to be used as a primary walking and major cycle route. This section of corridor also provides access to the Takaanini Station and the Conifer Grove residential catchment.		 FOUR LANE FTN ARTERIAL
Great South Road (Taka St – Tironui Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the Takaanini town centre and industrial area offers a variety of land use activities which attracts activity from across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to have high traffic volumes in the future and high multi-modal demands and will continue to be used as a primary walking and major cycle route.		 FOUR LANE FTN ARTERIAL

Table 5-12: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

Great South Road (Tironui Rd – Coles Cres)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M3 Place Assessment: The supporting rationale is that that the future land use enables higher density development (at least 6 storeys. However, this section is likely to be visited by people who live in/ near the area and would predominantly have a local function. Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to have high traffic volumes in the future and high multi-modal demands and will continue to be used as a primary walking and major cycle route.		THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)
Great South Road (Coles Cres – Broadway)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that Papakura Metropolitan Centre is likely to develop and may attract activity from across the region and country. Movement Assessment: The rationale for the M3 assessment is that the corridor will “have high strategic significance with high volume of users”. Walking and cycling are expected to be high in the future due to the Metropolitan Centre zoning, Papakura Train Station and nearby amenities.		THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)

Table 5-13: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

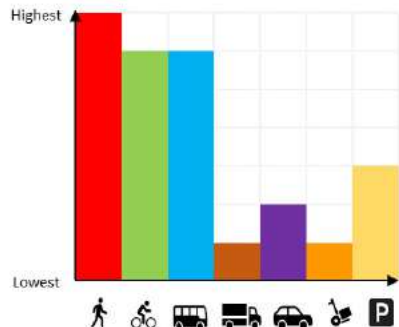
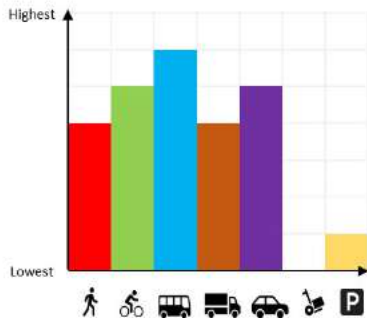
Great South Road (Broadway – Wellington St)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that the future land use around Papakura Town Centre is likely to have higher density development (at least 6 storeys) and may attract activity from across a region. Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to see an increase in the number of cyclists and pedestrians accessing the Papakura Train Station and the nearby amenities in the metropolitan centre.		TOWN CENTRE – works within the road reserve/ no route protection
Great South Road (Wellington St – East St)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M3 Place Assessment: The supporting rationale is that the future land use is low density, and it is likely that this section will be visited by those who live in the area or by people who are visiting those who live there. Movement Assessment: The rationale for the M3 assessment is that this corridor will have high multi-modal demands, high traffic volumes and will continue to be a primary walking and major cycling route. This section of GSR provides resilience in the network as there are limited north-south connections in this part of South Auckland.		 THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)

Table 5-14: RASF and CFAF Mandates Summary – Great South Road FTN (multi-modal connections)

Great South Road (East St – Waihoehoe Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that the future land use around the Drury Central Station and the Town Centre is likely to have higher density development which will attract activity across the region and even across the country. Movement Assessment: The rationale for the M3 assessment is that the corridor will provide access onto the SH1/Drury interchange. This corridor will also support high numbers of pedestrian and cyclists, as well as buses servicing Drury Central Station.		THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)
Great South Road (Waihoehoe Rd – Drury Interchange)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that the future land use around the Drury Central Station and the Town Centre is likely to have higher density development which will attract activity across the region and even across the country. Movement Assessment: The rationale for the M3 assessment is that the corridor will provide access onto the SH1/Drury interchange. This corridor will also support high numbers of pedestrian and cyclists, as well as buses servicing Drury Central Station.		FOUR LANE ARTERIAL FOUR LANE ARTERIAL BRIDGE

Table 5-15: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

Weymouth Road (bus interchange – Great South Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that the future land use around the Manurewa Station and the Town Centre is likely to have higher density development (at least 6 storeys) and may attract activity from across a region. Movement Assessment: The rationale for the M3 assessment is that the corridor will be a key east-west connection for all road users and provides access to the Manurewa bus interchange and train station. It is also expected to have strong multi-modal demands. This corridor also provides a key connection out west to the Roscommon Road key arterial.		FOUR LANE FTN ARTERIAL
Alfriston Road (Great South Rd – Flemmings St)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the presence of the Manurewa town centre will attract activity from across a subregion or neighbouring local board area. Higher density development is also enabled here. Movement Assessment: The rationale for the M3 assessment is that Alfriston Road is a key east-west connection in the network for people to cross SH1. Alfriston Road will have high strategic significance for all modes.		FOUR LANE FTN ARTERIAL

Table 5-16: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

Alfriston Road (Flemmings St – Porchester Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M3 Place Assessment: The supporting rationale is that the presence of the surrounding area is largely residential with a local centre. The area will predominantly have a local function with a small catchment of users. Movement Assessment: The rationale for the M3 assessment is that Alfriston Road is a key east-west connection in the network for people to cross SH1. Alfriston Road will have high strategic significance for all modes. This section of corridor will also provide SH1 access via Claude Road and provides access to the Randwick Park residential area.		FOUR LANE FTN ARTERIAL (Flemmings St – Magicway) THREE LANE FTN ARTERIAL (EASTBOUND BUS ONLY) (Magicway – Porchester Rd)
Porchester Road (Alfriston Rd – Papakura Stream)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the adjacent land use is future urban zone. The surrounding land use is expected to intensify and develop over time, attracting activity from across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that this extent of Porchester Road is expected to be a key north-south route in the future especially for PT (FTN), walking, cycling and general traffic.		TWO LANE ARTERIAL

Alfriston Road (Flemmings St – Porchester Rd)	Future Modal Priority	CFAF Cross-Section
This section also provides an access point to the Takaanini industrial area. Hence, some freight may traverse this section to access the industrial area. Porchester Road has high strategic significance.		

Table 5-17: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

Porchester Road (Papakura Stream – Manuroa Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the adjacent land use is future urban zone and light industrial. The surrounding land use is expected to intensify and develop over time, attracting activity from across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that this extent of Porchester Road is expected to be a key north-south route in the future especially for PT (FTN), walking, cycling and general traffic. This section also provides an access point to the Takaanini industrial area. Hence, some freight may use the northern section to access the industrial area. Porchester Road has high strategic significance.		TWO LANE ARTERIAL
Porchester Road (Manuroa Rd – Walters Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M3 Place Assessment: The supporting rationale is that the presence of the surrounding area is largely residential with a local centre. The area will predominantly have a local function with a small catchment of users. Movement Assessment: The rationale for the M3 assessment is that this extent of Porchester Road is expected to be a key north-south route in the future especially for PT (FTN), walking, cycling and general traffic. Hence, Porchester Road has high strategic significance.		TWO LANE ARTERIAL

Table 5-18: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

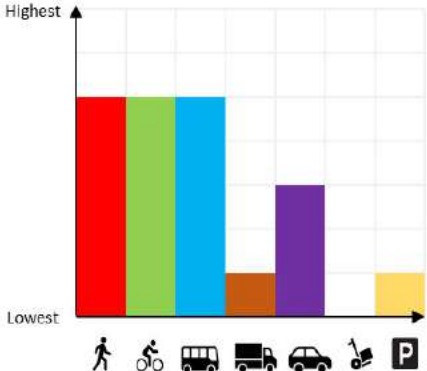
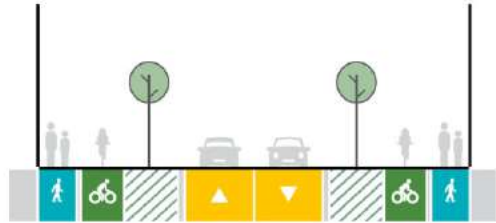
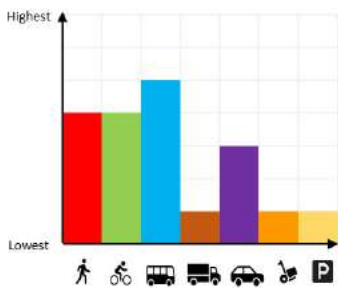
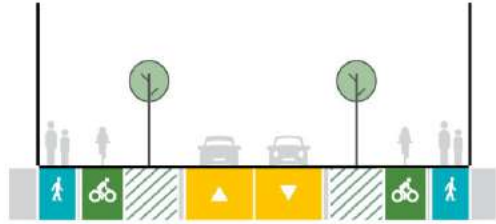
Walters Road (Porchester Rd – Grove Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that Walters Road is adjacent to Bruce Pulman Park which is a key regional sports and recreational centre, attracting activity from across a subregion or neighbouring local board area. Nearby schools will also be a key attractor. Movement Assessment: The rationale for the M3 assessment is that the corridor will support a range of modes: PT (FTN), walking, cycling and private vehicles. Walters Road will be a key east-west connection in the Takaanini network and provides access to the Takaanini town centre. Hence, this connection has medium strategic significance.		 TWO LANE ARTERIAL
Grove Road (Walters Rd – Clevedon Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M3 Place Assessment: The supporting rationale is that the future land use is likely to remain predominantly residential and the adjacent shops/services will have local function with a small catchment of users. Movement Assessment: The rationale for the M3 assessment is that Grove Road will support a range of modes: PT (FTN), walking, cycling and private vehicles, hence, this corridor will have high strategic significance.		 TWO LANE ARTERIAL

Table 5-19: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

Clevedon Road (Grove Rd – Willis Road)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the future surrounding land use is likely to enable higher density development (at least 6 storeys). The two local centres will also likely attract activity from across a subregion or neighbouring local board area in the future. Movement Assessment: The rationale for the M3 assessment is that Clevedon Road is a key east-west connection, providing access to/ from the Papakura Metropolitan Centre and Papakura Train Station.		TWO LANE ARTERIAL
Clevedon Road (Willis Rd – Broadway)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that the future land use around the Papakura Station and the metropolitan centre is likely to have higher density development (at least 6 storeys) and may attract activity from across a region. Movement Assessment: The rationale for the M3 assessment is that Clevedon Road is a key east-west connection, providing access to/ from the Papakura Metropolitan Centre and Papakura Train Station.		TWO LANE ARTERIAL

Table 5-20: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

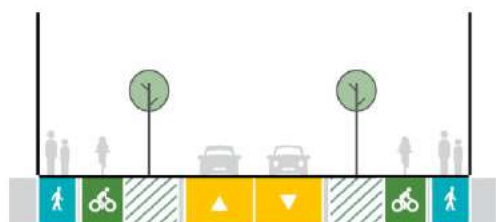
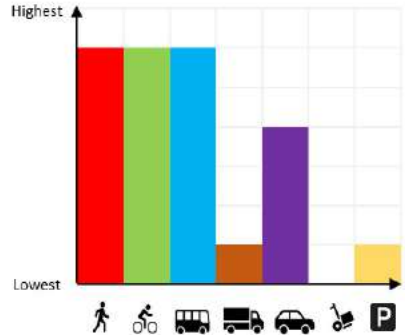
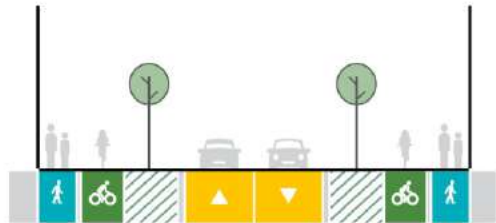
Railway Street West & Wood Street	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that the surrounding Papakura Metropolitan Centre and uplifting in residential zoning will likely attract activity from across the region. Movement Assessment: The rationale for the M3 assessment is that the corridor is likely to see an increase in buses connecting through to the Papakura Train Station. There will likely also be an increase in active mode users accessing the Papakura Train Station in the future, hence these corridors have high strategic significance.		 TWO LANE ARTERIAL
Ōpaheke Road (Great South Rd – Settlement Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M2 Place Assessment: The supporting rationale is that the surrounding residential land use is likely to have higher density development (at least 6 storeys) given the proximity to the Papakura metropolitan centre and the train station. The surrounding schools will likely also attract activity from across a subregion/ neighbouring local board area. Movement Assessment: The rationale for the M2 assessment is that Ōpaheke Road will likely be a key route for buses and connect with Great South Road and the Papakura Metropolitan Centre. The throughput of general traffic and freight will likely be limited through this corridor on the approach to the metropolitan centre.		 TWO LANE ARTERIAL

Table 5-21: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

Settlement Road (Ōpaheke Rd – Onslow Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the surrounding residential land use is likely to have higher density development (at least 6 storeys) given the proximity to the Papakura Metropolitan Centre and the train station. The surrounding schools will likely also attract activity from across a subregion/ neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that Settlement Road is a key east-west connection with a medium strategic significance, connecting to Great South Road, SH1/ Papakura Interchange and further west to Hingaia, Karaka and Kingseat.		TWO LANE ARTERIAL
Settlement Road (Onslow Rd – Hunua Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M3 Place Assessment: The supporting rationale is that the presence of the adjacent neighbourhood centre and school will continue to attract activity from across the subregion or neighbouring local board area. Movement Assessment: The rationale for the M3 assessment is that Settlement Road is a key east-west connection with a medium strategic significance, connecting to Great South Road, SH1/ Papakura Interchange and further west to Hingaia, Karaka and Kingseat.		TWO LANE ARTERIAL

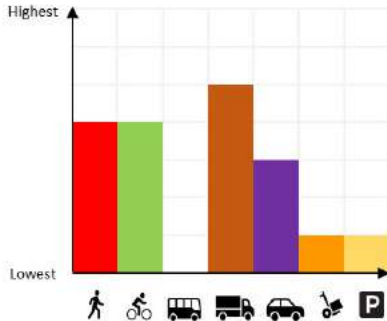
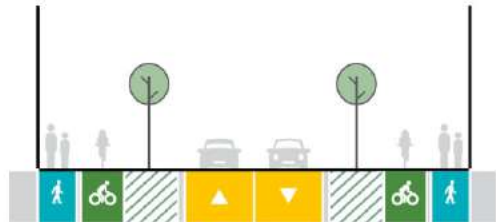
Table 5-22: RASF and CFAF Mandates Summary – Takaanini FTN (multi-modal connections)

Hunua Road (Settlement Rd – Calvert St)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M3 Place Assessment: The supporting rationale is that the surrounding land use is predominantly residential with a local function and a small catchment of users. Movement Assessment: The rationale for the M3 assessment is that the corridor connects with a strategic freight area planned to the south and will attract a high volume of freight and general traffic.		TWO LANE ARTERIAL
Hunua Road (Calvert St – Boundary Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P3/M3 Place Assessment: The supporting rationale is that the surrounding heavy industrial land use will attract freight activity across the region. Movement Assessment: The rationale for the M3 assessment is Hunua Road will connect further south to the Drury/ Ōpaheke area, via the new Ōpaheke N-S connection. This connection will have a high strategic significance with a higher volume of freight and general traffic.		TWO LANE ARTERIAL

Table 5-23: RASF and CFAF Mandates Summary – Popes Road urbanisation (multi-modal connections)

Popes Road (Takaanini School Rd – Porchester Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P2/M2 Place Assessment: The supporting rationale is that the surrounding Takaanini industrial zone is likely to develop and attract activity from across a subregion or neighbouring local board area. Movement Assessment: The rationale for the M2 assessment is that the corridor is likely to provide a connection between strategic routes and subregions. There is likely to be an increase in freight along this route accessing the Takaanini industrial area.		
Popes Road (Porchester Rd – Mill Rd)	Future Modal Priority	CFAF Cross-Section
Future Typology: P1/M2 Place Assessment: The supporting rationale is that the surrounding future urban zoned area is likely to be predominantly low density residential with potential local/ neighbourhood centres and a small catchment of users. Movement Assessment: The rationale for the M2 assessment is that this section of Popes Road will support a range of modes: walking, cycling, private vehicles, freight and connector PT services. Popes Road also serves as a key east-west connection between Mill Road (strategic corridor) and the Takaanini industrial area. There is likely to be an increase in all road users along this route as the adjacent future urban zone and Takaanini industrial area develop over time.		

Table 5-24: RASF and CFAF Mandates Summary – Croskery Road urbanisation (multi-modal connections)

Croskery Road	Future Modal Priority	CFAF Cross-Section																
Future Typology: P2M1																		
Place Assessment: The supporting rationale is that the future land use will remain industrial and this Papakura industrial area may attract activity from across a subregion or neighbouring local board area.	 <table><caption>Future Modal Priority Data (Estimated)</caption><thead><tr><th>Mode</th><th>Priority Level</th></tr></thead><tbody><tr><td>Pedestrian</td><td>High</td></tr><tr><td>Bicycle</td><td>High</td></tr><tr><td>Bus</td><td>Medium-High</td></tr><tr><td>Truck</td><td>Medium</td></tr><tr><td>Car</td><td>Low</td></tr><tr><td>Motorcycle</td><td>Low</td></tr><tr><td>Parking (P)</td><td>Low</td></tr></tbody></table>	Mode	Priority Level	Pedestrian	High	Bicycle	High	Bus	Medium-High	Truck	Medium	Car	Low	Motorcycle	Low	Parking (P)	Low	 TWO LANE ARTERIAL
Mode	Priority Level																	
Pedestrian	High																	
Bicycle	High																	
Bus	Medium-High																	
Truck	Medium																	
Car	Low																	
Motorcycle	Low																	
Parking (P)	Low																	

5.2.6 Intersection Form and Function

A process was undertaken to identify likely future intersection form and function for the South FTN DBC package of corridors. 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.

For the purposes of the intersection assessment the following factors were considered:

- Safety
- Transport network function (movement) and land use function (place)
- Form and Level of Service (LOS) / Quality of service required for different modes
- Land use integration
- Site specific constraints
- Design constraints
- Roundabout vs signals guidance
- Network staging and route protecting
- Future land use assumptions
- Future transport network assumptions

For each intersection control chosen, design features were also considered to ensure that the intersection meets the needs of different users safely and effectively and responds to the site-specific factors. The guidance adopts a 'Safe System' 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 considered appropriate for example due to engineering constraints, bus priority implications or land use implications, signalised intersections were then considered.

There are many intersections along the FTN corridors and these intersections were filtered to identify where intersection works are recommended for the function of the FTN. Through this filtering process, 37 key intersections were identified within the extents of the South FTN corridors. These intersections have been selected to address four principles:

- Provide for **efficient and more reliable bus services** – reducing the number of intersections that would cause disruption to the bus through moment. Spacing between proposed signalised intersections were considered.
- Provide **safe crossing points for pedestrians and cyclists** to access the public transport network and connect to amenities based on the desirable walking catchment (400m – 800m).
- Consider **site specific safety concerns** such as poor visibility, horizontal/ vertical grade issues and existing uncontrolled intersections at cross roads.
- Connecting **side road factors** such as volume, complexity and corridor hierarchy (arterial, collector and local road) while also considering whether the side road will likely provide access to key destinations such as schools, stations and the wider strategic network.

Intersections with local roads are generally priority-controlled and are assumed they will remain priority-controlled in the future. Based on this assessment, the 37 key intersections are recommended as either a roundabout or signalised intersection.

SIDRA modelling was undertaken to assess the impacts of the intersection form on the wider network. It should be noted that in some cases modelling constraints resulted in limited turning volumes. In these cases, high level assumptions on likely turning movements were utilised.

Figure 5-2 indicates the location and forms of the intersections analysed and proposed for modification.

Table 5-25 provides a summary of the existing and recommended intersection forms. Appendix 2 offers a summary of the proposed intersection forms that were tested along with the associated SIDRA modelling results for the 2048+ long term future network.

Figure 5-2: South FTN indicative proposed intersection forms



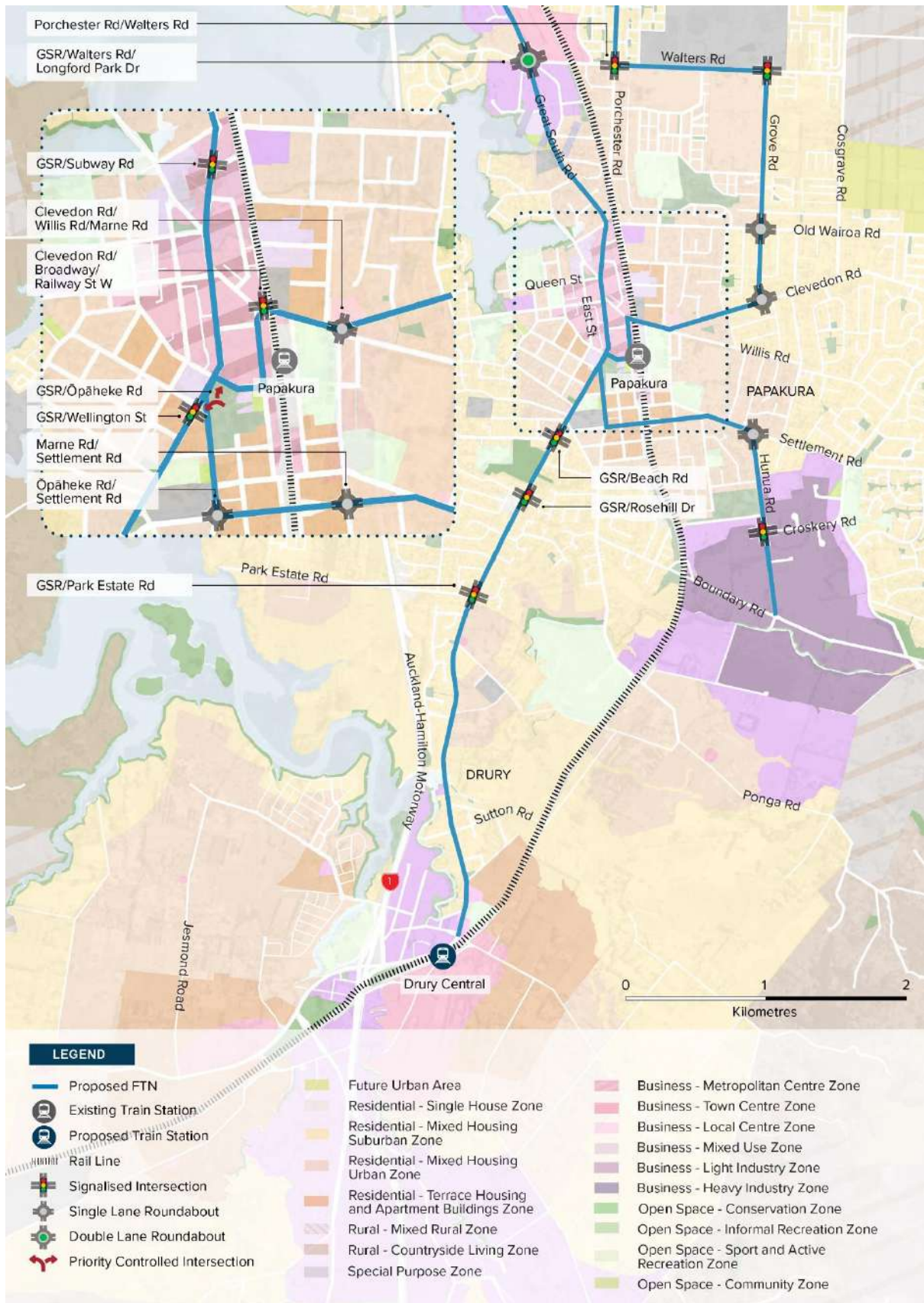


Table 5-25: Intersection summary

Intersection	Reason for key intersection	Existing intersection form	Recommended intersection form
Great South Road FTN			
Great South Road / Manukau Station Road / Redoubt Road	Key arterials intersecting, SH1 access	Signals	Signals
Great South Road / SH1 Offramp	SH1 access	Signals	Signals
Great South Road / Kerrs Road / Pacific Events Centre Drive	Key arterials intersecting	Signals	Signals
Great South Road / Browns Road / Orams Road	Key arterials intersecting	Signals	Signals
Greta South Road / Grand Vue Road	SH1 access, safety concerns for rat-running	Priority (stop)	Signals
Great South Road / Hill Road / Station Road	SH1 access	Signals	Signals
Great South Road / Weymouth Road / Alfriston Road	Key FTN routes and arterials intersecting	Signals with bus priority	Signals
Great South Road / Mcannalley Street	Alternative to Myers Rd (due to significant engineering constraint)	Priority (stop)	Signals
Great South Road / Mahia Road	Key arterials intersecting	Signals with bus priority	Signals
Great South Road / Taka Street / Walter Stevens Drive	Key arterials intersecting	Signals	Signals
Great South Road / Walters Road / Langford Park Drive / Inlet Road	Key arterials intersecting, safety concerns	Dual lane roundabout	Dual lane roundabout
Great South Road / Subway Road	Key arterials intersecting, 11,000 vpd (current)	Signals	Signals
Great South Road / Wellington Street	General traffic/ freight bypass route via Wellington St	Signals	Signals

Intersection	Reason for key intersection	Existing intersection form	Recommended intersection form
Great South Road / Beach Road	Key arterials intersecting, key E-W connection	Signals	Signals
Great South Road / Rosehill Drive	Rosehill Dr is part of the future indicative bus network	Priority (stop)	Signals
Great South Road / Park Estate Road	Links to a motorway crossing and Hingaia 1 development area	Priority (stop)	Signals
Takaanini FTN			
Weymouth Road / Manurewa Bus Interchange	Key bus movement out of interchange	Priority (stop)	Signals
Alfriston Road / Claude Road	SH1 access, 12,000 vpd (current daily volume)	Signals	Signals
Alfriston Road / Scotts Road	Reconfigured and assessed due to the construction of the SH1 bridge	Priority (stop)	Signals
Alfriston Road / Magic Way	Part of the future indicative bus network (buses turn into Magicway)	Signals	Signals
Alfriston Road / Porchester Road	Key arterials intersecting, buses turn right	Signals	Signals
Porchester Road / Popes Road	Key E-W connection to Mill Road/ Takaanini industrial area	Priority (stop)	Dual lane roundabout
Porchester Road / Manuroa Road	SB buses expected to turn onto Manuroa Rd to tie into Takaanini Station	Single lane roundabout	Single lane roundabout
Porchester Road / Airfield Road	Key arterials intersecting. Key E-W connection to Ardmore/ Clevedon	Single lane roundabout	Single lane roundabout
Porchester Road / Kauri Heart Avenue	SB buses expected to turn right out of Kauri Heart Ave after looping into the Station.	Signals	Signals
Porchester Road / Walters Road	Key arterials intersecting, buses turning	Single lane roundabout	Signals
Walters Road / Grove Road	Buses turning	Priority (give way)	Signals

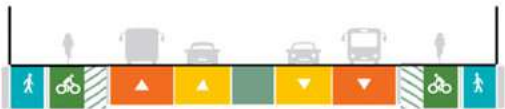
Intersection	Reason for key intersection	Existing intersection form	Recommended intersection form
Grove Road / Old Wairoa Road	Safety concerns at current priority-controlled cross-roads	Priority (stop)	Single lane roundabout
Grove Road / Clevedon Road	Buses turning	Priority (stop)	Single lane roundabout
Clevedon Road / Marne Road / Willis Road	Key arterials intersecting, key E-W connection	Single lane roundabout	Single lane roundabout
Clevedon Road / Broadway	Buses turning	Signals	Signals
Great South Road / Ōpaheke Road	Buses turning	Priority (stop)	Priority (stop)
Ōpaheke Road / Settlement Road	Buses turning	Signals	Single lane roundabout
Settlement Road / Marne Road	Safety concern (x-roads), 13,000 vpd on Marne secondary arterial (current)	Single lane roundabout	Single lane roundabout
Settlement Road / Hunua Road	Buses turning	Priority (give way)	Single lane roundabout
Croskery Road / Hunua Road	Part of the urbanisation of Croskery Road	Priority (give way)	Signals
Popes Road Urbanisation			
Popes Road / Takaanini School Road	Freight expected to turn into the Takaanini industrial area	Priority (give way)	Single lane roundabout

Appendix 1: Form and Function South FTN Corridors

Form & Function for South FTN Corridors

Great South Road FTN

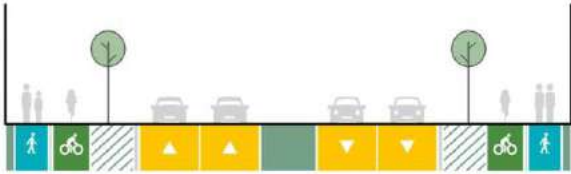
Section 1a: Manukau Station Road	CFAF Summary
 FOUR LANE FTN ARTERIAL	Purpose of Corridor: Manukau Station Road serves a number of bus routes and provides access to a major bus and rail interchange/ hub. This link provides access to the Manukau city centre and to the state highway network.
	General Vehicle Volume: ADT 18,700 in 2048+
	Priority Vehicle: 16 buses per hour (each direction) under indicative 2048 AT bus network
	Freight: OW/OD route. Not considered to have a key strategic freight role.
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 4 (Yes/ None)
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Regional cycle route.
	Speed Environment: 60km/h
	Parking and Access: Limited access; no parking

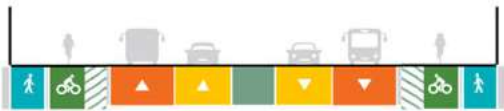
Section 1b: GSR – Manukau Station Road to Browns Road	CFAF Summary
 FOUR LANE FTN ARTERIAL	Purpose of Corridor: Primary north-south arterial providing access to Manukau City Centre and serving a number of bus routes.
	General Vehicle Volume: ADT 23,900 in 2048+
	Priority Vehicle: 14 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 3 freight route.
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 4 (Yes/ None)
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Regional cycle route.
	Speed Environment: 60km/h

Section 1b: GSR – Manukau Station Road to Browns Road	CFAF Summary
	Parking and Access: Limited access; no parking

Section 1c: GSR – Browns Rd to Northcrest Way	CFAF Summary
 THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)	Purpose of Corridor: Primary arterial providing access to the adjacent residential areas and providing a connection between Manukau City Centre and Manurewa Town Centre.
	General Vehicle Volume: ADT 14,700 in 2048+
	Priority Vehicle: 10 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 3 freight route.
	Vehicle Lanes Total: Two general traffic lanes, one northbound bus lane.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Regional cycle route.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 2: GSR – Weymouth Rd to Te Napi Drive	CFAF Summary
 THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)	Purpose of Corridor: Primary arterial providing access to the adjacent residential areas and to the Te Mahia Train Station.
	General Vehicle Volume: ADT 17,100 in 2048+
	Priority Vehicle: 10 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 3 freight route. Provides access to the Te Mahia industrial area.
	Vehicle Lanes Total: Two general traffic lanes, one northbound bus lane.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Regional cycle route.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 3: Interchange area (Te Napi Dr to Manuroa Rd)	CFAF Summary
RETAIN EXISTING LAYOUT AT THE INTERCHANGE  FOUR LANE ARTERIAL	Purpose of Corridor: Primary arterial providing access to the Takaanini interchange and access to the State Highway 1 network. Section to the south provides access to the Takaanini industrial area.
	General Vehicle Volume: ADT 40,900 in 2048+
	Priority Vehicle: 6 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 1B freight route. Provides access to the Takaanini industrial area.
	Vehicle Lanes Total: Retain existing lane arrangement at the interchange. The section of corridor south of the interchange to Manuroa Road is proposed to remain as four general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Shared use path at the interchange. This section provides access to the Southern Path regional cycleway.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 4a: Manuroa Rd to Tironui Road	CFAF Summary
 FOUR LANE FTN ARTERIAL	Purpose of Corridor: Primary arterial providing access to the Takaanini Town Centre and Train Station.
	General Vehicle Volume: ADT 23,700 in 2048+
	Priority Vehicle: 6 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 1B freight route.
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 4 (Yes/ None)

Section 4a: Manuroa Rd to Tironui Road	CFAF Summary
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Major cycle route.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 4b: Tironui Road to Coles Cres	CFAF Summary
 THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)	Purpose of Corridor: Primary arterial providing a connection between the Takaanini town centre and the Papakura metropolitan centre.
	General Vehicle Volume: ADT 26,300 in 2048+
	Priority Vehicle: 6 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 1B freight route.
	Vehicle Lanes Total: Two general traffic lanes, one northbound bus lane.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Major cycle route.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 5a: GSR – Wellington St to Park Estate Rd	CFAF Summary
 THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)	Purpose of Corridor: Primary arterial providing a connection to the Papakura metropolitan centre, and access to the adjacent residential catchment. This is a crucial link providing suburban connectivity between Papakura and Drury.
	General Vehicle Volume: ADT 15,600 in 2048+
	Priority Vehicle: 10 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 3 freight route.
	Vehicle Lanes Total: Two general traffic lanes, one northbound bus lane.

Section 5a: GSR – Wellington St to Park Estate Rd	CFAF Summary
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Major cycle route.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 5b: GSR – Park Estate Rd to Drury	CFAF Summary
 THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY)	Purpose of Corridor: Primary arterial providing a connection to the Drury metropolitan centre, and access to the adjacent residential catchment. This is a crucial link providing suburban connectivity between Papakura and Drury.
	General Vehicle Volume: ADT 19,700 in 2048+
	Priority Vehicle: 10 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OW/OD route. Level 3 freight route.
	Vehicle Lanes Total: Two general traffic lanes, one northbound bus lane.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Major cycle route.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Takaanini FTN

Section 6a: Weymouth Rd	CFAF Summary
 FOUR LANE FTN ARTERIAL	Purpose of Corridor: Key east-west connection, providing access to the Manurewa Town Centre, rail station and bus interchange hub. Crucial link in the PT network as it serves a number of key bus services and ties into the Manurewa bus interchange.
	General Vehicle Volume: ADT 15,100 in 2048+
	Priority Vehicle: 22 - 26 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OD route. Not a significant freight route.
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 4 (Yes/ None)
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 6b: Alfriston Road – Weymouth Rd to Magic Way	CFAF Summary
 FOUR LANE FTN ARTERIAL	Purpose of Corridor: Key east-west connection, providing access to the Manurewa Town Centre and rail station. Crucial link and connection over SH1. Alfriston Road is the key east-west PT connection in Takaanini network.
	General Vehicle Volume: ADT 18,000 in 2048+
	Priority Vehicle: 16 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OD/ OW route. Not a significant freight route.
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 4 (Yes/ None)

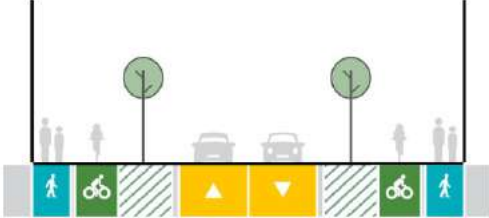
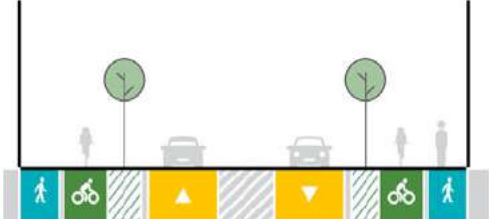
Section 6b: Alfriston Road – Weymouth Rd to Magic Way	CFAF Summary
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

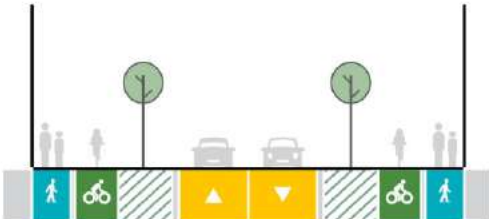
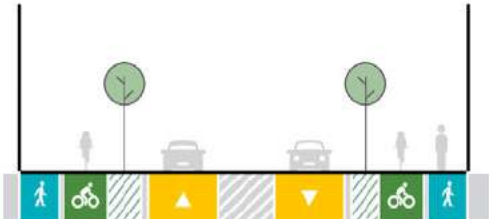
Section 6c: Alfriston Rd (Magic Way to Porchester Road)	CFAF Summary
 THREE LANE FTN ARTERIAL (EASTBOUND BUS ONLY)	Purpose of Corridor: Key east-west connection, providing access to the Randwick Park area and the Takaanini area. Alfriston Road is the key east-west PT connection in Takaanini network.
	General Vehicle Volume: ADT 11,400 in 2048+.
	Priority Vehicle: 12 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OD/ OW route. Not a significant freight route.
	Vehicle Lanes Total: Two general traffic lanes, one northbound bus lane.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

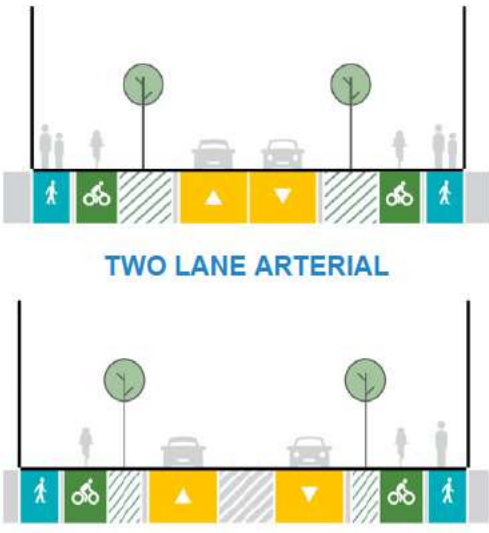
Section 7: Porchester Rd (Alfriston Road – Manuroa Road)	CFAF Summary
	Purpose of Corridor: Key north-south connection, providing access to the Randwick Park, Takaanini area and the Takaanini industrial area. This corridor serves the adjacent FUZ and existing brownfield area.

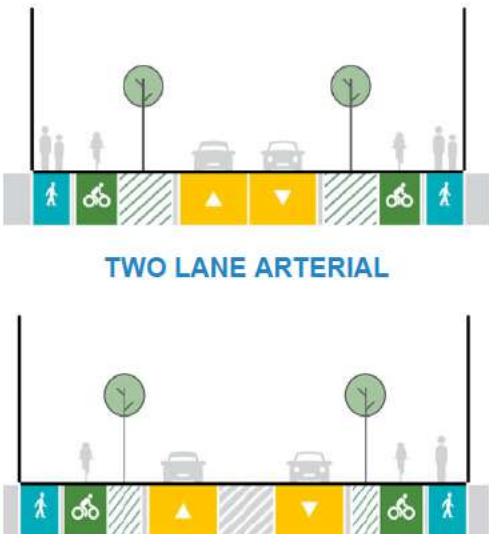
Section 7: Porchester Rd (Alfriston Road – Manuroa Road)	CFAF Summary
 TWO LANE ARTERIAL	General Vehicle Volume: ADT 15,600 in 2048+.
	Priority Vehicle: 6 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: OD route. Not a significant freight route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

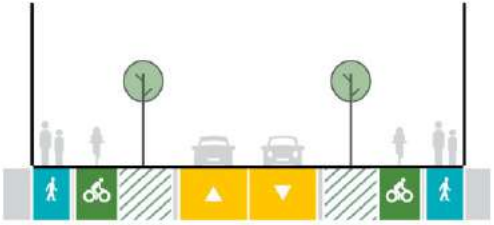
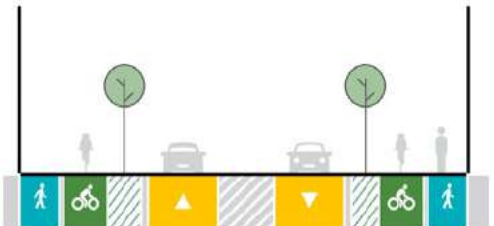
Section 8: Porchester Road (Manuroa Road to Walters Road)	CFAF Summary
 TWO LANE ARTERIAL  TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Key north-south connection providing access to the adjacent residential catchment in Takaanini.
	General Vehicle Volume: <u>Porchester Road:</u> ADT 17,600 in 2048+
	Priority Vehicle: 8 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Not a key freight route. Porchester Road is an OD route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

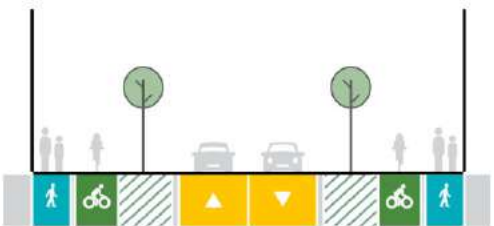
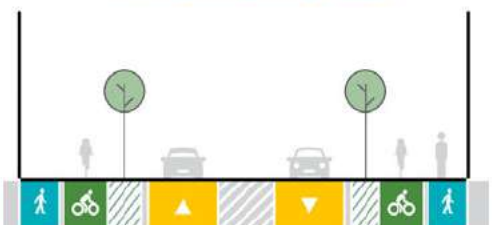
Section 8: Walters Road	CFAF Summary
 TWO LANE ARTERIAL  TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Important strategic connection for resilience and improved walking and cycling connection. Key east-west connection as the adjacent east-west connections are not in close proximity. Provides access to the Bruce Pulman Park which is a key attractor.
	General Vehicle Volume: <u>Walters Road</u>: ADT 17,600 in 2048+
	Priority Vehicle: 6 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Not a key freight route. Porchester Road is an OD route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

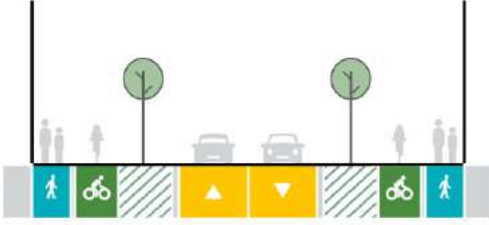
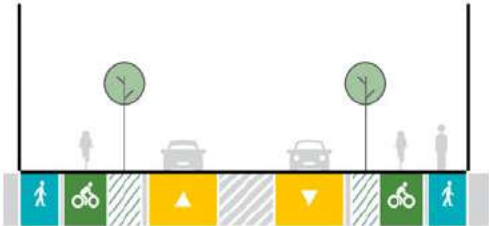
Section 8: Grove Road	CFAF Summary
 TWO LANE ARTERIAL  TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Key north-south route through Takaanini
	General Vehicle Volume: <u>Grove Road</u>: ADT 7,100 in 2048+
	Priority Vehicle: 6 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Not a key freight route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 8: Clevedon Road/ Broadway	CFAF Summary
 TWO LANE ARTERIAL TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Key east-west route providing access to the Papakura Metropolitan Centre and Papakura Train Station.
	General Vehicle Volume: <u>Clevedon Road/ Broadway:</u> ADT 12,300 in 2048+
	Priority Vehicle: 6 - 9 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Not a key freight route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

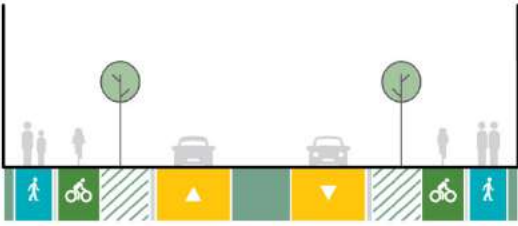
Section 9: Railway Street West	CFAF Summary
 TWO LANE ARTERIAL TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Key connection to the Papakura Train Station and bus interchange. Many bus services tie in at the station here.
	General Vehicle Volume: <u>Railway Street West:</u> ADT 5,600 in 2048+
	Priority Vehicle: 18 - 23 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Not a key freight route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 9: Ōpaheke Road	CFAF Summary
 TWO LANE ARTERIAL  TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Key bus route to connect to the Papakura Metropolitan Centre and Papakura Train Station.
	General Vehicle Volume: <u>Ōpaheke</u>: ADT 6,700 in 2048+
	Priority Vehicle: 10 - 14 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Not a key freight route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

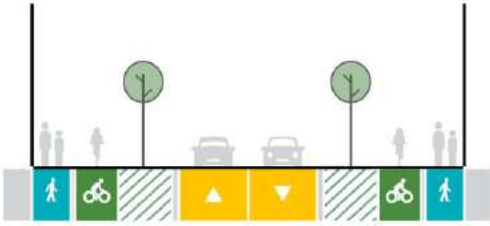
Section 9: Settlement Road	CFAF Summary
 TWO LANE ARTERIAL  TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Key east-west route providing access to Great South Road and the Papakura SH1 Interchange.
	General Vehicle Volume: <u>Clevedon Road/ Broadway</u>: ADT 13,900 in 2048+
	Priority Vehicle: 6 - 8 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Key freight route with Level 1B.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

Section 9: Hunua Road	CFAF Summary
 The diagram shows a cross-section of a 'TWO LANE ARTERIAL' road. From left to right, it features a blue sidewalk with a pedestrian icon, a green cycle lane with a bicycle icon, a yellow hatched area, a yellow lane with an upward-pointing triangle, a yellow lane with a downward-pointing triangle, another yellow hatched area, a green cycle lane with a bicycle icon, and a blue sidewalk with a pedestrian icon. Trees and cars are shown in the travel lanes. TWO LANE ARTERIAL  The diagram shows a cross-section of a 'TWO LANE ARTERIAL (ALTERNATIVE)' road. From left to right, it features a blue sidewalk with a pedestrian icon, a green cycle lane with a bicycle icon, a yellow hatched area, a yellow lane with an upward-pointing triangle, a yellow lane with a downward-pointing triangle, another yellow hatched area, a green cycle lane with a bicycle icon, and a blue sidewalk with a pedestrian icon. Trees and cars are shown in the travel lanes. TWO LANE ARTERIAL (ALTERNATIVE)	Purpose of Corridor: Key north-south route providing access to the Papakura industrial area. This link connects further through the Ōpaheke North-South arterial.
	General Vehicle Volume: Hunua Road: ADT 16,300 in 2048+
	Priority Vehicle: 6 buses per hour (each direction) under indicative 2048 AT bus network.
	Freight: Key freight route providing access to the Papakura industrial area. Level 2 and 3 freight route.
	Vehicle Lanes Total: Two general traffic lanes.
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor.
	Speed Environment: 50km/h
	Parking and Access: Limited access; no parking

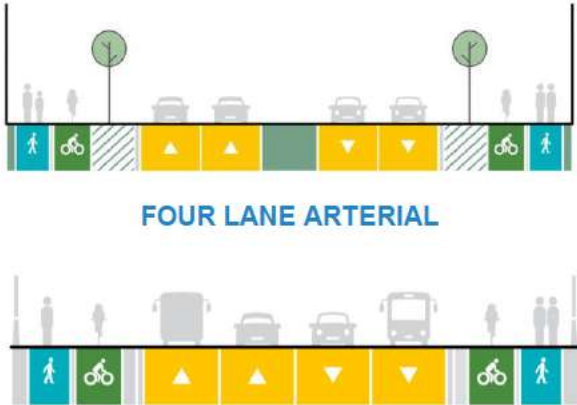
Popes Road urbanisation

Popes Road (Takaanini School Road – Mill Road)	CFAF Summary
 TWO LANE ARTERIAL	Purpose of Corridor: Provides access to the adjacent FUZ, key strategic Mill Road arterial, and the Takaanini industrial area. Key walking and cycling connection providing access to employment in the future, given the expected increase in jobs in the Takaanini industrial area.
	General Vehicle Volume: <u>Popes Road (FUZ section):</u> 5,700 <u>Popes Road (industrial section):</u> 13,600
	Priority Vehicle: expected to provide for connector PT services
	Freight: <u>Popes Road (FUZ section):</u> Level 3 route. OD/OW route. <u>Popes Road (industrial section):</u> Level 2 freight route. Key freight connection in the Takaanini industrial area
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 2 (None/ None)
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor
	Speed Environment: 50km/h
	Parking and Access: Limited access, no parking

Croskery Road Urbanisation

Croskery Road (Hunua Road – Dominion Road)	CFAF Summary
 TWO LANE ARTERIAL	Purpose of Corridor: Provides for the integration with future upgrades; Mill Road and FTN corridor. Provides a better connection between the communities by adding a new active mode corridor.
	General Vehicle Volume: 5,000
	Priority Vehicle: no buses expected on this corridor
	Freight: Part of AT's Level 2 freight network – adjacent to industrial area
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 2 (None/ None)
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor
	Speed Environment: 50km/h
	Parking and Access: Limited access, no parking

Great South Road, Drury corridor upgrade

Great South Road (Waihoehoe Road – Drury Interchange)	CFAF Summary
 FOUR LANE ARTERIAL FOUR LANE ARTERIAL BRIDGE	Purpose of Corridor: Provides an important connection to the Drury Central Station and metropolitan centre. This corridor also provides access to the strategic network.
	General Vehicle Volume: 12,000 – 19,000. The location and role of this corridor in the wider network, with providing motorway access, suggests that creating a bottleneck at the two-lane bridge would be undesirable.
	Priority Vehicle: potential route for buses, however, is not an FTN route.
	Freight: Existing OW/OD route, key strategic freight role.
	Vehicle Lanes Total (Priority Lanes / PT Priority at Intersections): 4 general traffic lanes (None/ None)
	Active Modes: Separated cycle lanes and footpaths on both sides of the corridor. Connects into walking and cycling facilities proposed to the north and south.
	Speed Environment: 50km/h
	Parking and Access: Limited access and no parking

Appendix 2: Intersection Methodology and Performance Summary

Intersection Proforma Guidelines

Table A2.1: Suitability of types of traffic control to different road types based on operational and Safe Systems objectives¹⁴

Corridor type	Arterial (80kph)	Arterial (50kph)	Collector	Local
Roundabouts				
Arterial (80kph)	L	L	M	U
Arterial (50kph)	L	L	L	U
Collector	M	L	L	M
Local	U	U	M	M
Signalised				
Arterial (80kph)	M	M	M	U
Arterial (50kph)	M	M	M	U
Collector	M	M	U	U
Local	U	U	U	U
Stop signs or give way signs				
Arterial (80kph)	U	U	M*	L*
Arterial (50kph)	U	U	M	L
Collector	M*	M	L	L
Local	L*	L	L	L

Legend:

L = Likely to be an appropriate treatment

M = May be an appropriate treatment

U = Unlikely to be an appropriate treatment

Inside bold area = intersections considered in Te Tupu Ngātahi network

*Likely to be controlled right turns

The below table is designed as a “quick reference” guide and should not be treated as definitive. For example, any proposed signalised intersection in a rural area will be labelled as “unlikely” to be an appropriate type of treatment. This does not automatically preclude it as a possible treatment since most issues can be “engineered out”, albeit at a cost.

¹⁴ Source: Adapted from WA, Roundabout and Traffic Signals: Guidelines for the Selection of Intersection Control, 2015

Table A2.2: Site specific factors and form of control choice¹⁵

Site specific factors	Roundabouts	Signals
Physical Controls		
Number of intersection legs	M – Up to maximum of 6	M – Up to maximum 4
Number of through/ circulating lanes if roundabout (use SIDRA to determine number of lanes needed to achieve desired LOS. Does 1 lane work?)	L – 1 M – 2 U – 3 – subject to design	L – Up to 3 (if was roundabout)
Space available (work with designer to determine suitability using SIDRA layout and standard intersection design)	M/U – subject to design (may be difficult in existing urban areas)	M – subject to design
Site topography (work with designer to determine suitability using SIDRA layout and standard intersection design)	M/U – subject to design (may be difficult in hilly terrains)	M – subject to design
Access to adjacent properties	M – subject to design (can assist with allowing u-turns)	M – subject to design
Road Environment		
Land Use: - Rural area - Urban – Low density - Urban – Med/ High density	L L L	U (M – if 3-leg) M L
Gateway area (e.g. rural/ urban transition, approach to town centre, amenity features)	L	M
High speed approaching traffic	L - with design features to control approach speed	U (M – if 3-leg, may consider with 80 km/h speed limit & warning signs /flashing lights & other design features)

Road Users	Roundabouts	Signals
Pedestrian needs: - Vulnerable users - High pedestrian flows	M – single lane and raised pedestrian crossing facility (may need pedestrian signals for vulnerable users) U – multi-lane unless grade separated or signalised pedestrian crossing (*see	M – single lane L – multi-lane

¹⁵ Source: Adapted from WA, Roundabout and Traffic Signals: Guidelines for the Selection of Intersection Control, 2015

Road Users	Roundabouts	Signals
	below for criteria to determine if either option appropriate)	
People on bikes - Vulnerable users - On primary/ secondary cycle network - Recreational route – either high use or designated	L – single lane with low speed design & off-road raised crossing option U – multi-lane unless grade-separated* or signalised cyclist crossing** *Consider grade-separation active modes where: - Higher speed environment - Rural/ semi-rural area - High movement function & low place function - High ped movements & significant land use e.g. train station - Topography & space available is suitable **AT considers that signalised ped/cyclist crossings are more desirable and only consider grade-separation by exception	M – single lane as long as cyclist protection provided L – multi-lane as long as cyclist protection provided
Needs of large vehicles	M – may be difficult with high volumes & high % heavies, but could help minimise braking	L- subject to design for turning and conflict with cyclists

Traffic Management	Roundabouts	Signals
Route or area strategies: - Adjacent to linked signals - Isolated locations - Adjacent sites controlled with roundabouts - Control of traffic through a local area e.g. to reduce rat-running, allow for gaps in traffic, manage traffic flow	U L L U	L M M L
Traffic volumes and capacity - Balanced flows - Unbalanced flows - Significant turning volumes	L M – with metering signals L	M M M – with adequate turn lane capacity

Traffic Management	Roundabouts	Signals
Minimising off-peak delays	L	U
Public transport (Light Rail) Trams - Bus lane/ priority lanes on corridor - Bus priority needed on intersection approach - Adjacent to a railway level crossing	U M – if LOS acceptable for 2-lane circulating roundabout (terminate bus/ priority lane in advance of roundabout) U U	L L L L

Legend:

L = Likely to be an appropriate treatment

M = May be an appropriate treatment

U = Unlikely to be an appropriate treatment

Intersection Operational Performance

Table A2.3: Intersection SIDRA Results – 2048+ model year

Intersection Summary											
Intersection	Proposed Form	AM			IP			PM			Commentary
		LOS	DOS	Delay (s)	LOS	DOS	Delay (s)	LOS	DOS	Delay (s)	
Great South Road FTN											
Great South Road / Manukau Station Road / Redoubt Road	Signals	C	0.80	24.5	E	1.03	70.9	F	1.51	377.9	Layout remains as existing with bus jump included on Manukau Station Road and Great South Road (south). Congestion is evident during all peaks as per existing.
Great South Road / SH1 Offramp	Signals	B	0.69	19.6	C	0.81	22.2	B	0.77	15.1	Acceptable
Great South Road / Kerrs Road / Pacific Events Centre Drive	Signals	E	0.99	71.2	D	0.82	45.6	D	0.97	38.9	Layout remains as existing in addition to bus lanes on Great South Road departure sides. Congestion is evident during all peaks.
Great South Road / Browns Road / Orams Road	Signals	D	0.99	42.2	C	0.86	29.5	D	0.96	52.4	Layout remains as existing without the left slip lane on Orams Road. The performance for bus movements are considered acceptable.
Greta South Road / Grand Vue Road	Signals	B	0.57	17.9	B	0.42	13.9	B	0.42	18.3	Acceptable

Intersection Summary

Great South Road / Station Road	Signals	C	0.87	29.8	B	0.75	19.4	F	1.22	158.6	Layout remains as existing with congestion evident in PM peak period.
Great South Road / Hill Road	Signals	D	0.85	36.1	B	0.51	15.4	C	0.83	31.4	Acceptable
Great South Road / Weymouth Road / Alfriston Road	Signals	D	0.98	54.1	D	0.99	38.5	D	0.92	49.1	The intersection is congested as existing during all peak periods. Footprint is widened to accommodate for congestion with bus route LOS a C.
Great South Road / Mcannalley Street	Signals	C	0.88	23.8	B	0.75	16.4	B	0.76	15.4	Acceptable
Great South Road / Mahia Road	Signals	C	0.92	33.3	D	0.96	51.8	C	0.85	22.6	Acceptable for bus routes as LOS is at worst a C. Mahia Road LOS is an E during the inter peak which skews the intersection rating,
Great South Road / Taka Street / Walter Stevens Drive	Signals	D	0.89	47.0	D	0.93	49.8	C	0.84	33.0	Layout remains as existing however without the left slip lane on Walter Stevens Drive. Bus lanes are provided on approach and departure of Great South Road. AM and inter peak periods result in LOS E for right turns on Great South Road, Walter Stevens Drive and Taka Street. For bus lanes, the worst case LOS is LOS D on Great South Road (north). This intersection is congested as existing.

Intersection Summary

Great South Road / Walters Road / Langford Park Drive / Inlet Road	Dual lane roundabout	A	0.52	6.1	B	0.67	10.6	B	0.83	19.8	Acceptable
Great South Road / Subway Road	Signals	C	0.72	22.3	C	0.68	22.1	C	0.74	23.1	Acceptable
Great South Road / Wellington Street	Signals	A	0.38	9.1	A	0.37	8.9	B	0.80	12.0	Acceptable
Great South Road / Beach Road	Signals	C	0.81	30.0	C	0.89	26.8	D	0.96	44.2	Acceptable. Bus route PM LOS is a C on Great South Road (north) and a B on Great South Road (south). Intersection LOS D is based on Beach Road and Settlement Road LOS D as well as second through route on Great South Road (north).
Great South Road / Rosehill Drive	Signals	B	0.57	11.2	B	0.63	11.5	C	0.95	34.5	Acceptable
Great South Road / Park Estate Road	Signals	B	0.68	16.3	B	0.68	17.2	B	0.77	18.9	Acceptable

Takaanini FTN

Intersection Summary

Alfriston Road / Claude Road	Signals	C	0.92	31.1	B	0.65	18.2	C	0.90	26.2	Acceptable
Alfriston Road / Scotts Road	Signals	B	0.73	14.7	B	0.69	14.2	C	0.89	23.8	Acceptable
Alfriston Road / Magic Way	Signals	B	0.61	17.0	B	0.57	18.3	C	0.82	21.4	Acceptable
Alfriston Road / Porchester Road	Signals	D	0.94	37.8	C	0.77	23.1	C	0.99	53.5	Intersection layout is similar to existing; however, in place of left slip lanes, a dedicated left turn lane is provided. LOS D will affect right turns onto Porchester Road; however, the delay only occurs in the AM. Inter peak and PM is suitable for an FTN,
Porchester Road / Popes Road	Dual lane roundabout	D	1.12	39.5	A	0.60	7.8	C	0.98	24.6	Acceptable as AM intersection LOS is skewed by the two southern legs where LOS is C and F. Buses will travel in the left-most through lane which will not be affected by the volume of right-turning vehicles.
Porchester Road / Manuroa Road	Single lane roundabout	A	0.84	9.4	A	0.50	5.8	B	0.79	10.9	Acceptable

Intersection Summary

Porchester Road / Airfield Road	Single lane roundabout	A	0.73	8.0	A	0.48	4.7	A	0.75	7.0	Acceptable
Porchester Road / Kauri Heart Avenue	Signals	C	0.89	31.9	C	0.80	27.3	C	0.89	32.4	Acceptable
Porchester Road / Walters Road	Signals	D	0.87	35.1	D	0.94	43.2	D	0.91	48.1	AM and inter peak intersection LOS is skewed by LOS F for right-turning vehicles from Porchester Road (south) onto Walters Road (east). PM intersection peak is skewed by right-turning vehicles from Porchester Road and Walters Road (west). All of which do not affect proposed bus routes.
Walters Road / Grove Road	Signals	C	0.27	20.4	B	0.27	18.8	B	0.65	14.6	Acceptable
Grove Road / Old Wairoa Road	Single lane roundabout	A	0.40	5.2	A	0.22	4.5	A	0.72	8.0	Acceptable
Grove Road / Clevedon Road	Single lane roundabout	A	0.38	6.0	A	0.24	4.5	A	0.51	6.7	Acceptable

Intersection Summary

Clevedon Road / Marne Road / Willis Road	Single lane roundabout	A	0.75	8.0	A	0.57	7.6	F	1.44	146.1	Layout remains as existing with significant congestion in the PM peak. This will affect buses; however, this is based on the 95% of queues. This layout does not preclude future upgrades to this intersection.
Clevedon Road / Broadway	Signals	C	0.72	24.4	C	0.63	21.3	B	0.66	19.8	Acceptable
Ōpaheke Road / Settlement Road	Single lane roundabout	A	0.47	4.5	A	0.34	4.4	A	0.69	8.2	Acceptable
Settlement Road / Marne Road	Single lane roundabout	B	0.85	17.1	A	0.55	8.3	D	1.04	37.9	Intersection layout remains as existing. PM LOS shows B on Marne Road, A on Settlement Road (west) and F for Settlement Road (east). This is not on a proposed bus route and therefore is acceptable.
Settlement Road / Hunua Road	Single lane roundabout	B	0.91	10.1	A	0.46	6.2	A	0.57	6.3	Acceptable
Croskery Road / Hunua Road	Signals	D	0.94	38.5	A	0.56	9.4	B	0.65	10.4	Intersection remains as existing as it has been recently upgraded. No upgrades intended. Intersection is congested as existing during AM peak periods.

Popes Road Urbanisation

Intersection Summary

Popes Road / Takaanini School Road	Single lane roundabout	A	0.48	5.9	A	0.29	5.7	A	0.39	6.6	Acceptable
--	---------------------------	---	------	-----	---	------	-----	---	------	-----	------------

Appendix 3: KPI Development Methodology

Investment Objectives and KPIs for South FTN

The KPIs for the South FTN investment objectives allows a qualitative and quantitative assessment to be made of how well the recommended network performs compared to a Do minimum scenario where the projects outlined in the recommended network are not implemented.

The investment objectives for each of the problem themes were developed, and specific benefits and KPIs for identified for each objective. The KPI's and measures were pulled from a programme wide 'bank' of KPIs and measures developed internally within Te Tupu Ngātahi.

The problem themes and subsequent investment objectives, benefits and KPI's were agreed upon by the relevant stakeholders.

Investment Objectives

Table A3.1 below summarises the Investment Objectives for the South FTN network within the Takaanini recommended network.

Table A3.1: South FTN Investment Objectives

Investment Objectives	South FTN
	Access: Enable access to economic and social opportunities by providing high quality public transport between Drury and Manukau that integrates with the rail network
	Integration: Support planned growth by integrating high quality public transport corridors with the current and planned transport system and land use
	Travel choice: Support growth and mode share shift towards low carbon transport modes

Table A3.2 below summarises the key performance indicators and measures for the Level Crossings within the Takaanini recommended network.

Table A3.2: South FTN Investment Objectives

Investment Objective	South FTN	
	KPI	Measure
Access	Job Access	Proportion of employment accessible within 15, 30, 45 mins accessible by PT and active modes
	Key destination access	Reduction in travel time between key social and employment destinations in Manukau and Drury (PT)
	Travel time	Travel time variability (PT)
Integration	Proximity to PT network	No. of households with access to high quality PT (within 800m of the FTN corridor)
	Provision of Bus Lanes on network	% / KMs of new bus lanes
	Amenity of the street	KMs of new and improved transport network with enough space for street furniture/lighting and tree planting appropriate to the known place function and built form
Travel Choice	Patronage uplift	% patronage uplift expected on the FTN routes
	Mode Share	% PT and active mode share for local trips (within South) in AM peak
	Daily active mode-km uplift	Walk-km and cycle-km uplift
	Provision of high-quality active modes network / Perceived safety (active modes)	% / KMs of new and improved cycle network achieving required QoS (from AT Statement of Intent 2018-21)
	DSI (active modes and overall)	No. of active mode incidents resulting in serious injury and deaths. No. of overall incidents resulting in serious injury and deaths
	Emissions	Proportion of employment accessible within 15, 30, 45 mins accessible by active modes
	Vehicle Kilometres Travelled (VKT)	Proportion of employment accessible within 15, 30, 45 mins accessible by car

Appendix 4: Modelling Specifications

Do Minimum Context

The project has followed the principles of the Te Tupu Ngātahi programme wide approach for the definition of the Do Minimum. The Do Minimum is defined as the least effort to maintain the existing system, including maintenance and operation of the existing system.

The components/ projects assumed in the Do Minimum are as follows and are consistent across both the Do Minimum and the recommended network:

- **Four tracking** between Papakura and Pukekohe in 2048 and 2048+; whereas two tracking in 2038;
- Three **new rail stations** at Maketuu, Ngaakoora and Paeraataa (Drury Central, Drury West and Paerata) in 2038, 2048 and 2048+;
- The **Drury arterials upgrade** of Bremner, Jesmond, Waihoehoe and SH22 for the years 2038, 2048 and 2048+ as defined in the Drury Local Business Case;
- The **North South-Ōpaheke arterial** is included in both 2048+ Do minimum network. The arterial is not included in the interim model years.
- **Pukekohe Expressway** is assumed in 2048 and 2048+ network
- **Mill Road upgrade:** Four-lane, lower speed Mill Road corridor project is assumed in both the 2048 and 2048+ Do minimum network. The two-lane Mill Road corridor safety project is assumed in the interim year; 2038 network.
- **Takaanini Level crossings/ grade separation:** The closure of the Spartan Road and Manuroa level crossings and replacement with new active mode bridges, and the grade-separation of Taka Street, Walters Road, and Manuia Road for the years 2038, 2048 and 2048+ as defined in the Takaanini Level Crossings DBC.
- **Wastney Road,** a new N-S collector through the Takaanini FUZ is assumed. This corridor connects the existing Wastney Road at Alfriston Road in the north, with Airfield Road in the South. This N-S collector through the Takaanini FUZ is consistent in both the Do minimum and recommended 2048+ network.
- **Bus vehicle type** assumed on Great South Road and the Takaanini FTN corridors are consistent between both the Do minimum and recommended network.

The following corridor projects/ components only apply to the Do Minimum context and are not consistent in the recommended network:

- **Popes Road urbanisation project:** The Popes Road east-west connection between Takaanini School Road (in the west) and Mill Road (in the east), is assumed to be a two-lane rural corridor with no walking and cycling facilities.
- **Croskery Road urbanisation project:** Croskery Road (between Hunua Road and Mill Road) is assumed to be a two-lane rural corridor with no walking and cycling facilities.
- **Great South Road FTN corridors:** the Do Minimum network assumes current bus priority and facilities along GSR. This includes:
 - Eastbound bus lane on Manukau Station Road
 - Northbound bus lane on Great South Road (between Browns Road and Northcrest way)
 - Bus priority at Kerrs Road and Weymouth Road intersections.
- **Takaanini FTN corridors:** There are no bus priority assumed in the Do Minimum network along the corridors. Intersections are retained in the current/ existing form

- **Bus headway** is assumed as 20 minutes on Great South Road and the Takaanini FTN corridors in the Do minimum network.
- **Great South Road, Drury section:** the Do Minimum network assumes this is a two-lane corridor in 2038, 2048 and 2048+. No cycling facilities and a footpath are assumed in the Do minimum network.
- Existing **active mode facilities** are assumed along the Great South Road and Takaanini FTN corridors in the Do Minimum network.

Recommended Network Context

The following corridors/ projects indicate the changes expected in the recommended transport network against the Do minimum. These are noted below:

Urbanisation projects:

- **Popes Road urbanisation project:** The Popes Road east-west connection between Takaanini School Road (in the west) and Mill Road (in the east), is expected to urbanise to a two lane multi-modal connection with separated walking and cycling facilities. The modelling assumes Popes Road will urbanise from 2048 onwards.
- **Croskery Road urbanisation project:** Croskery Road (between Hunua Road and Mill Road) is expected to urbanise to a two lane multi-modal connection with separated walking and cycling facilities. The modelling assumes Croskery Road will urbanise from 2048 onwards.
- **Great South Road FTN:** Frequency of buses increases for service 33 to a 10-minute headway. Parts of the corridor are upgraded to have bus lanes in both directions, while other sections are upgraded to have a northbound bus lane. Bus lanes are not modelled through the Manurewa town centre and Papakura metropolitan centre (as consistent with the Do Minimum network). Intersection improvements at key intersections are included in the recommended network.
- **Takaanini FTN:** Frequency of buses increases for the 'Takaanini FTN' service to a 10-minute headway. Weymouth Road bridge and Alfriston Road (between GSR and Magicway) is upgraded to include bus lanes in both directions. Intersection improvements at key intersections are included in the recommended network.
- **Great South Road, Drury section:** this section of corridor is upgraded to four general traffic lanes in 2038, 2048 and 2048+.
- **Active Mode Connections:** Separated walking and cycling facilities are proposed along the corridors in the South FTN routes on Great South Road, and the Takaanini FTN corridors in the recommended network.

MSM

The Macro Strategic Model (MSM) is a region-wide model which analyses the forecast land use and informs trip generation, trip distribution and mode choice at regional level. The MSM model responds to the network assumptions, forecasted land use and regional economic policy inputs to predict regional traffic patterns and PT patronages. The outputs from the MSM model are used as:

- Demand inputs for the traffic simulation model SATURN, which analyses them at a mesoscopic level
- PT Patronage inputs for the MPT model, which analyses these at a strategic level

- Active mode inputs for the SAMM model, which analyses these at a mesoscopic level

The MSM is a four-step multi-modal model. This model was originally developed based on extensive data collected in 2006. Using observed data, and a full model validation exercise it was recently updated to reflect 2016 inputs and data. The MSM produces demands for five periods of the day, and separate assignment models exist for the morning (AM) and evening (PM) peak and weekday inter-peak (IP) periods.

- The model itself comprises of the following key modules:
 - Trip generation: This is where the number of person-trips are estimated as a function of the land use data (population, employment, school roll etc.)
 - Mode Choice: This is where the choice of recommended travel mode is determined, based on the relative costs of the various modes. The MSM modes for mode choice are car (driver and passenger combined) and passenger transport. Trips by car are converted into vehicle trips later in the model. The model also estimates the number of active mode trips, such as walking and cycling, although these are not fully modelled through to link flows.
 - Trip Distribution: This is where the trips produced in each zone (generally by households), are matched to a recommended destination. This distribution is predicted as a function of the relative attractiveness for each destination zone and the travel costs to reach each destination.
 - Time of Day: This is where the proportion of daily trip making occurring in each period is calculated. These proportions change in response to changes in travel costs to represent peak spreading.
 - Trip Assignment: This is where the resulting travel demand, in the form of origin to destination trip tables, are loaded to the road and public transport networks. For the road assignment, an iterative process is used to firstly identify the lowest-cost route between each origin and destination followed by an estimation of the speeds and delays on each route between origin and destination, followed by an estimation of speeds and delays on each route associated with the predicted traffic flows on the route.

General Network Assumptions

The following general network assumption have been made in the MSM model:

- All committed developments and respective infrastructure upgrades planned as outlined in the ATAP (Auckland Transport Alignment Project) 2.0 and RLTP (Regional Land Transport Plan) have been coded in the future MSM model
- The access points (MSM zone connectors) for each model option scenarios in the business case areas were reviewed and refined accordingly to reflect the future infrastructure upgrades

The future local bus services for each model option scenarios, were updated based on inputs from the AT Metro, specifically related to routes, frequencies, bus capacities and bus speeds.

MSM Outputs

There are a number of outputs from the transport modelling, including:

- Demand patterns (Origin-Destination travel) and facility usage (flows)
- Network performance
- Travel times and costs (real and perceived) for economic analysis

- Delays, queues and Level of Service (LoS) for design and assessment
- Aggregate travel statistics on travel such as Vehicle Kilometres Travelled (VKT), Passenger Kilometres Travelled (PKT) and total travel costs
- Flow and performance for environmental analysis
- Inputs to vehicle emissions models
- Inputs to noise analysis

SATURN

SATURN is a mesoscopic traffic simulation and assignment model used to undertake a variety of area wide strategic assessments through to more detailed local area assessments. It can be used as a conventional model for the analysis of traffic-management schemes over localised networks as well as for major investment improvements at a regional level. The SATURN model ensures factual representation of vehicle flow patterns and congestion on midblock sections and intersections in the form of 'arrival' flows rather than 'demand' flows. Additionally, it is used as a high-level junction simulation model that evaluates the traffic flow behaviour on junctions.

It represents 'congested assignment' of multiple user classes modelled separately, including bus priority and high occupancy vehicle lanes. Figure A4.1 provides an overview of the SATURN model is used and its interdependencies with other models, showing the modelling hierarchy.

Figure A4.1: Modelling Hierarchy and Associated Outputs



SATURN Outputs

There are a number of outputs from the SATURN model, including:

- Vehicular flow pattern -Actual flow, Demand flow, Queued flow
- Network performance- Link and Node delays, Queue Statistics, V/C Ratios
- Mid-block capacities and speeds
- Aggregate travel statistics on travel such as Total Travel Time(hrs), Distance Travelled (kms)

SAMM

The Strategic Active Mode Model (SAMM) has been developed to fit within the existing suite of regional travel demand models operated by the Auckland Forecasting Centre (AFC). It derives land use and network data directly from the Macro Strategic Model (MSM) while using the same refined zone system as used in the Macro PT Model (MPT). The model has a strong interface with MSM to provide key inputs but can be operated independently to assess specific changes to the active mode network.

Both the walk and cycle models adopt a fairly traditional '4-step' demand model structure including trip generation, distribution, mode shift and assignment

The purpose of the model was identified by the AFC as follows:

- To enable an objective measure of walk and cycle responses to infrastructure changes, demographic changes and to changes in other modes at a regional level.

The scope of travel represented in the model is as follows:

- It only represents active travel where walking or cycling are the primary mode used. Multi-modal trips using active modes and either PT or car modes remain represented via the MSM and MPT models, and are generally not included in SAMM (with the exception of active trips that use a Ferry to cross the harbour)
- A trip based model that represents movement via Origin-to-Destination trip matrices
- Represents typical weekday, daily trips (based on March data)
- Represents travel done for transportation reasons, rather than recreational or sport. However, it does estimate additional 'recreational' flows on key high-amenity coastal cycle routes
- It covers the whole Auckland Region, consistent with the MSM and MPT models

The model is targeted as a 'strategic demand' model, with a focus on estimating active-mode travel from demographic and network inputs, rather than via the direct use of observed travel patterns. This requirement means it is focussed more on developing a robust process to estimate overall demand patterns, rather than detailed calibration to count data. This approach means it is also suitable for use in greenfield areas where existing activity and data would not reflect the planned future state. The model provides a suitable platform for localised refinement and calibration as may be required for assessment of specific projects.

SAMM specifications and details

The SAMM requires export of network and trip data from MSM. After the network import the local or regional cycle network are coded in SAMM, the links are made less/more attractive for the active mode trips by specifying an added attribute termed as 'cycle facility'. The following inputs are imported from MSM:

- Land use data
- Active trip ends by purpose
- Network
- Link speed
- Auxiliary volumes
- Home based Work Car and PT generalised cost and daily person matrix

After the import from MSM the following refinement is done in SAMM for assignment of Active Modes

- Coding of cycle and walk links
- Assigning cycle facility type to the cycle network
- Hilliness factor and amenity factor
- Refinement of zone connectors

The trip generation, distribution, mode shift and assignment models all attempt to replicate travel choices using 'perceived' travel costs. These costs are equivalent to the 'Generalised' costs used in the MSM multi-modal model and are based on actual travel times with adjustments to account for user perceptions. For cyclists this includes perceptions of facility provided, the type of road it operates on and the amenity and hilliness of the route. The walk model uses a similar approach but with fixed walk speed and without differentiation by facility or road type. Use of such costs mean that the cycle demands will respond to changes in the speed, quality, amenity and hilliness of each section, while walking will respond to amenity and hilliness.

Station Access Modelling

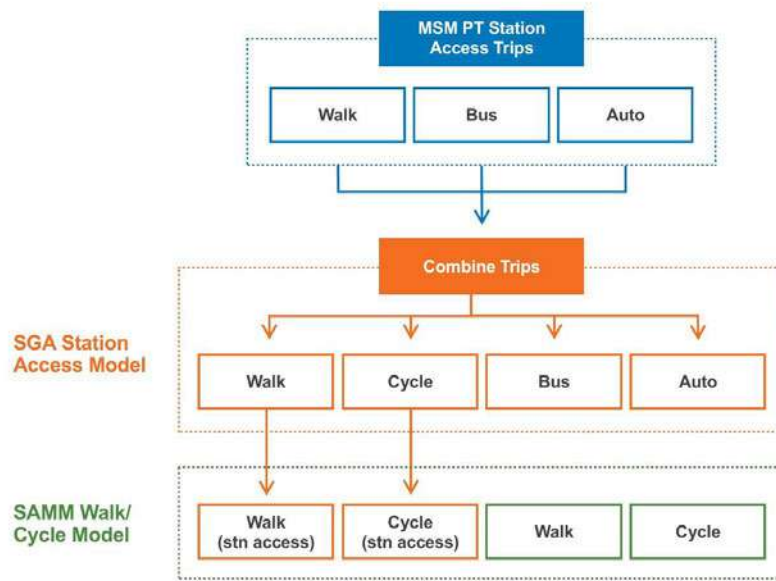
Te Tupu Ngātahi uses the Auckland Forecasting Centre's Strategic Active Mode Model (SAMM) to estimate volumes of walking and cycling trips on the future networks. As mentioned above SAMM only includes where walking and cycling is the main mode. Public transport trips are estimated using the Macro Strategic Model (MSM), which uses simple functions to represent access to stations. Access to stations is represented in MSM as:

- Direct walk-up trips
- Transfer trips from other PT services, such as local buses
- Auto-access trips, representing kiss-and-ride and park-and-ride. This access mode is only represented at major stations with formal Park and Ride facilities

The approach to this work is to develop a new tool that estimates the potential walk and cycle trips accessing major stations. The primary tool for estimating PT trips remains the MSM. For economic analysis purposes, the station-access tools are ignored, as station access is included in PT benefits extracted from MSM.

The total trips accessing stations from MSM is retained, with the station access tool effectively only reallocating them between sub-modes. The walk and cycle station-access trips are then passed to the SAMM model (as origin-destination matrices). This concept is indicated in Figure A4.2 below.

Figure A4.2: Structure of Station-Access Model



The MSM and SAMM models are operated by the AFC and have been through detailed review processes. The Te Tupu Ngātahi Station-access tool is only used to provide estimates of cycle/walk demand near major stations specific to Te Tupu Ngātahi areas. As such, it is not part of the formal AFC-owned models and it has not been independently reviewed.

The key steps in its operation are as follows:

- Obtain station access trips from MSM peak-period models. Including from direct walk-up and auto-access links)
- Combine to daily estimates (SAMM operates only at a daily level)
- Obtain car and bus travel times from MSM
- Get walk and cycle perceived travel costs from SAMM
- Create generalised costs for each mode, by applying assumed modal constants
- Allow for impact of electric bikes as a sub-mode of cycling
- Apply a logit choice model that re-estimates the split between the four access modes
- Extract car and cycle station access trips and assign in SAMM to get link flows

SIDRA

Signalised (and unsignalised) Intersection Design and Research Aid (SIDRA) is a micro-analytical tool used for evaluating intersection performance. It has a comprehensive, lane-based network modelling approach applicable to all types on intersections-signal, priority or sign control and roundabouts. SIDRA allows the modelling of various movement classes (Light vehicle, Heavy vehicle, Buses, Bicycle, Large Trucks, Light Rail/ Trams) with distinctive vehicle features to be assigned to designated lanes, segments and signal phases.

The Te Tupu Ngātahi SIDRA model is used to analyse the form and function of proposed intersections along strategic corridors. Based on the demand flow outputs from the SATURN Model, the intersection turning flows are determined. The performance measures of the intersection in terms of capacity, delay, Level of Service (LOS), queue length on approach lanes and optimum vehicle-pedestrian signal phasing is calculated.

Capacity Analysis

The capacity of an intersection to operate satisfactorily depends on the volumes of turning traffic and the distribution of traffic on the various approach legs at the intersection. Capacity analysis and intersection performance has been adjusted for the Business Case given the brownfields context of the project. The key output measures which determine the operational performance of an intersection are as follows:

- LOS - The Level of Service measures 'control delay' on intersections in seconds. A greater focus of Level of Service was placed on the expected bus movement at the intersection. AT's Auckland Network Operating Plan¹⁶ provides a benchmark to design intersections for various modes.
 - The plan suggests an aspirational user experience/ LOS of B/C for buses on the frequent transit network.
 - The plan suggests an aspirational user experience/ LOS of C/D for vehicles in the strategic general traffic network during commuting peaks. Typically LOS rating A, B or C is considered as a positive outcome for traffic, whereas D, E or F increasingly highlights a deficiency for vehicles in that peak. For satisfactory intersection performance the LOS for major movement should be lower than 'D' and for minor movement LOS should be lower than 'E'. The LOS definition (Highway Capacity Manual 2010) used are given below:

Table A4.1: LOS Categories for Intersections

Level of Service	Control delay per vehicle in seconds (d) including geometric delay	
	Signalised Intersections	Priority Controlled and Roundabouts
A	$d \leq 10$	$d \leq 10$
B	$10 < d < 20$	$10 < d < 15$
C	$20 < d < 35$	$15 < d < 25$
D	$35 < d < 55$	$25 < d < 35$
E	$55 < d \leq 80$	$35 < d \leq 50$
F	$d > 80$	$d > 50$

- DOS - The Degree of Saturation is the ratio of demand flow to capacity. The movement DOS is the largest DOS for any lane of the movement. The desirable degree of saturation for Signalised Intersection should be less than 0.9 and for Roundabouts it should be less than 0.85

¹⁶ Auckland Network Operating Plan, Version 3, November 2020

- Queue Length - It is used to determine the length of auxiliary through lanes or storage in turn lanes.
- Effective stop rate measure - the average number of stops per vehicle in the queue and indicates how many signal cycle times are required to clear a queue at the intersection.

Prior to the start of construction, it is recommended that a preliminary design safe system audit is undertaken for the Project. This will determine if any mitigation measures are required to address any safety risks to the businesses/ properties which exist on the western side of the rail line at the time of implementation.

In summary, a design safe system audit/ road safety assessment should be undertaken at implementation to understand what interventions are required to ensure safe system practices at the interchange.



TE TUPU NGĀTAHI
SUPPORTING GROWTH

Appendix H

Design Report

South FTN and Key Connections

October 2023

Version 1.1

Document Status

Responsibility	Name
Author	
Reviewer	
Approver	

Revision Status

Version	Date	Reason for Issue
0.1	29 May 2023	Draft for internal review
1.0	23 June 2023	Issue for IQA review
1.1	31 October 2023	Final

Table of Contents

1	Introduction.....	1
2	Approach to design.....	1
2.1	Interface with Other Projects.....	1
2.2	Topographical survey and aerial photography	2
2.2.1	Topographical survey.....	2
2.2.2	Aerial photography.....	2
2.3	Corridor form and function.....	2
2.4	Intersection Form and Function.....	7
2.5	Access and driveways	7
2.6	Clearance Envelope.....	7
2.7	Geometric design	8
2.7.1	Roading geometric design	8
2.8	Geotechnical design.....	10
2.8.1	Slope stability.....	10
2.8.2	Retaining walls.....	10
2.8.3	Bridge abutments.....	11
2.9	Structures design for bridge upgrades	11
2.10	Stormwater Design and Flooding	11
2.10.1	Stormwater runoff capture and conveyance.....	12
2.10.2	Stormwater treatment and hydrologic mitigation	12
2.10.3	Flood effect mitigation.....	13
3	FTN Corridors	14
3.1	Great South Road FTN Section 1	14
3.2	Great South Road FTN Section 2	16
3.3	Great South Road FTN Section 3	17
3.4	Great South Road FTN Section 4	18
3.5	Great South Road FTN Section 5	19
3.6	Takaanini FTN Section 6	22
3.7	Takaanini FTN Section 7	24
3.8	Takaanini FTN Section 8	26
3.9	Takaanini FTN Section 9	27
4	Popes Road Urbanisation.....	29
5	Croskery Road Upgrade	31
6	Great South Road Drury Central Upgrade.....	32

Appendices

1	Appendix A - General arrangement plan
2	Appendix B - Safety in Design (SiD)
3	Appendix C - Croskery Rd Upgrade Stormwater Design Memorandum
4	Appendix D – Road Safety Audit Exemption

Figures

Figure 1 Takaanini FTNs scope of works	1
Figure 2 - GSR FTN and Takaanini FTN section split	14

Tables

Table 1 - Interfacing Projects	1
Table 2 - GSR FTN form and function summary	3
Table 3 - Takaanini FTN form and function summary	4
Table 4 - GSR Drury form and function summary	6
Table 5 - Popes Rd form and function summary	6
Table 6 - Croskery Rd form and function summary	7
Table 7 - Clearance envelopes	8
Table 8 - Approach to geometric design	8
Table 9 - GSR FTN Section 1 Design Features	15
Table 10 - GSR FTN Section 2 Design Features	16
Table 11 - GSR FTN Section 3 Design Features	17
Table 12 - GSR FTN Section 4 Design Features	19
Table 13 - GSR FTN Section 5 Design Features	20
Table 14 - Takaanini FTN Section 6 Design Features	22
Table 15 - Takaanini FTN Section 7 Design Features	24
Table 16 - Takaanini FTN Section 8 Design Features	26
Table 17 - Takaanini FTN Section 9 Design Features	27
Table 18 - Popes Rd Design Features	29
Table 19 – Croskery Rd Design Features	31
Table 20 – Great South Rd Drury Design Features	32

Acronym/Term	Description
AC	Auckland Council
AGRD	Austroads Guide to Road Design
AMC	Active Modes Corridor/Connection
ASD	Approach Sight Distance
AUP	Auckland Unitary Plan
AT	Auckland Transport
DBC	Detailed Business Case
FTN	Frequent Transport Network
GSR	Great South Road
LIDAR	Light Detection and Ranging
MSE	Mechanically Stabilised Earth
NIMT	Northern Island Main Trunk (Rail)
NZGD	New Zealand Geotechnical Database
NZTA / WK	Waka Kotahi New Zealand Transport Agency
NZTM	New Zealand Transverse Mercator
SGA	Te Tupu Ngātahi Supporting Growth Alliance
SMAF	Stormwater Management Area Flow
SSD	Stopping Sight Distance
TDM	Transport Design Manual

1 Introduction

This document has been prepared as Appendix H of the Takaanini FTNs Detailed Business Case (DBC). It has been prepared to document the design development principles behind the concept designs within the Takaanini FTNs DBC. The concept design is used to determine the areas where route protection is likely to be required, noting majority of the corridor upgrade are to be carried out within the road reserve.

The design report has been developed with technical inputs from a wide range of engineering design specialities including traffic, geometric, geotechnical, stormwater, urban design, road safety and structures.

The Takaanini FTNs DBC identifies the construction of the transport network to occur in the long term. It is therefore anticipated the concept design contained in this document will be revised and reconfirmed at that time of implementation to reflect any changes in standards, planning conditions, network demands, and/or any other construction related matters.

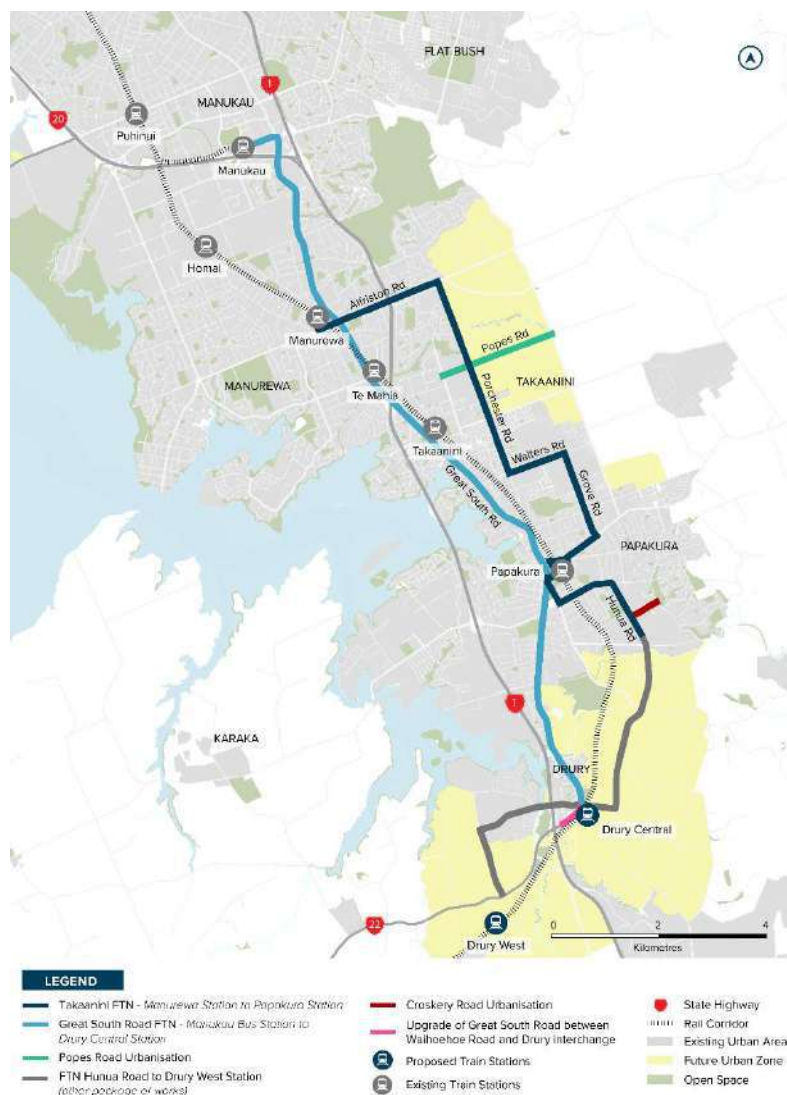


Figure 1 Takaanini FTNs scope of works

2 Approach to design

Te Tupu Ngātahi Supporting Growth Alliance (the Alliance) has been established to provide route protection of strategic transport infrastructure to support the future growth of Auckland. As such, most of the projects within the Programme will not be constructed for several years, and it is anticipated that the preliminary design will need to be revised at that time to reflect the standards, transport demands, and requirements. Therefore, the design to support the option assessment process and the cost estimate will be limited to a level that supports the designation footprint, effects, and a number of generic assumptions will be made.

There are several design elements that will not be considered in the development of designs for both the concept and recommended option design development as they will not inform the assessment of effects. The design elements where there will be no specific design developed are as follows:

- Pavement design and road surfacing
- Vehicle tracking
- Street lighting
- Road safety barriers
- Utilities design
- Signs and line markings
- Traffic signal design
- Advanced Traffic Management Systems (ATMS) requirements
- Intelligent Traffic Systems (ITS)
- Landscape design
- Urban streetscape design features

2.1 Interface with Other Projects

The Takaanini FTNs programme of works have interfacing requirements imposed by the projects and developments listed in Table 1 below.

Table 1 - Interfacing Projects

Project / Development Name	Interfacing Requirements
KiwiRail Four Tracking	• Interfaces with rail overbridge upgrade on Weymouth Rd
Auckland Transport Ponga Road and Opakehe Road Upgrade Designation - 1837	• Designation interfaces with Takaanini FTN route through Opakehe Rd and Opāheke Rd/Settlement Rd roundabout
Airport to Botany Notice of Requirement (Route protection)	• Designation interfaces at the GSR FTN section 1 western tie in
Te Tupu Ngātahi Takaanini Level Crossing DBC/NoR (route protection)	• Designation interfaces at the GSR / Manuia Rd / Challen CI intersection • Designation interfaces at the GSR / Taka St intersection • Designation interfaces at the GSR / Walters Rd intersection

Project / Development Name	Interfacing Requirements
	Designation interfaces at the Walters Rd / Porchester Rd intersection
NZUP Waihoehoe Road West Upgrade	Designation interfaces at the GSR FTN section 5 southern tie in.
NZUP Drury Central Station	Designation interfaces GSR eastern side south of the Waihoehoe Rd intersection

2.2 Topographical survey and aerial photography

2.2.1 Topographical survey

Light detection and ranging (LiDAR) is an optical remote-sensing technique that uses laser light to densely sample the surface of the earth, producing highly accurate x, y, z measurements. LiDAR data was provided by Land Information New Zealand (LINZ) and has been used to develop the preliminary design for the road corridors part of this package.

New Zealand Transverse Mercator (NZTM) projection is the coordinate system for the project. The vertical datum is named AUK46, obtained from Auckland Council.

2.2.2 Aerial photography

The aerial photography is provided by Nearmap Ltd. The orthophotography flown over the southern area twice yearly. The imagery used in the design is sourced from different periods depending on location. Imagery supplied as 7.5cm pixel resolution – resampled to 10cm pixel resolution for download.

2.3 Corridor form and function

The **Table 2** provides a summary of the form and function of the corridors. These are the recommended minimum width cross sections. It is noted that some areas of the road corridor are wider than the recommended cross section, and alternative wider cross section arrangements are possible at implementation within the road reserve or designation.

Potential departures to certain elements may be required at implementation to facilitate the outcomes preferred at the time of implementation, within the road corridor available. No departures are sought at this stage to avoid restricting (or facilitating) certain decisions and to allow these to be determined on a site-specific basis, based on relevant standards in effect in future.

Table 2 - GSR FTN form and function summary

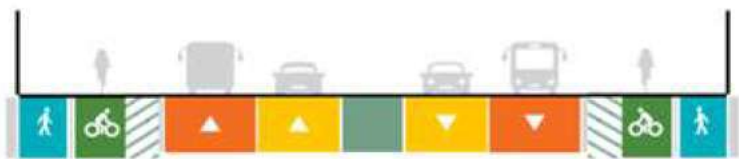
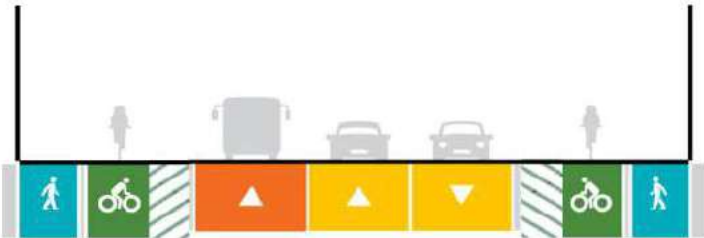
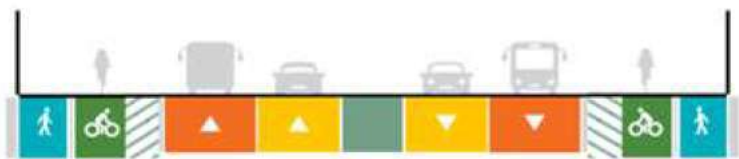
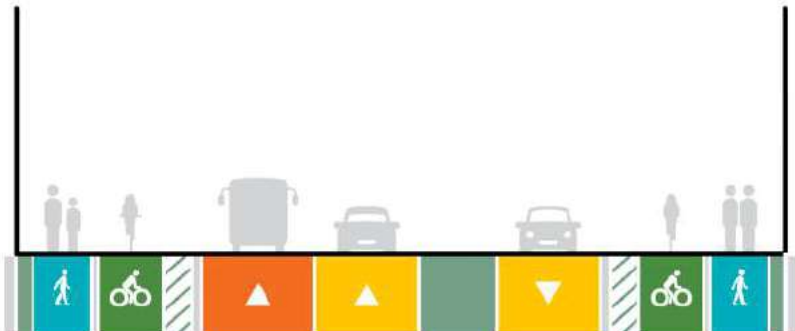
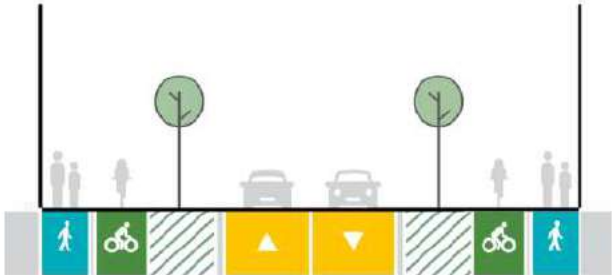
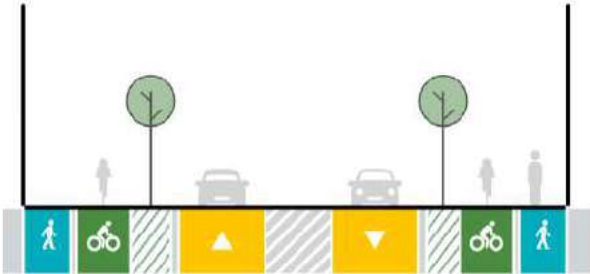
Road corridor	Typical cross section
GSR FTN – Mainline	 FOUR LANE FTN ARTERIAL – 26.5M (Alternative corridor layout possible within 26.5m)  THREE LANE FTN ARTERIAL (NORTHBOUND BUS ONLY) – 20M (Alternative corridor layout possible within 20m)
GSR FTN - Bridge (where bridge structure upgrade is proposed)	 THREE LANE ARTERIAL BRIDGE – 21M

Table 3 - Takaanini FTN form and function summary

Road corridor	Typical cross section
Takaanini FTN - Mainline	 FOUR LANE FTN ARTERIAL – 26.5M (Alternative corridor layout possible within 26.5m width)
	 THREE LANE FTN ARTERIAL (EASTBOUND BUS ONLY) – 24M (Alternative corridor layout possible within 24m)
	 TWO LANE ARTERIAL - 20m
	 TWO LANE ARTERIAL (ALTERNATIVE) - 20m

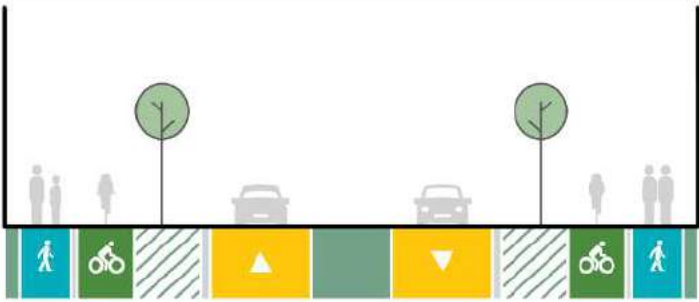
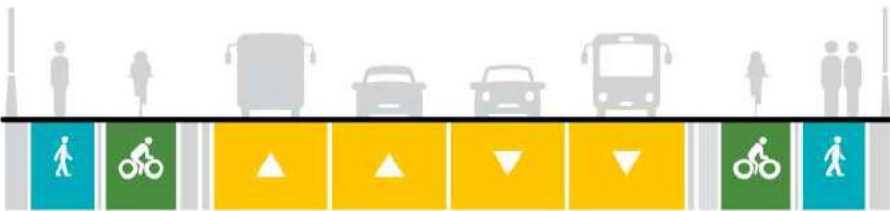
Road corridor	Typical cross section
Takaanini FTN – Mainline adjacent to FUZ	 TWO LANE ARTERIAL – 24M
Takaanini FTN - Bridge (where bridge structure upgrade is proposed)	 FOUR LANE ARTERIAL BRIDGE – 24M
Takaanini FTN – Mainline adjacent existing stormwater conveyance channel	 TWO LANE ARTERIAL (SEPARATED ACTIVE MODE PATH) – WIDTH VARIES, 20m MIN.

Table 4 - GSR Drury form and function summary

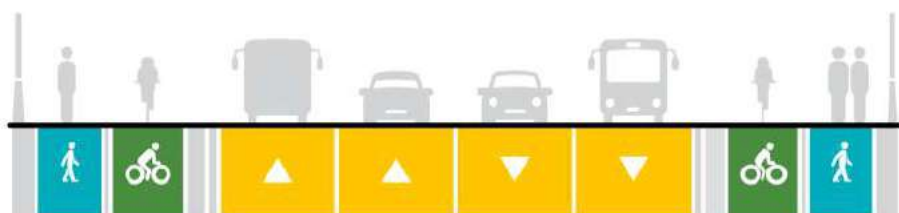
Road corridor	Typical cross section
GSR Drury – Mainline	 FOUR LANE FTN ARTERIAL – 26.5M (Alternative corridor layout possible within 26.5m width)
GSR Drury – Bridge	 FOUR LANE ARTERIAL BRIDGE – 24M

Table 5 - Popes Rd form and function summary

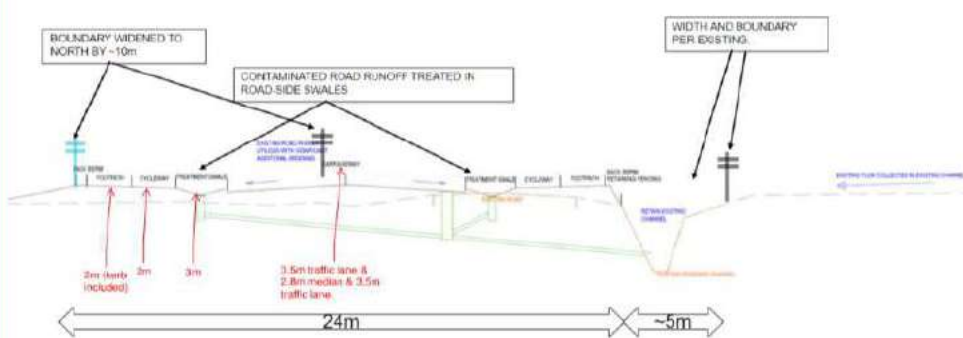
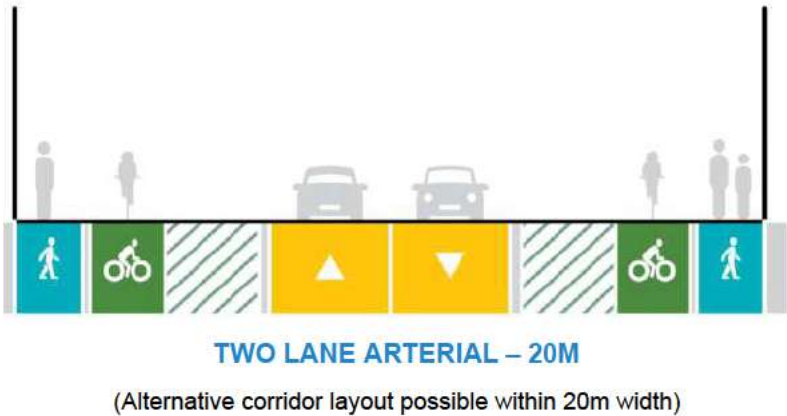
Road corridor	Typical cross section
Popes Rd – Mainline	 TWO LANE ARTERIAL – 24M

Table 6 - Croskery Rd form and function summary

Road corridor	Typical cross section
Croskery Rd – Mainline	 TWO LANE ARTERIAL – 20M (Alternative corridor layout possible within 20m width)

2.4 Intersection Form and Function

The intersection form and function are summarized in section 3 and 4 for the GSR FTN and Takaanini FTN corridors. Refer to the Appendix G Transport Outcomes Report within the Detailed Business Case for further details.

2.5 Access and driveways

In general, there is limited change to vertical levels and accessways are to be retained and modified to suit changes to the roadside including active modes.

Design checks for accessways onto the proposed road corridor to be carried out in accordance with the Auckland Unitary Plan (AUP) E27. Transport. in the following design stages.

The design generally does not make specific determination to individual property access provision.

In areas where designation is required, there is sufficient flexibility to determine in future whether provision of flush medians for access, raised medians to restrict access to left-in left-out or no median provision is most suitable.

2.6 Clearance Envelope

The following clearance envelopes are to be taken into consideration when designing the corridors within the Takaanini FTNs project, as set out in Table 7.

Table 7 - Clearance envelopes

Items	Clearance envelope	Considerations
Road over stream	Allow 2.4m vertical clearance to road surface from 100 year flood level	100 year flood level based on rainfall intensity derived from RCP 4.5 to 2120. Vertical clearance consisting of 1.8m bridge superstructure (deck + beam) and surfacing 0.6m freeboard (Bridge manual) for normal circumstances
Road over rail* (Weymouth Road / Manurewa Station)	Allow 7.8m vertical clearance to road surface. Horizontal clearance varies.	Vertical clearance consisting of: 0.2m rail height above sleepers/ballast 5.5m rail vertical clearance envelope, according to KiwiRail standards* 2.1m for bridge superstructure (deck + beam) and surfacing. Thickness dependent on span requirements. Horizontal clearance assumptions to accommodate rail four tracking: 4m between paired rail tracks (existing rail tracks or future rail tracks when on a single side of existing tracks) 6m between existing rail tracks and future rail tracks 6.4m beyond outside track centrelines - Additional track(s) and clearances as required for specific rail requirements near stations <i>* Note clearances are assumed based on preliminary engagement with KiwiRail and are subject to change through further engagement.</i> <i>* Vertical clearance can taper down from 5.5m clearance for the extent of horizontal envelope, at 0.5m from outermost rail centreline down to 3.25m height above rail at 2.3 m from centreline of track. Refer to KiwiRail NRSS / 6 Engineering Interoperability Standards Appendix E for fixed structure gauge.</i>
Road over motorway	Allow 7.8m vertical clearance and horizontal clearance to accommodate existing motorway cross section	Vertical clearance consisting of: 6m road vertical clearance (Bridge Manual) 1.8m for bridge superstructure (deck + beam) and surfacing.

2.7 Geometric design

2.7.1 Rooding geometric design

The Table 8 describes the key elements of the geometric design from a roading point of view.

Table 8 - Approach to geometric design

Design element	Approach to design	Comments
Cross section	As per section 2.3 of this report	N/A
Posted Speed	50 km/hr* *Town centres and school zones may have lower speed limits	N/A

Design element	Approach to design	Comments
Design Speed	Horizontal – 50 km/hr Vertical – 50 km/hr	As per TDM Geometric design
Horizontal alignment* *Excludes design specific to intersections, auxiliary (non-FTN) roads and accessways	Preferred minimum radius 120m with minimum curve length of 70m for new road alignments or significant changes to existing road alignments.	As per AGRD Part 3 to allow 3.0% adverse crossfall to be applied., Existing road geometry is generally not proposed to be improved due to spatial constraints.
Vertical alignment* *Vertical alignment generally to match existing road geometry. On approach to new structures more significant changes to vertical alignment are proposed.	Grade: - Desirable maximum grade of 8% Minimum crest curve: - K=6.8 Minimum sag curve: - K=6	Maximum grade as per TDM without requiring specific treatment for pedestrian routes. Minimum crest curve as per AGRD Part 3 to satisfy SSD requirements. Crest curves at intersections to be assessed for ASD. Minimum sag curve as per AGRD Part 3. Governed by comfort requirement and conforms with an increased design speed of 60km/h.
Clearance envelope	As per section 2.6 of this report	N/A
Accessway and driveways	As per section 2.5 of this report	N/A
Signalised intersections	Intersection form and stacking lanes details are as per Appendix G Transport Outcomes Report. Existing intersections not otherwise mentioned are proposed to retain their existing layout, although generally have active mode facilities proposed to be improved.	
Single lane roundabout	Minimum ICD of 31m for new, single lane roundabout within existing urbanised area. Single lane roundabout ICD differing from 31m are covered in the subsequent section design descriptions. Existing intersections not otherwise mentioned are proposed to retain their existing layout, although generally have active mode facilities proposed to be improved.	The typical section of an ICD consists of: 8m central island radius 7.5m circulating carriageway width. - Roadside width of 5.75m: 1.25m front berm/buffer 2.0m cycleway 2.0m footpath 0.5m back berm
Dual lane roundabout	Minimum ICD of 55m for new, dual lane roundabout within existing urban / FUZ area	The typical section of an ICD consists of: 12m central island radius 15.5m circulating carriageway width.

Design element	Approach to design	Comments
	Existing intersections not otherwise mentioned are proposed to retain their existing layout, although generally have active mode facilities proposed to be improved.	- Roadside width of 5.75m: 1.25m front berm/buffer 2.0m cycleway 2.0m footpath 0.5m back berm
Uncontrolled intersections	To utilise the existing geometry as much as possible.	N/A
Slope embankment and retaining walls	As per section 2.8 of this report.	N/A
Sight distance	Stopping Sight Distance (SSD), Approach Sight Distance (ASD) and Safe Intersection Sight Distance (SISD) have been checked to inform the geometrics design	SSD as per AGRD Part 3 Section 5.3 Table 5.5. ASD for at grade intersections as per AGRD Part 4A Section 3.2.1 Table 3.1 SISD as per AGRD Part 4A Section 3.2.2 Table 3.2

2.8 Geotechnical design

2.8.1 Slope stability

No numerical analysis has been carried out in this phase of design, with assessment based on review of recent and historic investigation data. Stability of slopes has been assessed based on the mapped geomorphology, and the performance of similar geological areas.

1V:3H slopes have been adopted as the default batter for cut and fill slopes to meet maintenance requirements. Within the Auckland region, similar slopes have been widely utilised successfully in soils that do not have known slope instability issues.

Typically, where the alignment crosses alluvial, or swamp deposits on the geological map, embankment side slopes of 1V:4H would be adopted and not the general 1V:3H applicable for the remainder of the soils in the Takaanini area. However, since the extent of the embankments on alluvial or swamp deposits are minor to negligible, persevering with the 1V:3H embankment slopes is recommended except for Great South Rd Drury.

2.8.2 Retaining walls

Vertical retaining walls have been placed where necessary to limit impact on properties and manage topographic constraints, e.g. low retaining walls are proposed at back of active mode paths to minimise third party land take associated with earthwork embankments. Fill walls have been assumed to be constructed using generic mechanically stabilised earth techniques.

Given the limited geotechnical information available, the form of the retaining walls has not been determined, with the most suitable wall types identified to inform the construction method statement and cost estimation.

Final decisions around wall type will be undertaken during subsequent design phases once further site investigation is carried out.

2.8.3 Bridge abutments

Vertical abutment walls have been adopted as the default approach to bridge abutments within the existing urbanised/industrial area. The vertical abutment walls have been assumed to be constructed using mechanically stabilised earth walls.

No specific design of abutment walls slope stability has been carried out during this phase of design.

2.9 Structures design for bridge upgrades

Given the high-level nature of design input, the route protection philosophy is that no preliminary or detailed design is undertaken for the structures, but the basic structural form (Span, deck type and substructure configuration) defined to confirm viability of the chosen alignment and designation. Abutment forms are designed as vertical walls and bench-type atop cut faces. Refer also to section 2.8.3 for information at bridge abutments.

The following design standards have been referenced for this design:

- The NZTA: Bridge manual 3rd edition published, Revision 4
- The NZTA: Highway structures design guide 1st edition
- NZTA Research Report 364: Standard precast concrete bridge beams

The philosophy with regards to bridge superstructure form is to utilise standard precast concrete girders with cast in-situ topping slabs. This is to ensure that the bridges can be designed and constructed using readily available building materials and standard forms.

Bridge skew angles are limited to a maximum of 30 degrees relative to the service being crossed. This is to ensure that no standard bridge design is precluded from future detailed design. Typically, girder type and box type bridge decks are only suitable up to skews of 30 degrees.

The design approach is to provide equal spans stream crossings while for road over road and road over rail bridges to have backspan to mainspan ratio of between 0.6 and 0.8. The chosen structural articulation is as follows:

- Single span bridges up to a maximum structure length of 35 m
- Multi-span bridges for structure lengths exceeding 35 m, or as dictated by geometric constraints.

2.10 Stormwater Design and Flooding

Stormwater design includes four separate yet related considerations:

- Stormwater runoff capture / conveyance system design,
- Treatment design (water quality mitigation),
- Water quantity design (hydrologic mitigation) and
- Flood effect mitigation (peak flow increase and displacement effects).

Each of these stormwater design features are prescribed for management within Auckland Council Guidelines and/or required by the Unitary Plan - Operative in Part (AUP:OP). The Auckland Design

Manual, the Auckland Transport Design Manuals and the Unitary Plan are the key documents that govern the stormwater design approach.

In general, the key stormwater objectives are to provide stormwater treatment and retention/detention for new impervious surfaces, re-use and re-purpose existing infrastructure, enhance with green infrastructure and provide water quality treatment for stormwater runoff from existing surfaces where possible, including where existing runoff mixes with new prioritising high loading areas such as intersections. This stormwater design approach adopted by this project does not include resolving existing flooding issues in sections of the corridor which are located in flood plains and recommends these issues to be looked at separately from a holistic manner.

2.10.1 Stormwater runoff capture and conveyance

The Road Drainage chapter of the Auckland Transport Design Manual sets out the performance requirements for stormwater capture and conveyance systems for local roads in Auckland. The details of this system shall be developed and confirmed at the resource consent application phase of the project.

For Takaanini FTN project, the new road sections will have kerb and channel along both sides and the new bridge sections will have concrete barrier to intercept road runoff and the flow will be conveyed by underground piped network.

The intercepted road runoff will either flow into linear stormwater management device (SWMD) for treatment on both sides of the road or captured in catchpits. The untreated water will flow into downstream SWMD for treatment and attenuation, if required. The treated water will be discharged into either stormwater pipe network, stream or overland flow path.

For the Popes Road urbanisation project, the new road sections will have swales along both sides to serve both conveyance and treatment purposes. The road runoff will sheet flow into the swales and then the treated water will be discharged into conveyance channels via scruffy domes and pipes. The conveyance channel will eventually outfall to stream.

The Popes Road proposed stormwater design was the preferred option after a workshop with Auckland Transport Stormwater Team. This design option will allow for retaining the existing large conveyance channel on southern side of road while the proposed works will widen the road on the northern side into Future Urban Zone (FUZ).

2.10.2 Stormwater treatment and hydrologic mitigation

Stormwater runoff is considered polluted when flowing from high vehicle use impervious areas. The Auckland Unitary Plan (AUP), chapter E9 considers the construction of roads, greater than 5000m² of new impervious road area, as a controlled activity and treatment is required in accordance with Guidance Document 2017/001 *Stormwater Management Devices in the Auckland Region* (GD01). Raingardens/bioretention systems, planted or grassed swales, wetlands and proprietary cartridge treatment systems are common practice to meet this requirement.

For Takaanini FTN project, wetlands are the preferred stormwater treatment option. If a wetland is not feasible due to space or flood plain constraints, linear SWMD (i.e. bioretention/raingarden) are proposed.

For Popes Road urbanisation project, the preferred stormwater treatment option is treatment swales on both sides of road following workshop with Auckland Transport Stormwater Team.

Water quality treatment and hydrologic mitigation requirements on high-use roads are considered when sizing swales, wetlands and bioretention/raingarden systems. Treated and detained stormwater runoff from the road will be discharged into the stormwater network or stream.

Stormwater discharge into stormwater network is permitted activity in accordance with AUP:OP chapter E8 if the post development flow does not increase stormwater runoff to the receiving network. Attenuation of the 10% AEP rainfall event is assumed when discharging into the existing stormwater pipe network, to mitigate inundation of the existing stormwater pipe network. The network utility operator shall confirm this at resource consent stage.

Stormwater discharge into a stream receiving environment will need to comply with the hydrologic mitigation requirements in AUP:OP chapter E8 and E10. Hydrologic mitigation refers to the retention, detention and slow release of stormwater runoff to prevent downstream erosion. AUP:OP chapter E8 contains a trigger for restricted discretionary activities that require SMAF 1 hydrologic mitigation regardless of being in the (Stormwater Management Area) SMAF control overlay or not. The Auckland Unitary Plan E10 defines the approach to retention and detention as either SMAF 1 or SMAF 2. SMAF is an acronym for Stormwater Management Area Flow and generally refers to control overlay in the unitary plan where the requirement is identified based on downstream environment sensitivity.

Detention requirements for 10% AEP or 1% AEP can be fulfilled by using wetlands, wetland swale, propriety underground detention system or large diameter pipes. Stormwater management devices (SWMDs) will be designed in accordance with AC GD01.

2.10.3 Flood effect mitigation

Flood effects can arise by blocking overland flow paths, having additional new impervious area (increasing stormwater runoff) and by displacing flood storage. The proposed road widening and earthworks within floodplain are potential sources of flood effects and may require mitigation.

AUP:OP chapter E12 states that earthworks within 100-year AEP flood plain must not result in any adverse changes in flood hazard beyond the site.

It can be assumed that flood effects can be managed to an acceptable level through provision of bridges or larger culverts, (and/or lengthening and raising bridges) and this design is best carried out at the time of implementation when the adjacent land use is known.

Wetland, dry pond, or detention swale may be provided for flow attenuation if required for flood effect mitigation. AEE flooding assessment input (based off the Revision A design) is anticipated for areas where third party land is required for the proposed works to inform required flood mitigation measures. These measures will be considered in Revision B design with proposed designation updated to allow for such measures.

3 FTN Corridors

The Great South Road FTN and Takaanini FTN are split into 9 main sections. Refer to the main body of the DBC document and Options Assessment Appendix C for rationale on the section split. Figure 2 below outlines the section split.

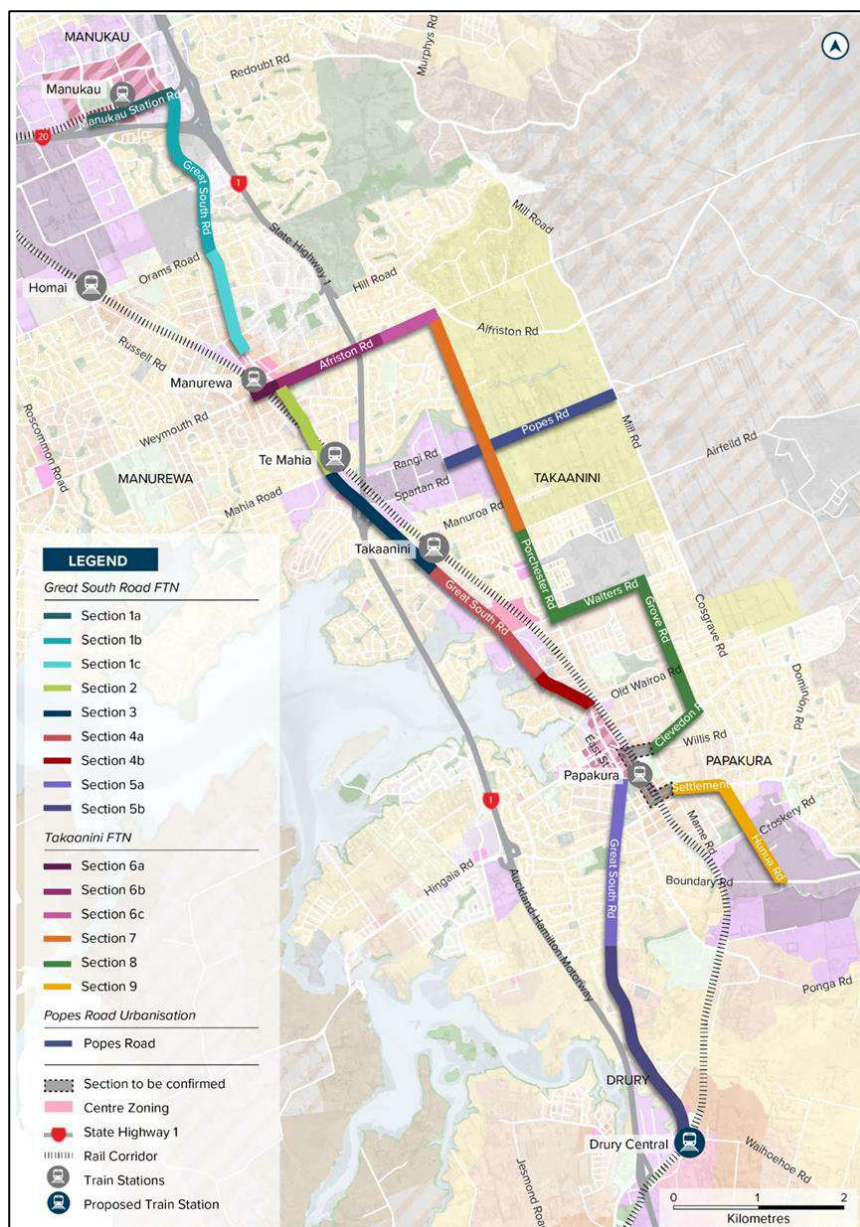


Figure 2 - GSR FTN and Takaanini FTN section split

3.1 Great South Road FTN Section 1

Table 9 below describes the key elements of GSR FTN Section 1 design. Refer GSR FTN Sheets 1 to 4 in Appendix A of this report for general arrangement plan.

Table 9 - GSR FTN Section 1 Design Features

Design item	Comments
Cross section	Retain existing kerblines and provide separated active mode path within designation, with retaining walls where required on Manukau Station Road from Lambie Dr to GSR, and on GSR from Manukau Station Road to SH20. Retain existing carriageway and retain existing segregated active mode path from SH20 to Superclinic Road. Retain existing kerblines and provide separated active mode path within designation from Superclinic Rd to Browns Rd. Three lane arterial 20m cross section as per Table 2 applied from Browns Road to Manurewa town centre. Median and berm widths to vary along corridor to tie into adjacent intersections and bridges.
Horizontal and vertical alignment	Design as per Table 8. Vertical alignment - Generally retained along corridor. Horizontal alignment - Generally retained along corridor, except - At the GSR / Browns Rd / Oram Rd intersection and GSR / Grande Vue Rd intersection, where widening is favoured on the eastern side to reduce overall property impacts.
Intersections	- Manukau Station Rd/ GSR / Redoubt Rd signalised intersection to remain as signalised but upgraded Manukau Station Rd leg to accommodate right turn bus lane into GSR. - GSR / Browns Rd / Orams Rd signalised intersection to remain as signalised but upgraded to suit proposed intersection form with slip lanes removed on the southern GSR leg. - GSR / Grande Vue Rd priority control intersection upgraded to signalised intersection. - All other intersections not listed retain their existing intersection form/function and includes active mode upgrade only within existing road corridor.
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. Retaining walls of up to 2.0 m are proposed at infrequent intervals along the alignment. For GSR from Manukau Station Rd to Browns Rd intersection, investigations found peat at depths as shallow as 3.4m inferring the potential for some settlement issues to occur without mitigation. It is recommended this to be further investigated at time of implementation and any appropriate mitigation measures to be confirmed/agreed with the asset owner. Otherwise, the proposed earthworks along the existing roadway are minor.
Bridge design	SH20 Overbridge - Existing structure achieves sufficient vertical clearance outlined in Table 7. - Design proposes to retain existing structure and existing segregated active mode on the bridge. There is opportunity to reconfigure the bridge surface to improve the active mode path if desired at implementation. Puhinui Creek Bridge

Design item	Comments
	- Existing structure potentially has insufficient vertical clearance for 1 in 100y flood levels based on structure depth (assumed to be of similar depth to SGA new structure proposed at 2.1m) and freeboard assumptions. - Design proposes to retain existing structure and existing segregated active mode on the bridge. There is opportunity to reconfigure the bridge surface to improve the active mode path if desired at implementation.
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8, and Activity A7 of Chapter E10. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

3.2 Great South Road FTN Section 2

Existing topography between Woodside Road and Myers Road/NIMT generally consists of terrain sloping down on the west and terrain slightly elevated on the east. Driveway access regrading per requirements of AUP make a significant number of properties on the west unable to be retained following corridor widening. Note that many of these are existing non-compliances based on the existing road layout. This in turn, has motivated a larger proportion of corridor widening to be carried out on the west.

Table 10 below describes the key elements of GSR FTN Section 2 design. Refer drawing GSR FTN Sheets 4 and 5 in Appendix A of this report for general arrangement plan.

Table 10 - GSR FTN Section 2 Design Features

Design item	Comments
Cross section	Four lane arterial 26.5m cross section as per Table 2 from GSR / Weymouth / Alfriston Rd intersection to Mcannalley St. Three lane 20m cross section as per Table 2 with northbound bus lane only from south of the Mcannalley St to Mahia Rd.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor. Horizontal alignment - From Woodside Rd to Myers Rd, the alignment is modified to reduce property impacts. Widening is favoured on western side due to existing deficiencies with property accessways. - Further south of Myers Rd, the alignment largely follows the existing.

Design item	Comments
Intersections	- GSR / Weymouth Rd / Alfriston Rd signalised intersection to remain as signalised but upgraded to suit proposed intersection form, and with slip lane removed on the northern GSR leg. - GSR / Mcannalley St priority control intersection to be upgraded to signalised intersection - All other intersections not listed retain their existing intersection form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e., embankment batters of 1V:3H. Retaining walls of up to 2.0 m are proposed at infrequent intervals along the alignment. The proposed earthworks along the existing roadway are minor.
Bridge design	NIMT rail overbridge - Design proposes to retain existing structure and reconfigure the bridge surface to have wider separated active modes on either side of existing kerb lines, and replacement of existing barriers to suit geometry. - It is noted that the structure may be unsuitable for future KiwiRail Four Tracking given constraints to lateral clearance. Therefore, there may be future opportunities to consolidate project outcomes (e.g. to improve capacity over the bridge).
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8, and Activity A7 of Chapter E10. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

3.3 Great South Road FTN Section 3

Table 11 below describes the key elements of GSR FTN Section 3 design. Refer GSR FTN Sheets 5 and 6 in Appendix A of this report for general arrangement plan.

Table 11 - GSR FTN Section 3 Design Features

Design item	Comments
Cross section	Retain existing shared active mode path and lane arrangement from Papakura Stream Bridge to Manuia Rd. Four lane arterial 26.5m cross section as per Table 2 widening to full road reserve where possible from Manuroa Rd to Taka St. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.

Design item	Comments
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor. Horizontal alignment - Generally retained along corridor, except between the northern extent to Papakura Stream Bridge, where widening is favoured on eastern side to utilise property yards with minimal development and avoid full building / property acquisitions
Intersections	- GSR / Mahia Rd signalised intersection remain as signalised but upgraded to suit proposed intersection layout, and with slip lane removed. - GSR / Manuia Rd / Challen Cl priority control intersection upgrade to signalised intersection is included in the SGA Takaanini Level Crossings NoR 1. This intersection upgrade is intended to tie into the section 3 GSR FTNs layout. - GSR / Manuroa Rd / Beaumaris Way signalised intersection remain as signalised but upgraded to suit proposed intersection layout, and with slip lanes removed. - All other intersections not listed retain their existing intersection form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. No retaining wall or notable embankments proposed in the design.
Bridge design	Papakura Stream Bridge - Existing structure has insufficient cross-sectional width (approx. 17m) to reconfigure surface to provide improved active mode facilities on the bridge. Existing structure does not meet current Bridge Manual loading requirements, nor sufficient vertical clearance for 1 in 100y flood levels based on structure depth and freeboard assumptions. - Design proposes to retain existing bridge structure and existing constrained active modes facilities on the bridge. There is opportunity to reconfigure the bridge surface to improve the active mode path if desired at implementation.
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

3.4 Great South Road FTN Section 4

Table 12 below describes the key elements of GSR FTN Section 4 design. Refer GSR FTN Sheets 6 to 8 in Appendix A of this report for general arrangement plan.

Table 12 - GSR FTN Section 4 Design Features

Design item	Comments
Cross section	Four lane arterial 26.5m cross section as per Table 2 from Walters Rd to Tironui Rd Three lane arterial 20m cross section as per Table 2 with northbound bus lane only from Tironui Rd to Subway Rd. Median and berm widths to vary along corridor to tie into adjacent intersections.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor Horizontal alignment - Generally retained along corridor, except on approach to the GSR / Subway Rd intersection where widening is favoured on the eastern side to reduce amount of full building / property acquisitions and avoid heritage building and notable trees on the western side.
Intersections	- GSR / Walter Strevens Dr / Taka St signalised intersection to remain as signalised but upgraded to suit proposed intersection layout, with slip lane removed. - GSR / Subway Rd signalised intersection to remain as signalised but upgraded to suit proposed intersection layout. - All other intersections not listed retain their existing intersection form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. One retaining wall with 2.0 m height proposed before the GSR/Walters Rd intersection, otherwise no notable embankments proposed in the design.
Bridge design	N/A
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

3.5 Great South Road FTN Section 5

Table 13 below describes the key elements of GSR FTN Section 5 design. Refer GSR FTN Sheets 8 to 11 in Appendix A of this report for general arrangement plan.

Table 13 - GSR FTN Section 5 Design Features

Design item	Comments
Cross section	Three lane arterial 20m cross section as per Table 2. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor, except on approaches to the upgraded Slippery Creek bridge. - Modified at bridge over Slippery Creek to increase vertical level and provide clearance envelope as per Table 7 Horizontal alignment - Generally retained along corridor, except at the GSR/ Settlement Rd / Beach Rd intersection upgrade where widening is favoured on the eastern side to avoid encroachment into Kirks Bush SEA on the west.
Intersections	- GSR / Settlement Rd / Beach Rd signalised intersection to remain as signalised but upgraded to suit proposed intersection layout. - GSR / Rosehill Dr priority control intersection to be upgraded to signalised intersection. - GSR / Park Estate Rd priority control intersection to be upgraded to signalised intersection. - All other intersections not listed retain their existing intersection form/function.
Accessways	Existing access from GSR to Slippery Creek south of Slippery Creek bridge to be reinstated following bridge upgrade works.
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. Retaining walls of up to 2.0 m are proposed at infrequent intervals along the alignment. Ground investigations found peat at shallow depths inferring the potential for settlement issues to occur without mitigation for these retaining walls. On approach to the upgraded Slippery Creek bridge, retaining walls of up to 3 m are proposed. The area is locally mapped as recent alluvium (Holocene) which could be soft and compressible. Adjacent bore log describes soils including peat over mudstone from 14m depth. The lower elevation of the bridge compared to the bore location may indicate rock near the surface at the bridge. It is likely the surface soils are weak, compressible, and unstable near the stream bank. However, they are likely to be < 5 m thick based on observed comparison of the stream bank surface and possible rock surface in the stream bed. In this situation undercut to rock would be viable beneath approach embankment fills provided a temporary sheet piled cofferdam is constructed to control water ingress. Possibly the bridge can be supported on shallow foundations bearing on rock, though piles are more likely viable, particularly for any pier foundations in the stream. Rock strength is unknown, but it would be necessary to socket the piles in rock and bored piles would achieve that for most conditions more reliably than driven.
Bridge design	Slippery Creek Bridge

Design item	Comments
	- Existing structure has insufficient cross-sectional width (approx. 9.2m) to reconfigure surface to suit a 3 lane arrangement with separated active mode facilities on both sides. Existing structure does not meet current Bridge Manual loading requirements. Existing structure has insufficient vertical clearance for 1 in 100y flood levels based on structure depth and freeboard assumptions. - Design proposes to replace existing bridge with a new single span, 34m long bridge, with 3 lane 21m cross section as per Table 2 and vertical clearance as per Table 7. Embankments will be retained to avoid spill into the riparian zone.
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

3.6 Takaanini FTN Section 6

Table 14 below describes the key elements of Takaanini FTN Section 6 design. Refer Takaanini FTN Sheets 1 and 2 in Appendix A of this report for general arrangement plan.

Table 14 - Takaanini FTN Section 6 Design Features

Design item	Comments
Cross section	Four lane arterial 26.5m cross section as per Table 3 on Weymouth Rd and Alfriston Rd up Magic Way. Three lane arterial 20m cross section as per Table 3 on Alfriston Rd from Magic Way to Porchester Rd. Median and berm widths to vary along corridor to tie into adjacent intersections and bridges.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor, except on approaches to the upgraded Weymouth Rd bridge over NIMT and Alfriston Rd bridge over SH1 Southern Motorway - Modified at Weymouth Rd bridge over NIMT to increase vertical level and provide clearance envelope as per Table 7 - Modified at Alfriston Rd bridge over SH1 Southern Motorway to increase vertical level and provide clearance envelope as per Table 7 Horizontal alignment - For the western extent (Weymouth Rd) to GSR / Weymouth Rd / Alfriston Rd intersection, widening is favoured on northern side to align with indicative Manurewa Station layout and allow partial offline construction of bridge - From GSR / Weymouth Rd / Alfriston Rd intersection to Gallagher Park, widening is favoured on south to limit impact on church and high density block - From Gallagher Park to Alfriston Rd / Claude Road intersection, widening favoured on north to limit impact on community housing and high density block - From Alfriston Rd / Claude Road intersection to Alfriston Rd / Magic Way intersection, widening of corridor is applied to both sides to limit full building / property acquisitions - Further east of Alfriston Rd / Magic Way intersection, the alignment largely follows the existing.
Intersections	- Weymouth Rd / Manurewa Train station access road priority control intersection to be upgraded to signalised intersection - Weymouth Rd / Beaumonts Way intersection is proposed to be closed, with cul-de-sac head proposed at the northern end of Beaumonts Way to residential standard. - Weymouth Rd / GSR / Alfriston Rd signalised intersection remain as signalised but upgraded to suit proposed intersection layout, and with slip lane removed on the northern GSR leg. - Alfriston Rd / Claude Rd priority control intersection to be upgraded to signalised intersection. - Alfriston Rd / Scotts Rd priority control intersection to be upgraded to signalised intersection.

Design item	Comments
	- Alfriston Rd / Magic Way signalised intersection to remain as signalised but upgraded to suit proposed intersection layout - Alfriston Rd / Porchester Rd signalised intersection remain as signalised but upgraded to suit proposed intersection layout, and with slip lanes removed. - All other intersections not listed retain their existing intersection form/function.
Accessways	A 4m wide active mode path has been incorporated into the design to retain pedestrian/cyclist connectivity between Weymouth Rd and Beaumonts Way cul-de-sac. A 2m wide footpath has been provided in design to provide pedestrian access from northern end of Shifnal Dr to Alfriston Rd.
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. Retaining walls of up to 2m are proposed at the end of the Alfriston Rd upgrades. On approach to the upgraded Weymouth Rd rail overbridge, fill embankments of up to 4m are proposed in the design. The area is mapped as Puketoka formation (alluvium). No investigation data is available, and it is assumed that sandstone rock is shallow as per at Myers Rd. Ground conditions are assumed to be competent with stiff clays and sandstone rock at shallow to medium depth. Approach embankments would likely be earthfill given existing fill and batter presence. Ground improvement likely can be limited to shallow undercut. Bridge foundations are likely required to be bored concrete piles founding at around 10-15m depth, to be confirmed at implementation with further geotechnical investigation. On approach to the upgraded Alfriston Rd SH1 overbridge, retaining walls of up to 6m are proposed in the design. The area is mapped as Puketoka formation (alluvium). Ground conditions based on adjacent bore log (Borehole BH_89142) describes soft to very stiff and loose to medium dense completely weather ECBF from 1.5m depth and siltstone from 23m depth. Approach embankments can be 2H:1V to 3H:1V soil fill batters. Given the substantial depth (23 m) of completely weathered rock some settlement could develop but this is likely to occur given the mix ground conditions and potential for faster draining through sand layers, i.e., wick drains are unlikely to be required. Bridge foundations would be bored concrete piles founding in ECBF rock with total length of about 30m.
Bridge design	Weymouth Road Rail Overbridge - Existing structure has insufficient cross-sectional width (approx. 10.3m) to reconfigure surface to suit the desired lane arrangement to achieve the transport outcomes (four lanes with separated active modes). Existing structure does not meet current Bridge Manual loading requirements. - Design proposes to replace existing bridge with a new 52m long bridge with the standard SGA 24m 4 lane cross section as per Table 3. - Bridge span arrangement (likely multi-span) will need to be coordinated with the KiwiRail Four Tracking / Manurewa Station Upgrade project(s) at time of implementation. Opportunity for integration/coordination of bridge pier with station platform. Bridge skew to be managed in coordination with existing and proposed rail track alignments. Alfriston Rd SH1 Overbridge - Existing structure has insufficient cross-sectional width (approx. 9m) to reconfigure surface to suit the lane arrangement for the desired transport outcomes. Existing structure does not meet current Bridge Manual loading requirements.

Design item	Comments
	Design proposes to replace existing bridge with a new multi-span 62m long bridge with the standard SGA 24m 4 lane cross section as per Table 3.
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8. Four wetlands are proposed for water quality treatment and hydrologic mitigation. Wetlands integrated with a larger landscape plan would be the preferred solution. The detention requirement for the last catchment of Section 6 along Alfriston Road east of Magic Way will be fulfilled by providing propriety underground detention system or using large diameter pipes.

3.7 Takaanini FTN Section 7

Table 15 below describes the key elements of Takaanini FTN Section 7 design. Refer Takaanini FTN Sheets 3 and 4 in Appendix A of this report for general arrangement plan.

Table 15 - Takaanini FTN Section 7 Design Features

Design item	Comments
Cross section	Two lane arterial 24m cross section as per Table 3 on Porchester Rd from Alfriston Rd to edge of FUZ north of Manuroa Rd. Two lane arterial 20m cross section as per Table 3 on Porchester Rd from Manuroa Rd to Airfield Rd. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor Horizontal alignment - Modified along corridor to reduce property impacts - From the northern extent (Porchester Rd) to Papakura Stream bridge, widening is favoured on eastern side to utilise FUZ land and reduce impact on live zoned properties - From Papakura Stream to Porchester Rd / Popes Rd intersection, the road widening is favoured on the western side to reduce impact on the existing large stormwater conveyance channel to the east. This does in turn increase impact on the existing live zoned properties. A separated active mode facility is proposed to the east of the existing stormwater conveyance channel in FUZ to reduce impact on live zone properties. This active mode facility terminates on approach to the Papakura Stream bridge, and a mid-block crossing is recommended for active mode connectivity. - From the Porchester Rd / Popes Rd intersection to the edge of FUZ, widening is favoured on the eastern side to utilise FUZ land.

Design item	Comments
	Towards the southern extent in the live zone, the alignment largely follows the existing.
Intersections	- Porchester Rd / Popes Rd priority control intersection to be upgraded to dual lane 55m ICD roundabout. - Porchester Rd / Manuroa Rd / Berwyn Ave roundabout to be upgraded to single lane 31m ICD roundabout as per Table 8. - All other intersections not listed retain their existing intersection form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. The majority of proposed earthwork cuts and fills along existing roadways are minor for profile reshaping, widening existing carriageways and adding paths. The exception is the newly proposed roundabout between Porchester Rd and Popes Rd where some ground stabilisation may be required.
Bridge design	Porchester Rd Papakura Stream Bridge - Existing structure has insufficient cross-sectional width (approx. 9m) to reconfigure surface for improved active mode facilities on bridge. Existing structure does not meet current Bridge Manual loading requirements, nor sufficient vertical clearance for 1 in 100y flood levels based on structure depth and freeboard assumptions. - Design proposes to retain existing bridge with shared active mode path on western side only. Midblock pedestrian/cyclist crossings are recommended on approaches to this bridge to allow for active mode connectivity.
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8. Due to space constraints the majority of the road catchments will be provided with linear SWMD (i.e. bioretention/raingarden) for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes. Two wetlands are proposed for water quality treatment and hydrologic mitigation on both banks of Papakura Stream.

3.8 Takaanini FTN Section 8

Table 16 below describes the key elements of Takaanini FTN Section 8 design. Refer Takaanini FTN Sheets 4 to 8 in Appendix A of this report for general arrangement plans.

Table 16 - Takaanini FTN Section 8 Design Features

Design item	Comments
Cross section	Two lane arterial 20m cross section in existing live zone as per Table 3. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor. Horizontal alignment - Generally retained along corridor, except: - Along the Walters Rd mid-block east of Papakura Normal Primary School to Walters Rd / Grove Rd intersection, widening is favoured to the northern side to reduce property impacts, with the proposed active mode path running along the outside of the existing Bruce Pulman Park carpark.
Intersections	- Porchester Rd / Airfield Rd existing roundabout to be upgraded to 31m ICD roundabout with modified geometry. - Porchester Rd / Walters Rd roundabout to be upgraded to signalised intersection. - Walters Rd / Grove Rd priority control intersection to be upgraded to signalised intersection - Grove Rd / Old Wairoa Rd priority control intersection to be upgraded to 31m ICD roundabout - Grove Rd / Clevedon Rd priority control intersection to be upgraded to 31m ICD roundabout - Clevedon Rd / Marne Rd / Willis Rd existing roundabout to be upgraded to 31m ICD with modified geometry. - All other intersections not listed retain their existing intersection form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. The proposed earthwork cuts and fills along existing roadways are minor for profile reshaping, widening existing carriageways and adding paths.
Bridge design	Clevedon Rd Rail Overbridge - Existing structure has insufficient cross-sectional width (approx. 16.9m) to reconfigure surface to provide wider active mode facilities on bridge. - Design proposes to retain existing bridge with constrained active mode path. There is opportunity to reconfigure the bridge surface to improve the active mode path if desired at implementation.

Design item	Comments
	It is noted that the KiwiRail Four Tracking project will require upgrade or replacement of this bridge and there may be future opportunities to consolidate project outcomes (e.g., to improve active mode facilities).
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8, and Activity A7 of Chapter E10. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

3.9 Takaanini FTN Section 9

Table 17 below describes the key elements of Takaanini FTN Section 9 design. Refer Takaanini FTN Sheets 8 to 10 in Appendix A of this report for general arrangement plans.

Table 17 - Takaanini FTN Section 9 Design Features

Design item	Comments
Cross section	Two lane arterial 20m cross section in existing live zone as per Table 3. Median and berm widths to vary along corridor to tie into adjacent intersections and bridge.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor. Horizontal alignment - Generally retained along corridor, except - At the Opaheke Rd / Settlement Rd proposed roundabout, where widening is favoured along the southern quadrants to avoid impacting on the Papakura Cemetery. The proposed roundabout is contained within the designation set by the SGA Drury NoR D5 Ponga Rd Upgrade & Opaheke Rd (Urban) Upgrade & Opaheke Rd (Rural) Upgrade project. - At the Hunua Rd / Croskery Rd intersection, where widening is favoured on the eastern side to minimise impact on the FirstGas site and Griffins above ground utilities, and to favour culvert extension on one side only.
Intersections	- GSR / Wood St / Opaheke Rd signalised intersection to remain as signalised but upgraded to suit proposed intersection layout. - Opaheke Rd / Settlement Rd signalised intersection to be upgraded to 38m ICD roundabout, within designation set by the Auckland Transport Ponga Road and Opaheke Road Upgrade Designation mentioned in Table 1.

Design item	Comments
	- Additional ICD width recommended due to skew to improve bus tracking for turns between Opaheke and Settlement Roads. - Settlement Rd / Marne Rd existing roundabout to be upgraded to 31m ICD roundabout. - Settlement Rd / Hunua Rd priority control intersection to be upgraded to 31m ICD roundabout. - Hunua Rd / Croskery Rd priority control intersection to be upgraded to signalised intersection. - All other intersections not listed retain their existing intersection form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. The proposed earthwork cuts and fills along existing roadways are minor for profile reshaping, widening existing carriageways and adding paths.
Bridge design	Settlement Rd Rail Overbridge - Existing structure has insufficient cross-sectional width (approx. 12m) to reconfigure surface to provide improved active mode facilities on bridge. - Design proposes to retain existing bridge and constrained active mode facilities on the bridge. - Opportunity to provide a new active mode bridge offline to the existing at implementation if required. A high-level test indicates this could be achieved with no third-party land required due to existing wide road corridor and access via Railway St West. - It is noted that the KiwiRail Four Tracking project will require upgrade or replacement of this bridge and there may be future opportunities to consolidate project outcomes (e.g., to improve active mode facilities).
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8, and Activity A7 of Chapter E10. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

4 Popes Road Urbanisation

Table 18 below describes the key elements of Popes Rd Urbanisation design. Refer drawing SGA-DRG-STH-005-GE-3400 in Appendix A of this report for general arrangement plans.

Table 18 - Popes Rd Design Features

Design item	Comments
Cross section	Two lane arterial 24m cross section, refer table 5. Median and berm widths to vary along corridor to tie into adjacent intersections.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor, with minor changes to allow longitudinal drainage to be installed. Further investigation of vertical alignment expected at detailed design and accommodated within designation. Horizontal alignment - Modified along corridor to reduce property and stormwater impacts: - At the Popes Rd / Takanini School Rd roundabout, widening is favoured on north-eastern parcel to utilise existing council land - Along the rest of Popes Rd, widening is generally favoured on northern side to retain existing roadside conveyance channel / overland flow path.
Intersections	- Popes Rd / Takaanini School Rd priority control intersection to be upgraded to 41m ICD roundabout - Additional ICD width recommended due to significant usage by Heavy Commercial Vehicles to avoid central island/apron overrun - Porchester Rd / Popes Rd priority control intersection to be upgraded to dual lane 55m ICD roundabout. - All other intersections not listed retain their existing intersection form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The available geological information supports the default design for earthworks, i.e. embankment batters of 1V:3H. Popes Rd is on soft organic silt. The design proposes to fill up to 1m thickness with the road widening to the north. This is likely to generate ground settlement given the underlying >10m thickness of soft compressive organic silt soils. Fills may need to be topped up by 20% of their thickness to compensate for settlement. If settlement durations exceed construction programme limits, settlement can be accelerated using wick drains and surcharge fill. Subgrade requirements are likely to involve 0.5m to 1m of undercut, placement of geotextile and backfilling, possibly with lightweight pumice sand to limit settlement effects.
Bridge design	N/A
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8. The treatment swales will be provided for water quality treatment and SMAF1 hydrologic mitigation. Swales integrated with a larger landscape plan would be the preferred solution.

Design item	Comments
	No additional detention for higher storm event is recommended for Popes Road urbanisation. The existing conveyance channel on the southern side of Popes Road will be overtopped in the existing 10% AEP event and flood the surrounding areas. The provision 10% AEP detention for Popes Road Urbanisation Project will not improve the channel overtopping or the flooding situation.

5 Croskery Road Upgrade

Table 19 below describes the key elements of Croskery Rd Upgrade design. Refer the Croskery Rd Upgrade drawing set in Appendix A of this report for general arrangement plans.

Table 19 – Croskery Rd Design Features

Design item	Comments
Cross section	Two lane arterial 20m cross section, as shown in Table 6. At the culvert crossing, the cross section locally narrows down to approximately 15.5m by applying narrowed footpath, cycleway and berm.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor Horizontal alignment - Generally retained along corridor. Note the alignment is taken from the 2020 Croskery Rd upgrade design as part of the SGA Drury Arterials project.
Intersections	All intersections retain their existing form/function.
Accessways	N/A
Embankment slope/Geotech considerations	It is not anticipated for embankments to be required as part of the proposed works due to the relatively flat topography. Small amount of level differences may be resolved via grading of the berm or active mode path.
Bridge design	N/A
Stormwater	Refer Appendix C – Croskery Rd Memo, section 3.3 recommendation.

6 Great South Road Drury Central Upgrade

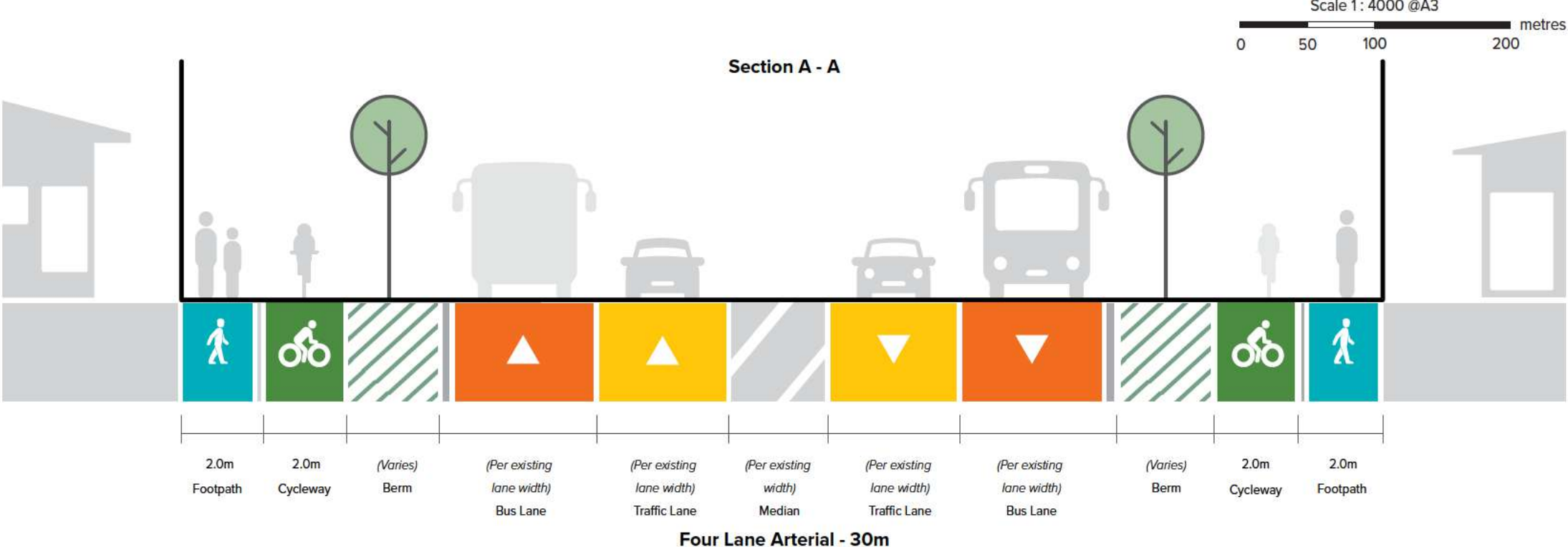
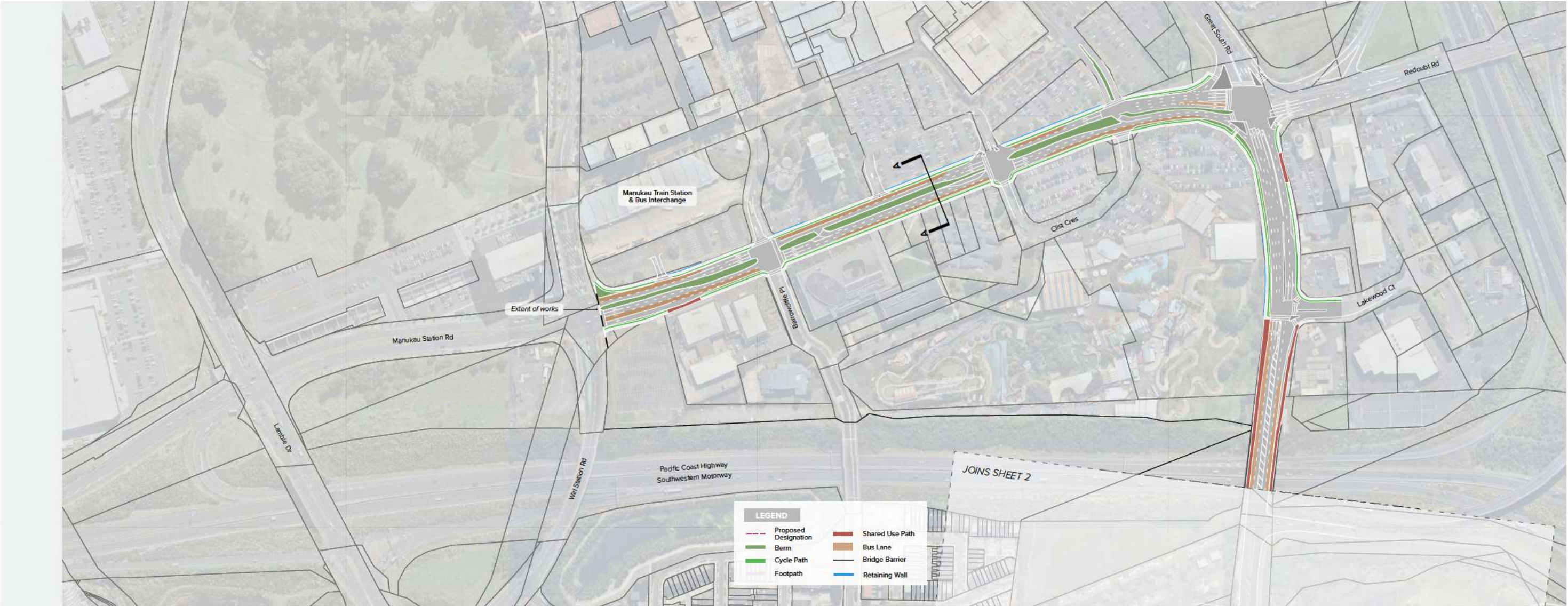
Table 20 below describes the key elements of Great South Road design, between Waihoehoe Road and SH1 Drury Interchange. Refer drawing SGA-DRG-STH-005-GE-2400 in Appendix A of this report for general arrangement plan.

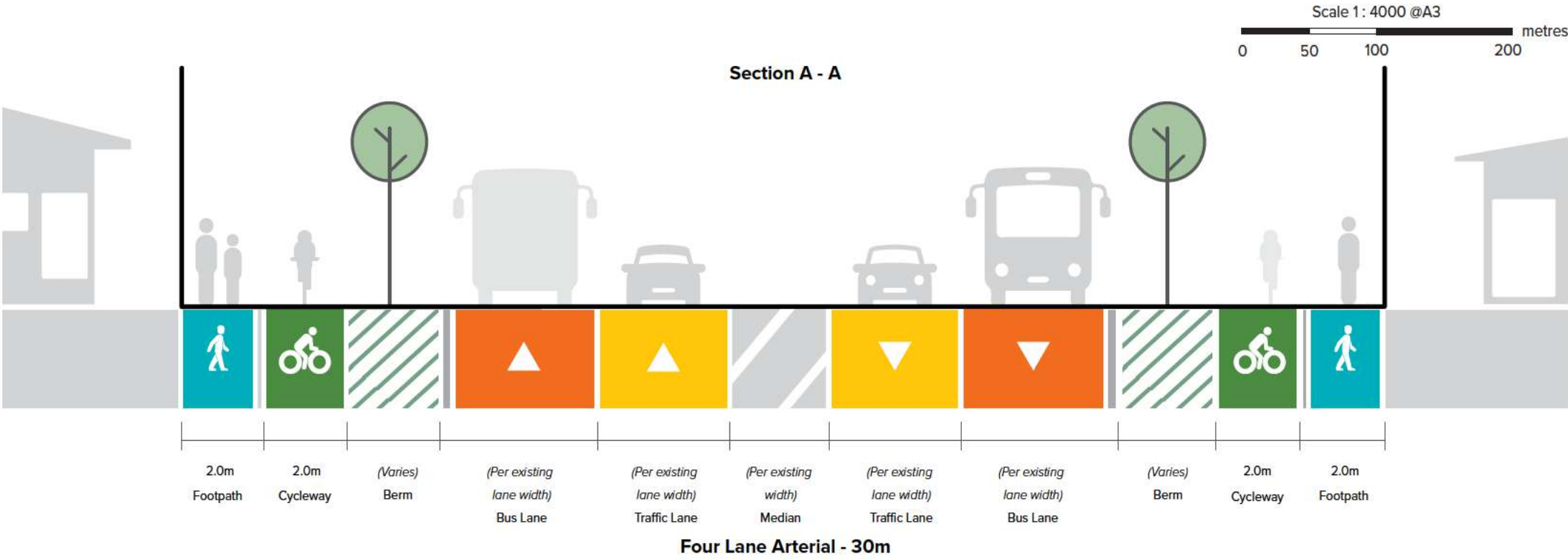
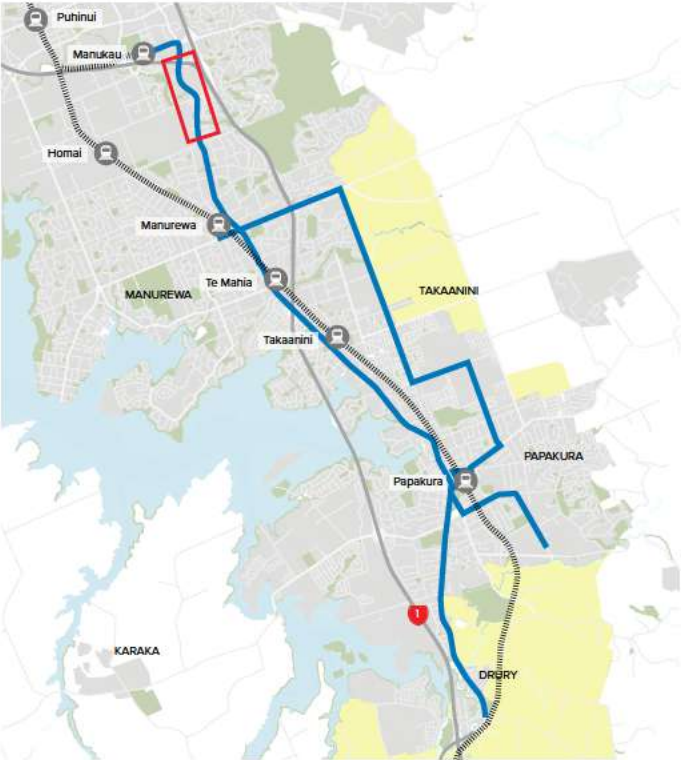
Table 20 – Great South Rd Drury Design Features

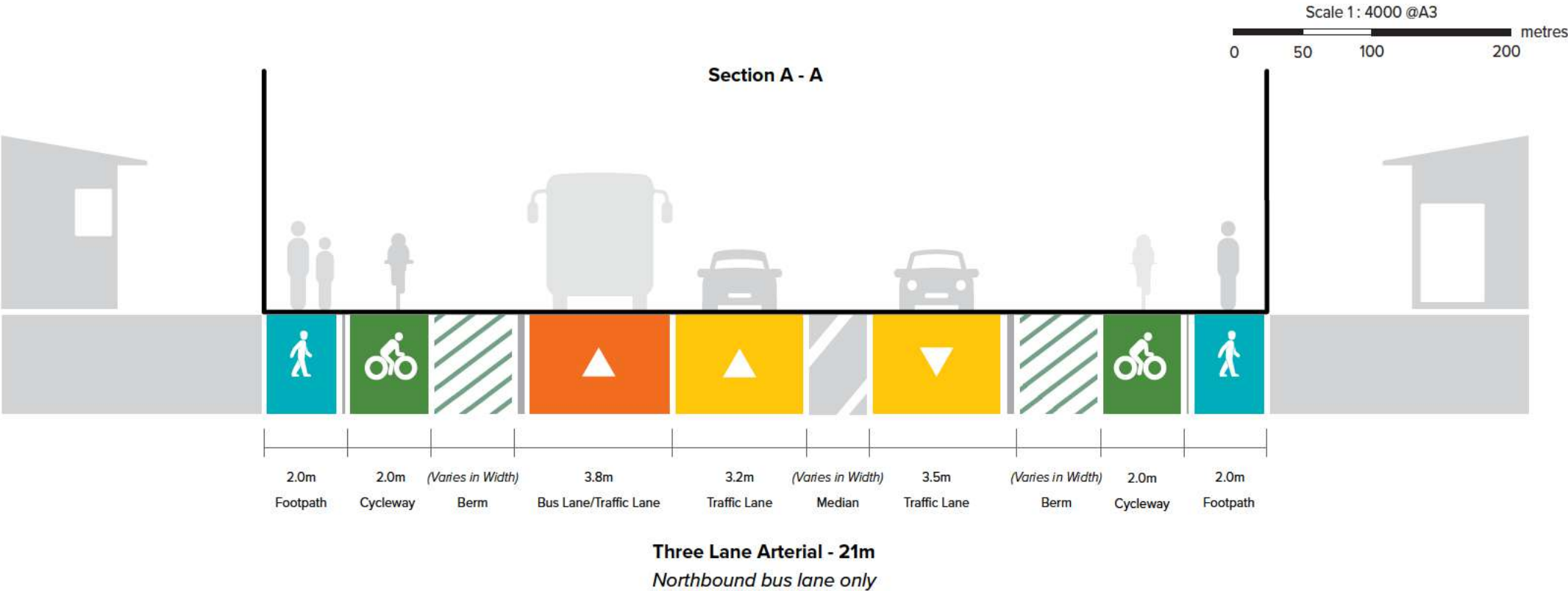
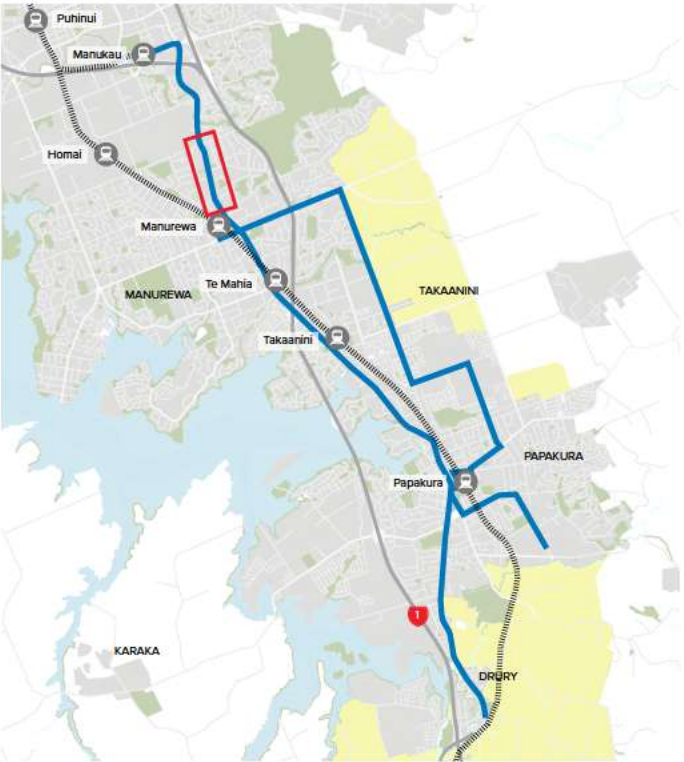
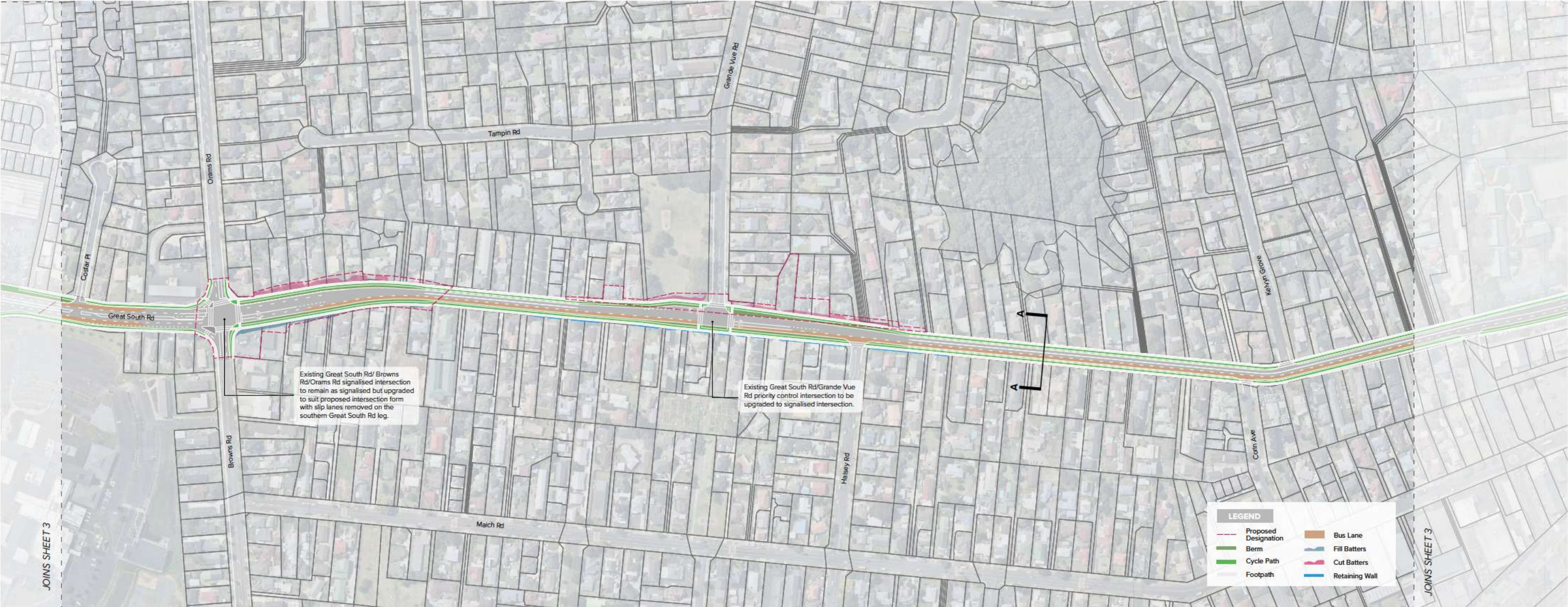
Design item	Comments
Cross section	Four lane arterial 26.5m cross section as per Table 4.
Horizontal and vertical alignment	Design as per Table 8 Vertical alignment - Generally retained along corridor, except on approaches to the upgraded Hingaia Stream bridge - Modified at bridge over Hingaia Stream to increase vertical level and provide clearance envelope as per Table 7 Horizontal alignment - Retained at interface with Waihoehoe Road intersection and SH1 Drury Interchange - Modified along remainder of length to utilise existing road reserve and allow partial construction of bridge offline
Intersections	All intersections retain their existing form/function.
Accessways	N/A
Embankment slope/Geotech considerations	The approaches to the newly proposed 4-lane bridge have filling of up to 3.6 m thickness (measured at the road centreline at CH400) proposed. This is likely to generate some ground settlement given the presence of soft and highly variable underlying layers (based on borehole log and geological map) of alluvial deposits. Fills may need to be topped up by 20% of their thickness to compensate for settlement. If settlement durations exceed construction programme limits, settlement can be accelerated using wick drains and surcharge fill. Embankment side slopes of 1V:4H would be adopted and not the general 1V:3H applicable for the remainder of the soils in the Takaanini area. A provision for ground improvement needs to be made, which would potentially incorporate wick drains coupled with a preloading surcharge. Alternatively, the programme could be shortened by installing stone columns or other in-ground support measures. Piles are likely the viable option, particularly for any pile foundations in the stream. Rock strength and depth are unknown, but it would be necessary to socket the piles in rock and bored piles would achieve that for most conditions more reliably than driven.
Bridge design	Hingaia Stream Bridge Existing structure has insufficient cross-sectional width (approx. 10m) to reconfigure surface to suit a 4 lane arrangement with separated active mode facilities on both sides. Existing structure does not meet current Bridge Manual loading requirements. Existing structure has insufficient vertical clearance for 1 in 100y flood levels based on structure depth and freeboard assumptions. Design proposes to replace existing bridge with a new multi-span 70m long bridge (20m, 30m and 20m span composition to avoid bridge piers in stream), with 24m 4 lane cross section as per Table 4 and vertical clearance as per Table 7.

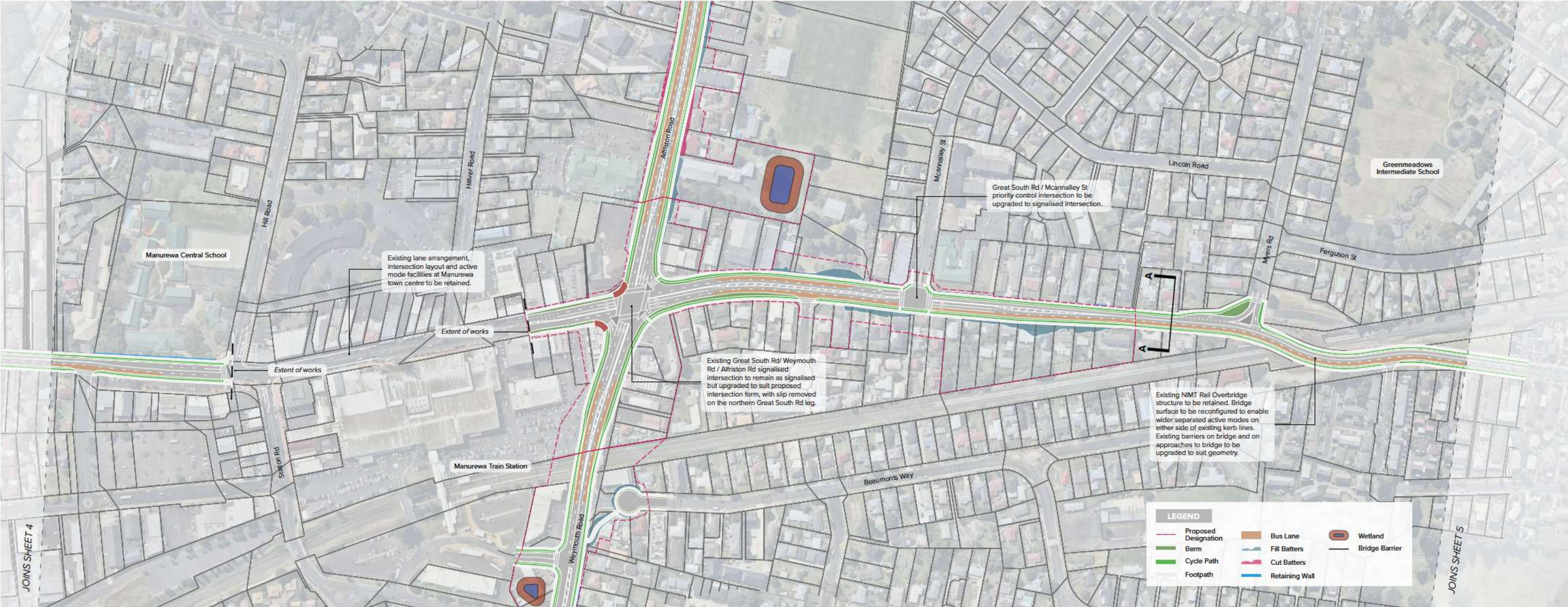
Design item	Comments
Stormwater	Water quality treatment is required by the Auckland Unitary Plan, Activity A1 of Chapter E8 and Activity A7 of Chapter E9. Hydrological mitigation is required by AUP, Activities A1, A5 and A10 of Chapter E8, and Activity A7 of Chapter E10. Due to space constraints, linear SWMD (i.e. bioretention/raingarden) will be provided for water quality treatment and hydrologic mitigation for SMAF. Detention requirement for larger storm event, i.e. 10% AEP or 1% AEP, will be fulfilled by providing propriety underground detention system or using large diameter pipes.

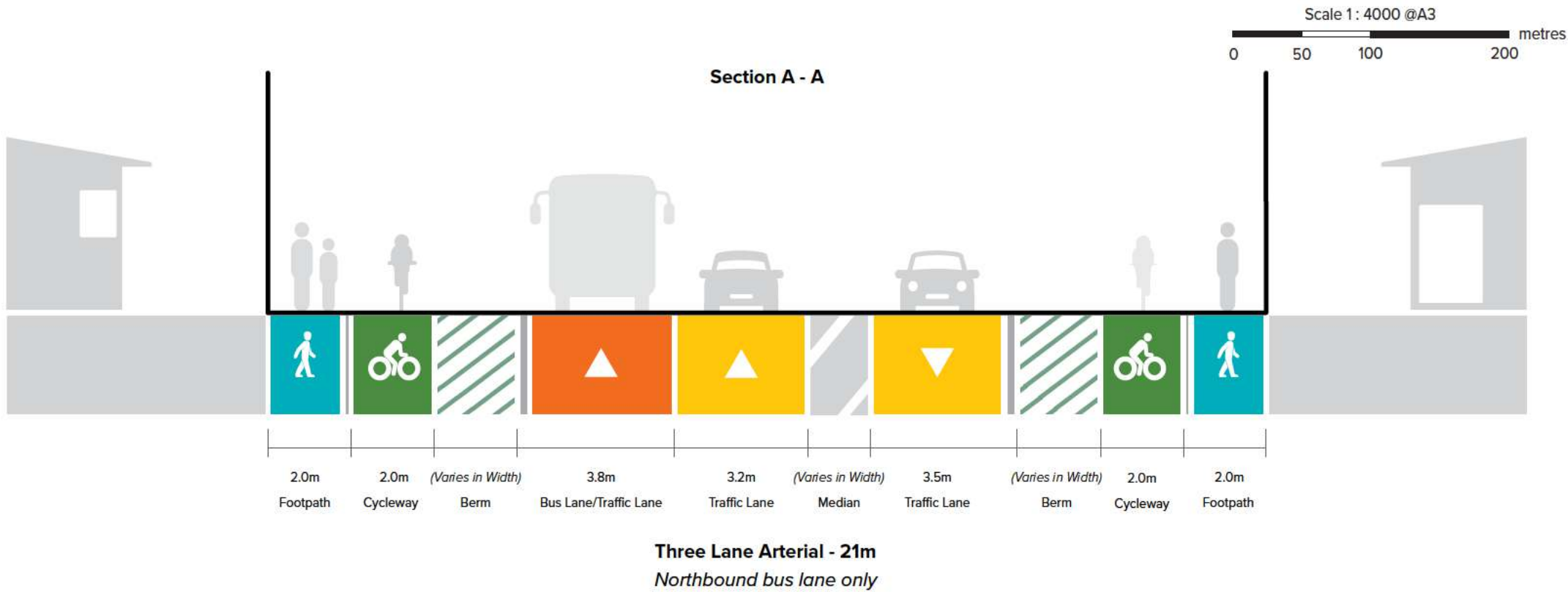
1 Appendix A - General arrangement plan

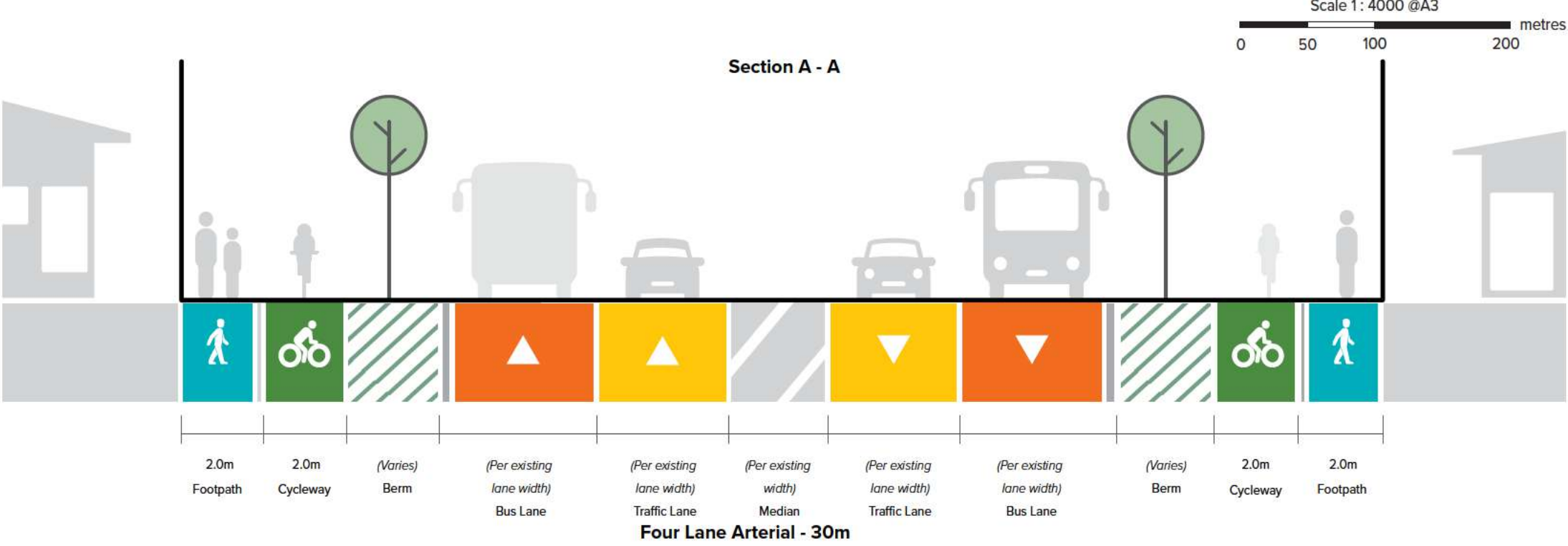
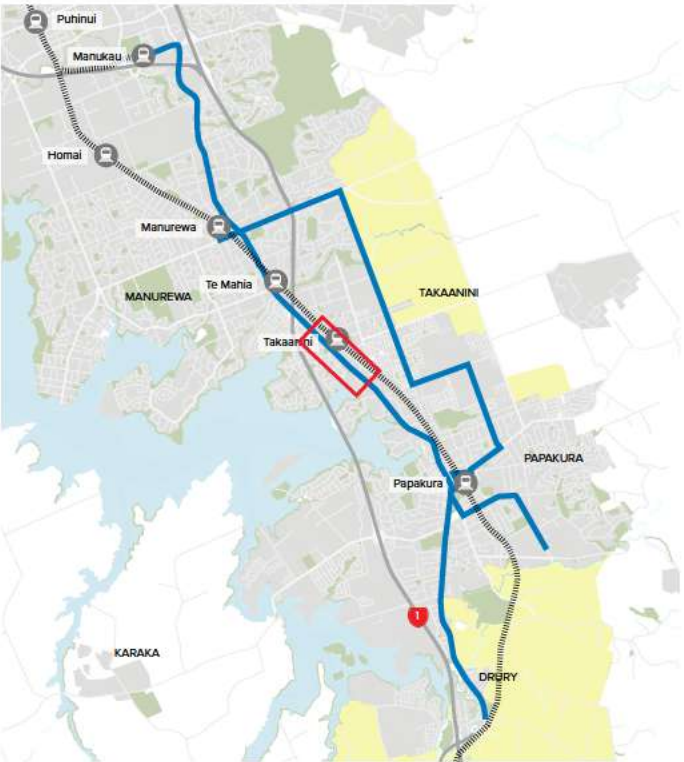


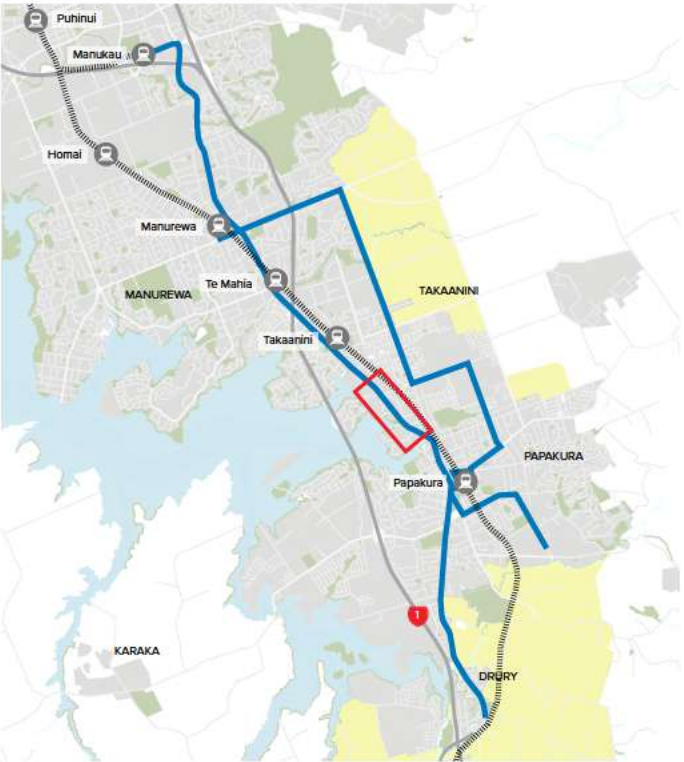
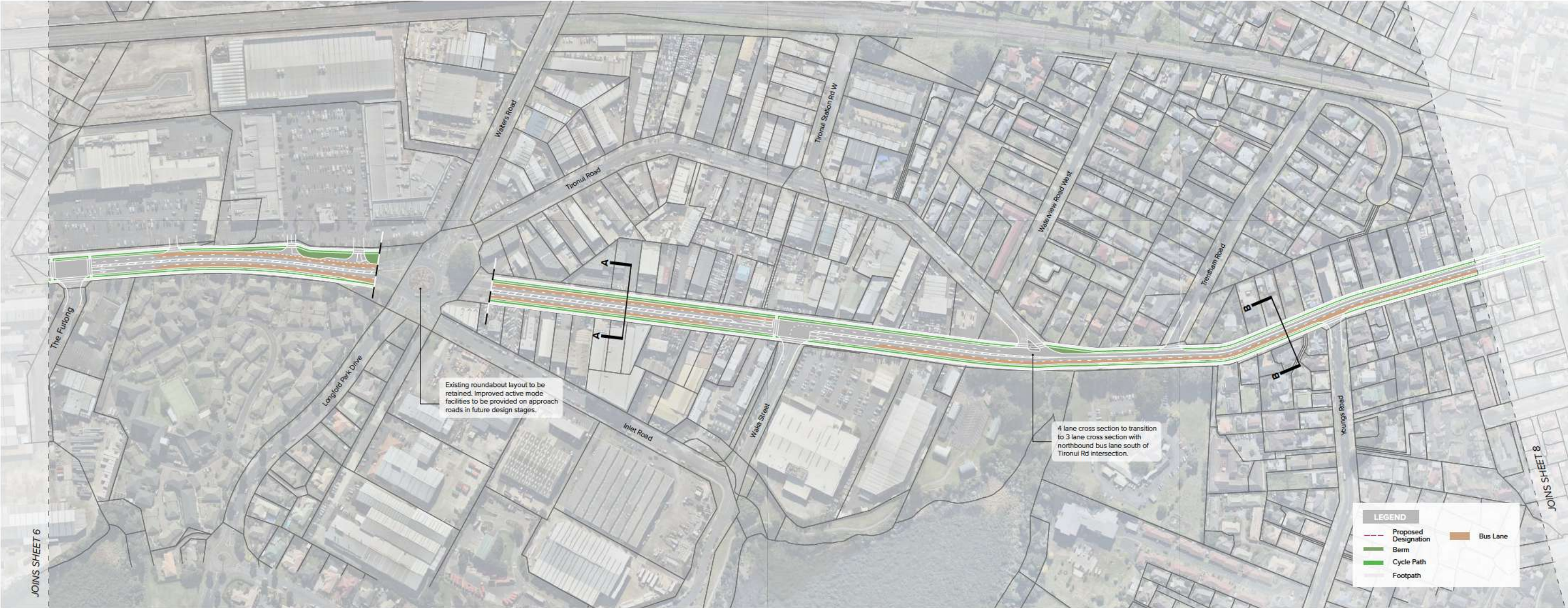






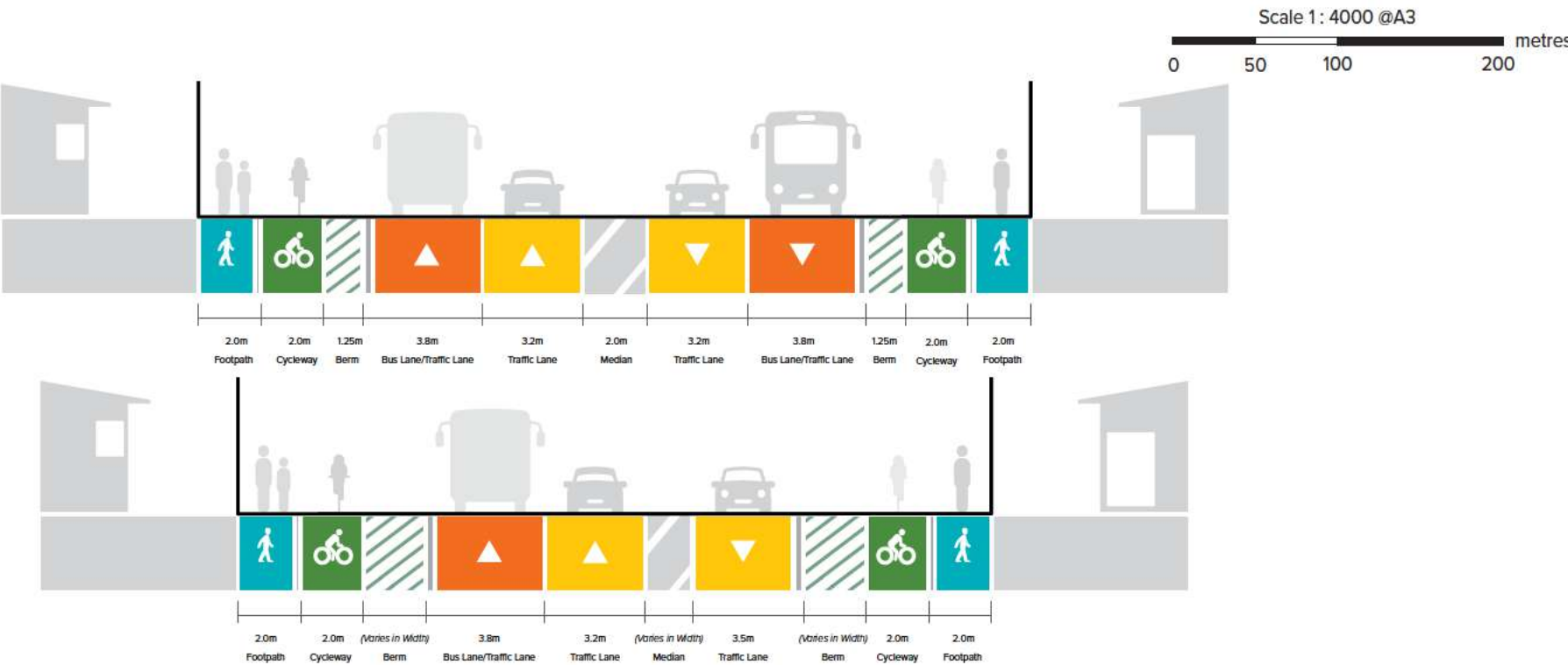


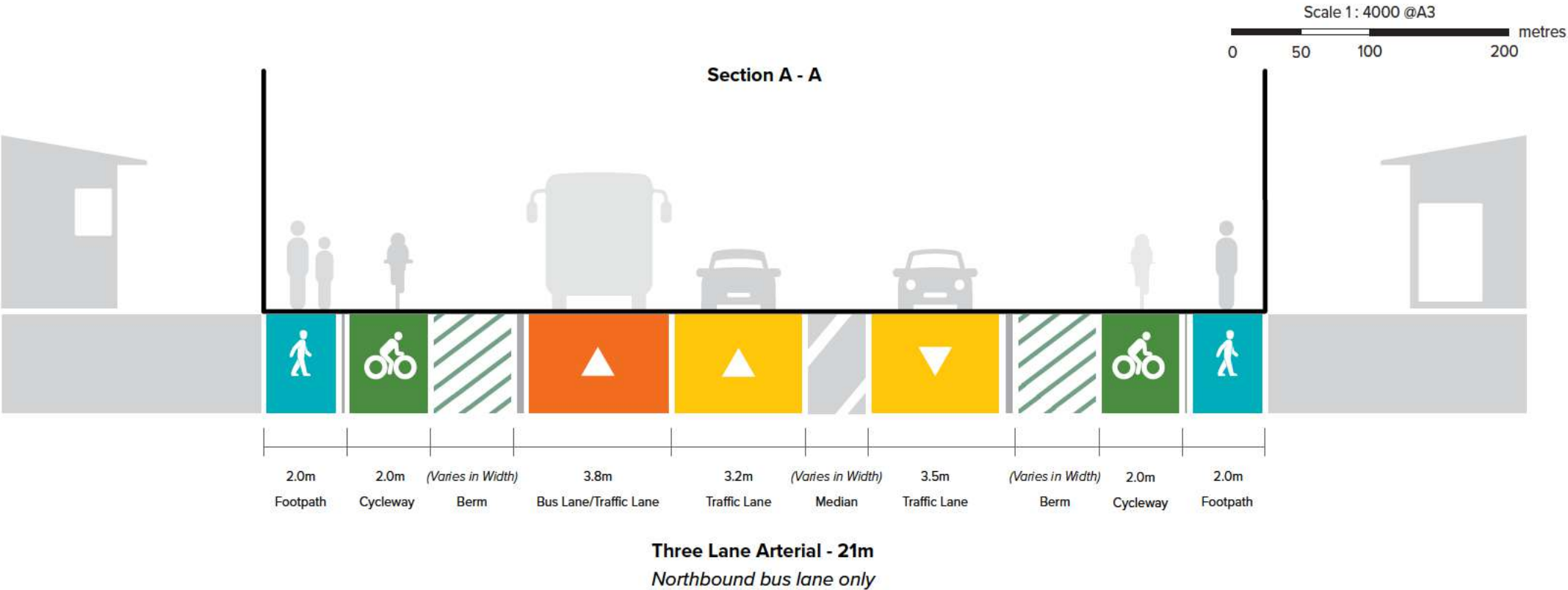
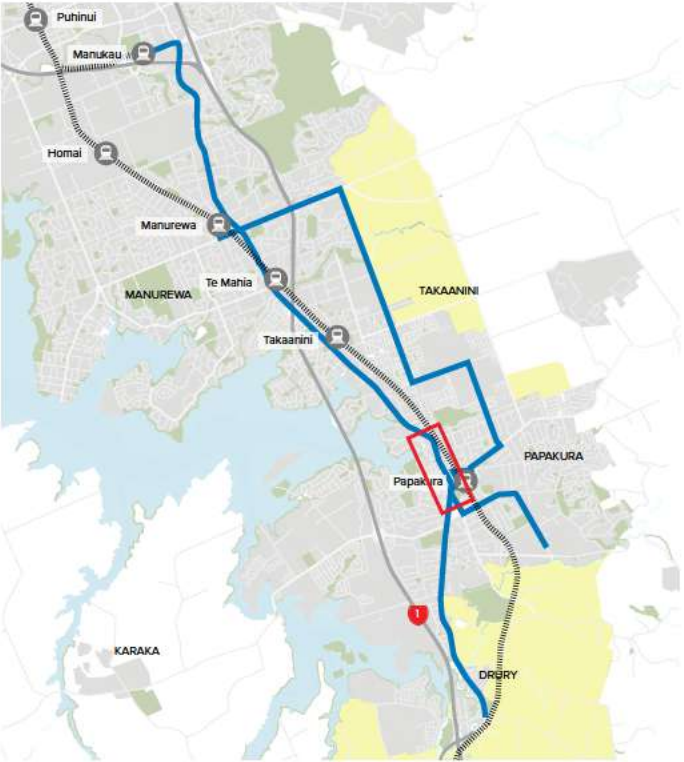


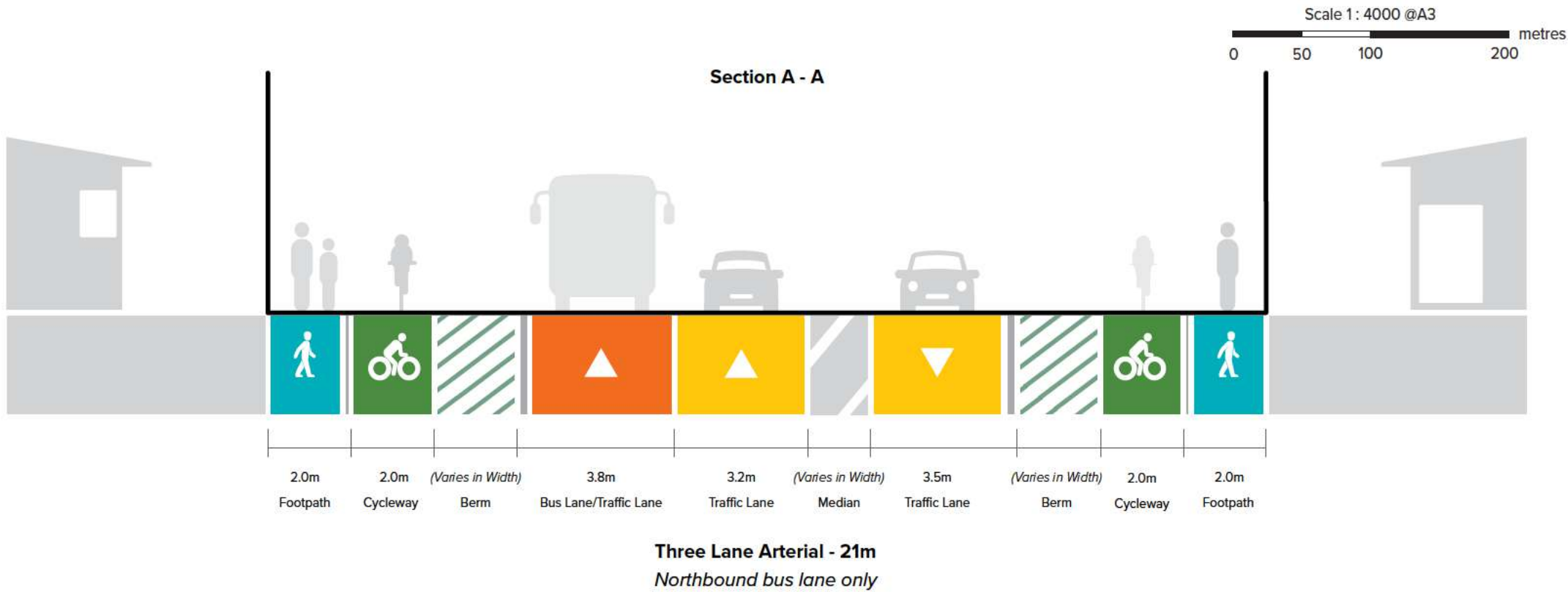
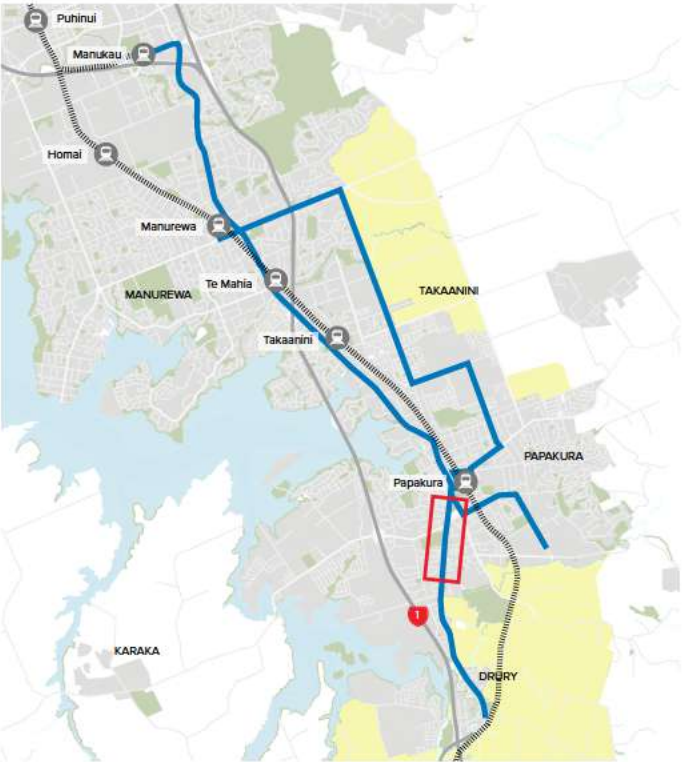


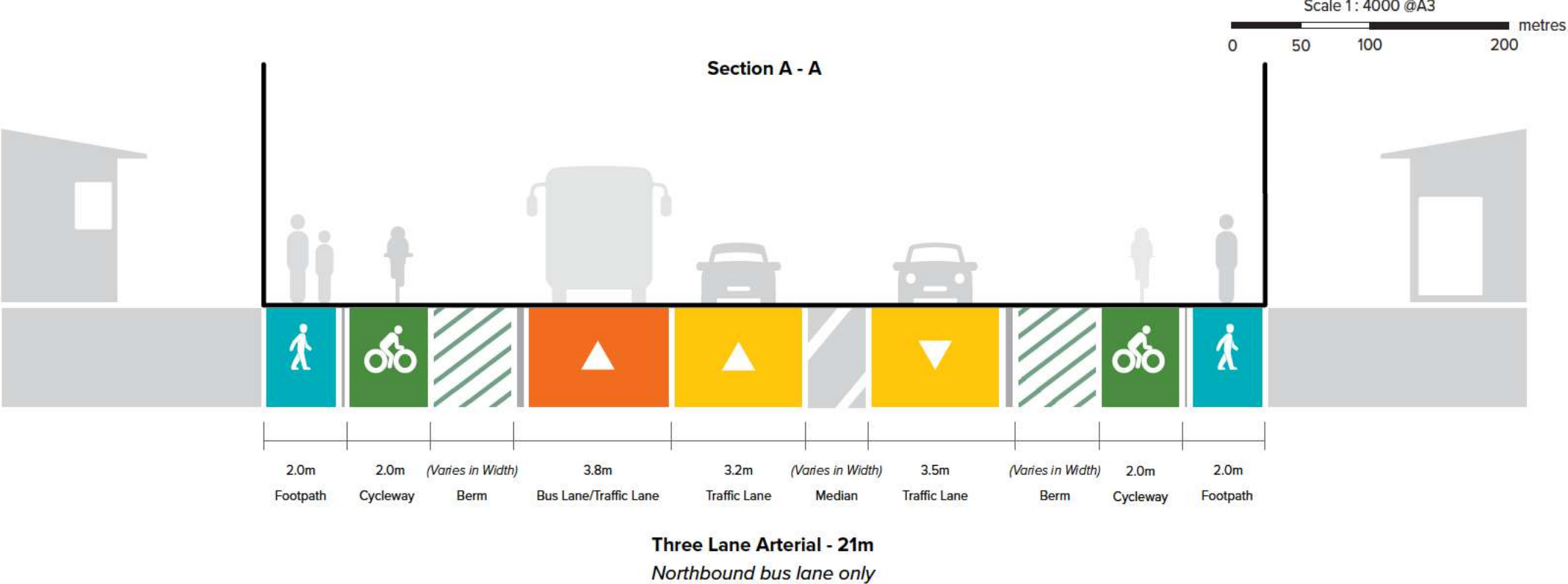
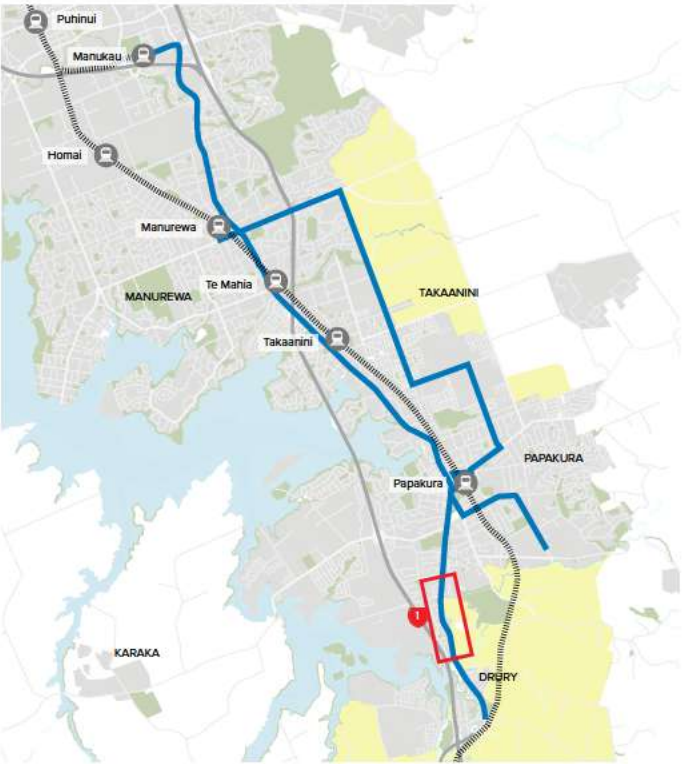
Section A - A
Four Lane Arterial - 30m

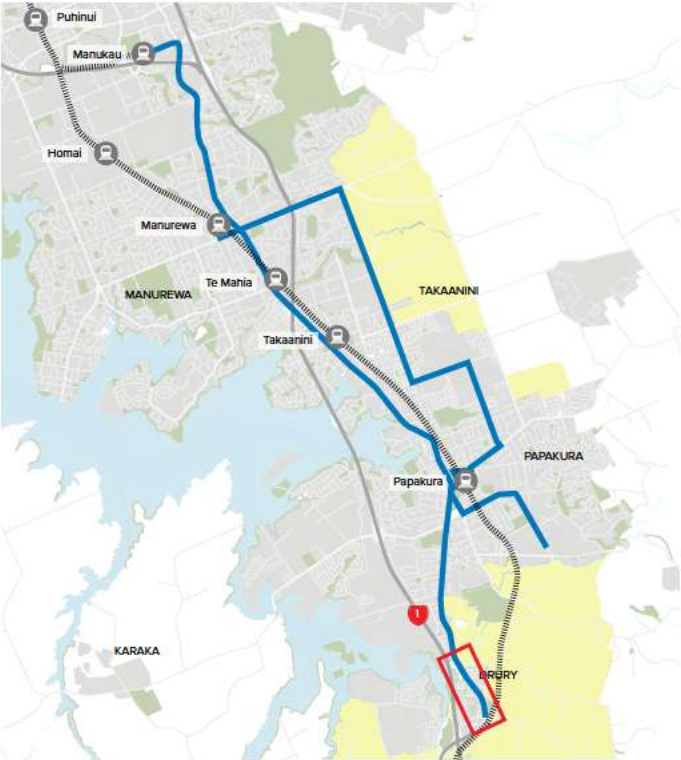
Section B - B
Three Lane Arterial - 21m
Northbound bus lane only





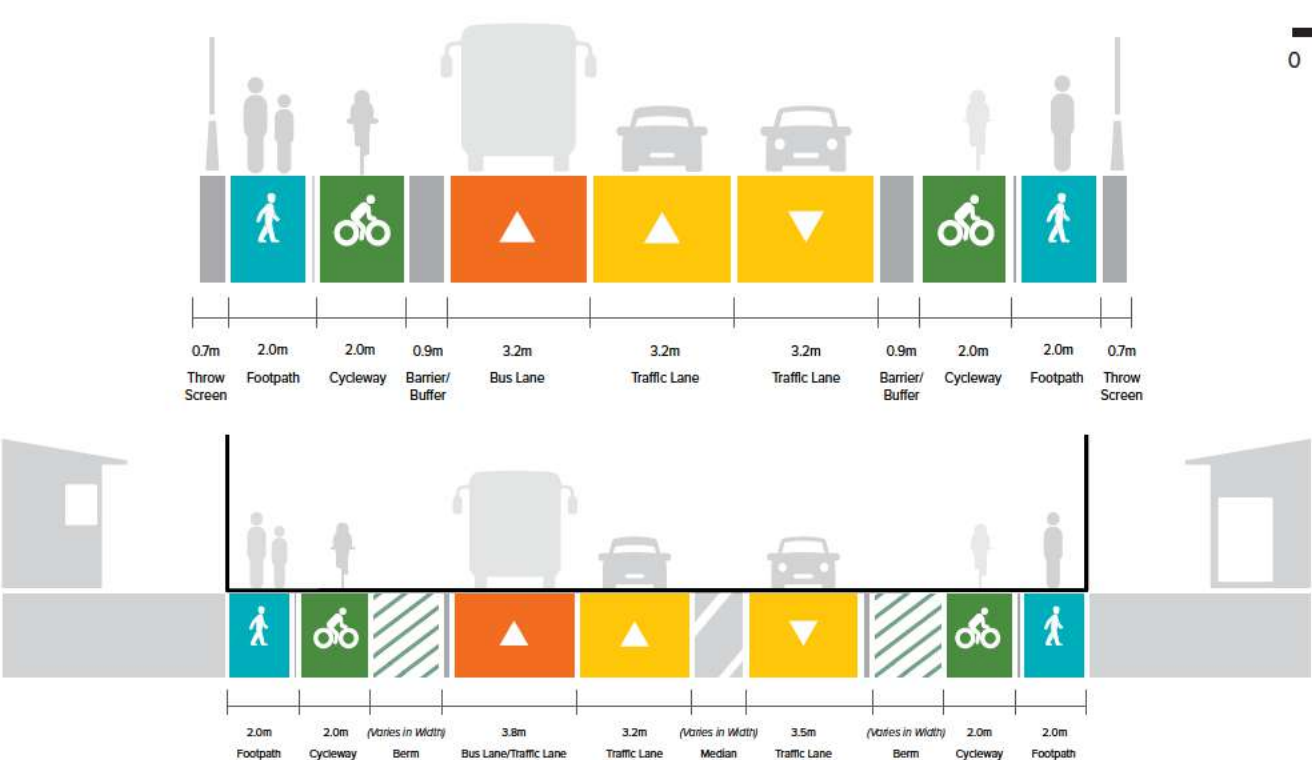


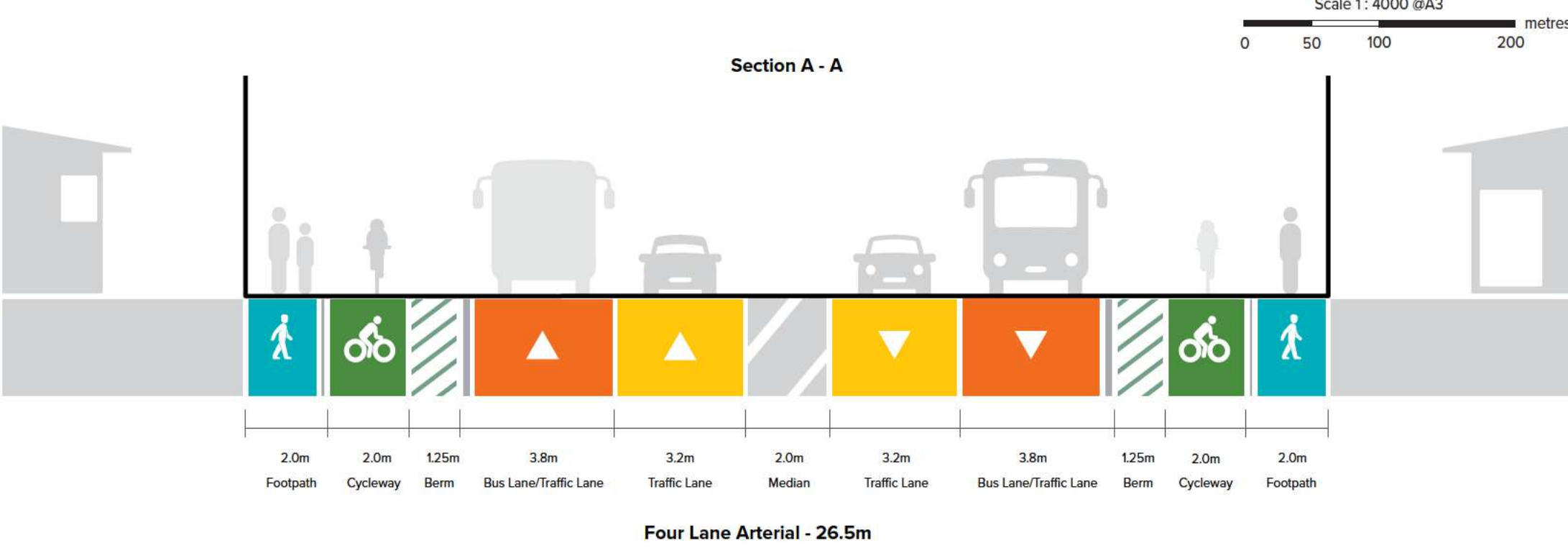
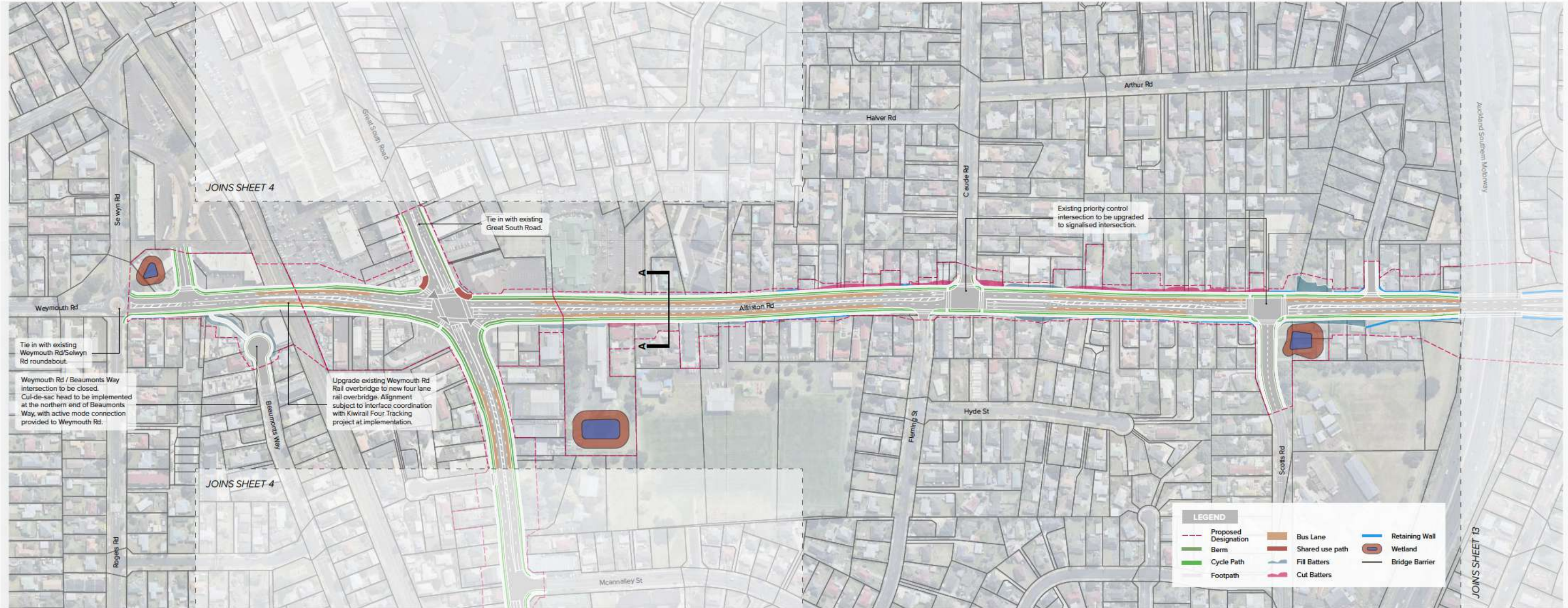




Section A - A
Three Lane Arterial Bridge - 21m
Northbound bus lane only

Section B - B
Three Lane Arterial - 21m
Northbound bus lane only

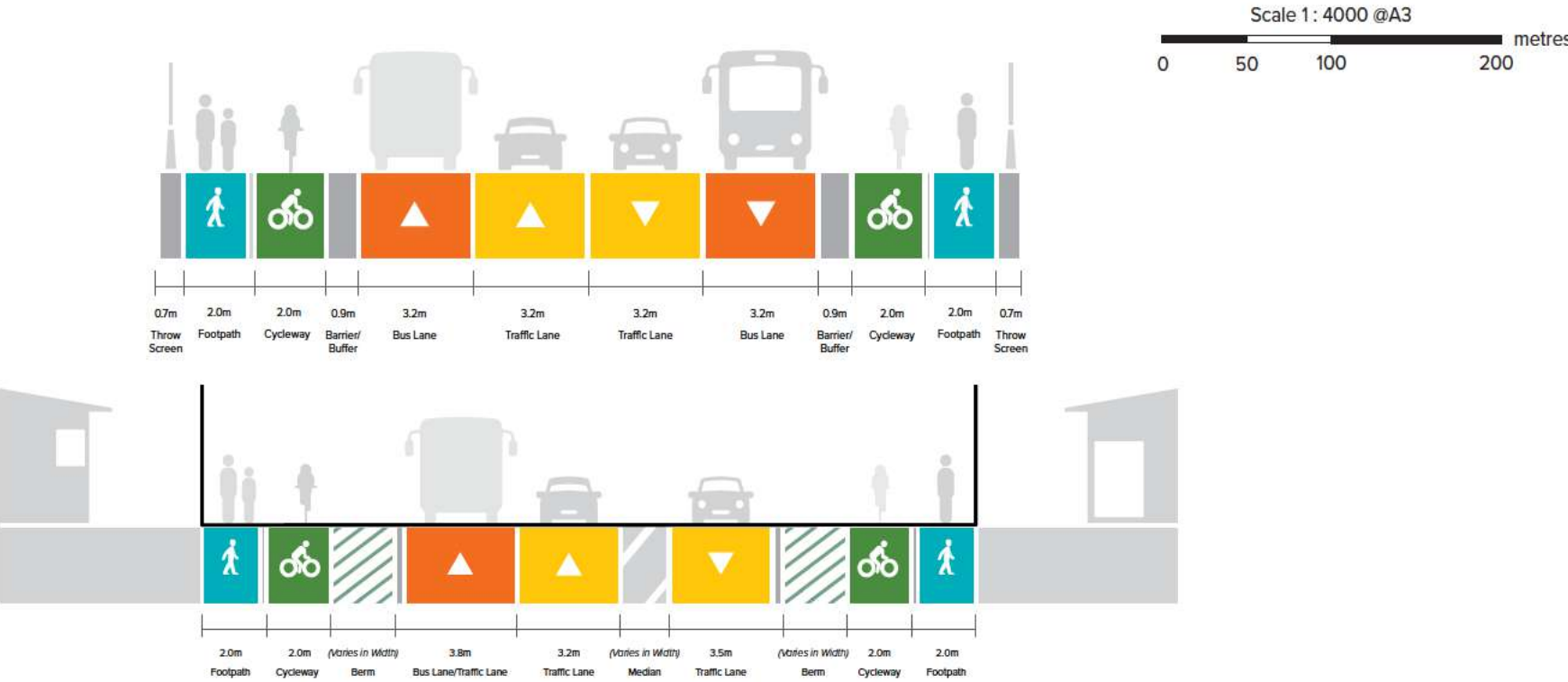


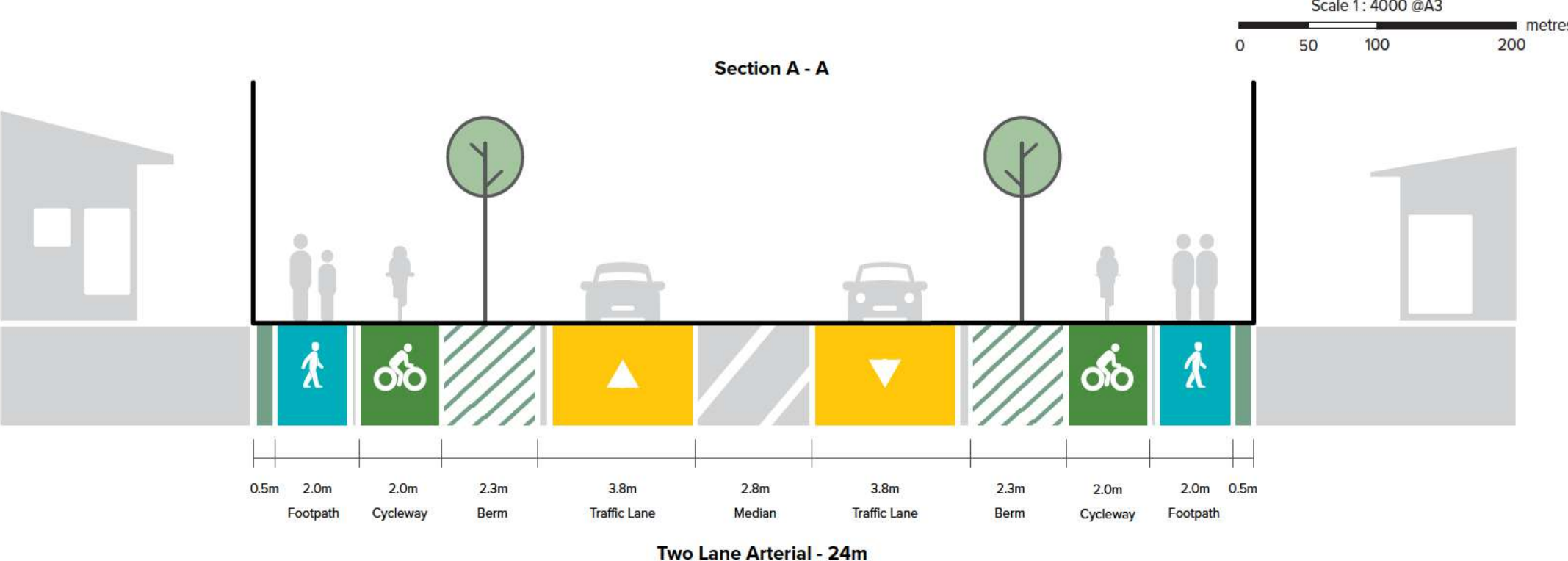
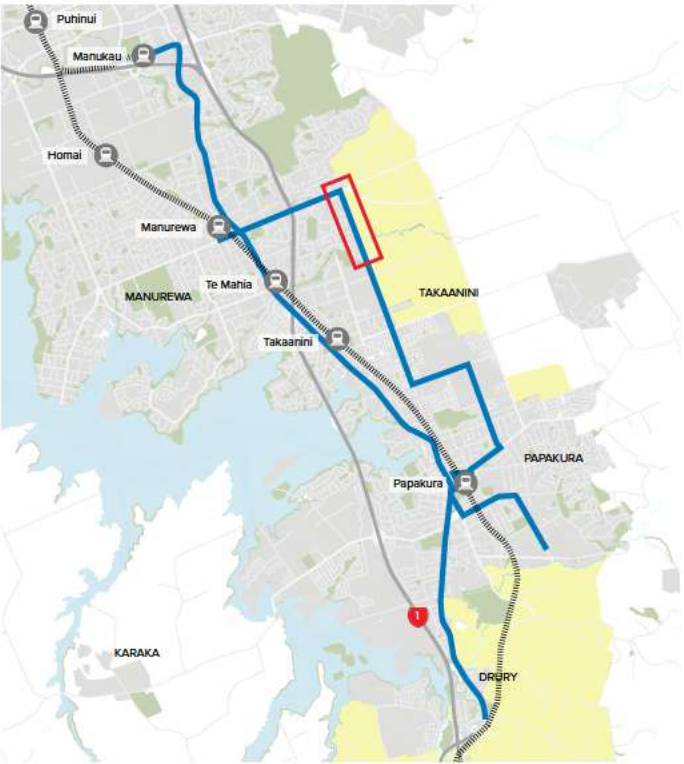
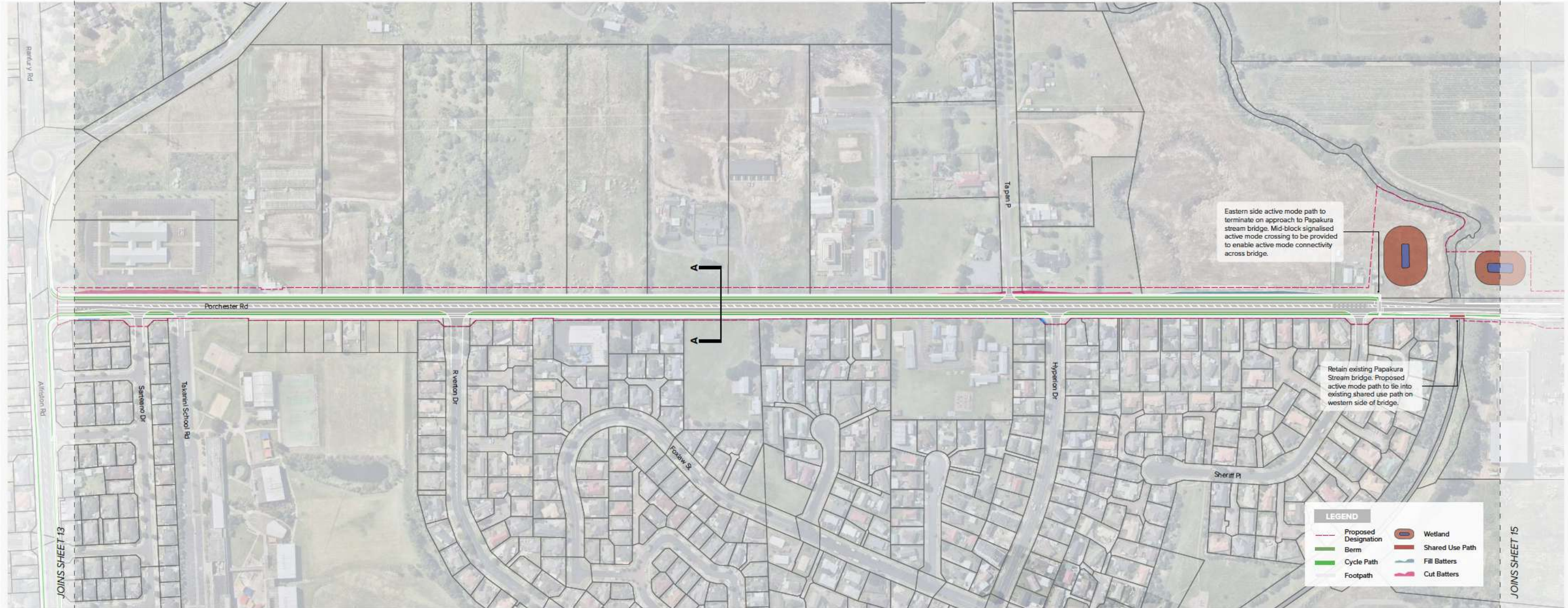


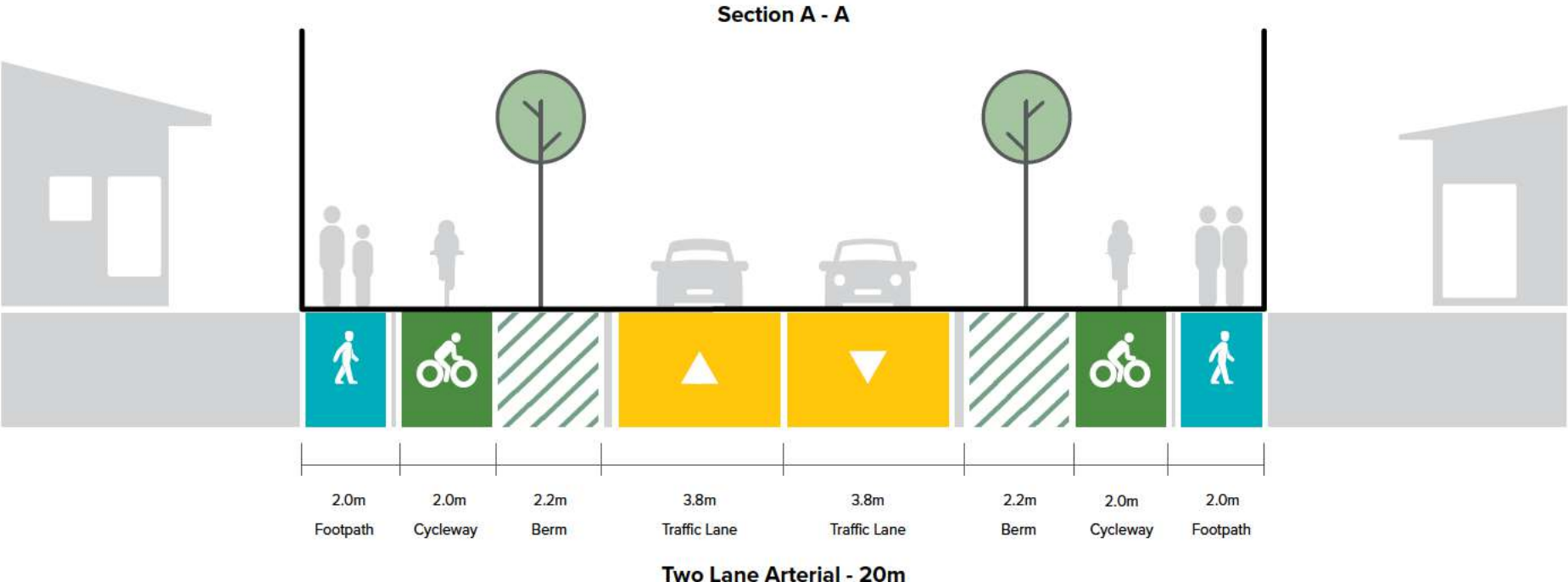
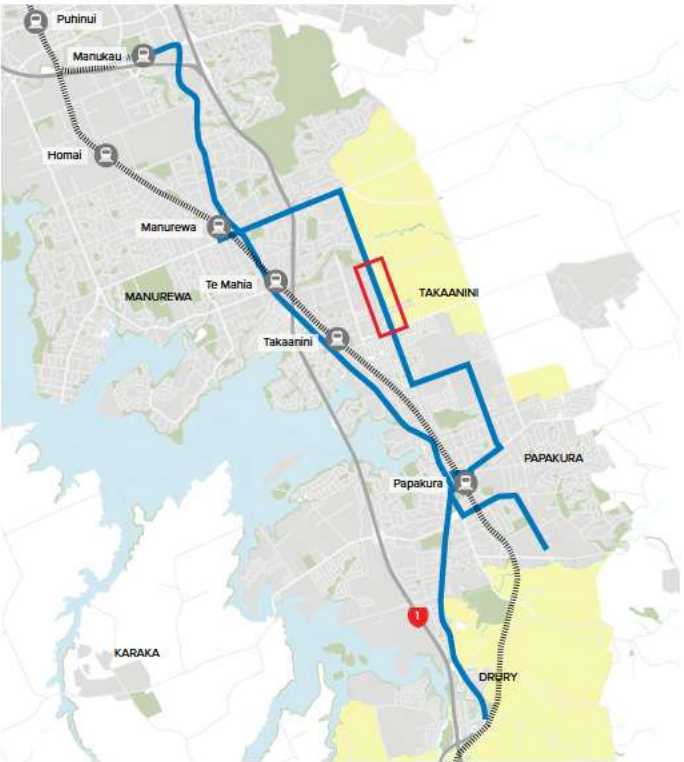
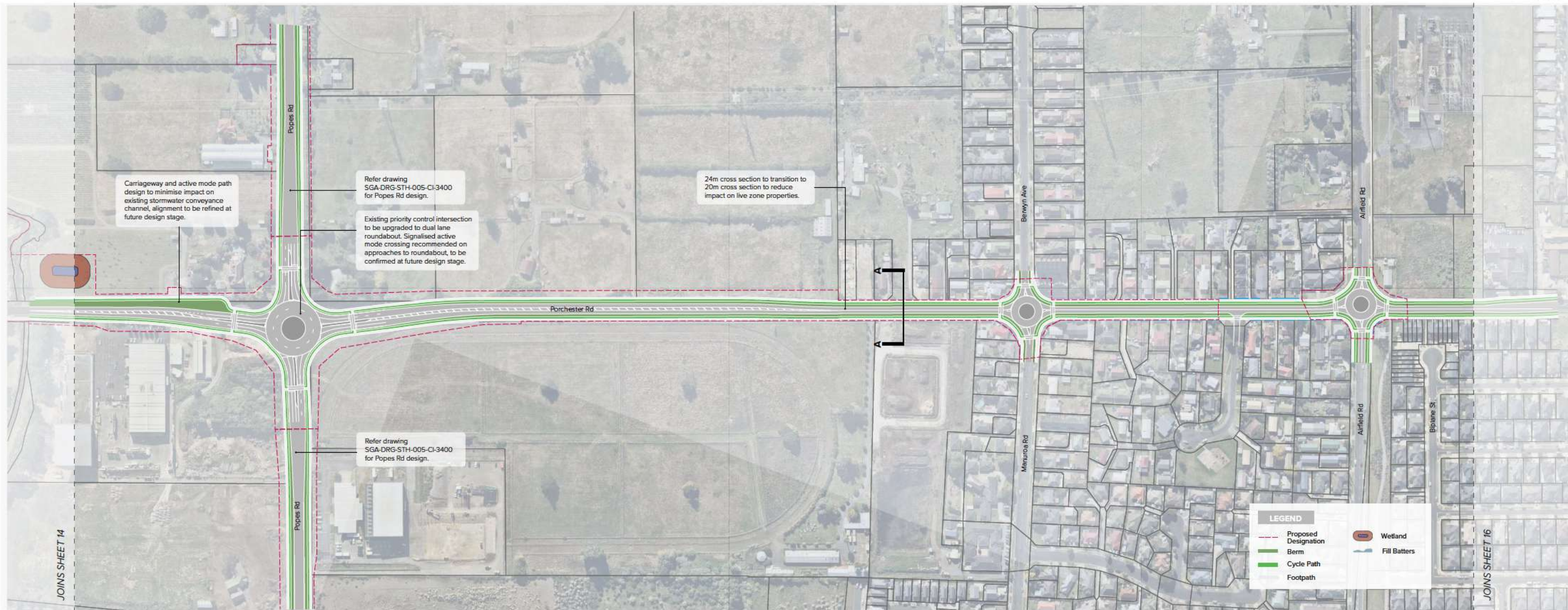


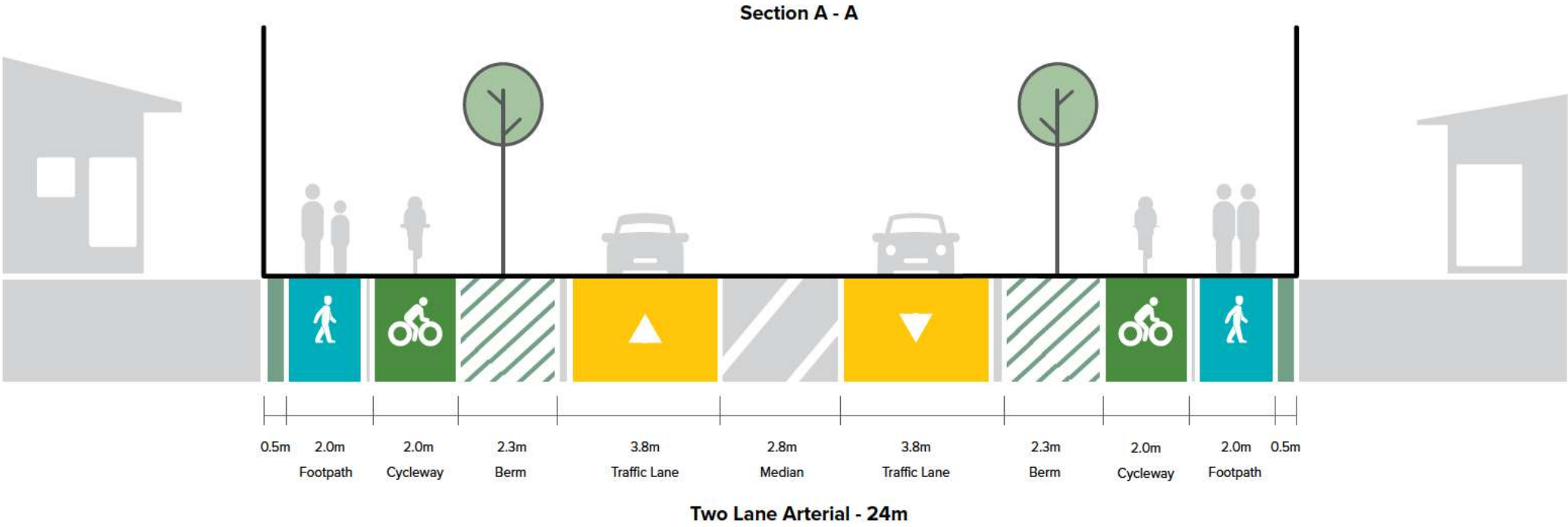
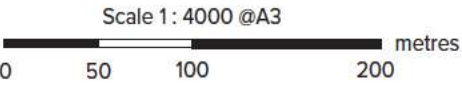
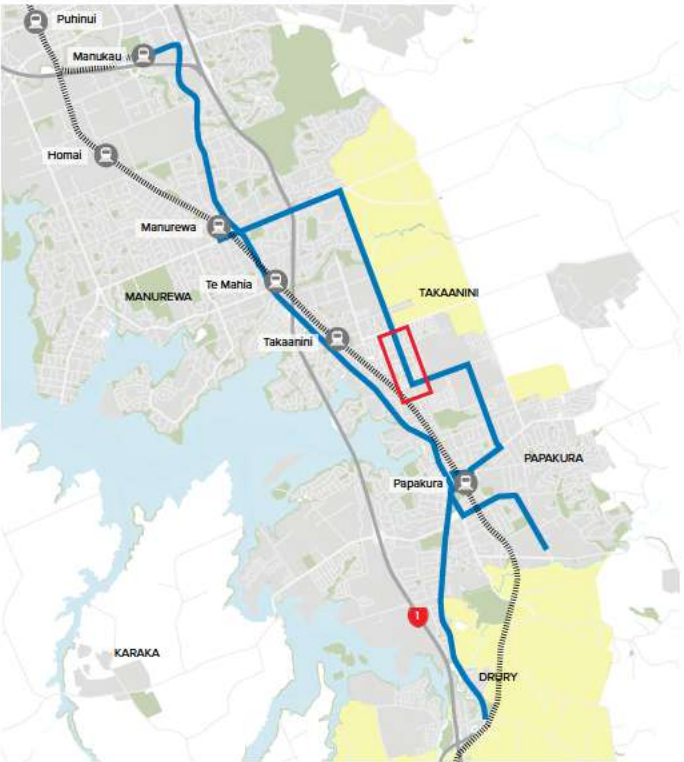
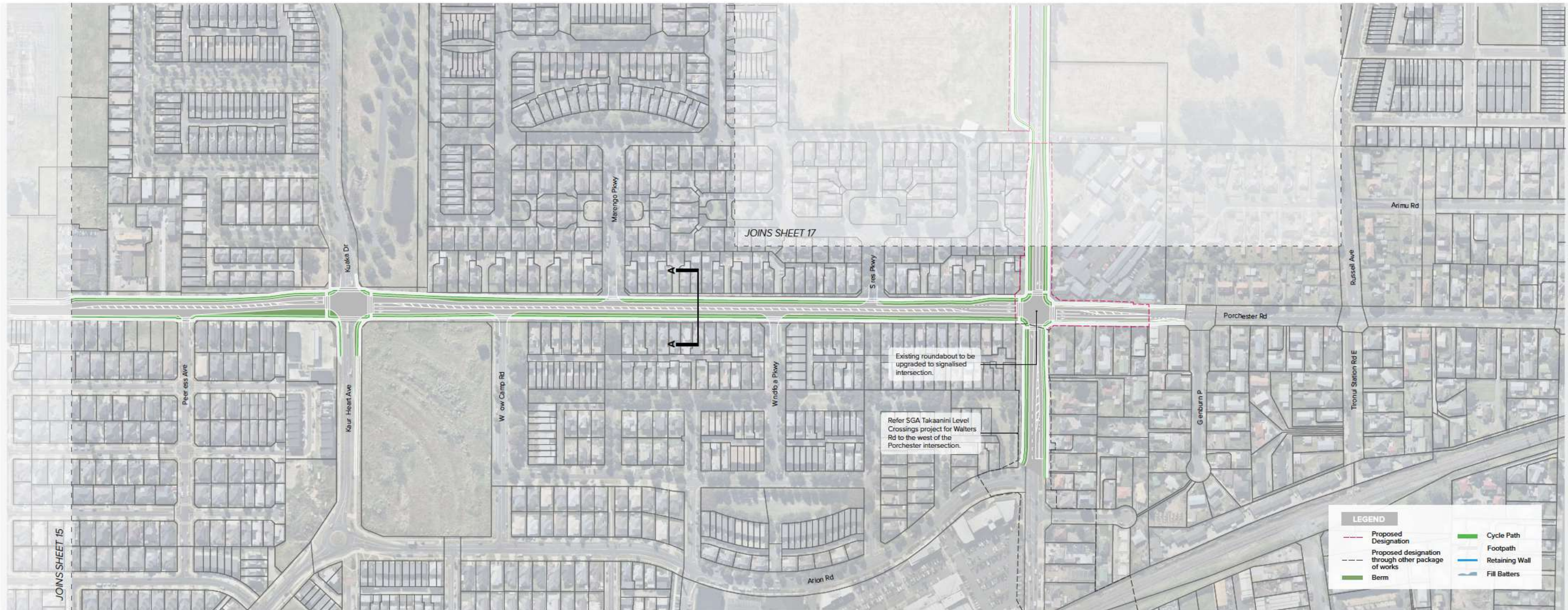
Section A - A
Four Lane Arterial Bridge - 24m

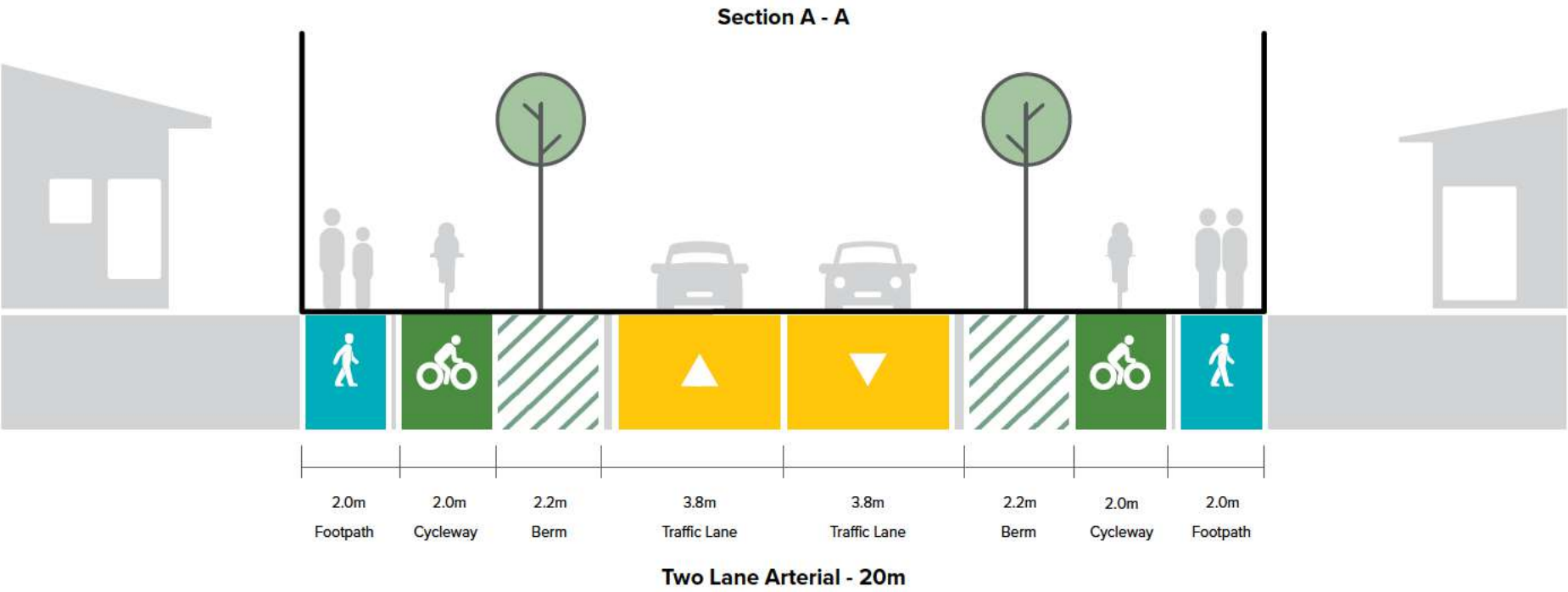
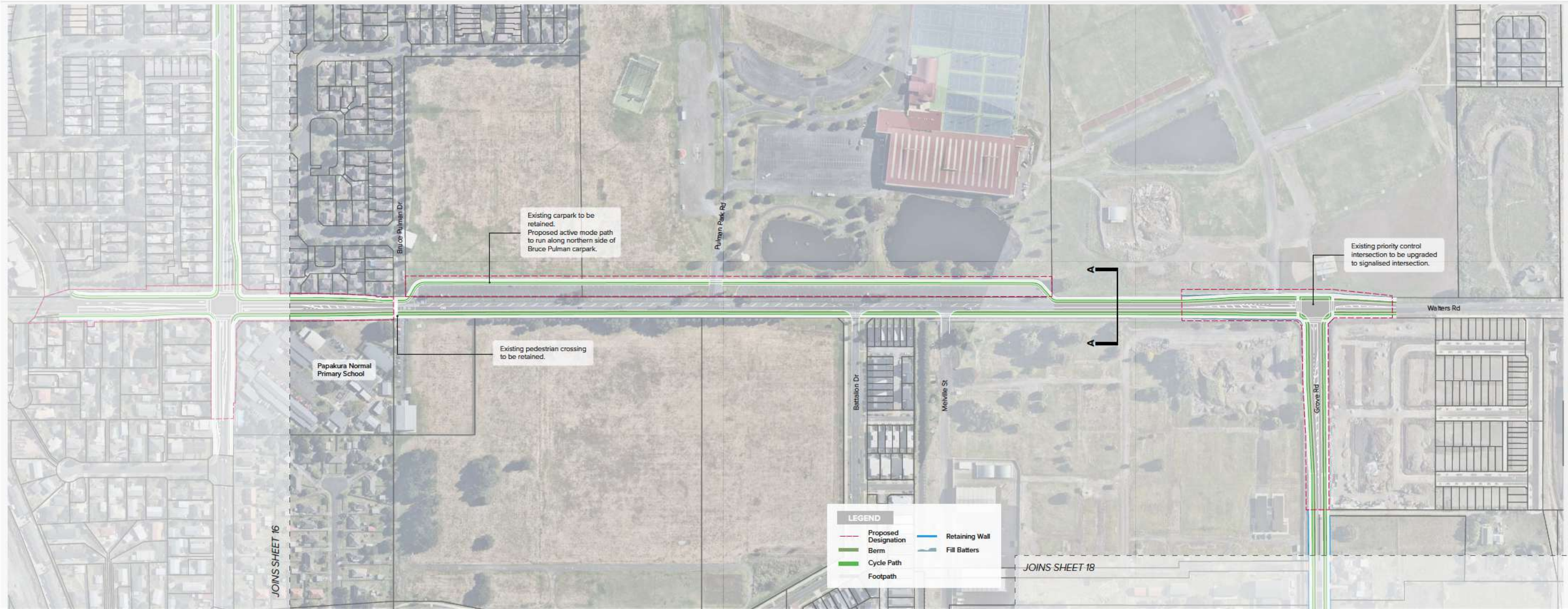
Section B - B
Three Lane Arterial - 21m
Eastbound bus lane only

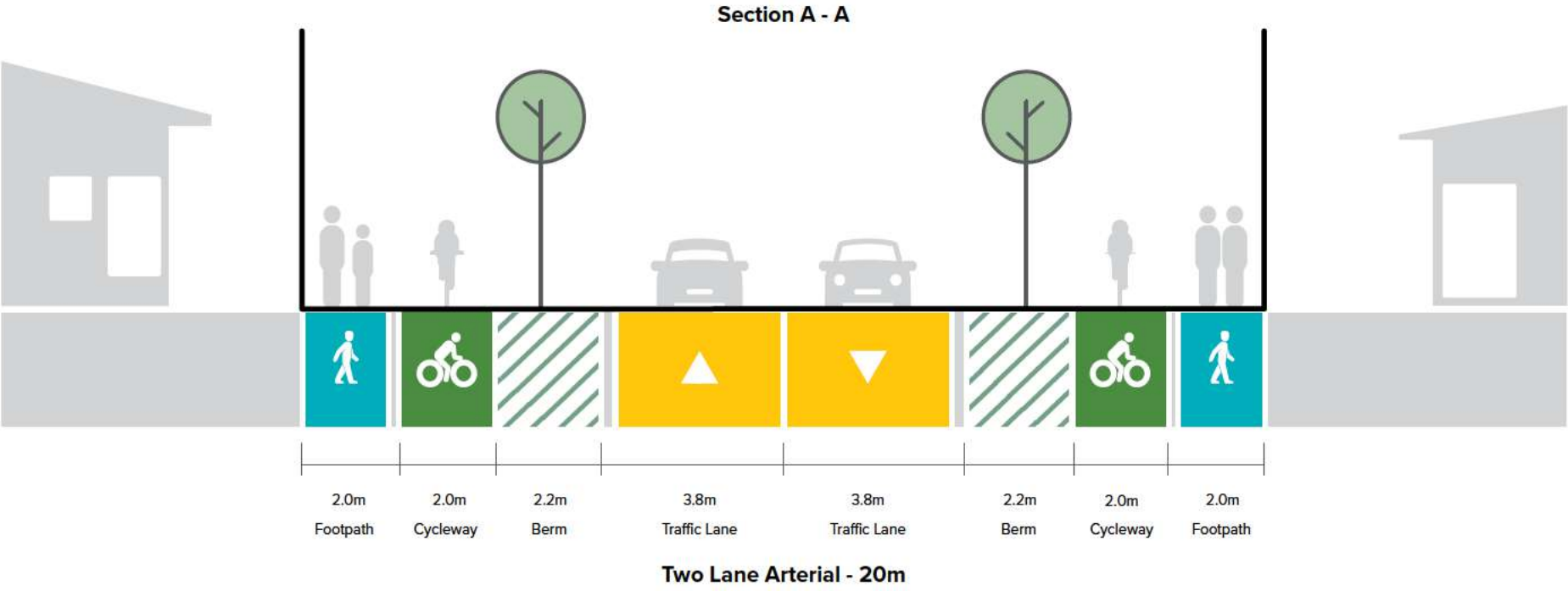
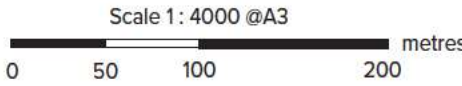


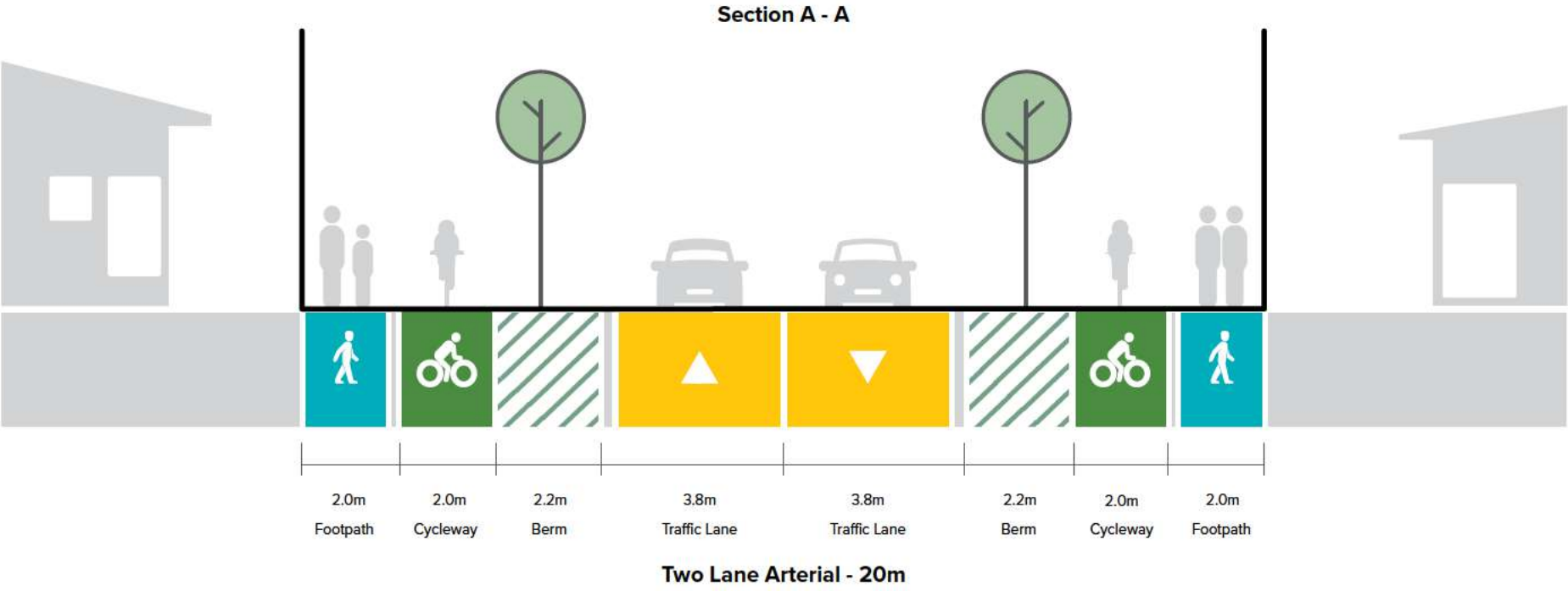
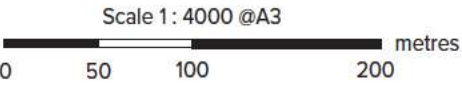
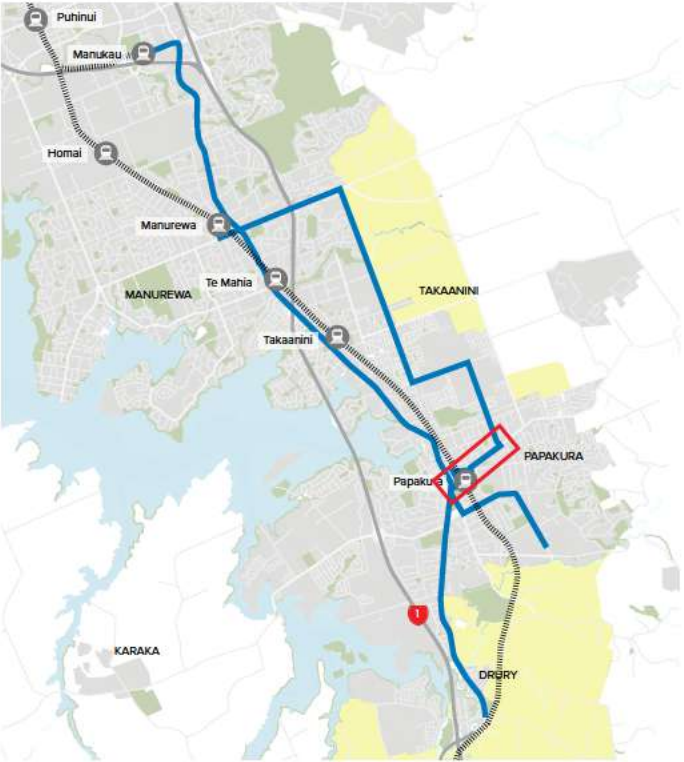


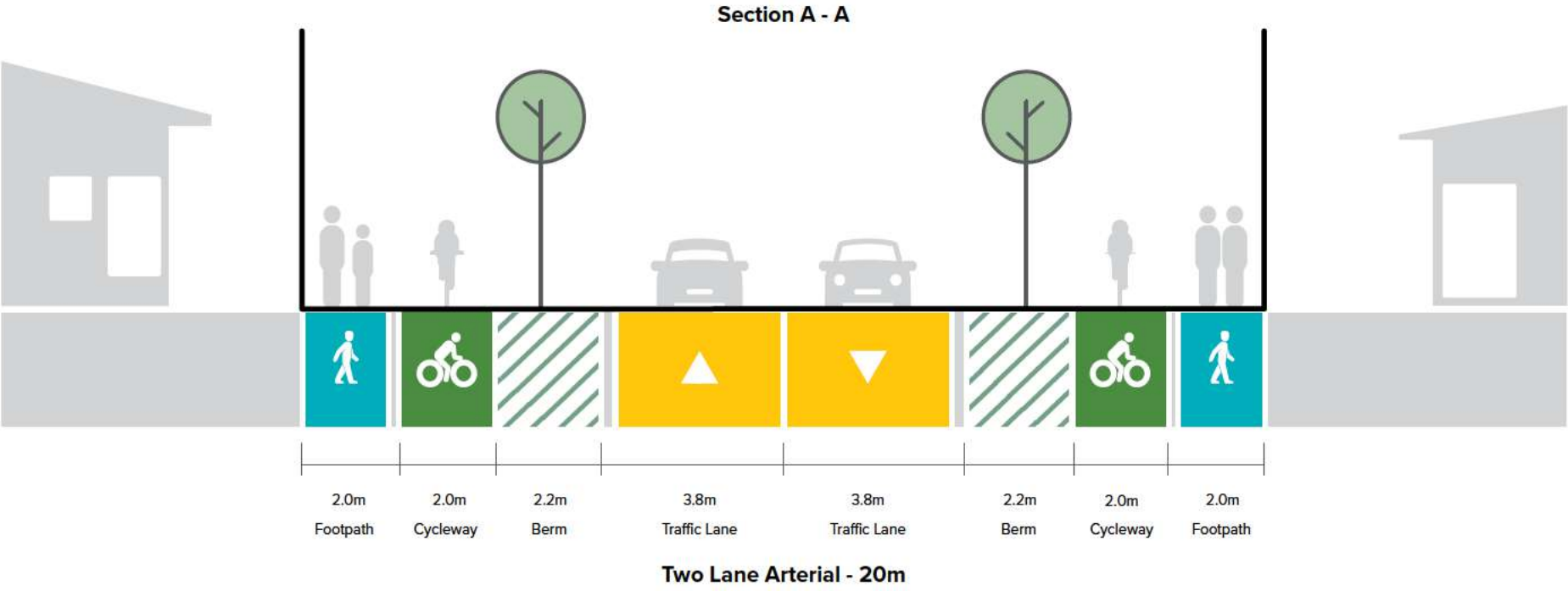
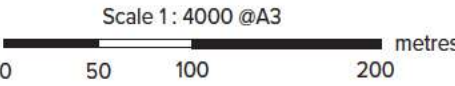
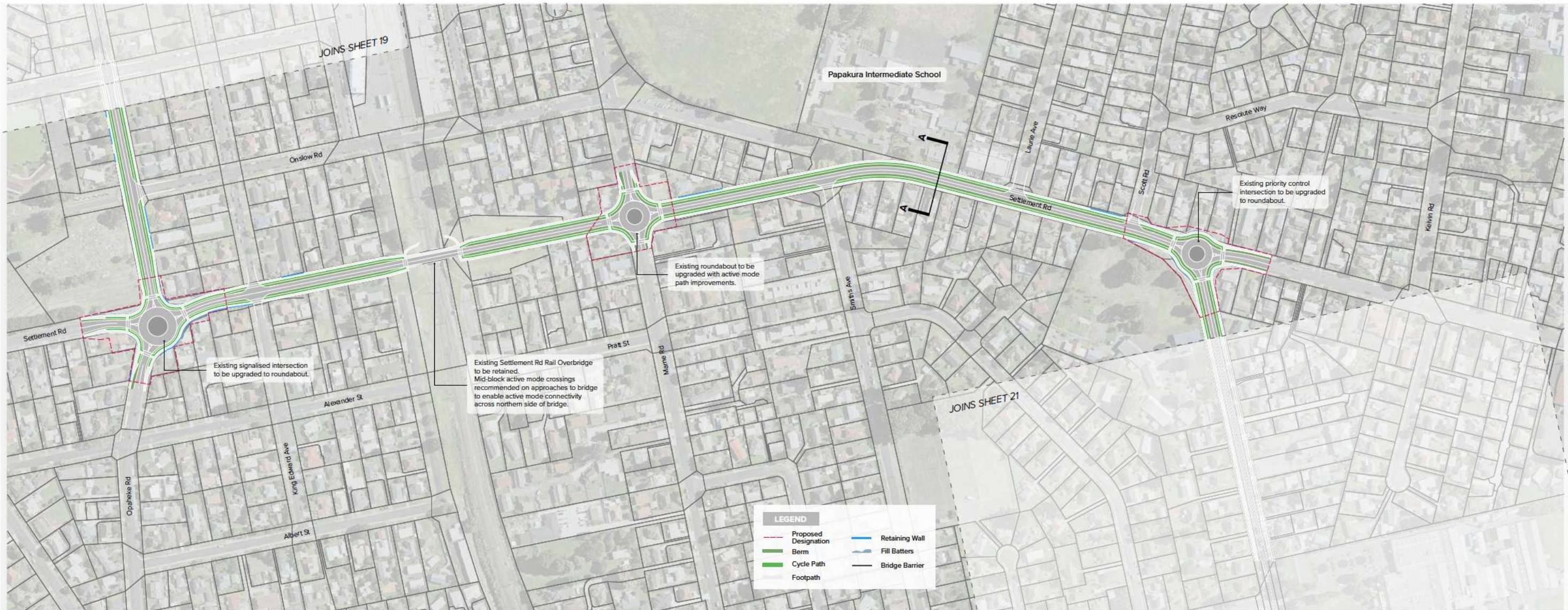


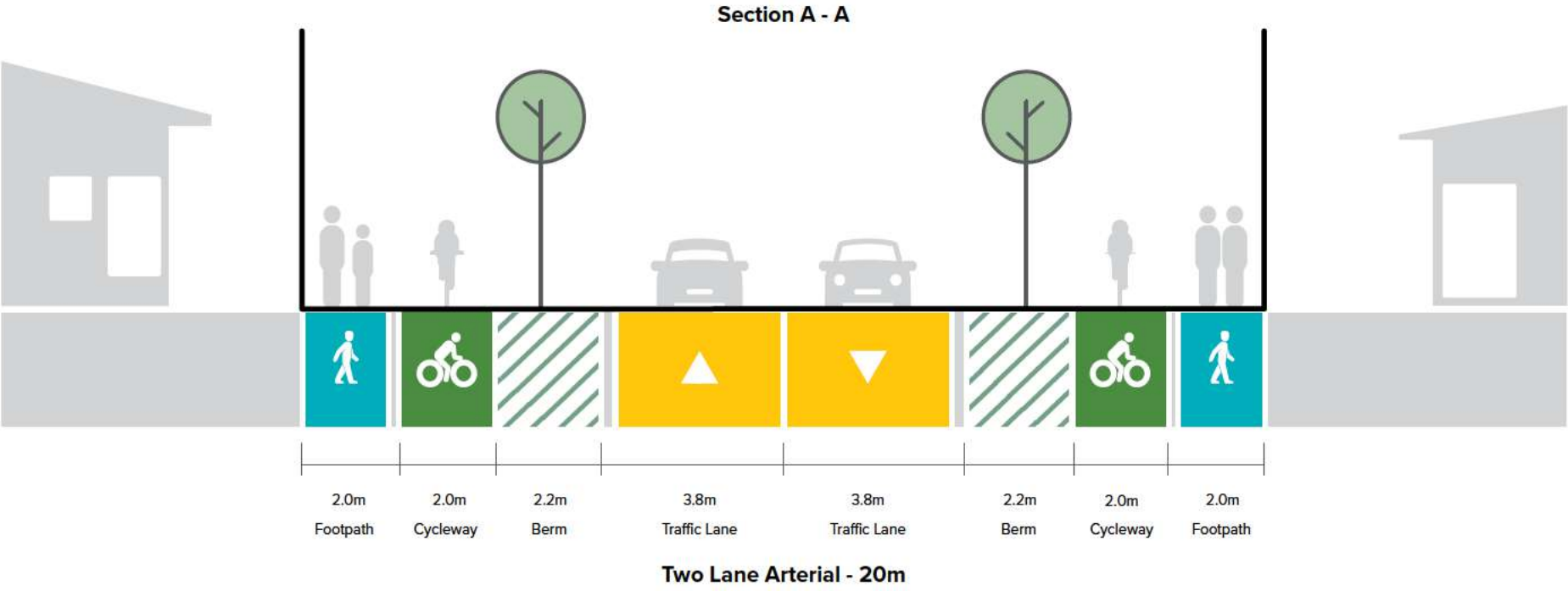
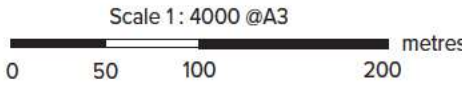
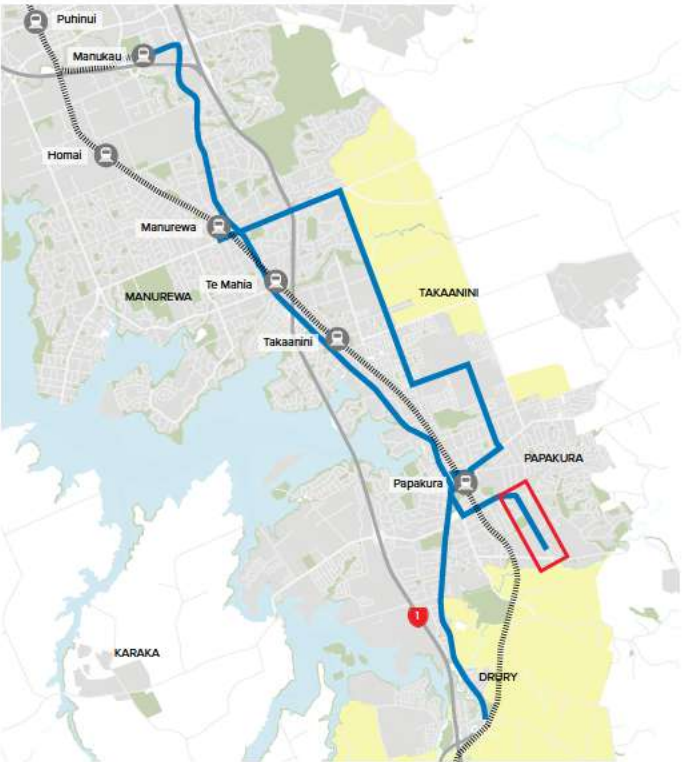
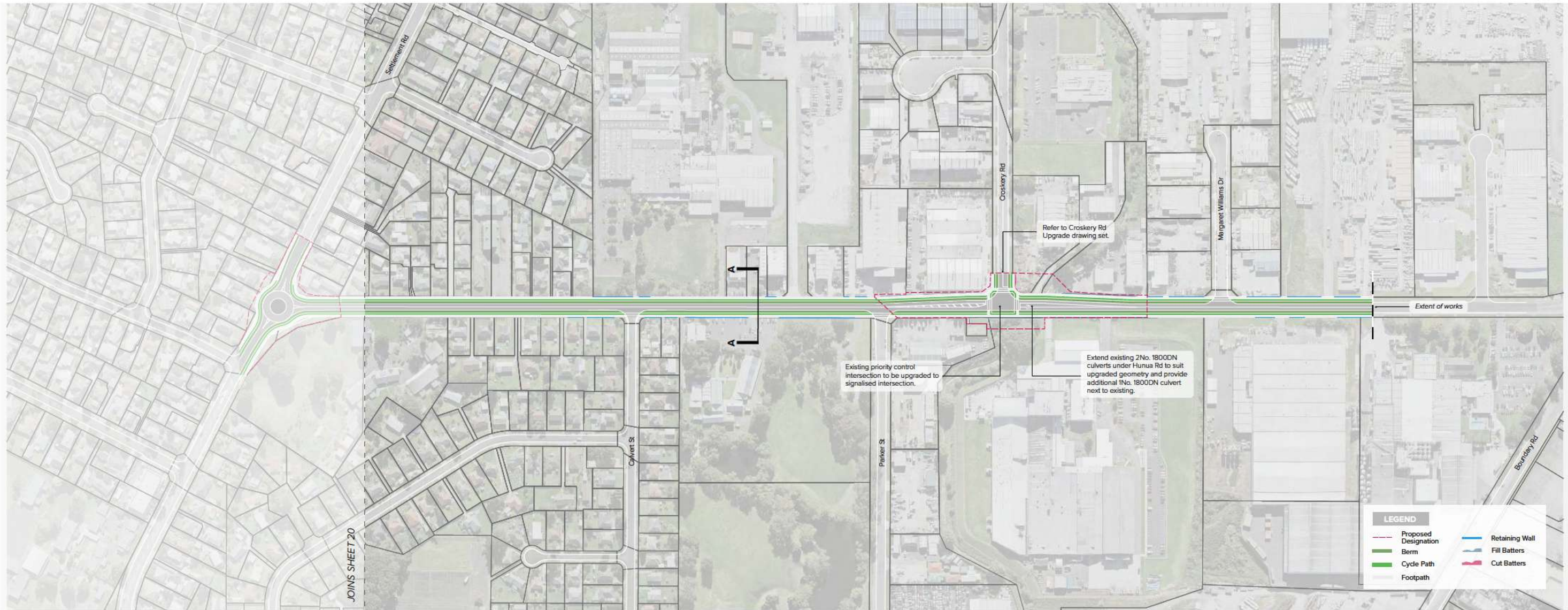












2 Appendix B - Safety in Design (SiD)

Safety in Design Risk Assessment Register

Author (Role):
Approved By:

Kylie Wang
Bruno Busnardo

Date: 23 June 2023

Takaanini & GSR
FTN Detailed
Business Case

Revision: A

Project Name:

Stage of Design /
Project: Preliminary Design
(Note: minimum of 2 reviews per project)

RISKS ASSOCIATED WITH DESIGN ELEMENTS							Risk Matrix			PROPOSED & APPROVED MITIGATION MEASURES							Mitigated Risk & Resolution				RESIDUAL RISK	
Ref	Hazard (Guideword)	Cause & Outcome	Are Human Factors (HF) involved?	Existing controls, if any	L	C	R	Proposed Control (1 Eliminate, 2 Substitute, 3 Reduce, 4 Control)				L	C	LR	Risk Owner	Client Approved	Design Status	Date	Risk Owner	Action Required		
1 Construction Phase																						
1.01	Load / Force / Energy	Damage to existing utility services (water, gas, power, comms, etc) during construction leading to potential gas leak / fire / electrocution / explosion.	.	Utility company stand over procedures and Contractors safe work methodology.	3	5	E	Detailed designer to design around critical services interface if possible. Obtain B4UDig information/as-builts prior to any excavation works. Pilot trench for key utilities location as needed. Contractor to develop work methodology and safe work procedures to minimise chance of accidental utility strike.				2	5	H	Detailed Designer / Construction Contractor		Open					
1.02	Load / Force / Energy	Injury to members of the public from construction plant / operations on busy live arterial roads.	Yes - inattentive / irresponsible plant operators and members of public	N/A		3	4	H	Contractor to manage site operations with appropriate barriers/fencing to keep members of the public out of active construction site, and to protect construction workers from errant vehicles during construction. Traffic management plan to be set up to provide appropriate traffic/active mode diversions for public. Temporary roads to be clear of ghost markings to eliminate confusion for general public.				1	3	M	Construction Contractor		Open				
1.03	Position / Location	Construction of new retaining walls/bridge structure, particularly in soft soils (e.g. peat) leading to potential instability / settlement of structure and adjacent structures/properties. Potential injuries if embankments/bridge elements were to collapse.	No	Design standards, site investigations to inform ground conditions		3	4	H	Detailed designer to design retaining walls and structures in accordance with relevant design standards, based on known ground conditions and loading conditions. Geotechnical investigations to consider depth of foundations with underlying soft soil layers and impact on groundwater. Extent of batter slopes and location of structure to be optimised to minimise potential impacts to adjacent structures. Existing storm water outfalls and flow paths to be considered during design to minimise chance of scour and associated long term embankment stability issues.				2	4	H	Detailed Designer		Open				
1.04	Hazardous Materials	Contaminated land - potential Asbestos risk, and other potential contaminants. Illness / death as a result.	No	N/A		3	5	E	Site investigations to be undertaken to determine extent of contamination and concentrations of contaminants. Contamination management plans to be prepared with methodologies to remove dangerous contaminants. Contractors methodology to consider contamination risks, and appropriate procedures and PPE for works to be in place.				2	4	H	Detailed Designer / Construction Contractor / Client		Open				
1.05	Heights / Depths	Construction workers falling from height during bridge / retaining wall construction works, leading to potential injury / death.	Yes - inattentive construction workers	N/A		2	5	H	Detailed designer to minimise height of retaining structures where possible. Pre-casting of retaining panels to be considered to minimise exposure of workers at height. Contractor to implement appropriate safe works methods including providing barriers, fencing, fall arrest systems and staging as required to keep construction workers safe at all times.				1	3	M	Detailed Designer / Construction Contractor		Open				
1.06	Environmental conditions	Surface flooding on temporary works roads caused by large storm events and insufficient drainage for temporary works, resulting in injuries/fatalities, damage to plant and equipment	No	N/A		3	5	E	Contractor to plan for different road/storm conditions in construction methodology, and provide appropriate drainage design for construction site.				1	3	M	Construction Contractor		Open				
1.07	Load / Force / Energy	Construction equipment/plant striking overhead powerlines, leading to injuries/fatalities, damage to plant and equipment, power outage	Yes - inattentive plant operator	N/A		3	5	E	Contractor to establish vertical/horizontal clearance to existing overhead powerlines in construction methodology and liaise with utilities operator on planned outage as required.				1	3	M	Construction Contractor		Open				
1.08	Position / Location	Construction over/near water at stream crossings, leading to drowning/fatalities. Construction material falling into stream from height, which may have environmental implications and safety for wild life in stream.	Yes - inattentive plant operator	N/A		2	5	H	Detailed Designer to design stream crossing upgrades with consideration for fish passage, upstream/downstream erosion control and other environmental factors. Contractor to establish construction methodology to cover safe working practices over stream and temporary bunding/conservation measures to allow for construction of stream crossing upgrades with reduced impact on wild life				1	3	M	Detailed Designer / Construction Contractor		Open				
2 Operation & Maintenance Phase																						
2.01	Egress / Access	Berms, planted areas, raingardens, detention devices, wetlands require regular maintenance works - increasing risk of maintenance related injuries.	Yes - maintenance workers taking risks	N/A		2	3	M	Landscape/stormwater designer to consider maintenance needs when selecting planting and other stormwater treatment in berm. Wetland design to incorporate appropriate maintenance access routes.				2	2	L	Detailed Designer		Open				
2.02	Movement Direction	Road users loss of control incidents resulting in vehicle leaving the road and driving onto the active mode path, or falling off edge of bridge structure - potential for injury / death.	Yes - drunk / speeding / inattentive drivers	Road rules		3	5	E	Detailed design to consider speed control measures and/or physical separators for active modes in agreement with road authority for higher risk areas. Safety barriers to be incorporated into Detailed Design for road side hazards in order to reduce severity of consequence.				2	3	M	Detailed Designer		Open				
2.03	External safety interfaces	Pavement deterioration leading to premature maintenance works - potential for disruption to local traffic network and exposure of maintenance workers to incidents - potential injury. Also potential for differential settlement at edge of bridged structure leading to bump in road and hence additional maintenance needs.	Yes - inattentive drivers hitting maintenance worker	N/A		2	4	H	Pavement design to consider in situ subgrade conditions and traffic loadings. Robust pavement design to be provided to achieve design life. Settlement slab to be provided on approach and departures from upgraded bridge to reduce risk of differential settlement in the pavement.				1	4	M	Detailed Designer		Open				
2.04	Position / Location	Intersections located below steep grades - insufficient length for deceleration, potential for injury	Yes - inattentive / irresponsible members of public	N/A		3	3	H	Detailed designer to give consideration of grades and vertical levels. Design of appropriate speed controls for vehicles travelling down steep grades. Intersections to be designed in accordance with relevant geometric design standards and in accordance with safe system principles.				3	2	M	Detailed Designer		Open				
2.05	Load / Force / Energy	Vehicles pulling out of driveways hitting active mode users, leading to injuries/fatalities.	Yes - inattentive / irresponsible members of public	N/A		3	4	H	Detailed design to consider omission of visually obstructive planting/street furniture near driveways so both active mode users and vehicles can have clear view of each other to minimise collision incidents.				3	2	M	Detailed Designer		Open				
3 Demolition Phase																						
3.01	Load / Force / Energy	Demolition of existing dwellings, sheds, minor structures, and live services leading to injury or death of construction worker.	Yes - inattentive / irresponsible plant operators and members of public			2	3	M	Contractor to establish safe work methodology for demolition and utilise experienced demolition contractors for these specific works.				2	3	M	Construction Contractor		Open				

Key:
C= **Consequence** 1) Low 2) Moderate 3) Significant 4) Major 5) Critical
L= **Likelihood** 1) Rare 2) Unlikely 3) Possible 4) Likely 5) Almost Certain

LR = **Level** L) Low M) Moderate H) High E) Extreme

Notes: Hazards / risks considered are those that are project / site specific, non-standard / bespoke designs, special processes, high hazard risks (e.g. non 'business as usual' hazards) that have been identified at the time of the review(s). Other risks will continue to appear during the design life of the project and should be assessed and managed by appropriate parties.

3 Appendix C - Croskery Rd Upgrade Stormwater Design Memorandum

Memorandum

To:	Te Tupu Ngātahi – Takaanini Project team
From:	Te Tupu Ngātahi – Takaanini Engineering team
Date:	April 2022
Subject:	Croskery Road
File/Ref No:	SGA-005-DBC-Croskery Road

1 Purpose

Croskery Road is part of the Te Tupu Ngātahi – Takaanini Frequent Transit Network (FTN) and level crossings project. This memorandum documents the approach taken to the development of the Croskery Road upgrade.

Croskery Road has been identified as a key East-West connection between Hunua Rd and Dominion Road. This road connects the future Mill Rd (via Dominion Road) and FTN corridors. This corridor is categorised as 'Level 2 Freight' as per Auckland Transport's Future Connect (first decade network). This indicates that Croskery Road is part of the local freight network and adjacent land is primarily used for industrial purposes. Croskery Road is also categorised as 'Level 2 Major' for Cycle and Micromobility network. This indicates the corridor is expected to be a key spine cycling/ micromobility connection in the first decade. The Drury-Opaheke structure plan also indicates the Croskery Road as a key route.

2 Background

2.1 Existing corridor

Croskery Road is approximately 575m long. It is an urban local road that connects two arterial roads, Hunua Road on the west and Dominion Road on the east. There are two uncontrolled intersections (Berlane Place and Markedo Place) on the road which gives access to existing industrial/commercial business as shown on Figure 1.



Figure 1 Existing Croskerry Road location map

The existing road corridor includes two opposing lanes that are approximately 5m wide each (10m total distance from kerb to kerb), an existing footpath on both sides of the road, and a wide grass verge between kerb line and footpath on the eastbound and a grass verge on the footpath edge on the westbound.



Figure 2 Croskerry Road existing cross section

The road also crosses perpendicularly on the Otuwairoa Stream/ Slippery Creek by having a box culvert to enable the stream to flow through below the road. Figure 3 shows a fence line on both sides of the road that delineates the extent of the box culvert and its headwall. The fence line functions as a road safety mitigation to protect pedestrians from falling from the road to the stream.

From an existing utilities perspective, a first gas main transmission pipe runs on the eastbound of the road under the grass berm by the carriageway kerb line. There is also a transmission wastewater pipe from Hunua Road to Berlane Place indicatively located on the eastbound adjacent to the gas main pipe.



Figure 3 Croskery Road Box Culvert that crosses Otuwairoa Stream/ Slippery Creek

2.2 Croskery Road Upgrade - Te Tupu Ngātahi Drury Arterials, April 2020

The Croskery Road upgrade draft design has been previously developed by the Te Tupu Ngātahi Drury Arterials project in April 2020. The corridor was not progressed for route protection with the rest of the Drury Arterials project and has since been transferred into the Takaanini project scope for progression.

From a design perspective, the Te Tupu Ngātahi Croskery Road upgrade has assumed the following:

2.2.1 Proposed Road layout

The 2020 Croskery Road upgrade project followed the existing road geometry from both a horizontal and vertical point of view. The project also kept the existing intersection forms at Hunua Road, Berlane Place, and Markedo Place (all priority-controlled t-intersections). Further to the east, the project assumed a future tie in with Dominion Road as part of the Mill Road project route protection project, also part of the Te Tupu Ngātahi in early 2020. Note: the Mill Road project is currently on hold, so the likely route and potential form of this intersection remain uncertain.



Figure 4 Te Tupu Ngātahi Drury Arterials Croskery Road Upgrade proposed layout

2.2.2 Typical Cross section

The Drury Arterials project proposed narrowing the kerb line inwards from 10m to 7.5m. This enabled more space on the roadsides so a walking and cycling corridor could be built on both sides of the road, as shown on Figure 5. Endorsement of the 20m wide cross section was sought by the Drury

Arterials team as it departed from the SGA 24m typical section for a two lane corridor. This was granted by Auckland Transport at the time, for this specific circumstance.

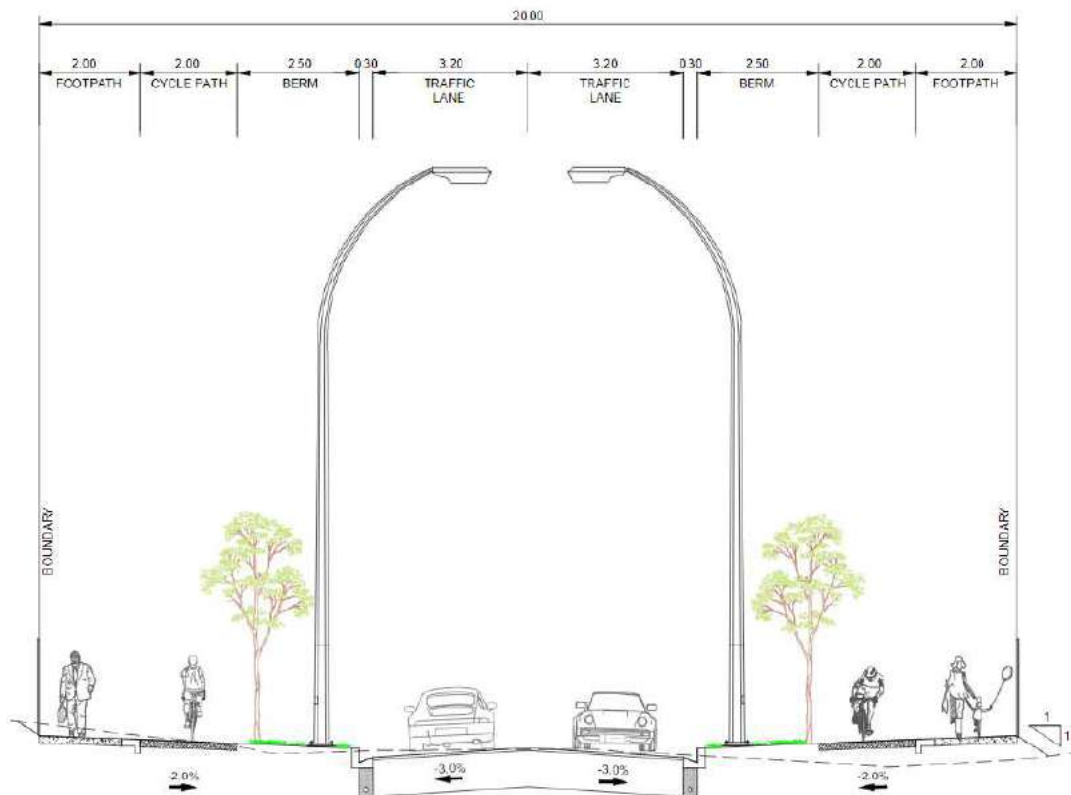


Figure 5 Te Tupu Ngātahi Drury Arterials Croskery Road Upgrade typical cross section

2.2.3 Approach to Stormwater

A new stormwater pipe and treatment system was proposed as the kerb line was to significantly change and treatment was to be provided. The stormwater design accounted with the following key elements:

- a) New stormwater pipe system
- b) Two new wetlands to treat the water, and
- c) Extension of the existing culvert.

The areas required for the wetlands and the indicative new stormwater pipe network system is shown on the Figure 6.

Figure 6 illustrates that the stormwater treatment would occur outside of the existing road reserve. If this were to be taken forward as the preferred option, it would likely require designation and property purchase. This would include existing industrial buildings in the area.



Figure 6 Te Tupu Ngātahi Drury Arterials Croskery Road Stormwater design

3 Takaanini FTN team assessment (2022)

When the Takaanini project re-started in late 2021, the Croskery Road project was included in the scope. The team understood the previous history as part of the Drury Arterials project and undertook a comprehensive review of the recommended option. In particular, the stormwater design was of interest as these elements were outside the road reserve. It was noted the transport needs of the corridor could be serviced within the road reserve, so careful consideration was given to alternative stormwater management approaches.

The Takaanini FTN project team has therefore assessed the following items:

- Corridor role in the network, form, and function
- Existing road reserve, cross section, and available space, and
- Stormwater treatment approach and possible alternatives.

3.1 Form and function review

The corridor functions as a collector that provides access to existing businesses and from a capacity point of view is assumed to not have a significant volume increase over time. Therefore, the typical section indicated by the Drury Arterials team is considered appropriate as it provides a single lane in each direction with active modes on both sides of the corridor. Therefore, no further assessment is required.

It is important to note Croskery Road is mostly used by heavy vehicles. The 20m cross section looks to bring the kerb line inwards and this may impact the operation/performance of the heavy vehicles which could lead to localised road widening. If the existing kerb line is to remain in place, the operational risk would be mitigated.

Intersection improvements were excluded from this review. The working assumption is that the Mill Road project would take precedence of the final form of the eastern intersection and no changes to the other intersections along the route. Note: The Hunua Road/ Croskery Road intersection is part of the Takaanini FTN scope of works, and it is likely this intersection form will be proposed to change via this project.

3.2 Analysis of the existing road reserve width

The team has undertaken an analysis of the road reserve width throughout Croskery Road. The results are shown on Figure 7.

The road reserve varies between 20m to 25m along mainline corridor, averaging 23.70m. The road reserve widens between 25-30m at the intersections points e.g., Hunua Road and Markedo Place. It widens to over 30m at the intersection with Dominion Road.

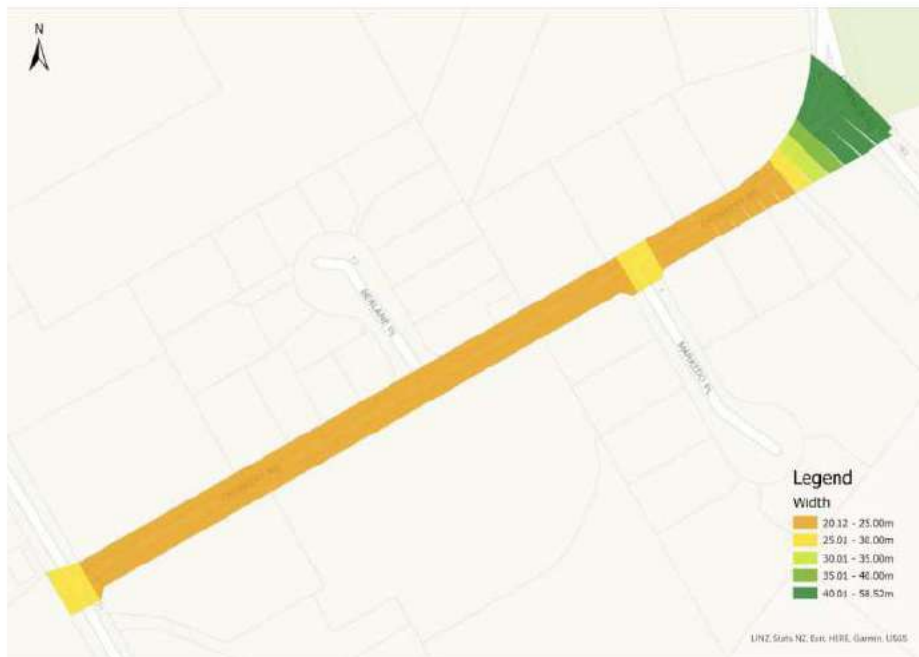


Figure 7 Existing Road Reserve width

3.3 Alternative approach to stormwater design

The section discusses an alternative approach to stormwater design which differs from the approach assumed as part of the Drury Arterials project. For the purposes of this assessment, a worst-case scenario was adopted from an area of treatment perspective. That is, an assessment to provide treatment to the existing road scenario as it accounts for 13.0m approx. of impervious area made up of 10m of carriageway and 2 footpaths of 1.5m approx.

It is understood the application of 20m cross section adopted by the Drury Arterials team would reduce the impervious area of the road as the kerb line narrows as the wider berm takes place.

Assuming the existing carriageway remains in place, the proposed impervious area will be a 2.0m cycle path and 2.0m footpath on both sides of the road – meaning there is an increase in impervious area of $4m - 1.5m = 2.5m$ on both sides of the road (over the current impervious area). The increase in impervious area is therefore approximately 2,625 m² (525m road length x 5m).

The receiving environment for the project would be the Otuwairoa (Slippery) Creek. There are existing flooding issues along the creek and the increase in impervious area means an increase in runoff which could slightly exacerbate the flooding. The increase in impervious area is also a potential issue in terms of exacerbating stream erosion. The cycleway and footpath are both low contaminants generating surfaces and stormwater quality is not considered to be an issue.

The Auckland Unitary Plan (AUP) allows stormwater discharges from new impervious area of up to 5,000 m² to be carried out as a permitted activity by a road controlling authority. No stormwater quality

treatment is triggered by the AUP but there could be a requirement for stormwater retention to manage stream erosion. Flood attenuation may be required depending upon the timing of whole of catchment flows, but the whole area is already inundated during major events and therefore attenuation should be focussed on smaller events.

The previous stormwater approach proposed to take land for stormwater wetlands to allow for stormwater flood attenuation to the 10-year, retention and quality treatment. This is a robust approach in that all stormwater effects would be mitigated but is costly because of the land take in particular.

We have reviewed this approach and consider an alternative approach of a vegetated berm/infiltration trench within the road corridor could be used instead. Stormwater would runoff from the footpath/cycleway as sheet flow and into/over a vegetated strip in the berm. The vegetated strip would sit over a gravel filled trench which would allow some water to be stored and allow some soakage. The soakage and attenuation within the berm would be say 1.5m wide with 300mm of topsoil and 800mm depth of no fines gravel. This would allow soakage for retention (if subsoil conditions allowed) and would provide enough storage for runoff up to the 10-year event. A subsoil outlet to the stream would be provided. This approach would provide an appropriate level of attenuation and retention along with some quality treatment.

Other methods could also be explored in more constrained areas i.e. stormwater treatment devices and raingardens. However, a further assessment is to be undertaken on the next phase of the project once constraints are fully identified. As there is a gas mainline pipe running on the Croskery Road and an overhead power line on the eastbound as mentioned on the section 2.1 of this memorandum.

Overall, we therefore recommend that the cross section allows for a 1.5m width of vegetated berm/infiltration trench to provide stormwater management each side of the road instead of the previously proposed wetlands.

3.4 Constructability

The existing corridor consists of two lanes, a footpath, and a grass berm on each side of the road. The existing environment consists of local business and hence the dominance of heavy vehicles. The existing footpath provides a connection between Hunua Rd and Dominion Rd. This is the shortest route of these two roads and therefore likely to be the most used infrastructure to connect the community.

The proposed cross-section (refer to Figure 5) accounts for two single lanes and similar roadside amenities as existing with the addition of a wider footpath, unidirectional cycleway and a strip of a grassed berm on each side of the road. The grassed berm, as proposed in section 3.3 of this memorandum will serve to manage the stormwater runoff (vegetated berm/infiltration trench). It will also be used to have lighting poles and/or overhead power poles as well as any localised roadside furniture.

As mentioned in section 3.2, the typical width of the proposed cross-section is 20m and there is an average of 23.70m of existing road reserve of enabling works, minimum road reserve width of 20m. Therefore, this indicates that there is sufficient width to construct the proposed cross-section without further land acquisition.

Temporary construction areas (offsets from permanent outer edge elements) may be required during construction to allow the machinery to work while maintaining the normal operating condition of the road.

The existing road crosses the Otuwairoa Stream/ Slippery Creek via a box culvert which is intended to be extended so the 20m typical section can take place. Further considerations are to be undertaken to decide whether an active modes bridge could be built rather than the extension of the box culvert as the area is currently under a flood plain and a footbridge could potentially decrease the flooding effects of the area. However, it's understood both scenarios would ultimately result in a similar footprint and therefore no land acquisition for the stream crossing is to be progressed.

The working assumption is that all the works related to the active modes can be undertaken from the grass berm. A staged construction approach would be used so the drainage and new kerb line can be placed. Temporary road closures of segments of the road are likely to be required as well as temporary traffic diversion. The existing carriageway is wider than the usual for a single lane corridor (10m wide between kerb to kerb) which helps in providing flexibility regarding future works on the corridor.

Further work will be required during the implementation phase from a coordination of utilities/clash detection point of view as its noted a presence of a gas main pipe, overhead power lines, new utilities and stormwater management trench.

From a construction yard point of view, the working assumption is that an area of approximately 600m² (Figure 8) within the existing road corridor that can be used that its adjacent to the existing Croskery Road alignment. There are also parking slots on the existing properties alongside the road which could be utilised as temporarily by the construction team.



Figure 8 Alternative assumption of construction yard

The intersections on both ends of the road (Hunua and Dominion Road) are excluded of this constructability assessment as of the unknown status of the Mill Road project at Dominion Road and the inclusion of the Hunua Road intersection in the Takaanini FTN scope of works.

To conclude, we understand the implementation of the proposed cross-section is to be straightforward as the urbanisation of the corridor follows the existing road geometry and well established construction methods are to be adopted. Therefore, the available road reserve width is deemed appropriate for the proposed works, not requiring extra land.

4 Recommendation

Based on the areas assessed by the different disciplines, it is recommended that route protection for the Croskery Road corridor is not required.

This recommendation is based on an analysis of the existing road reserve available for the urbanisation of the corridor in a scenario where single lanes, active modes corridor and an allowance of 1.5m width of vegetated berm/ infiltration trench to provide stormwater management each side of the road are to be provided.

It is noted however, further design will be required when implementing the project to assess the considerations made on this document which will consider not part of this document such as, utilities investigations, soils and pavement conditions, the presence of other services and interaction with the road layout. Notwithstanding these potential constraints, there is a considerable benefit in not taking land for the wetlands and the increased size of the impervious area is small in the context of the overall catchment and is expected to cause only minor effects on the receiving environment in any case.

5 Next steps

This technical memo will be appended to the Takaanini Business Case and discussed as appropriate in the main body of the document. Although route protection is not required, consideration will be given to the likely cost and timing of this upgrade, to support Owner planning and funding processes.

Name:	Bruno Busnardo
Title:	Engineering Lead – Takaanini FTN/Level Crossings
Email:	Bruno.busnardo@supportinggrowth.co.nz
Mobile:	022 406 1877

4 Appendix D – Road Safety Audit Exemption

Road Safety Audit Exemption Form



File reference	SGA-900-DBC-WPL-Road Safety Exemption Form
Project name	Supporting Growth Alliance (SGA)
Project stage	Detailed Business Case for Route Protection
RCA	Auckland Transport/ Waka Kotahi (NZ Transport Agency)

Brief project description and location:

The Supporting Growth Programme is a collaboration between Auckland Transport and Waka Kotahi NZ Transport Agency to plan transport investment in Auckland's future urban zoned areas over the next 10 to 30 years. The programme includes numerous transport corridors proposed within the Auckland Region over a 30+ year timeframe

The scope of the SGA programme where Safety Audit Exemption is sought includes all transport corridors where construction funding is **not** being sought (i.e. a route protection designation only).

Exemption rationale:

The Supporting Growth Business Cases are being developed to enable a designation footprint to be identified for future projects, and the design effort has been limited to that which will inform the designation footprint and Assessment of Environmental Effects for designation (i.e. the deliverable is the designation boundary rather than the design itself). The footprint will include sufficient land requirement to allow for construction and this will provide flexibility for design development to be made in future. It is expected that the future design will achieve a safe system outcome which will align with AT's Vision Zero for Tamaki Makaurau, Unitary Plan and Road and Street Framework.

As pre-implementation and construction funding is not being sought from this business case, several typical design tasks (intersection tracking, drainage design, geotechnical investigation and topographical survey) are not being carried out at this stage. The primary objective of a road safety audit is to help ensure a project achieves an outcome consistent with Safer Journeys and the Safe System approach – that is, minimisation of death and serious injury. It is considered that there is insufficient development of the design to undertake a safety audit at this point in time. An 'Implementation Business Case' will subsequently be required at some time in the future when construction is imminent to identify and confirm funding. The design for this business case will incorporate the latest design principles and standards that are relevant at the time, and there is a high likelihood that these will differ from today's requirements. Therefore, a Concept (Stage 1) Safety Audit is not proposed for the current route protection process and will be deferred until the project is ready to progress to implementation. A Concept Safety Audit will be required at that time regardless of whether one is carried out now.

To adequately incorporate safety into our route protection business case, consultation with various AT's department to ensure adequate footprint is being secured. We will be applying the Safe System Assessment Framework to our programme and will also carry out a Safety in Design review during the pre-implementation design stage.

Declaration:

Having checked the above project with reference to the relevant procedures as laid down in Road Safety Audit Procedures for Projects - Guidelines, 2013, I consider that an independent road safety audit is not required for this stage subject to the following:

1. A Safety in Design Register is included in the Design Report
2. Safe System Principles to be applied to all design development and are documented in the design Report
3. A Concept (Stage 1) Safety Audit is undertaken for the subsequent Detailed Business Case required for implementation funding

Recommended by (Auckland Transport Owner Interface Manager):

Name	Alastair Lovell
Position	SGA Auckland Transport Owner Interface Manager
Signature	
Date	28 August 2020

Recommended by (Waka Kotahi - NZ Transport Agency Owner Interface Manager):

Name	Deepak Rama
Position	SGA Waka Kotahi Owner Interface Manager
Signature	
Date	28 August 2020

Endorsed by (Auckland Transport Safety Engineer):

Name	Irene Tse
Position	Technical Lead Road Safety Engineering
Signature	
Date	28 August 2020

Endorsed by (Waka Kotahi -NZ Transport Agency Safety Engineer):

Name	Shashi Lakshminarasimhaiah
Position	Senior Safety Engineer
Signature	
Date	17 August 2020

South FTN and Key Connections

Appendix I – Property Overview

November 2023

Version 1.1

Document Status

Responsibility	Name
Author	[REDACTED]
Reviewer	[REDACTED] [REDACTED]
Approver	[REDACTED]

Revision Status

Version	Date	Reason for Issue
0.1	01/06/23	Draft for SME Review
1.0	23/06/23	Issue for IQA review
1.1	9/11/23	Final

Table of Contents

1	Introduction.....	5
1.1	Purpose of the Property Overview.....	6
1.2	The DBC Recommended Package	6
1.2.1	Timing	8
2	Affected Properties	9
2.1	Indicative Land Requirements	9
2.1.1	Development in the area.....	9
2.2	Acquisition Issues and Risks	9
2.3	Access	11
2.4	Land Tenure Issues	11
3	Compensation.....	12
3.1	Base Price Methodology	12
3.2	Base Property Internal Quality Assurance	15
3.3	Base Property Estimate	15
3.4	Stage Two PWA and LVT Cost Estimate	15
3.5	Expected P50 and P95 Property Costs	15
3.5.1	Expected (P50) Costs	15
3.5.2	P95 Contingency.....	16
3.5.3	Summary.....	16
4	Package property acquisition approach	17
4.1	NoR with Contemporaneous Purchase	17
4.2	NoR with Future Purchase.....	17
5	Future Property Appreciation	18
5.1	Challenges of appreciation in long term growth areas	18
5.2	Risk Profile	18
5.3	Risk Analysis.....	18
5.4	Property Appreciation Application	19
6	Early Acquisition Liability	21
6.1	Demand for Purchase of land with NoR in place	21
6.2	Section 185 RMA Purchase Obligation	22
6.3	Risk Analysis.....	23
6.3.1	Acquisition approach.....	23
6.4	Early Acquisition Approach	23
6.5	Early Acquisition Liability Application	24
7	Potential Implications on Acquisition Cashflow	26
8	Ongoing management	28
8.1	Ongoing property management	28
8.2	Disposal	28

9	Contingent Project Liability	28
9.1	General.....	29
9.2	Governance	29
9.3	Resourcing	29
9.4	Developer Agreements.....	30
9.5	Wider Te Tupu Ngātahi Property Management	30
10	Resource Consent and Public Consultation.....	32
10.1	Engagement	32
10.2	Consents.....	32
11	Recommendations	32

Table of Figures

Figure 1-1 : DBC Scope.....	5
Figure 1-2 : Recommended Package	7
Figure 1-3 : Recommended staging	8
Figure 2-1 : Indicative impact of property prices.....	11
Figure 3-1 : Property acquisition by type by individual projects	13
Figure 5-1 : Property cost summary	20
Figure 7-1 : Route protection cashflow	26
Figure 7-2 : RLTP 21/22 – 30/31 period property cashflow by project.....	27
Figure 7-3 : Forecast property cashflow range	27
Figure 9-1 Strategic Property Fund components.....	31
Figure 11-1: Profile A: Acquisition at Implementation	33
Figure 11-2: Designate and Moderate Acquisition	34
Figure 11-3: Profile C: Designate and High Early Acquisition	35

Table of Tables

Table 2-1 : Property Acquisition Summary	9
Table 2-2: Property Risks	10
Table 3-1 : Base property estimate summary (excluding contingency and Stage two PWA and LVT costs and).....	15
Table 3-2 : Property Cost Summary	16
Table 5-1 : First decade property liability sensitivity (Base estimate)	19
Table 6-1 : Property acquisition profiles	25

Appendix

Appendix A - Assumed Acquisition Profiles

1 Introduction

The South FTN and key connections DBC follows on from the solutions and outcomes identified at both the Programme Business Case (PBC) and Indicative Business Case (IBC). The DBC considers two frequent transit networks (FTN) and three key connections identified within the Indicative South Transport Network (ISTN). These are shown in **Figure 1-1**.

Figure 1-1 : DBC Scope



1.1 Purpose of the Property Overview

This Property Overview has been developed to outline the anticipated property requirements for the South FTN and key connections DBC.

It is important to note that whilst this has been developed for the DBC, its primary purpose is for **route protection**. Typically, there will be a subsequent Implementation Business Case to seek approval for implementation funding of individual project, which will include more detailed analysis of the property issues.

The Te Tupu Ngātahi programme has developed a Programme Wide Property Strategy that outlines the principles for property acquisition for the entire programme. The Te Tupu Ngātahi programme includes both Waka Kotahi and Auckland Transport (AT) projects and both property teams have been part of the development of programme wide guidance and approaches. For this DBC, it is AT's project thus a focus on AT in this document but note that Waka Kotahi have been involved in the review of processes and approaches. These principles have guided the development of the property approach with the key points being:

- The programme is about long-term affordability and property will be generally acquired closer to implementation.
- It is recognised there will potentially be an early property acquisition liability as soon as the NoR is lodged for each project.
- The Requiring Authority will take the lead on property negotiations for that specific project, utilising the current processes of that organisation (Auckland Transport (AT)).
- AT's Early Acquisition Guideline processes will apply.
- Where there is opportunity for strategically important properties to be acquired, these should be taken.
- Opportunities for resultant value capture from residual land will be considered as part of the land use integration.

[REDACTED]. This Property Overview outlines the analysis and approach to providing as much certainty as possible to what this early property acquisition liability could be into the future.

It is a living document developed for the route protection detailed business case phase. Given the long-term timeframes envisaged for this route protection, the Property Overview will need to be revisited, reviewed, and updated in the lead up to project implementation. The acquisition programme is dependent on detailed design and land requirement plans being completed.

This Property Overview is intended to sit alongside the Route Protection Strategy and a strategy to commence a dialogue with developers at resource consent subdivision pre application stage to secure additional arterial road widths.

1.2 The DBC Recommended Package

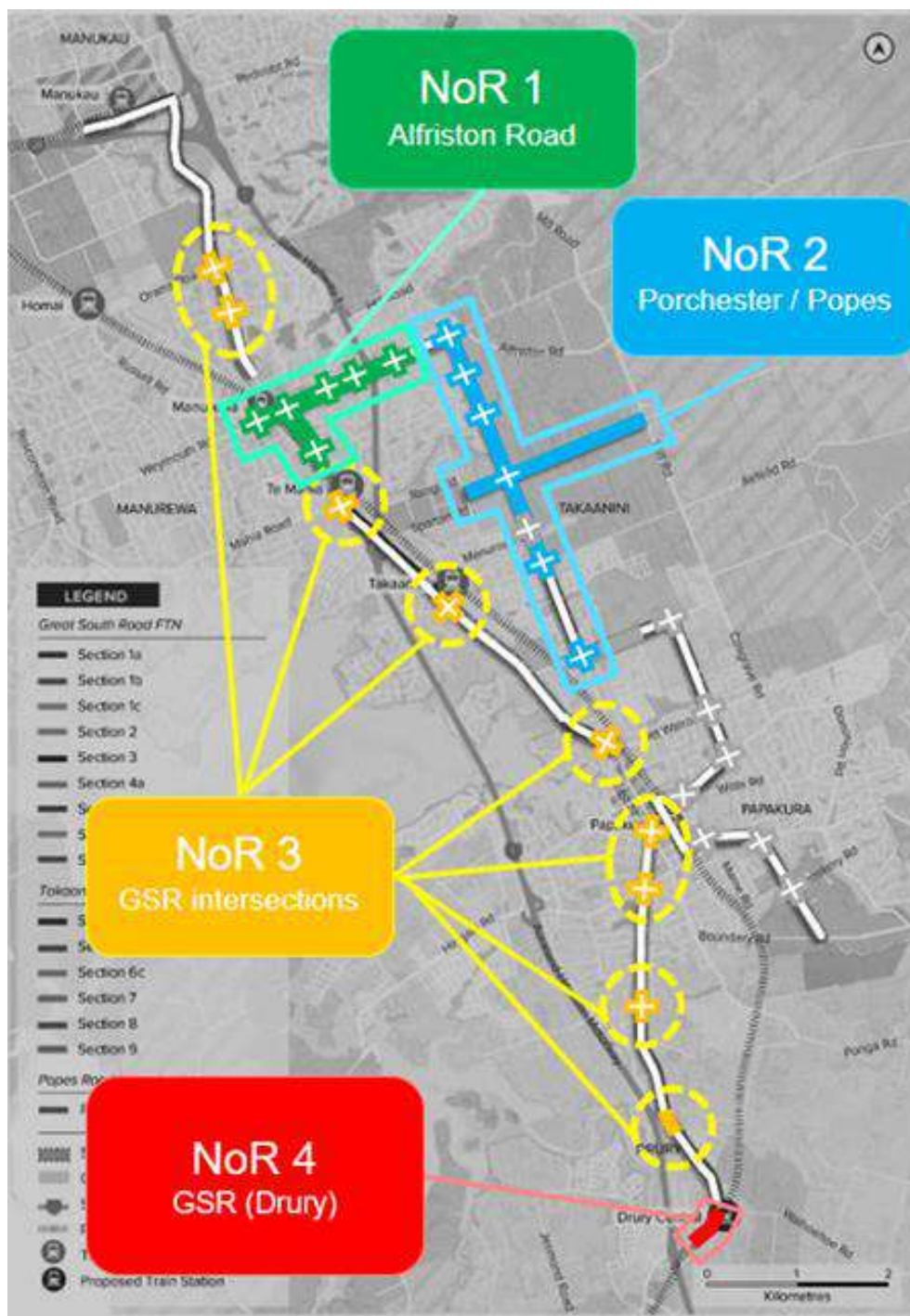
The DBC recommended package of five projects is shown in Figure 1-2 and includes:

- Great South Road (GSR) FTN
- Takaanini FTN
- Upgrade of Popes Road

- Upgrade of Croskery Road
- Upgrade of Great South Road between Waihoehoe Road and Drury Interchange.

The Route Protection Strategy has identified 4 different notice of requirements of these to be progressed for route protection as shown in **Figure 1-2**. In some cases, a project has been split into multiple NORs i.e. Takaanini FTN.

Figure 1-2 : Recommended Package



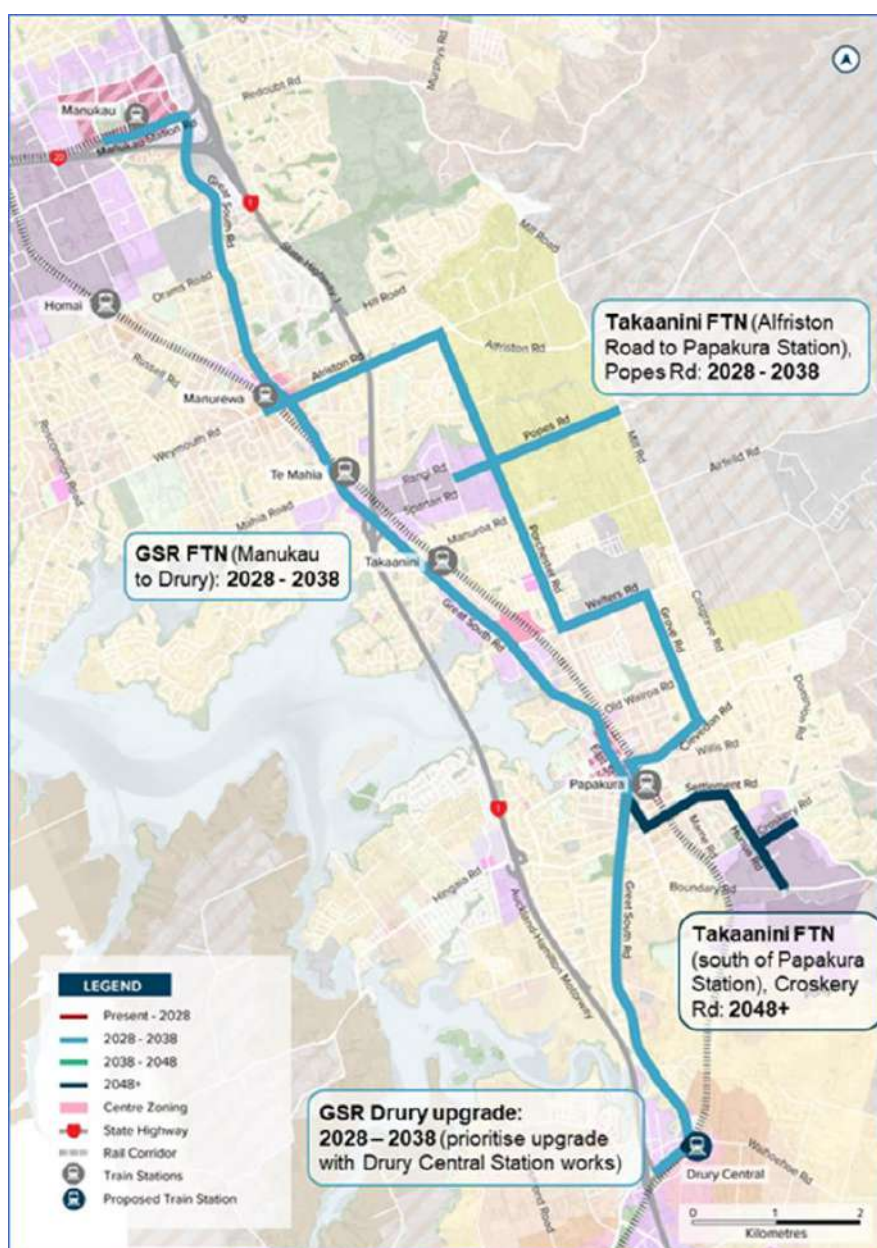
The upgrade of Croskery Road will not proceed to route protection as the project seeks to implement upgrades within the road reserve. Thus, the project has been excluded from the rest of the report.

1.2.1 Timing

The projects in this package have different dates for planned implementation. These dates are heavily reliant on development triggers and timing of land use. Importantly, as this DBC has focussed on route protection, a further 'Implementation DBC' is to be completed prior to implementation to secure implementation funding. A much more detailed project specific property assessment will be undertaken at that time.

Figure 1-3 sets out the current forecast programme.

Figure 1-3 : Recommended staging



2 Affected Properties

2.1 Indicative Land Requirements

A detailed analysis of the number of properties and what type of resultant property purchase is required (full, partial, partial and temporary, or temporary) has been undertaken by Auckland Transport for the DBC.

A total of 446 property interests have been identified for acquisition as outlined in **Table 2-1**.

Table 2-1 : Property Acquisition Summary

Project	Total Property Interest	Full	Partial	Temporary Occupation	Partial & Temporary Occupation
Great South Road FTN	174	31	143	168	311
Takaanini FTN	234	30	204	212	416
Popes Road	34	1	33	59	92
GSR between Waihoehoe Rd and Drury Interchange	4	1	3	38	41
Total	446	63	383	477	860

The above shows that only 14% of property of interest are full purchases and most purchases are partial and/or temporary occupations. A small number of properties do not require acquisition as they are already owned e.g., road.

2.1.1 Development in the area

There are private plan changes under consideration in the area, of significance is the Alfriston Road Plan Change within the Takaanini FUZ. This shows there are already potential development pressures in the area.

2.2 Acquisition Issues and Risks

An assessment of the key risks has been undertaken. A three-tiered risk assessment scale has been used:

- **High** – Significant risk that will require sustained and active management.
- **Medium** – Moderate risk that will require active mitigation.
- **Low** – Minimum risk that can be appropriately managed.

Table 2-2: Property Risks

[REDACTED]



A recent example of the increasing land values in Auckland can be seen with the interventions planned for Redhills. These corridors are located within land zoned through the Auckland Unitary Plan (AUP) process. Auckland Council data on land value changes in 2017 confirms that the Redhills area has experienced an increase in land values of around 100% after the rezoning of the land to live zone from future urban zone. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

2.3 Access

All properties will retain access to the transport system, A number of properties will require their access to be modified during the acquisition process. The details of this will be worked through in the later design stages of the project. The land identified for acquisition has taken this access principle into account and is reflected in the scale of land to be acquired. Where it is unlikely that access can be maintained then the property has been identified for full acquisition.

For some of the properties, temporary access may be required and will be investigated during the project development phases in the future. It is recommended that this temporary investigative access be obtained as early as possible for any property identified for future acquisition.

2.4 Land Tenure Issues

This assessment has not been undertaken at this time due to the route protection nature of this DBC.

3 Compensation

3.1 Base Price Methodology

The AT property team have undertaken the property cost estimate for the project on behalf of Te Tupu Ngātahi. This section of the Property Overview outlines the methodology adopted by the AT property team in developing the property cost estimate.

The level of information provided to AT to inform the base cost estimate is commensurate with the business case, which is for NoR route protection purposes. Unlike traditional detailed business cases, the implementation dates for the DBC vary within the next 10 – 40 years.

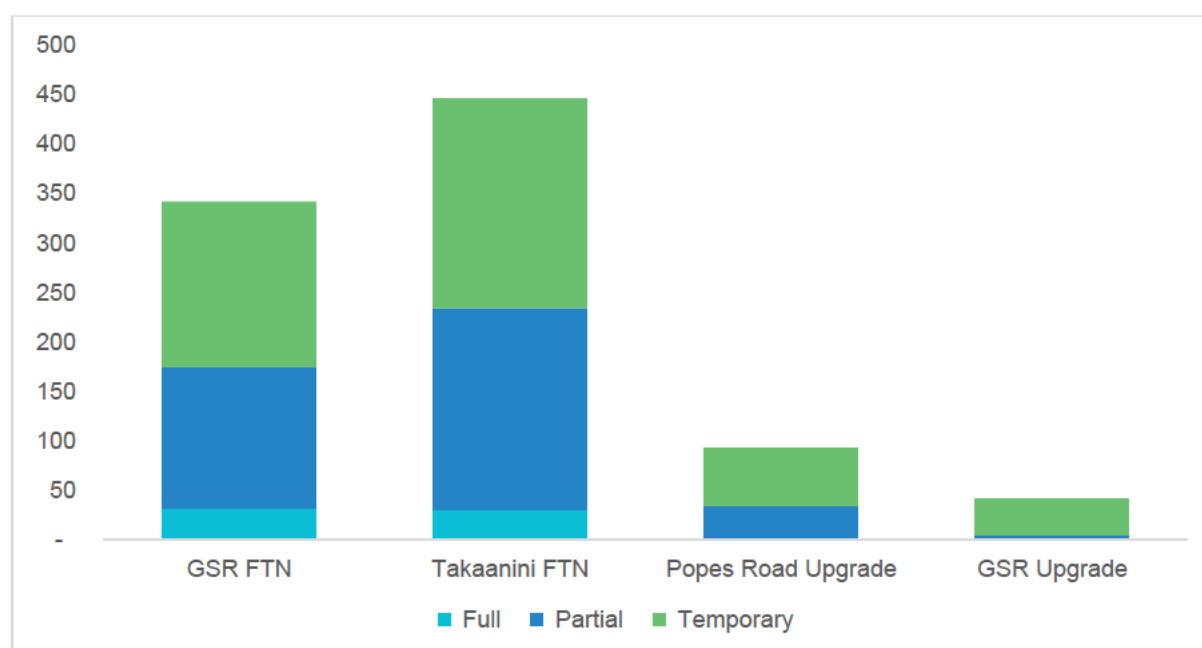
The AT property team assessed the 12 property packages which contained all the project in the DBC proceed to route protection. Note that some projects were separated into different package due to the varying nature of the corridor. The inputs provided by Te Tupu Ngātahi to AT, consisted of GIS maps showing indicative permanent and temporary land requirements for the projects and supporting data identifying the affected properties on a property-by-property basis. The inputs provided at this stage did not include detailed investigation of property impacts, for example topographical and geotechnical impacts.

Informing the base cost estimate are the following assumptions:

- For arterial road corridors, the full arterial road width has been included, notwithstanding the land acquisition programme may be developer led with developers providing the local corridor width at no cost. This reflects the need for the full arterial road corridor width to be within the proposed NoR boundary.
- It is assumed the land acquisition programme will be developer led within the Future Urban Zone (FUZ). Generally, given the long-term route protection, the majority of the earthwork batters have been included within the temporary occupation area rather than the permanent acquisition area, within the FUZ, as it is expected development will be built up to the road boundary.
- The prospect of zoning changes and specifically future urban land being subject to Plan Change and the timing of these processes re Te Tupu Ngātahi relative to any route protection forms part of the additional analysis undertaken by Te Tupu Ngātahi.
- Injurious affection is an estimate of the adverse effect that a partial acquisition of land will have on the remainder of the land. In this estimate, no allowance has been made for injurious affection. This will need to be considered when design is refined.

Figure 3-1 shows the type of property acquisition by each corridor. This confirms most acquisitions are partial with very few full acquisitions envisaged. All corridors will have some full acquisitions but full acquisition only accounts for 14% of total properties to be acquired.

Figure 3-1 : Property acquisition by type by individual projects



The exercise undertaken for providing the based cost estimate is as below:

Task	Additional information
AT undertook a desktop assessment of land values expressed on a rate per square metre basis for raw (un-subdivided) block land (i.e., land requiring earthworks, roading and servicing prior to any development) for the different zonings including Light Industry, Mixed housing suburban, Town Centre, Future Urban Zone and Heavy Industry. The valuation inputs were provided by independent registered valuers.	Adopted: - Future Urban Zone - [REDACTED] - Residential – Single House Zone - [REDACTED] - Residential – Large Lot Zone - [REDACTED] - Business – Light Industry Zone - [REDACTED] - Business – Town Centre Zone - [REDACTED] - Residential – Mixed Housing Urban Zone - [REDACTED] - Business – Mixed Use Zone - [REDACTED] - Residential – Mixed Housing Suburban Zone - [REDACTED] - Residential – Terrace Housing and Apartments - [REDACTED]
Each property and land requirement has been assessed on a property - by-property basis.	For full acquisitions, an estimate of the current market value was obtained using Online resources such as Property Guru data and Auckland Council GIS.
Land cost component contingency	An assessment has been undertaken to determine the appropriate contingency to apply to the land cost component of the base cost estimate. Considering the lack of investigations (e.g., topographical and Geotech), high-level design and the depth of market and level of available sales evidence, the contingency applied to the base land cost estimate component has been assessed at 15%.

Task	Additional information
PWA cost estimates have been assessed on a parcel-by-parcel basis.	• Section 72 PWA costs. • Section 66 PWA costs allowing for the issue of section 18 PWA Notices of Desire, if required. This is based upon analysis of previous s66 claim history of comparable claims over recent years. • Costs of acquisition including legal and valuation costs and staff time. This also allows for the issue of section 18 PWA Notices of Desire, if required. The base cost estimate does not include the cost of using external acquisition service providers. Costs are based upon the AT internal acquisition model. • The upper end of the section 66 PWA and estimated costs of acquisition has been adopted for each acquisition type. Across the whole land acquisition programme, the methodology adopted is reasonable for the required level of input. • In addition to the base cost estimate costs associated with stage two of the PWA compulsory acquisition process and LVT proceedings are assessed on an aggregate basis across each tranche of acquisitions. This allowance is estimated based on the historic aggregate number of acquisitions that progress to the s23, s26 and LVT Proceedings. The assumptions are outlined in the following section.
Stage 2 PWA compulsory acquisition and Land Valuation Tribunal (LVT) proceeding costs.	An allowance has been made on an aggregate basis based on the following assumptions: ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED]
Stage Two PWA and LVT cost component contingency	• At the request of the AT property team a contingency of 15% has been added to the Stage Two PWA and LVT cost component by Te Tupu Ngātahi. • The base cost estimate excludes existing legal road areas that are already in AT/ Council ownership. • Where properties are included in more than one package project, this has been specifically noted and only counted once. • Various other cost elements, which are a cost to the physical works budget have also been identified. These form part of the early property acquisition project liability addressed in Section 10. The cost of mitigation on a property-by-property basis and temporary occupation during construction is an example of costs to the project, as part of the physical works construction cost. For temporary occupations, a rental rate of 7% of the land rate has been adopted on a per annum basis. This is informed by AT's current knowledge of temporary occupation rates.

3.2 Base Property Internal Quality Assurance

The base property cost estimate methodology has been reviewed by the property team at Align Property Consultants. They have reviewed the process outlined above to come up with the base property estimates and have advised that they are comfortable with the process used to establish the base costs.

3.3 Base Property Estimate

The total base property estimate, using the methodology outlined above, as at present dollar value is [REDACTED] excluding land cost contingency and PWA cost contingencies and annual temporary occupation rental. The temporary occupation costs are shown separately per annum.

3.4 Stage Two PWA and LVT Cost Estimate

To the base property estimate above, AT then added an allowance of [REDACTED] to the overall acquisition programme for the estimated section s23 and 26 PWA and LVT proceeding costs and prorated this figure between the projects, [REDACTED]

3.5 Expected P50 and P95 Property Costs

A contingency based on the assessed risk profile is added. This is done in two parts, a contingency to identify the base estimate, or P50 and then a further contingency to identify the P95 cost.

3.5.1 Expected (P50) Costs

A 15% contingency was applied to the base estimate of the acquisition cost to provide for uncertainty in relation to the estimate inputs and specific project threats and opportunities with a cost impact to derive the expected estimate (P50).

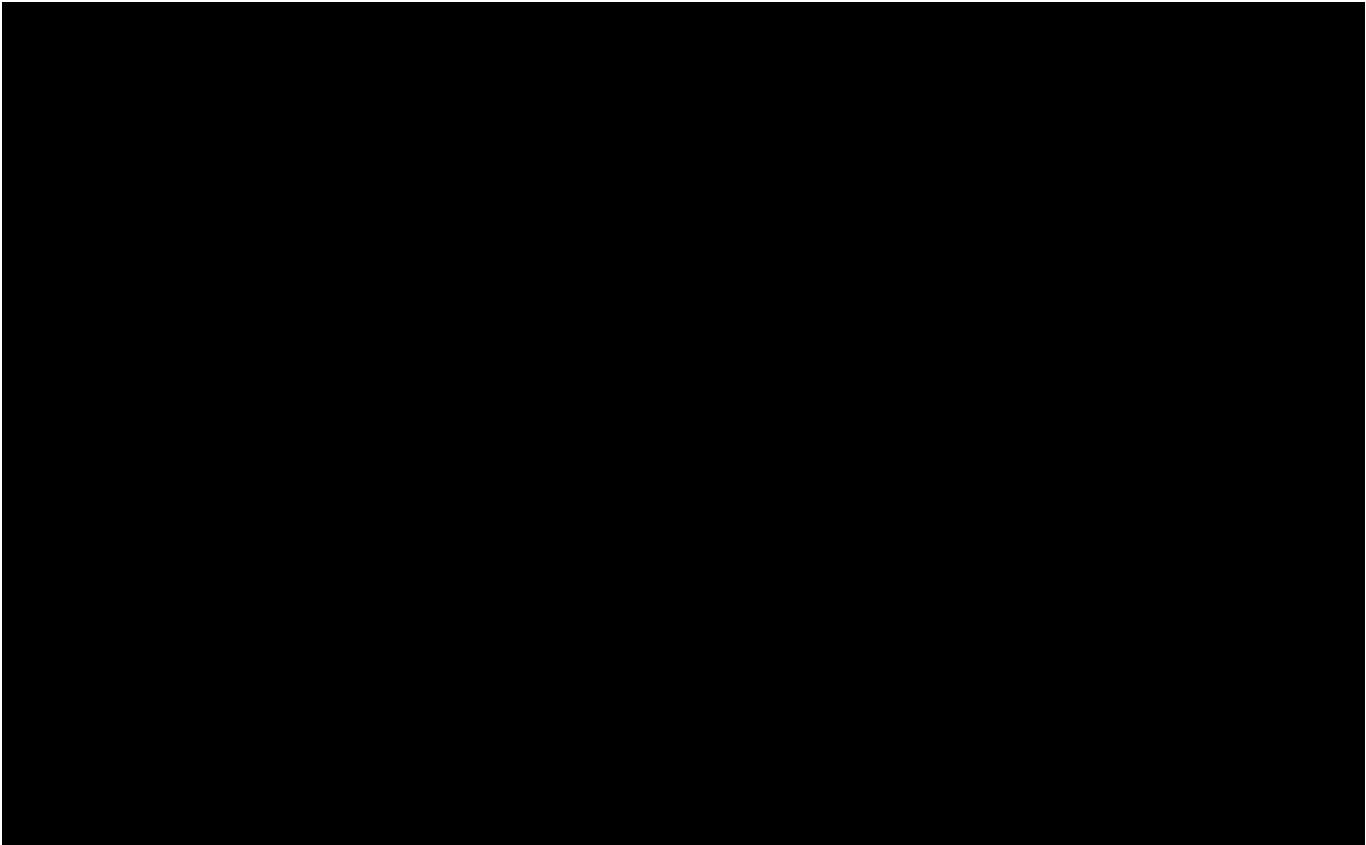
3.5.2 P95 Contingency

For the P95 contingency a further 20% has been added to the Expected Estimate (P50) contingency. This is based upon the detailed risk modelling (consistent with SM014) undertaken for the capital costs of each project in the programme and takes into account the risk profile accordingly. This approach is considered appropriate and is consistent with the CAPEX costs and approach.

3.5.3 Summary

This approach results in the costs (including contingency) shown in [REDACTED]

[REDACTED]



[REDACTED]

4 Package property acquisition approach

[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED] [REDACTED] [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]

³ <https://www.infrastructureaustralia.gov.au/sites/default/files/2019-06/CorridorProtection.pdf>

5 Future Property Appreciation

5.1 Challenges of appreciation in long term growth areas

A designation prevents physical/capital development of the land the designated areas, and therefore any inflation arising from that, it does not completely freeze the value uplift. From a PWA perspective, the value of compensation paid is assessed as at the date it is purchased and is evaluated with reference to surrounding comparable market values. When the expected time horizon of these projects is potentially several decades into the future, estimation of future costs is extremely unreliable. Property inflation can only sensibly be estimated three to five years into the future. Anything beyond this becomes problematic.

This risk is mitigated on a practical basis by regularly reviewing property estimates on a three yearly basis in line with the RLTP process.

5.2 Risk Profile

At a macro level the dynamism of the surrounding land-use changes will have an impact as this will result in land value appreciation. Route protection will occur over a range of land zonings, each with different potential for land value inflation. Areas that have the least potential for change to a more intensive zoning will have the least potential for land value inflation. For example, those with a current urban or rural zoning that will remain the same or similar over the project period will only be subject to inflation at the rate standard for that land-use class.

In contrast, areas that are transitioning from a FUZ to an urban zoning will significantly increase in value. [REDACTED]

- [REDACTED]
[REDACTED]
- [REDACTED]
[REDACTED]
- [REDACTED]
[REDACTED]

Although much of the area in this package of project is not within FUZ zoning, there are however large areas where properties are within Plan Change 78. [REDACTED]

- [illegible]

				I	I	I

⁴ Compounded year on year

experience has been in similar situations. This consideration identified that the appreciation rates applied would be appropriate over time, [REDACTED]

However, over the long-term of the route protection approach, the more simplistic approach is considered appropriate. This has given us confidence that the medium scenario gives an appropriate estimate of likely appreciation, and the high scenario adequately catches a potential upper bound.

[REDACTED]

There is an opportunity to work with the developers in the area to reduce these costs (as have been done elsewhere on the Te Tupu Ngātahi programme) through property being provided as part of wider infrastructure agreements (such as funding agreement of actual infrastructure). To enable this opportunity to be maximised, having a designation in place facilitates these discussions occurring and increasing the chance of the opportunity being realised. No discussions have been undertaken with developers at this stage.

6 Early Acquisition Liability

In addition to the future property appreciation risk, implementing a route protection strategy that aligns implementation of the property acquisition programme with future project delivery that is programmed in future decades, creates:

- The need for the Requiring Authority to respond to demand for early property acquisition.
- An obligation to acquire the protected land in some instances under section 185 of the RMA.

[Redacted]

6.1 Demand for Purchase of land with NoR in place

The timing of the demand for early purchase of land within the protected route will be driven by both the individual landowners' various land-use decisions and the anticipated construction date. This assumes the NoR is in place.

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

[Redacted]

6.2 Section 185 RMA Purchase Obligation

6.3 Risk Analysis

[illegible]

6.4 Early Acquisition Approach

AT have guidelines for managing early acquisition of property in advance of the project implementation phase, and in particular clarify the criteria and outline decision making processes for assessing each early acquisition on a case-by-case basis.

These guidelines anticipate the s185 process but are a less formal negotiated process. The process takes into account personal circumstances and recognises the NoR may have a blighting impact on property.

[illegible]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

-

[REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]

[Redacted text block]

[Redacted text block]

[Redacted text block]

7 Potential Implications on Acquisition Cashflow

This section outlines the estimated annual property cashflow forecast between commencing the RMA designation processes and when the future project is programmed for delivery.

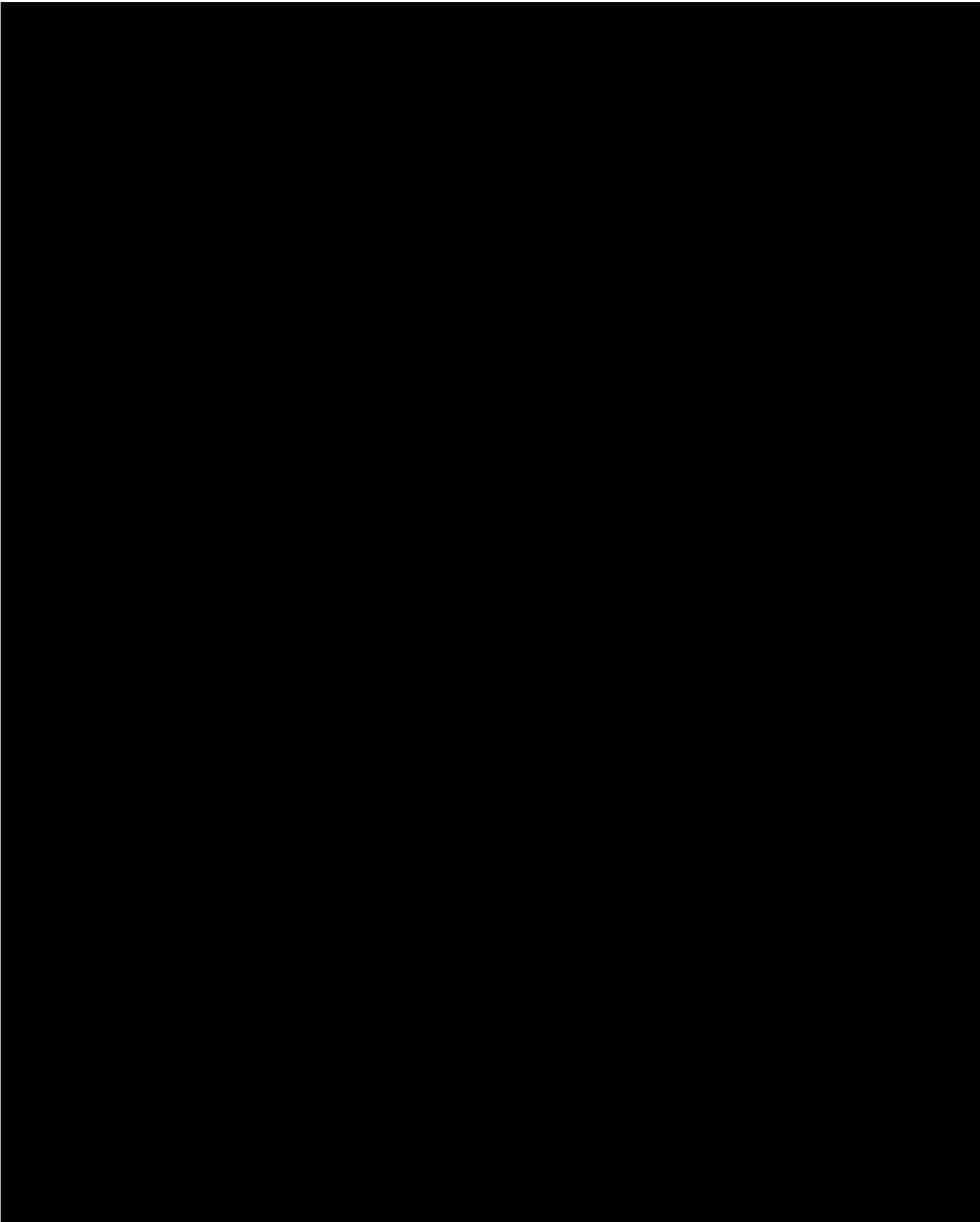
[REDACTED] It differentiates between the two property acquisition periods:

- Estimated early acquisition property liability which is the period once the NOR is notified but prior to the implementation period.
- Estimated implementation property liability which is the period just prior to implementation.

The implementation periods are based on the assumed staging set out within the DBC. [REDACTED]

[REDACTED]

[REDACTED]



8 Ongoing management

8.1 Ongoing property management

Both Agencies have comprehensive processes and teams dedicated to the ongoing management of properties once purchased. It is assumed that these existing processes will be used to manage properties, where required. With only 5% of the total acquisition plan being full purchases the ongoing management is somewhat reduced.

[REDACTED]

[REDACTED]

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

As well as the above issues, where applicable, there are the standard issues that will require attention, including:

- **Healthy Homes** – There will likely be a need to comply with the latest legislative requirements for any rental properties, including insulation, heating, and draft (windows) management.
- **Asbestos** – There maybe asbestos in some of the properties that will require removal.

The standard approach of the Agencies in the testing, implementation, and ongoing management of these issues (and any others) would be used.

[REDACTED]

[REDACTED].

8.2 Disposal

As no significant acquisition plan is forecast in the short term, this has not been addressed in this document and will need to be addressed closer to implementation and as part of the Implementation DBC and resultant property approach.

9 Contingent Project Liability

Various other cost elements, that are a cost to the physical works budget have also been identified including:

- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]
- An annual temporary occupation rental, subject to adjustment by the project team to reflect the assumed construction duration.

- The risk of potential business relocation and business loss PWA claims. [REDACTED]
- Cost of reinstatement works.
- [REDACTED]
- Demolition and relocation of improvements to enable the works construction. Where applicable, estimated QV Costbuilder rates have been provided.
- Mitigation, where possible, of the potential effects of road construction, noise, dust, and privacy issues etc.

9.1 General

There is considerable uncertainty around the property costs given the size of this programme (and the wider Te Tupu Ngātahi programme) and therefore to best manage this uncertainty and minimise the early property acquisition expenditure as much as possible until projects are implemented the following is proposed:

- Joint governance.
- Appropriate resourcing.
- Developer Agreement.

9.2 Governance

It is recommended that a joint property focussed decision making group be set up with a representative from each partner organisation. The purpose of this is that whilst individual property acquisitions will be managed on a day-to-day basis by the appropriate road controlling authority, overall joint governance is required to ensure that consistency of approach and priorities is maintained.

This joined up approach will provide increased certainty of outcome for all and a consistent approach across the programme.

9.3 Resourcing

There needs to be a dedicated resource of at least one person from each partner organisation who are focussed on the identification, acquisition, and enhancement of strategic properties. There is a real risk that without this dedicated resourcing that a property specific approach in isolation is taken rather than an all of programme view. This will ensure that there is consistency in approach and issues will be addressed early and hopefully this will result in acquisitions only occurring when necessary.

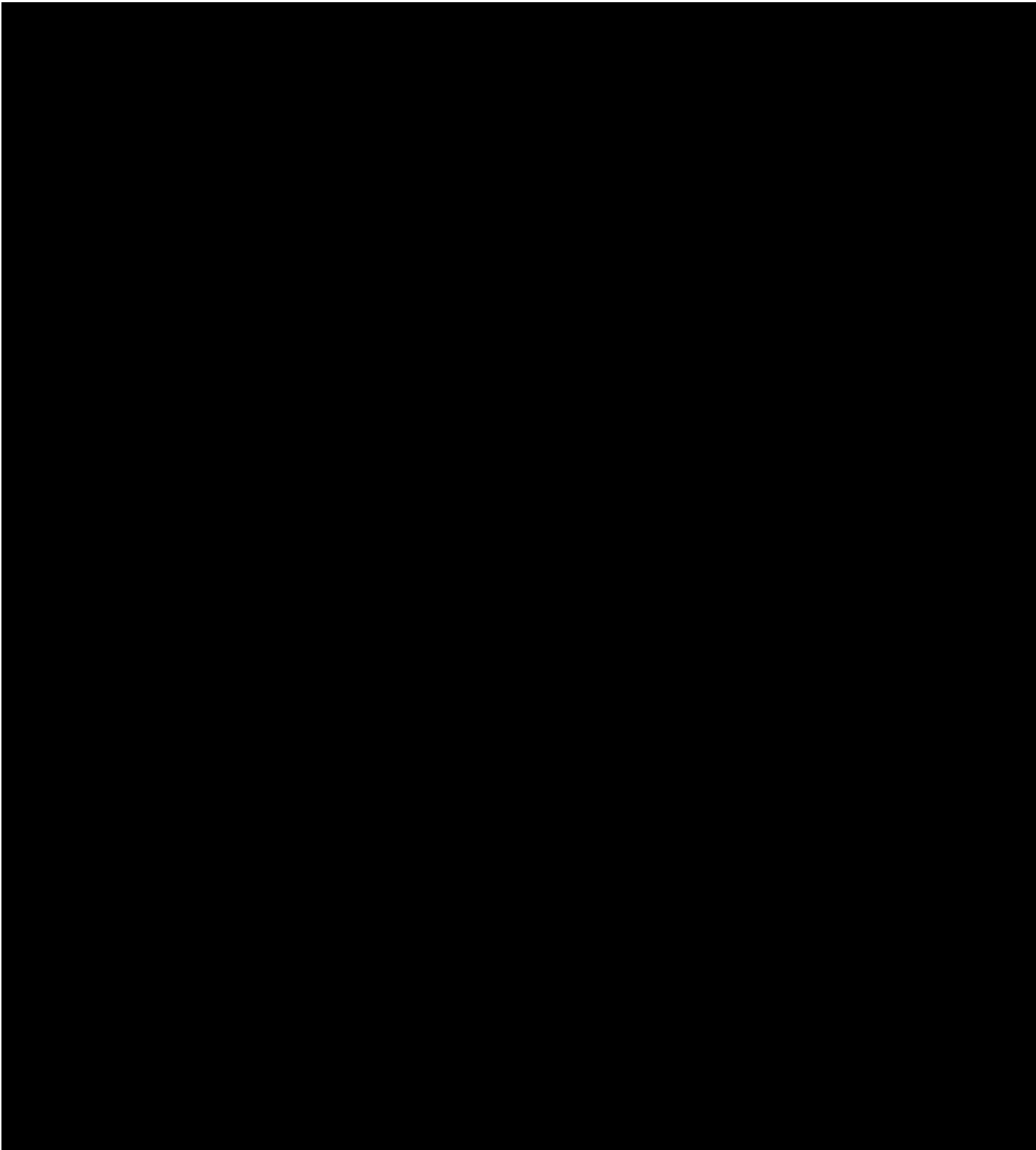
The wider Te Tupu Ngātahi programme is also seeking a dedicated resource from each organisation and the role would be part of this overall programme resourcing rather than additional resourcing.

9.4 Developer Agreements

Focussing on getting alignment of various plan changes will assist in identifying infrastructure priorities. This will clarify the need for early and comprehensive developer agreements, particularly with the significant developers in the area, to assist an acquisition programme and cashflow phasing.

9.5 Wider Te Tupu Ngātahi Property Management

[Redacted content]



10 Resource Consent and Public Consultation

10.1 Engagement

As part of this DBC's development, engagement on options (and the recommended option) has been undertaken with the community so there is an awareness of the scale of projects. A summary of the outcomes of the engagement undertaken so far can be found in the engagement section of the DBC.

The next stage is for the designation to be sought for these projects. This will require further community engagement, and in particular, discussion and engagement with affected property owners. The NoR development of documentation is ongoing and due to be lodged in October 2023.

10.2 Consents

Route protection for this package will be sought through the application of a designation for the new roads and widening identified. Resource consents will not be sought at this time, with these currently proposed to be obtained on an individual project basis closer to the time of implementation.

11 Recommendations

This programme is focussed on route protection. There remains uncertainty as to the exact timing of the property acquisition needs of the projects until implementation is [REDACTED]

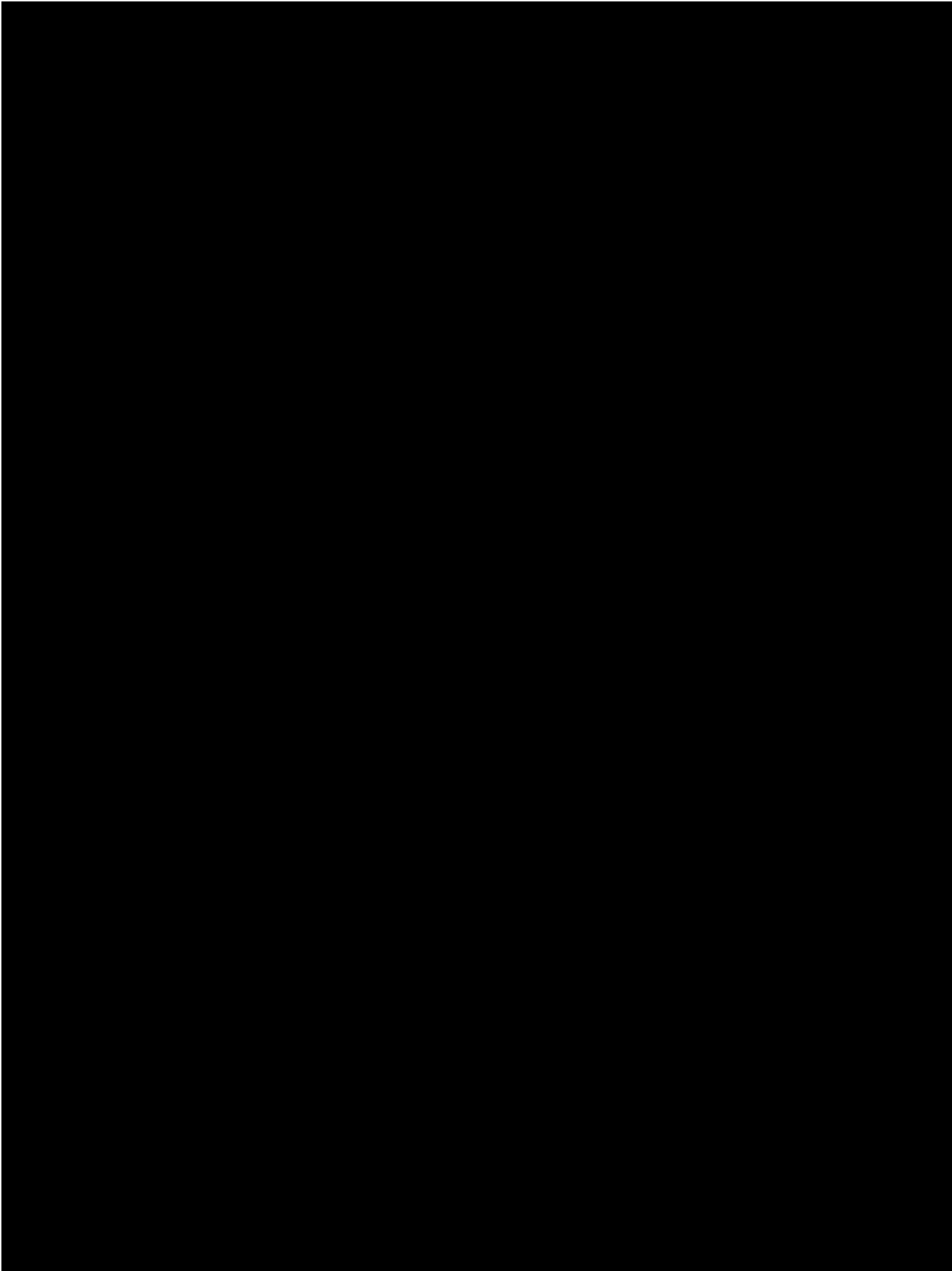
To appropriately and proactively manage this risk and uncertainty it is recommended that during the projects development the following occurs:

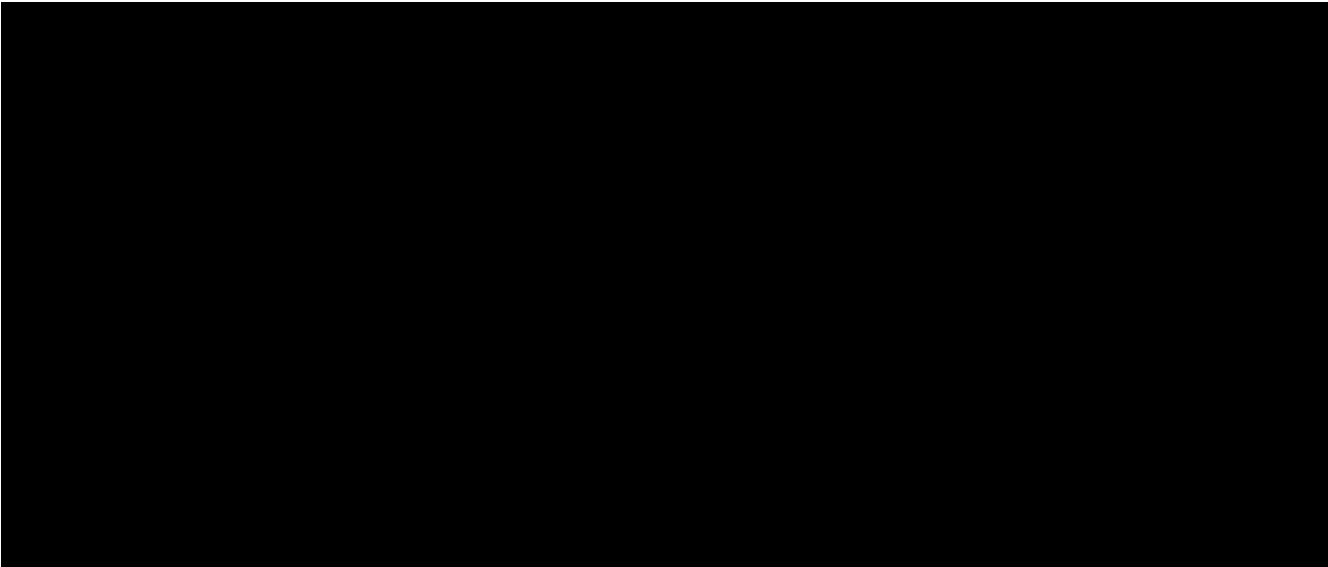
- The Implementation DBC reconfirm the property cost and requirements as design confidence is further developed.
- Any changes in design avoid the need for minor land requirements.
- Value engineering is undertaken to minimise the land required for projects.
- Detailed property valuations are undertaken closer to implementation.
- Agreements with developers are progressed and 'locked in' as soon as possible to try and reduce the total property costs of the programme. This requires the commitment of funding to enable agreements to be advanced.

[Redacted text block containing multiple lines of information]

[Large redacted text block]

[Redacted text block containing multiple lines of information]





South FTN and Key Connections

Appendix J – Cost Estimate

November 2023

Version 1.1

Document Status

Responsibility	Name
Author	
Reviewer	
Approver	

Revision Status

Version	Date	Reason for Issue
0.1	22/05/2022	Draft for Review
1.0	23/06/2023	Issue for IQA Review
1.1	9/11/2023	Final

Cost Estimate Summary Table

Category		Item	Unit	Quantity	Unit Price	Total Price
Construction	Site Preparation	Excavation	m ³	100	150	15,000
		Gravel	m ³	50	200	10,000
		Concrete	m ³	20	300	6,000
		Labour	hr	100	50	5,000
Materials	Structural	Steel	kg	500	20	10,000
		Brick	unit	1000	10	10,000
		Timber	m ³	50	200	10,000
		Labour	hr	100	50	5,000
Services	Electrical	Wiring	m	100	100	10,000
		Switches	unit	10	500	5,000
		Labour	hr	100	50	5,000
		Materials	unit	10	500	5,000
Total	Grand Total	Excavation	m ³	100	150	15,000
		Gravel	m ³	50	200	10,000
		Concrete	m ³	20	300	6,000
		Labour	hr	100	50	5,000

Table of Contents

1	Introduction.....	1
2	Approach to cost estimation.....	1
2.1	Property	1
2.2	Project development phase	2
2.3	Pre-implementation phase.....	2
2.4	Implementation phase.....	2
2.4.1	Implementation fees.....	2
2.4.2	Physical works	3
2.5	Risk and Contingencies	3
2.6	Escalation	4
2.7	Verification	4
3	Cost summary.....	1

Appendices

1	Appendix A Cost estimate summary forms (DBE)
2	Appendix B Property cost estimate memorandums
3	Appendix C Generic physical works assumption schedule
4	Appendix D DBE Project Costing Segments

Figures

Figure 1 Takaanini FTNs costing scope of works.....	2
---	---

Tables

Table 1 Elemental cost summary	ii
Table 2 Assumed temporary occupation by project corridor	1
Table 3 Cost summary by project costing segment.....	1

Acronym/Term	Description
AT	Auckland Transport
AUP	Auckland Unitary Plan
CEM	SM014 Cost Evaluation Manual
CH	Chainage
DBC	Detailed Business Case
WK	Waka Kotahi
FTN	Future Transport Network
GSR	Great South Rd

1 Introduction

This estimate has been prepared to provide an indication of costs for future budget forecasting and for inclusion in the economic analysis, part of the Appendix K - Economics Assessment within the Takaanini FTNs Detailed Business Case (DBC).

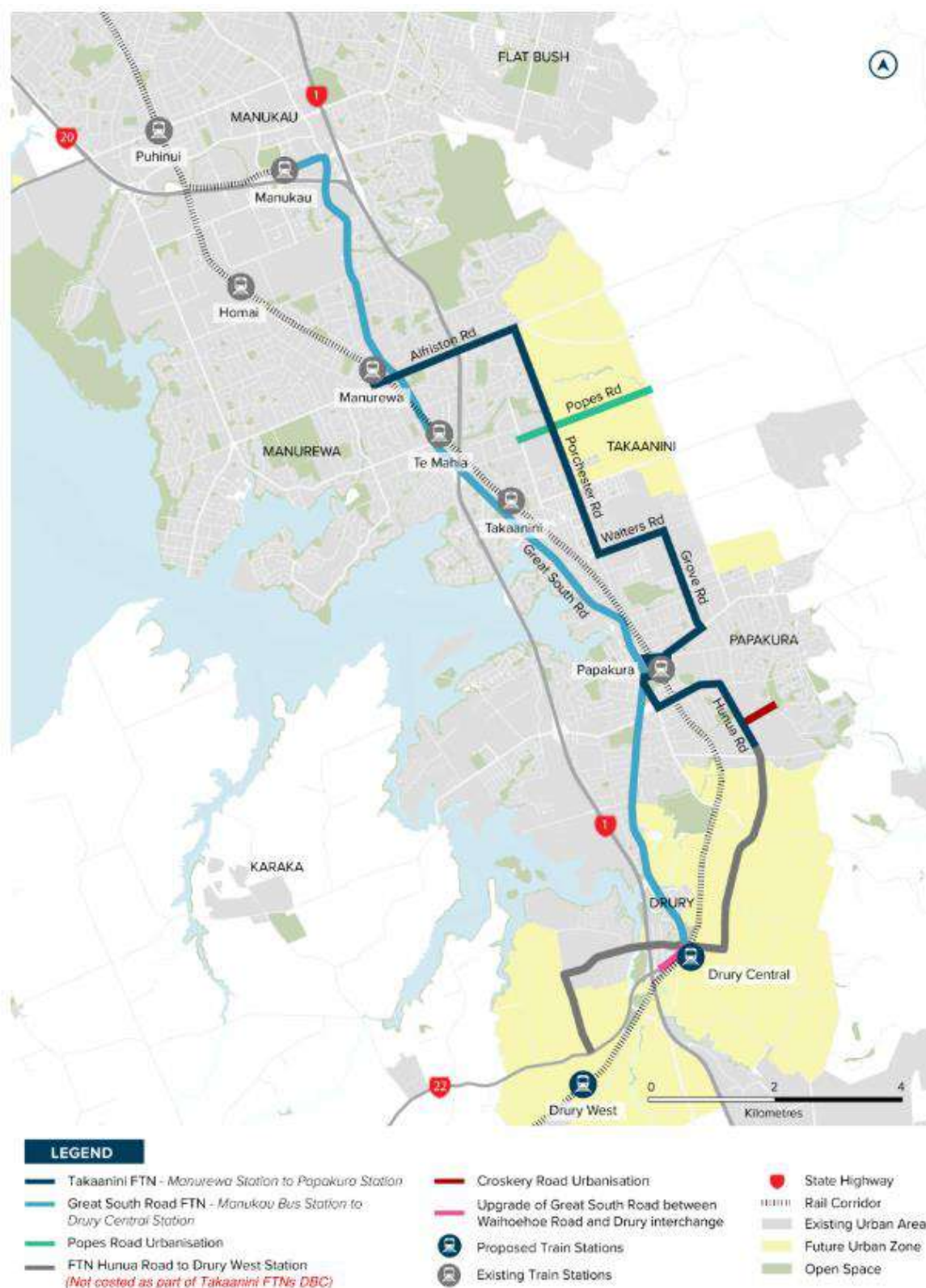
This document should be read in conjunction with the Appendix H - Design Report within the Takaanini FTNs DBC and appended general arrangement plans.

The costing of works has been based primarily on:

- The revision A general arrangement drawings dated May 2023, refer to Appendix H - Design Report within the Takaanini FTNs DBC
- The indicative property cost outlined in the Appendix B.
- The generic assumptions schedule outlined in Appendix C of this report,

The estimates have been prepared to reflect the corridors highlighted on the Figure 1.

Figure 1 Takaanini FTNs costing scope of works



Some corridor sections do not require property acquisition and assumes that all physical works can be undertaken within the existing road corridor. The corridor sections requiring property acquisition are indicated in the general arrangement plans with proposed designation.

2 Approach to cost estimation

The cost allowances formatting has been developed consistent with the Cost Estimation Manual (CEM) for a Detailed Business Case (DBC). No risk analysis has been undertaken.

2.1 Property

The cost of land forms a significant part of the estimate. Property cost estimates have been prepared by the Auckland Transport team on behalf of Te Tupu Ngātahi. These cost estimates have been prepared based on the land requirement (both temporary and permanent) represented by the proposed Designation boundary in the drawing set issued “For Approval”. The assumptions associated with the property cost estimates are attached in the Appendix B within this report.

The property costing approach is as follows:

- **Review the proposed alignment** – identify those properties where the proposed project alignment would have a significant impact requiring the acquisition of the full property. These full acquisitions are then costed at the current estimated market value using online resources
- **Obtain independent valuation advice** – consultant North Harbour Valuers was engaged to provide a report with land rates for the Auckland Unitary Plan zones applicable within the subject area
- **Develop an acquisition cost for each property** – develop an acquisition cost (for business case purposes) for the identified property by applying the appropriate land rate to the land required
- **Benchmark** – use the current pricing to inform the validity of the parcel pricing
- **Review** – property pricing reviewed by senior experienced valuation experts

The nett project property cost includes costs pertaining to both the temporary and permanent land requirement.

Table 2 Assumed temporary occupation by project corridor

Project corridor	Expected construction duration (years)	Assumed duration for temporary occupation (years)	
Great South Road FTN section 1	2 to 3 years	2 years	
Great South Road FTN section 2	2 to 3 years	2 years	

Project corridor	Expected construction duration (years)	Assumed duration for temporary occupation (years)	
Great South Road FTN section 3	2 to 3 years	2 years	
Great South Road FTN section 4	2 to 3 years	2 years	
Great South Road FTN section 5	3 to 4 years	3 years	
Takaanini FTN section 6	3 to 4 years	3 years	
Takaanini FTN section 7	2 to 3 years	2 years	
Takaanini FTN section 8	2 to 3 years	2 years	
Takaanini FTN section 9	2 to 3 years	2 years	
Popes Road urbanisation	1.5 to 2.5 years	1.5 years	
Great South Rd Drury	2 to 3 years	2 years	

2.2 Project development phase

An allowance of 2% of the sub total base physical works has been applied for project development phase. This includes the following:

- Consultant fees, including preliminary design, implementation business case
- Client managed costs.

2.3 Pre-implementation phase

An allowance of 9% of the sub total base physical works has been applied for pre-implementation phase. This includes the following:

- Consenting 1%, including environmental court risk
- Design fees 7%, including geotechnical investigation
- Client managed costs 1%, including IWI consultation

2.4 Implementation phase

2.4.1 Implementation fees

An allowance of 6% of the sub total base physical works has been applied for implementation fees within the Implementation phase. This includes the following:

- Consultancy fees 4%
- Client managed cost 1%
- Construction monitoring fees 1%

2.4.2 Physical works

Costs allowances for the physical works costs have been undertaken by the quantity surveying team based on assumptions scheduled as per the Appendix C of this report per each corridor. Quantity measurements are from the concept design shown on the General Arrangement drawings as part of the Appendix H - Design report of the Takaanini FTNs DBC.

An allowance of the following physical works items has been made:

- Environmental Compliance
- Earthworks
- Ground Improvement
- Drainage
- Pavement and Surfacing
- Bridges
- Retaining Walls
- Traffic Services
- Utility Services
- Landscaping
- Traffic Management
- Preliminary and General
- Extraordinary construction cost

2.5 Risk and Contingencies

The physical works allowances include a 25% contingency (P50) and a funding risk contingency (P95) of 20%, reflecting the uncertainty in the final form of the projects. These contingencies are required for cost estimation in accordance with the CEM. Definitions for those are as follows:

Contingency (P50)

A financial provision added to the base estimate to provide for uncertainty in relation to the estimate inputs and specific project threats and opportunities with a cost impact to derive the expected estimate. The 'contingency' represents the statistical mean.

Funding Risk Contingency (P95)

An additional financial provision for uncertainty in relation to the estimate inputs and project related threats and opportunities (funding risk contingency)

Advanced approach toward risk is to be undertaken on the Implementation Business Case in the future.

2.6 Escalation

The cost allowances provide an indication of infrastructure funding requirements at a base date and do not reflect programming over time. Therefore, escalation is not included directly in this report.

2.7 Verification

A Business Case of this scale would normally involve preparation of a parallel estimate by an independent estimator. However, as this Business Case is primarily focused on route protection and a subsequent stage will be undertaken to seek funding for implementation, the level of cost estimation accuracy is considered to be less than a typical DBC. Therefore, it has been agreed with both Auckland Transport and Waka Kotahi that the costs will be peer reviewed through 'cross verification' by a separate team within Te Tupu Ngātahi who were independent of the initial estimate preparation. .

From a property point of view, verification is suited to a route protection business case to follow the approach outlined on the section 2.1 on this report involving the following:

- Undertake a review of the methodology applied on the project
- Undertake a review of the rates/benchmarking used for different land uses and property types
- Internal review with AT and Waka Kotahi on property estimates

3 Cost summary

Table 3 Cost summary by project costing segment

Project costing segment		Cost estimate
Project costing segment 1		
Project costing segment 2		
Project costing segment 3		
Project costing segment 4		
Project costing segment 5		
Project costing segment 6		
Project costing segment 7		
Project costing segment 8		
Project costing segment 9		
Project costing segment 10		
Project costing segment 11		
Project costing segment 12		
Project costing segment 13		
Project costing segment 14		
Project costing segment 15		
Project costing segment 16		
Project costing segment 17		
Project costing segment 18		
Project costing segment 19		
Project costing segment 20		
Project costing segment 21		
Project costing segment 22		
Project costing segment 23		
Project costing segment 24		
Project costing segment 25		
Project costing segment 26		
Project costing segment 27		
Project costing segment 28		
Project costing segment 29		
Project costing segment 30		
Project costing segment 31		
Project costing segment 32		
Project costing segment 33		
Project costing segment 34		
Project costing segment 35		
Project costing segment 36		
Project costing segment 37		
Project costing segment 38		
Project costing segment 39		
Project costing segment 40		
Project costing segment 41		
Project costing segment 42		
Project costing segment 43		
Project costing segment 44		
Project costing segment 45		
Project costing segment 46		
Project costing segment 47		
Project costing segment 48		
Project costing segment 49		
Project costing segment 50		
Project costing segment 51		
Project costing segment 52		
Project costing segment 53		
Project costing segment 54		
Project costing segment 55		
Project costing segment 56		
Project costing segment 57		
Project costing segment 58		
Project costing segment 59		
Project costing segment 60		
Project costing segment 61		
Project costing segment 62		
Project costing segment 63		
Project costing segment 64		
Project costing segment 65		
Project costing segment 66		
Project costing segment 67		
Project costing segment 68		
Project costing segment 69		
Project costing segment 70		
Project costing segment 71		
Project costing segment 72		
Project costing segment 73		
Project costing segment 74		
Project costing segment 75		
Project costing segment 76		
Project costing segment 77		
Project costing segment 78		
Project costing segment 79		
Project costing segment 80		
Project costing segment 81		
Project costing segment 82		
Project costing segment 83		
Project costing segment 84		
Project costing segment 85		
Project costing segment 86		
Project costing segment 87		
Project costing segment 88		
Project costing segment 89		
Project costing segment 90		
Project costing segment 91		
Project costing segment 92		
Project costing segment 93		
Project costing segment 94		
Project costing segment 95		
Project costing segment 96		
Project costing segment 97		
Project costing segment 98		
Project costing segment 99		
Project costing segment 100		

1 Appendix A Cost estimate summary forms (DBE)

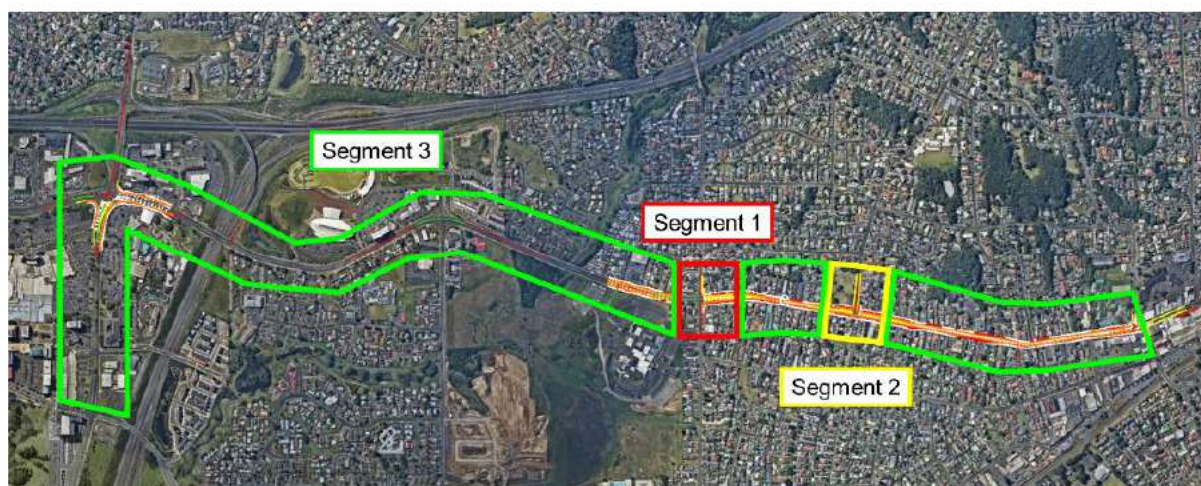
2 Appendix B Property cost estimate memorandums

3 Appendix C Generic physical works assumption schedule

4 Appendix D DBE Project Costing Segments

Great South Road FTN Section 1

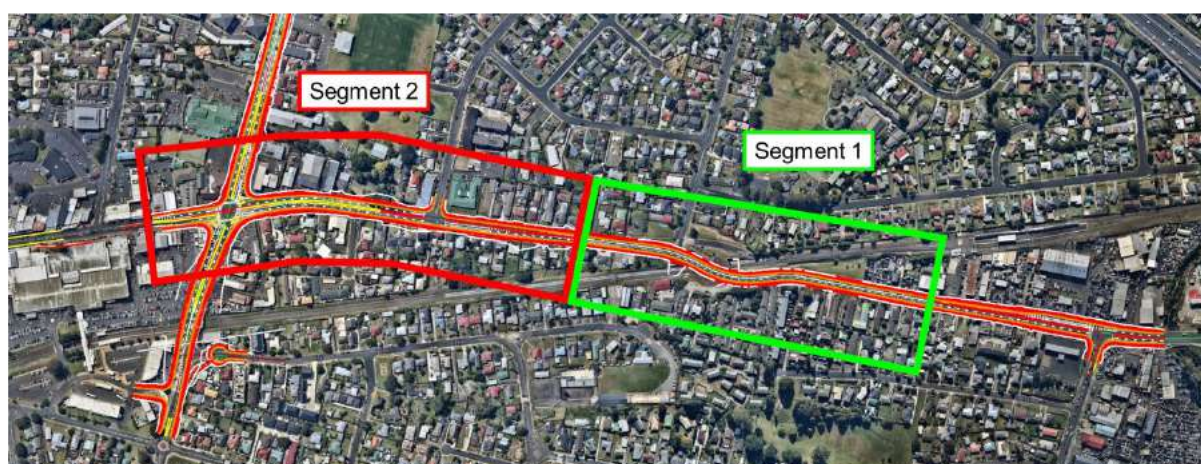
This section has been further segmented into 3 parts for costing purposes



Segment	Description
Segment 1	GSR/Browns Rd intersection works
Segment 2	GSR/Grand Vue Rd intersection works
Segment 3	Rest of section 1 corridor

Great South Road FTN Section 2

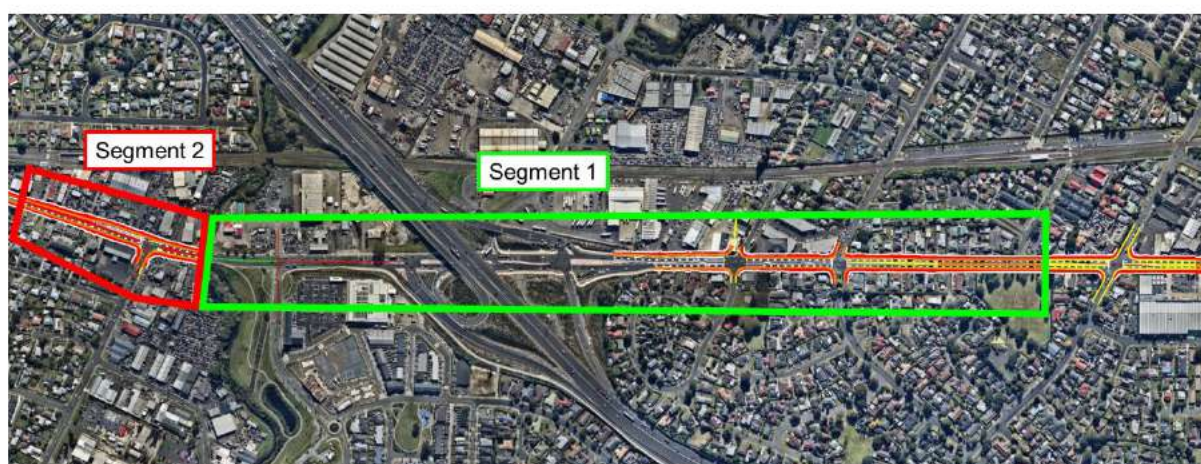
This section has been further segmented into 2 parts for costing purposes



Segment	Description
Segment 1	GSR/Weymouth Rd intersection to Myers Rd intersection
Segment 2	Rest of section 2 corridor

Great South Road FTN Section 3

This section has been further segmented into 2 parts for costing purposes



Segment	Description
Segment 1	GSR/Mahia Rd intersection works
Segment 2	Rest of section 3 corridor

Great South Road FTN Section 4

This section has been further segmented into 3 parts for costing purposes



Segment	Description
Segment 1	GSR/Taka St intersection upgrade
Segment 2	GSR/Subway Rd intersection upgrade
Segment 3	Rest of section 4 corridor

Great South Road FTN Section 5

This section has been further segmented into 4 parts for costing purposes



Segment	Description
Segment 1	GSR/Beach Rd/Settlement Rd intersection works
Segment 2	GSR/Park Estate Dr intersection works

Segment	Description
Segment 3	Slippery Creek bridge upgrade
Segment 4	Rest of section 5 corridor

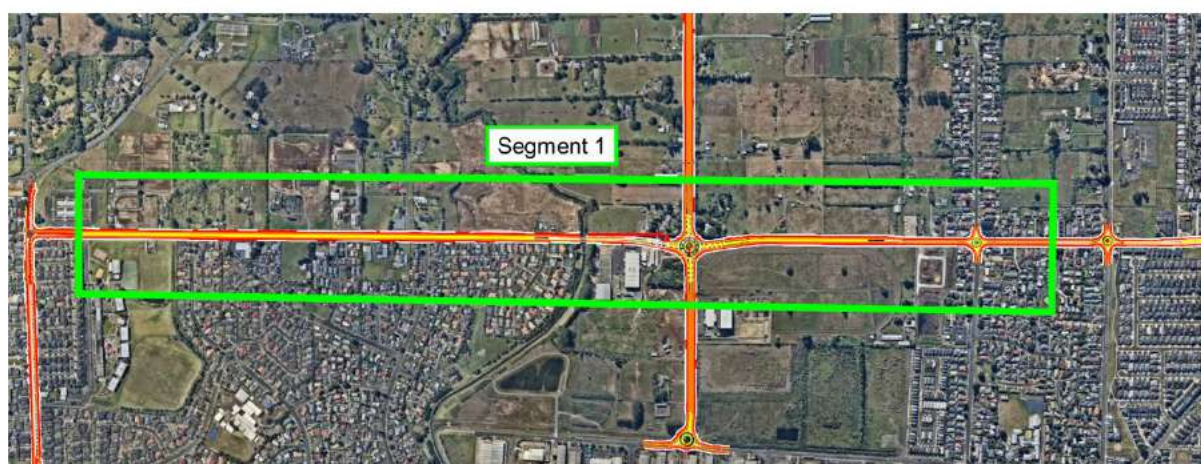
Takaanini FTN Section 6

This section has been further segmented into 2 parts for costing purposes



Segment	Description
Segment 1	Weymouth/Alfriston Rd to Magic Way intersection works
Segment 2	Alfriston Rd east of Magic Way intersection, including Porchester Rd intersection works

Takaanini FTN Section 7



Segment	Description
Segment 1	All physical works and property cost associated with designation.

Takaanini FTN Section 8

This section has been further segmented into 8 parts for costing purposes

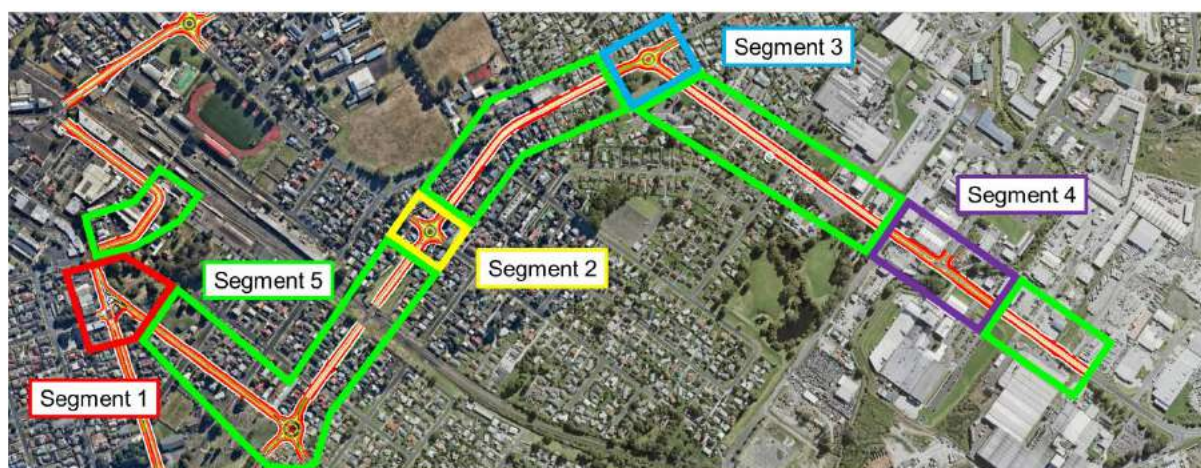


Segment	Description
Segment 1	Porchester/Airfield Rd intersection works
Segment 2	Porchester/Walters Rd intersections works
Segment 3	Walters Rd midblock works
Segment 4	Walters/Grove Rd intersection works
Segment 5	Grove/Old Wairoa Rd intersection works
Segment 6	Grove/Clevedon Rd intersection works

Segment	Description
Segment 7	Clevedon/Marne Rd intersection works
Segment 8	Rest of section 8 corridor

Takaanini FTN Section 9

This section has been further segmented into 5 parts for costing purposes



Segment	Description
Segment 1	GSR/Wood St/Opaheke Rd intersection works
Segment 2	Settlement/Marne Rd intersection works
Segment 3	Settlement/Hunua Rd intersection works
Segment 4	Hunua/Croskery Rd intersection works
Segment 5	Rest of section 9 corridor

Popes Rd Urbanisation

- The Takaanini School Rd/Popes Road intersection is costed separately to the rest of Popes Rd.
- The Popes Rd/Porchester Rd proposed intersection upgrade is costed as part of Takaanini FTNs section 7.

Croskery Rd Upgrade

- The Croskery Rd works have not been further segmented for costing purposes.
- There is no property cost accounted for as part of this package, as it is assumed all proposed works can be carried out within the existing road reserve.

Great South Rd Drury

- The works for this section of Great South Rd have not been further segmented for costing purposes.

South FTN

Appendix K – Economics Assessment

November 2023

Version 1.0

Document Status

Responsibility	Name
Author	████████████████████
Reviewer	██████████████████
Approver	██████████
Peer reviewer	██████████

Revision Status

Version	Date	Reason for Issue
N/A	09/02/2023	Draft report v1 sent to peer reviewer
N/A	29/05/2023	Draft report v2 sent to peer reviewer
0.1	16/06/2023	Draft report v3 sent to peer reviewer Issue for IQA review
1.0	9/11/2023	Final

Table of Contents

1	Introduction.....	1
1.1	Purpose.....	1
1.2	Approach and Key Issues.....	3
1.3	Modelling Tools and Assumptions	4
1.3.1	Modelling Tools.....	4
1.3.2	Modelling Key Principles and Assumptions.....	6
1.3.3	Modelling of the Public Transport Benefits	7
1.3.4	Modelling of Walking and Cycling Benefits.....	8
1.3.5	Modelling of Traffic Benefits	8
1.3.6	Modelling of Resilience Benefits.....	9
1.3.7	Modelled Scenarios	9
1.3.8	Estimation of Benefits for Each BCR	10
1.4	Evaluation Framework	12
1.4.1	Economic Evaluation Approach.....	12
1.5	Expansion of Benefits from Transport Models	13
1.6	Analysis Period.....	14
2	Benefits Analysis and Discussion	15
2.1	Public Transport Users Benefits.....	15
2.2	Public Transport Reliability Benefits.....	15
2.3	Public Transport Health Benefits.....	16
2.4	Active Modes Benefits	16
2.4.1	Travel Time Benefits.....	19
2.4.2	Health, Safety and Decongestion Benefits	19
2.5	Traffic Travel Time and Congestion Savings	20
2.6	Traffic Reliability Benefits.....	21
2.7	Vehicle Operating Costs	21
2.8	Resilience Benefits	21
2.9	Crash Cost Savings.....	21
2.10	Carbon Dioxide Emissions	22
2.11	Wider Economic Benefits	23
3	Project Costs	24
3.1	Capital Cost	24
3.2	Operation and Maintenance Costs	24
3.2.1	General Maintenance.....	24
3.2.2	Road Resurfacing	25
3.2.3	Bridge Maintenance	25
	Operation and Maintenance Costs Summary	25
3.3	Public Transport Operating Costs	25
3.4	Summary of Costs	25

4	Benefits-Cost Ratio (BCR)	27
4.1	National BCR Outputs	27
4.1.1	Key Observations	28
4.2	Sensitivity Tests	28
4.2.1	Analysis Framework Sensitivity Tests	28
4.2.2	Parameter Sensitivity Tests	30
4.2.3	Land Use Sensitivity	33
5	Summary	35

Table of Tables

Table 1-1: Time Zero, Construction Start Date and Period Assumptions	7
Table 1-2: Modelled Scenarios	9
Table 1-3: Update Factors for Benefits	13
Table 1-4: Traffic Annualisation Factors (2-hour MSM Models)	13
Table 1-5: Traffic Annualisation Factors (1-hour SATURN Models)	14
Table 1-6: PT Annualisation Factors (2-hour Models)	14
Table 2-1: Summary of Estimation of PT Reliability Percentages	16
Table 2-2: PT Stop/Station Walk Trips Health Benefits from MSM (Reference Option vs. Reference DM)	16
Table 2-3: Active Modes Travel Time Benefit – Year 2048+ (Reference Option vs. Reference DM)	19
Table 2-4: Active Modes Health, Safety and Decongestion Benefit – Year 2048+ (Reference Option vs. Reference DM)	20
Table 2-5: Crash Costs by Road Type and Speed	21
Table 2-6: Crash Cost Savings for the Modelled Years (Reference Option vs. Reference DM)	22
Table 2-7: Annual Emission Benefits for the Modelled Years (Reference Option vs. Reference DM)	22
Table 2-8: WEBs by Type Determined from MSM Models 2048+ (Reference Option vs. Reference DM)	23
Table 3-1: Undiscounted P50 Capital Cost and Property Cost of South FTN DBC Projects (\$M)	24
Table 3-2: Undiscounted P95 Capital Cost and Property Cost of South FTN DBC Projects (\$M)	24
Table 3-3: Summary of Undiscounted P50 Maintenance Costs (In Addition to Do Minimum) (\$)	25
Table 3-4: NPV Project Costs	25
Table 4-1: Summary of Core Benefits and BCRs for South FTN DBC	27
Table 4-2: BCR Variation with Different Discount Rate and Analysis Period	29
Table 4-3: BCR Variation including WEBs	30
Table 4-4: BCR Variation with Active Mode Benefits Change	31
Table 4-5: BCR Variation with Traffic Benefits Change	31

Table 4-6: BCR Variation with PT Benefits Change	32
Table 4-7: BCR Variation with PT Reliability Percentage.....	32
Table 4-8: BCR Variation with Capital Cost Change	32
Table 4-9: BCR Variation with MBCM Version	33
Table 4-10: BCR Variation with Land Use Changes	34
Table 5-1: BCR Summary.....	35
Table 5-2: BCR Range Summary	36
Table 5-3: MSM Sector-to-sector Traffic Benefit (veh-hr) Analysis – Year 2048+ AM Peak	38
Table 5-4: MSM Sector-to-sector PT Benefit (pax-hr) Analysis – Year 2048+ AM Peak.....	39
Table 5-5: Evaluation of PT Reliability Percentage Based on AML Assumptions	40

Table of Figures

Figure 1-1: South FTN recommended option	2
Figure 1-2: Suite of Transport Models	5
Figure 1-3: 40-Year Benefits Profile (Reference Option vs. Reference Do Minimum).....	13
Figure 2-1: Cycle Facilities for Reference Do Minimum Scenario in 2048+	17
Figure 2-2: Cycle Facilities for Reference Option Scenario in 2048+	18
Figure 4-1: Analysis Framework – BCR Variation for the South FTN DBC	29
Figure 4-2: Delayed Land Use Growth Effects on Total Benefits (\$M)	34
Figure 5-1: Economics Sector Map	37

Appendices

- 1 Appendix 1 – Sector-to-Sector Benefits**
 - 1.1 Sector-to-Sector Traffic Benefits**
 - 1.2 Sector-to-Sector PT Benefits**
- 2 Appendix 2 – Public Transport Reliability**

Acronym/Term	Description
AFC	Auckland Forecasting Centre
AML	Average Minutes Late
AT	Auckland Transport
ATAP	Auckland Transport Alignment Project
BCR	Benefit to Cost Ratio
CO ₂	Carbon Dioxide
CRL	City Rail Link
CRV	Congested travel time
DBC	Detailed Business Case
DM	Do Minimum
EL	Equivalent Time to a Minute Late Ratio
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GSR	Great South Road
HBE	Home-based Education
HBO	Home-based Other
HBW	Home-based Work
IBC	Indicative Business Case
MBCM	Monetised Benefits and Costs Manual
MSM	Macro Strategic Model
NIMT	North Island Main Trunk
NPT	Number of Passengers Affected
NPV	Net Present Value
NZ	New Zealand
PT	Public Transport
PV	Present Value
SAMM	Strategic Active Modes Model
TDM	Travel Demand Management

Acronym/Term	Description
TLC	Takaanini Level Crossings
V/C	Vehicle to Capacity
VEPM	Vehicle Emissions Prediction Model
VKT	Vehicle Kilometres Travelled
VOC	Vehicle Operating Costs
VoT	Value of Time
VTT	Vehicle Travel Time
WEB	Wider Economic Benefit

1 Introduction

1.1 Purpose

This report details the economic appraisal for the South Frequent Transit Network (FTN) Detailed Business Case (DBC) recommended network at the Supporting Growth Alliance (Te Tupu Ngātahi) programme. The South FTN DBC focuses on developing the strategic FTN corridors between Drury and Manukau to contribute to an integrated and reliable public transport (PT) network, support growth and offer sustainable travel choice and access to economic and social opportunities in South Auckland. The evaluation is primarily based on the standard evaluation method for transport infrastructure, which is typically dominated by travel time savings, although this has been extended to reflect the particular conditions of the appraisal.

The South FTN DBC considers two FTN routes, namely the Great South Road (GSR) FTN and Takaanini FTN, the urbanisation of Popes Road and Croskery Road, and the upgrade of the GSR “gap” between Waihoehoe Road and Drury interchange. **Figure 1-1** exhibits the South FTN DBC recommended network showing the corridors that are proposed to be upgraded; the recommendations are:

GSR FTN BCR

- **GSR FTN route** – bus lanes (and/or bus priority at intersections) and new active mode facilities between Manukau Station and Drury Central Station
- **GSR Gap (between Waihoehoe Road and Drury interchange)** - widening of the corridor to provide access to the future Drury Central Station, improve access for those in Drury and to State Highway 1

Takaanini FTN BCR

- **Takaanini FTN route** – bus lanes (and/or bus priority at intersections) and new active mode facilities between Manurewa Station and Papakura Station via Porchester Road
- **Popes Road and Croskery Road** (key east-west connections in the South network and connects with the proposed Takaanini FTN alignment) – urbanisation of the corridor and new active mode facilities

An economic appraisal has been undertaken on these upgrades, particularly the GSR FTN and Takaanini FTN components as well as a combined South FTN DBC package. This appraisal is undertaken in accordance with Waka Kotahi New Zealand (NZ) Transport Agency’s Monetised Benefits and Costs Manual (MBCM), version 1.5 (unless stated otherwise)¹ for consistency with earlier Te Tupu Ngātahi appraisals. All costs are reported in NZD unless otherwise stated. Non-monetised benefit measures are documented in **Appendix G** (Transport Outcomes Report) of the DBC but were calculated in intermediate steps in the process of monetising benefits for the present economic analysis.

¹ The South FTN DBC commenced prior to 14th April 2023, hence is not eligible for using the latest MBCM (version 1.6) for the core economic appraisal. It is noted that the application of MBCM version 1.6 would likely give higher benefits.

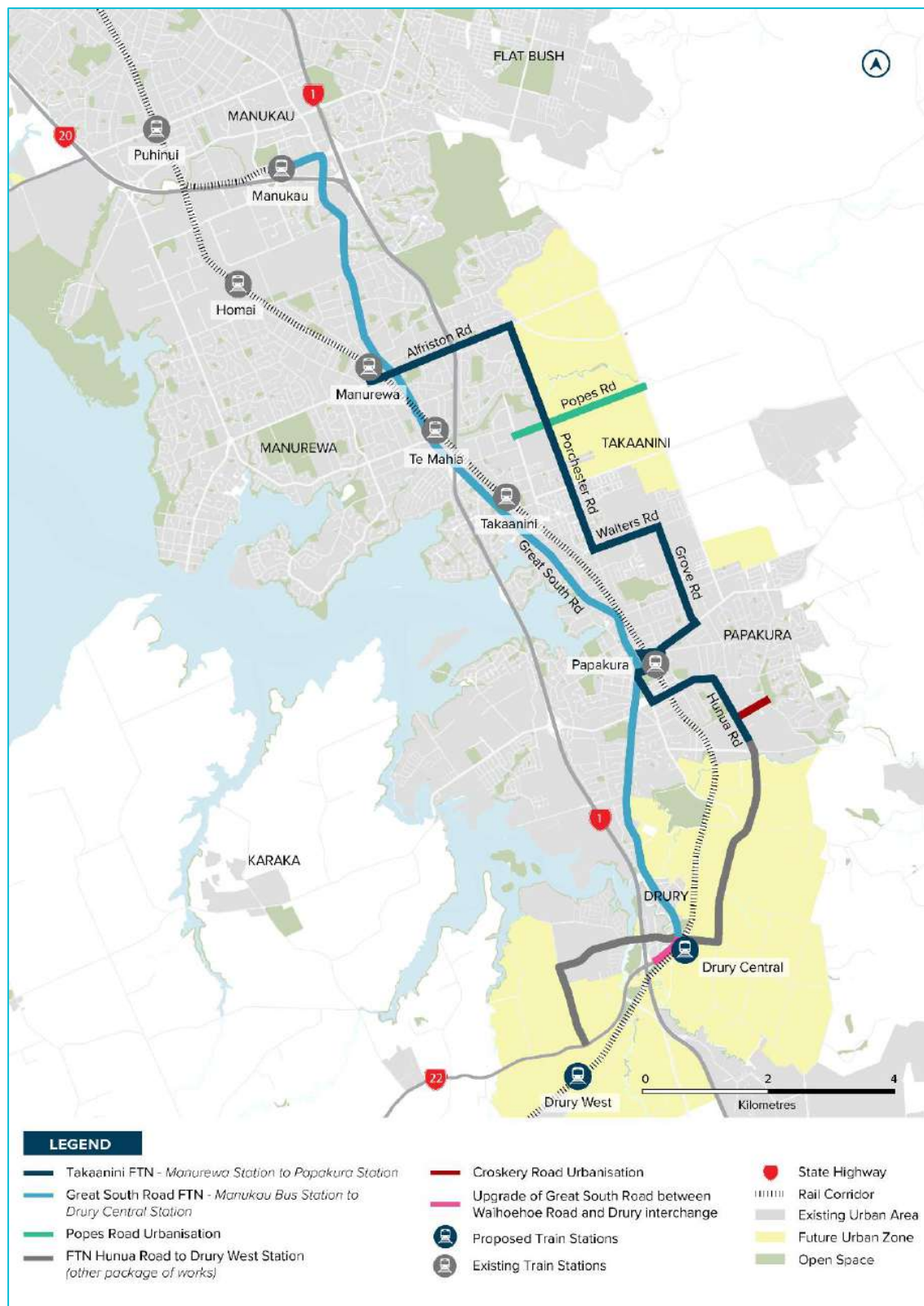


Figure 1-1: South FTN recommended option

1.2 Approach and Key Issues

The South FTN DBC is for the purposes of route protection, rather than imminent implementation. The appraisal has therefore been targeted at this decision (to progress to route protection), rather than at a more detailed assessment that could be expected for an implementation decision. The appraisal has also been undertaken in the context of the following key issues:

- Estimates of the type, scale, sequencing and rate of growth have been made for the DBC. However, the resulting growth is highly uncertain and subject to other regulatory processes such as Structure Plans, Plan Changes, sub-division consents and economic demand.
- The Te Tupu Ngātahi programme, via its owners and partners, will make decisions on the implementation of specific projects based on separate prioritisation and decision processes over the next 30+ years.
- The Te Tupu Ngātahi business cases have focussed on the transport elements and footprints to support the long-term, full build-out of the area. The actual land use development is likely to occur progressively in stages, which allows more detailed sequencing and staging decisions (e.g. some corridors could be improved with initial upgrades that are expanded in later years). This is particularly important given the, as yet, unknown long-term effects of the COVID-19 pandemic.
- The Te Tupu Ngātahi programme identified a network of improvements to support the growth with the desired outcomes for this area. The present DBC is being prepared in parallel with the Te Tupu Ngātahi Takaanini Level Crossings (TLC) DBC. It is currently assumed that the TLC elements will be implemented progressively between 2028 and 2038, but this is subject to funding being confirmed.
- The Te Tupu Ngātahi network is planned to comprise a part of a wider network, including projects such as the City Rail Link (CRL), four-tracking of the rail corridor between Wiri and Pukekohe, Drury Local DBC and Mill Road DBC. Whilst those projects are independent of the Te Tupu Ngātahi programme elements, the appraisal of the Te Tupu Ngātahi programme elements is dependent on the assumptions made about the timing of those other elements. It is currently assumed that these other elements will be implemented progressively between 2028 and 2048, but this is still subject to funding being confirmed.

Based on the purpose, scope and identified issues, the appraisal has adopted some key principles:

- A level of detail suitable to the route protection decision, rather than imminent implementation
- A focus on the appraisal of the full build-out project rather than analysis of fine-grained staging options
- Simplified modelling approach with limited analysis of project inter-dependencies, rather than extensive analysis of the various possible combination of project sequencing in the wider network
- Analysis of the project under a range of potential scenarios of project timing, discount rates, etc, rather than a focus on a single benefit to cost ratio (BCR), i.e., sensitivity tests
- The South FTN DBC recommended network scenario has been assessed against a 'reference' do minimum (DM) scenario (that includes an assumed sequencing of adjacent projects), rather than a 'true' DM that includes only committed projects. This is to avoid the potential for double counting of common benefits that would be assigned to whichever project is assumed to be implemented first.

- The overall combination of Te Tupu Ngātahi programme elements, termed as ‘South FTN recommended network’ in this report, has been considered against an overall ‘reference’ DM package for the modelled years (2038, 2048, 2048+).

‘Reference’ Option and ‘Reference’ Do Minimum Assumptions

The phasing of the project components of the Te Tupu Ngātahi Business Cases are uncertain, since the DBC purpose is for route protection, rather than imminent implementation. Hence for the modelling purpose it is considered that the 2048+ model will have the long-term, full build-out project components implementation, while interim years will include a subset of the recommended network.

The projects included in all option and DM models are as follows:

- Four-tracking between Papakura to Pukekohe in 2048 and 2048+, whereas two-tracking in 2038 as outlined in the Rail DBC
- Three new stations at Maketuu, Ngaakoora and Paeraataa (Drury Central, Drury West and Paerata) in 2038, 2048 and 2048+ as per the Rail DBC
- The upgrade for Bremner Road, Jesmond Road, Waihoehoe Road and SH22 for the years 2038, 2048 and 2048+ as defined in the Drury Local Business Case (noting that development in Drury has already begun)
- The north-south Ōpāheke arterial is considered only in 2048+ and taken out from earlier years
- Pukekohe Expressway and the full-length Mill Road upgrade is assumed in 2048 and 2048+
- The closure of the Spartan Road and Manuroa Road level crossings and replacement with new active mode bridges, and the grade-separation of Taka Street, Walters Road, and Manuia Road (i.e. the TLC elements) for the years 2038, 2048 and 2048+ as defined in the TLC DBC

1.3 Modelling Tools and Assumptions

1.3.1 Modelling Tools

The transport user costs and benefits have been estimated based on a suite of transport models owned by the Auckland Forecasting Centre (AFC). The models include:

- **The regional, multi-modal, macro strategic model (MSM).** This creates estimates of car, truck, and PT movements at a regional level based on land use, network, and policy inputs. This model is the primary tool to estimate future regional PT usage and provides the basis for the more detailed forecasts for the road network described below. Generally, these models are run using regional assumptions as per recent Auckland Transport Alignment Project (ATAP) planning, but with scenario-specific inputs in the Te Tupu Ngātahi growth areas. Given that the South FTN DBC is predominantly comprised of PT projects, MSM was used as the primary modelling tool. Models for years 2038, 2048 and 2048+ have been run and their outputs were used for general traffic benefits, PT benefits, crash savings, wider economic benefits (WEBs), and for obtaining traffic matrices for SATURN models.
- **A local traffic model (SATURN).**² This uses the traffic demands from MSM on a more detailed representation of the road network. For the economic analysis, the outputs from SATURN are extracted for resilience scenarios as described in **Table 1-2** for the modelled

² SATURN was initially tested to assess the traffic impacts from changes to the network and mode shift but was found to be overly sensitive to minor modelling adjustments (e.g. to signal timings). For the core model scenarios, SATURN produced results that were considered unstable and inconsistent, and therefore the more conservative and consistent general traffic benefits from MSM were adopted.

years 2028 and 2048+. For the economic assessment using SATURN outputs, the 2038 and 2048 benefits are estimated by interpolation. Similarly, the CO₂ savings from SATURN are extracted for core reference scenarios i.e., reference option and DM, for the modelled years 2038 and 2048+. For the economic assessment using SATURN outputs, the 2048 benefits are estimated by interpolating the 2038 and 2048+ benefits.

- **A strategic active modes model (SAMM).** This tool gives strategic-level estimates of walking and cycling demands that respond to land use, the quality of the walking and cycling network, and the relative change in costs for competing car and PT modes. It derives land use and network data directly from MSM whilst using a more refined zone system. MSM zones are disaggregated to a smaller zone system for use in SAMM, i.e., MSM covers the Auckland region via some 600 zones, while SAMM covers the same area via some 1,100 zones. The refined zone system was deemed necessary to obtain more precise trip costs, particularly for shorter and intra-zonal trips. The model has a strong interface with MSM to provide key inputs but can be operated independently to assess specific changes to the active modes network.

MSM is used to derive PT user benefits, crash savings, general traffic benefits, and WEBs, and provides traffic demand estimates for the SATURN model. The SATURN model is used to estimate resilience benefits and CO₂ savings, while SAMM was used to estimate benefits to walking and cycling, as shown in **Figure 1-2**. Each mode (PT, general traffic, walking and cycling) are appraised separately, albeit with the changes in mode share reflected in the demands for each mode. Sector-to-sector analysis has been carried out for understanding the benefits pattern of vehicular traffic (all vehicles) and PT traffic and are presented in **Appendix 1**.

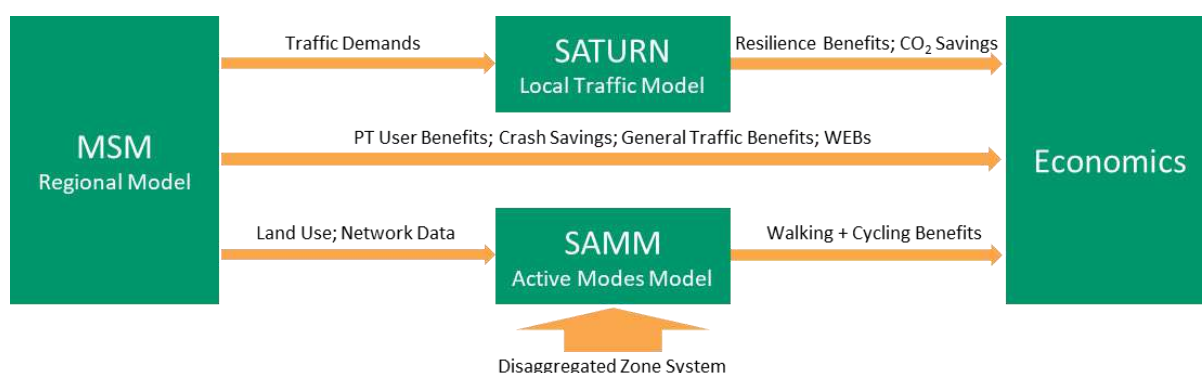


Figure 1-2: Suite of Transport Models

Although the regional model was suitably validated against observed 2016 conditions, analysis against 2013 census data indicated that not all 2016 commuter trip distribution patterns were well replicated. However, because the land use in the growth areas will significantly transform travel patterns in this area, those 2013 patterns will be of limited relevance to those future conditions. This means that while the changes in the predicted travel patterns and benefits which form the key element of this economic appraisal appear plausible, the total travel movements will continue to have some uncertainty. Additionally, longer term changes in travel behaviour due to COVID-19 could eventuate such as higher frequency of working from home. As these remain highly uncertain, no changes have been made to the model inputs or parameters to reflect COVID-19 changes in travel pattern. Considering this however, sensitivity tests have been undertaken (see **Section 4.2**), including with 25% less benefits and alternative patterns of land use development, which to a large extent would cover this issue.

1.3.2 Modelling Key Principles and Assumptions

Land Use Information

The modelling has been based on the regional growth assumptions reflected in land use 'scenario i11.6' forecasts released by AFC in mid-2020.

The scenario i11.6 forecasts are based on Statistics NZ medium population growth estimates for Auckland. In those forecasts the staging of greenfield growth is based on the direction indicated in Auckland Council's Future Urban Land Supply Strategy (FULSS). The standard scenario i11.6 forecasts extend to the year 2048, however, an additional scenario was developed for Te Tupu Ngātahi referred to as 2048+. This is based on the standard 2048 forecasts but reflects full build-out in the greenfield growth areas which would occur beyond 2048. The timing for full development build-out is uncertain, however for the purposes of this appraisal the 2048+ model results were allocated to the year 2053, estimated from the typical rate of growth predicted for the area. The effect of slower land use development has also been sensitivity tested in **Section 4.2.3**.

Option and Do Minimum Model Development Process

The recommended network comprises of two FTN routes (GSR FTN and Takaanini FTN), the urbanisation of Popes Road and Croskery Road, and the widening of the GSR Gap between Waihoehoe Road and Drury interchange in South Auckland. This recommended network scenario, also known as the South FTN recommended network (as in **Figure 1-1**), was adopted as the reference option, whilst the reference DM was created by modelling the existing form of the corridors and intersections in the DBC scope, and elements outside of the DBC scope which are assumed to occur independently of this DBC.

Due to the interdependencies with other projects in this area, DM and option scenarios were created for each modelled year, based on the aforementioned reference scenario. The reference scenario included an assumed sequencing of the full indicative business case (IBC) network. For example, the 2038 reference option model only included a subset of the DBC networks, while the 2048+ reference model included the full DBC network.

If the project being appraised was included in the reference model for the forecast year, then this was used as the option scenario. A matching DM was then created for that year that excluded the project being assessed. If the reference model did not include the candidate project, then this was adopted as the DM, and an option scenario was then created by adding the candidate project to the DM.

For example, for the BCR assessment of the GSR FTN, the reference DM model was adopted as the DM scenario, whilst the option scenario was created by adding the GSR FTN upgrades to the model. For the overall assessment of the South FTN DBC schemes, the reference DM was adopted as the DM scenario and the reference option was adopted as the option scenario (with the proposed upgrades (GSR FTN, Takaanini FTN, Popes Road and Croskery Road urbanisation, and the GSR Gap)). This method can generate lower benefits for individual elements in the later years compared to the project being evaluated in isolation (as it assumes all other projects are in place); this is discussed later in **Section 1.3.8**.

South FTN DBC Components Assumptions

There are uncertainties around the project implementation year. Hence, some broad assumptions are made on the construction start date based on the expected implementation period. The construction

periods were assumed based on advice from the Te Tupu Ngātahi South FTN DBC design team, as detailed in **Appendix J** of the DBC. The projects are to be implemented in stages:

- **GSR FTN** – the project is assumed to be implemented by 2038, with an assumed construction period of 4 years
- **Takaanini FTN** – the project is assumed to be implemented by 2038 (except for the portion south of Papakura Station, which is assumed to be implemented by 2046), with an assumed construction period of 4 years
- **Popes Road** – the project is assumed to be implemented by 2040, with an assumed construction period of 2 years
- **Croskery Road** – the project is assumed to be implemented by 2043, with an assumed construction period of 1 year
- **GSR Gap** – the project is assumed to be implemented by 2030, with an assumed construction period of 2 years

The 'time zero' is the date that all future cost and benefit streams are discounted to. Time zero for all project components is standardised to 1 July of the financial year in which the analysis is submitted, hence the present analysis uses a time zero of 1 July 2023. The time zero and the assumed construction periods for the South FTN DBC projects are given in **Table 1-1**.

Table 1-1: Time Zero, Construction Start Date and Period Assumptions

Project Components	Time Zero	Construction Start Year from Time Zero	Construction period (in years)
GSR FTN	1 July 2023	12	4
Takaanini FTN	1 July 2023	12 Southern section: 20	4 Southern section: 4
Popes Road	1 July 2023	16	2
Croskery Road	1 July 2023	20	1
GSR Gap	1 July 2023	6	2

1.3.3 Modelling of the Public Transport Benefits

The PT benefits are directly derived from MSM scenarios for all the modelled years. The MSM PT volume was used to calculate benefits using a simplified approach as discussed in **Section Error!** Reference source not found..

PT benefits are expected to primarily come from the GSR FTN and Takaanini FTN elements of the South FTN DBC. The provision of bus lanes and intersection upgrades along (portions of) the GSR FTN and Takaanini FTN routes is expected to contribute PT benefits by reducing travel times and improving the PT user experience, leading to higher patronage. Moreover, the reference option was modelled to have an improved headway, relative to the reference DM, for the GSR FTN and Takaanini FTN services with the rationale that PT travel time savings from the proposed infrastructure improvements along these routes will enable a higher frequency of bus services, leading to even higher patronage. This assumes that AT will increase the frequency of these FTN services. Although

this headway difference is expected to result in greater benefits, it will also result in higher PT operating costs to AT in the reference option.

1.3.4 Modelling of Walking and Cycling Benefits

SAMM was run only for the full build-out 2048+ scenario, with benefits allocated to earlier years based on assumed growth profiles. SAMM was run with the full South FTN DBC active mode network (reference option) and without the proposed active mode facilities (reference DM).

The provision of active mode facilities (i.e. along the FTN routes, and the new footpath from the urbanisation on Popes Road) is expected to contribute to walking and cycling benefits as follows:

1. Providing a complete, connected and legible active mode network improving accessibility to existing active mode facilities (such as the Southern Path) and future walking and cycling facilities along the active mode bridges recommended in the TLC DBC, and to key employment and social destinations within South Auckland
2. Providing safe, dedicated and separated active mode facilities (compared to the existing footpaths or shared paths and on-road unbuffered cycle lanes, if any), reducing the risk of exposure for those choosing to walk or cycle in South Auckland
3. Providing facilities to accommodate for the anticipated uptake of active modes and increased walking and cycling demand

1.3.5 Modelling of Traffic Benefits

The traffic impacts are calculated based on the matrix-based MSM outputs. Given that the South FTN DBC projects are predominantly PT schemes, minimal or negative traffic benefits are expected.

Some traffic benefits may arise due to alleviated traffic conditions as a result of mode shift from private vehicles to PT. The urbanisation of Popes Road and Croskery Road is expected to contribute traffic benefits as they provide key east-west connections in South Auckland. Popes Road is adjacent to the Takaanini future urban zone (FUZ) and is a key connection between Mill Road and the Takaanini industrial area. Popes Road is expected to serve 290 households in the Takaanini FUZ in 2028 which grows to 4,060 households in 2048+, as per the scenario i11.6 land use forecasts. Similarly, Croskery Road is a key connection between the future Mill Road and the Hunua industrial area and largely provides access to the adjacent industrial area. The urbanisation of Croskery Road provides for the integration between future upgrades; Mill Road and FTN corridor. This corridor also provides a better connection between the communities by adding a new active mode corridor.

Some traffic benefits may arise, given the FTN projects, due to alleviated traffic conditions as a result of mode shift from private vehicles to PT. However, traffic disbenefit is expected due to the reallocation of some existing general traffic lanes into bus lanes or active modes facilities.

Moreover, the widening of GSR between Waihoehoe Road and Drury interchange (GSR Gap) is expected to contribute to transport benefits by providing improved walking and cycling links over the short section of GSR and allowing greater efficiency of the large intersections either side of the corridor. However, given the network assumptions of which connections are assumed to be in place into Drury East in the reference model (such as the north-south Ōpāheke arterial, the direct motorway link, the Drury South interchange, Mill Road South, and the Brookfield Quarry link), initial modelling indicated minimal impacts from the GSR Gap and therefore these were not explicitly quantified. Given the uncertainty on the timings of the aforementioned alternative connections into Drury East, the benefits from the GSR Gap could be expected to be more significant.

1.3.6 Modelling of Resilience Benefits

The South FTN DBC projects are also expected to provide resilience benefits, namely PT resilience and flood resilience.

The proposed FTN improvements are expected to support rail by providing a PT alternative when rail services are cancelled or disrupted due to maintenance or unforeseen events, though the TLC elements that are assumed in both the reference option and DM are expected to reduce rail disruptions. Moreover, assuming that the proposed FTNs are implemented before the four-tracking of the NIMT, it is expected to provide PT resilience to the construction impacts and disruptions to rail services during the four-tracking implementation. However, the PT resilience benefits were not quantified in the current appraisal and hence the total PT benefits (in terms of resilience) may be understated.

Although benefits, under normal circumstances, from the GSR Gap were not quantified in the present appraisal, some benefits from its flood resilience were claimed using SATURN models. The GSR Gap project includes the upgrade of the GSR bridge over Hingaia Stream which is expected to provide resilience against flood events, providing an alternative route if the existing Norrie Road bridge is impacted. As noted in **Section 1.3.5**, these results could be quite conservative because of the modelling assumptions on the alternative connections into Drury East.

1.3.7 Modelled Scenarios

For the purpose of the economic assessment, scenarios were modelled in MSM, SATURN, and/or SAMM. **Table 1-2** summarises the modelled scenarios and their relevant modelling suites used for the economic assessment. DM and option scenarios were created for each modelled year (2038, 2048 and 2048+). For the reference option scenario, the full South FTN DBC projects (as presented in **Figure 1-1**) were modelled in the relevant years based on the staging described in **Section 1.3.2**. Individual projects were also modelled as described in **Table 1-2**. SATURN scenarios were modelled for fewer model years, with the benefits for intermediate years assessed by interpolation as per **Section 1.3.1**.

Two core scenarios were modelled in SAMM for year 2048+ (reference option and reference DM). The scenarios were developed by using the land use and network from the relevant MSM scenario, then applying relevant cycle facility and footpath updates and zone connector refinements.

Table 1-2: Modelled Scenarios

Scenario	Scenario Description	Modelling Suite(s) Used
Reference option	GSR FTN and Takaanini FTN: bus lanes (and/or bus priority at intersections) and new active mode facilities Popes Road and Croskery Road: urbanisation of the corridor and new active mode facilities GSR Gap: 4-lane corridor on GSR between Waihoehoe Road and Drury interchange – SATURN only	MSM (2038, 2048, 2048+) SATURN (2038, 2048+) SAMM (2048+)

Scenario	Scenario Description	Modelling Suite(s) Used
Reference DM	GSR FTN and Takaanini FTN: existing bus lanes, intersections, and active mode facilities (if any) Popes Road and Croskery Road: existing rural corridor and limited active mode facilities (if any) GSR Gap: 2-lane corridor between Waihoehoe Road and Drury interchange – SATURN only	MSM (2038, 2048, 2048+) SATURN (2038, 2048+) SAMM (2048+)
GSR FTN option	GSR FTN: bus lanes (and/or bus priority at intersections) and new active mode facilities Popes Road and Croskery Road: existing rural corridor and limited active mode facilities (if any) GSR Gap: 4-lane corridor between Waihoehoe Road and Drury interchange	MSM (2038, 2048, 2048+)
GSR Gap option – flood resilience scenario	GSR Gap: 4-lane corridor on GSR between Waihoehoe Road and Drury interchange Resilience: Closure of Norrie Road bridge over Hingaia Stream	SATURN (2028, 2048+)
GSR Gap DM – flood resilience scenario	GSR Gap: 2-lane corridor on GSR between Waihoehoe Road and Drury interchange Resilience: Closure of Norrie Road bridge and GSR bridge over Hingaia Stream	SATURN (2028, 2048+)

1.3.8 Estimation of Benefits for Each BCR

Three BCR assessments were undertaken as described below.

- **GSR FTN BCR** – the core BCR includes the quantified benefits and costs from the GSR FTN and GSR Gap projects
- **Takaanini FTN BCR** – the core BCR includes the quantified benefits and costs from the Takaanini FTN and urbanisation of Popes Road and Croskery Road
 - No adjustments were made to unclaim benefits from the urbanisation of Popes Road and Croskery Road as these were assumed to be minimal or to predominantly occur through interaction with the Takaanini FTN upgrades. A sensitivity test was performed where the costs of the urbanisation projects were excluded.
- **Combined Package BCR** – the core BCR includes the quantified benefits and costs from all South FTN DBC projects (GSR FTN, Takaanini FTN, urbanisation of Popes Road and Croskery Road, and GSR Gap)

The modelled scenarios described in **Section 1.3.7** were used to estimate the benefits of the individual projects and combined package as follows:

General Traffic Benefits

As a starting point, “overall” general traffic benefits were calculated by comparing the reference option and reference DM MSM models.

For the GSR FTN BCR assessment, the general traffic benefits were calculated by comparing the GSR FTN option model with the reference DM MSM models.

For the Takaanini FTN BCR assessment, the general traffic benefits were estimated by subtraction as the difference between the “overall” general traffic benefits and the general traffic benefits for the GSR FTN BCR.

Active Modes Benefits

As a starting point, “overall” walk and cycling benefits were calculated by comparing the reference option and reference DM SAMM models.

To allocate the “overall” cycling benefits to the GSR FTN BCR and Takaanini FTN BCR a percentage split was adopted based on the 2048+ cycle-km uplift on the GSR FTN and Takaanini FTN corridors from the reference option and reference DM SAMM models.

It was assumed that all the walk benefits were associated with the Takaanini FTN project in combination with the Popes Road urbanisation, and hence 100% of the walk benefits were allocated to the Takaanini FTN BCR.

Crash Cost Savings

The crash cost savings split for the GSR FTN BCR and Takaanini FTN BCR was determined using the same methodology as used for the general traffic benefits. That is, the crash cost savings for the Takaanini FTN BCR was estimated by subtraction as the difference between the “overall” crash cost savings and the crash cost savings for the GSR FTN BCR.

Public Transport Benefits

Similarly, as a starting point, the “overall” PT benefits were calculated by comparing the reference option and reference DM MSM models.

An initial test of estimating the PT benefits split for the GSR FTN BCR and Takaanini FTN BCR was performed using a similar subtraction method as used for general traffic benefits – this indicated that approximately 45% of PT benefits were for the GSR FTN and the remaining 55% for the Takaanini FTN in 2048+. However, these results were found to be inconsistent with the modelled split in passenger-km uplift along the GSR FTN and Takaanini FTN corridors which indicated that approximately 70% of the daily uplift in passenger-km were from the GSR FTN and the remaining 30% from the Takaanini FTN in 2048+. Given the inconsistencies in the benefits split, the average percentage split was adopted which resulted in allocating 55% of the “overall” PT benefits to the GSR FTN BCR and the remaining 45% to Takaanini FTN BCR.

Carbon Dioxide Emissions

As a starting point, “overall” CO₂ savings were calculated by comparing the reference option and reference DM SATURN models.

To allocate these CO₂ savings to the GSR FTN BCR and Takaanini FTN BCR the same percentage split as adopted for the PT benefits was applied.

Combined Package

A Combined Package BCR was estimated by the summation of individual project costs and benefits to account for the different start times of each of the South FTN DBC projects as described in **Section 1.3.2**. For the purpose of overall benefits check, the benefits were compared to the “overall” benefits obtained by comparing the reference option and reference DM models. It was found that the summation of the individual project benefits was 19% higher than the “overall” benefits, over the 40-year analysis period. This is mainly the result of the “overall” benefits’ start date being in line with the earliest project element (the GSR Gap), meaning that the first 8 years of the entire analysis period only claims the small number of quantified benefits from the GSR Gap. However, the BCR assessments using the summation of individual projects or the “overall” benefits produce similar BCRs and thus should be fit for purpose considering the intent to inform route protection measures.

1.4 Evaluation Framework

The economic evaluation is consistent with the Waka Kotahi NZ Transport Agency’s MBCM, 2021.

1.4.1 Economic Evaluation Approach

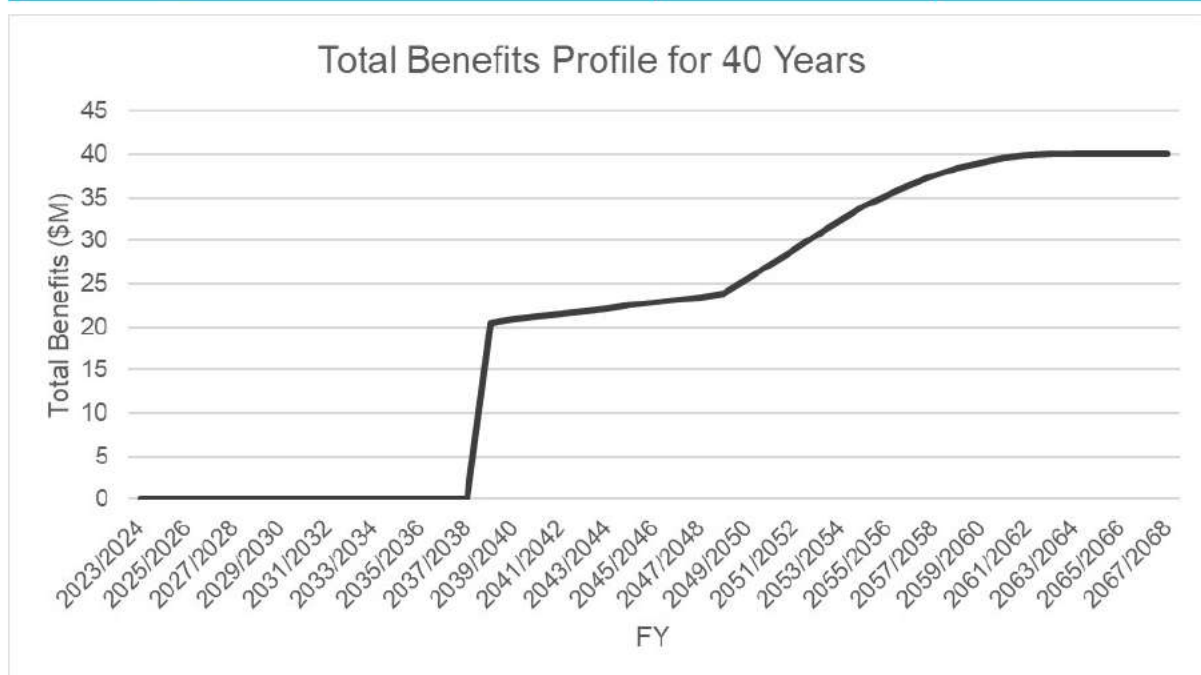
The overall economic evaluation is based on the following assumptions:

- Base values of time (VoT), vehicle operating costs (VOC), etc. are derived from the values set out in the MBCM, updated to current values with a base date of 1 July 2021 using update factors in **Table 1-3**.
- Assessment of base and congested travel time benefits from the SATURN models due to reasons detailed in **Section 1.3.5**
- Assessment of base running VOC from the SATURN models
- Time zero, construction start date and duration specified as in **Table 1-1**
- Analysis period is 40 years, but sensitivity tested at 60 years
- Discount rate of 4% applied to all annual benefits and costs, but sensitivity tested for 3% and 6%
- Traffic reliability benefits assumed as 8% as the base travel time benefit, as a standard approach
- PT reliability benefits was assumed to be 80% of the PT user benefits in the commuter peaks and 40% in other periods, as discussed in **Section 2.2**^{Error! Reference source not found.}
- Carbon dioxide (CO₂) benefits are calculated from the vehicle emissions prediction model (VEPM) version 6.3, with (upper bound) rates as per the MBCM and specified in **Table 2-7**.
- Travel time user cost is based on VoT by mode user and purpose from the MBCM.
- Walking and cycling benefits were estimated based on trip demand and travel cost matrices from SAMM, using the same method as used for PT benefits in MSM, and using the same approach as the Rail and Drury DBCs.
- As a sensitivity test, WEBs were calculated, in accordance with the MBCM, then applied to the project using an adopted percentage uplift on the conventional benefits. The analysis was done for three principal types of WEBs (agglomeration impact, imperfect competition and labour supply impact).
- Since the proposed improvements are constructed in phases, the benefits start date has been phased out accordingly. It is assumed that upon implementation of upgrades to the FTN corridors 70% of the total benefits from these project elements can be realised by 2036.

- Beyond the 2048+ modelled year (assumed to be allocated to year 2053) benefit growth is dampened out over 10 years and thereafter assumed to remain constant with no further benefits growth. **Figure 1-3** shows the benefits profile for a 40-year analysis period to demonstrate how benefits are treated over time. The earlier year benefits are staggered since as discussed above it is assumed that partial benefits can be realised upon the completed construction of various sections of the FTN corridors.

Table 1-3: Update Factors for Benefits

Item	Base date	Update factor to 2021
Travel time costs	July 2002	1.59
Vehicle operation costs	July 2015	1.15
Crash cost savings	July 2015	1.10
Travel behaviour change benefits	July 2008	1.28
Walking and cycling benefits	July 2018	1.06

**Figure 1-3: 40-Year Benefits Profile (Reference Option vs. Reference Do Minimum)**

1.5 Expansion of Benefits from Transport Models

Annualisation factors for private transport are shown in the following tables. The below factors are based on analysis of current traffic patterns.

Table 1-4: Traffic Annualisation Factors (2-hour MSM Models)

Period	Modelled period used	Equivalent hours per day	Days per year
Weekday AM	AM	1	245

Period	Modelled period used	Equivalent hours per day	Days per year
Weekday PM	PM	1	245
Weekday Interpeak	IP	3.6	245
Weekday evening / night	IP	2.0	245
Weekend / holiday	IP	6.5	120

Table 1-5: Traffic Annualisation Factors (1-hour SATURN Models)

Period	Modelled period used	Equivalent hours per day	Days per year
Weekday AM	AM	2	245
Weekday PM	PM	2	245
Weekday Interpeak	IP	7.2	245
Weekday evening / night	IP	3.9	245
Weekend / holiday	IP	13	120

A different set of factors was used for PT indicators, as its usage profile is different from the private cars.

Table 1-6: PT Annualisation Factors (2-hour Models)

Modelled Period	Annual factor
AM	245
IP	1524
PM	245

SAMM provides daily estimates of travel, therefore an expansion factor of 365 was assumed.

1.6 Analysis Period

The economic analysis was carried out for a 40-year analysis period as a base estimate, but sensitivity tested for 60 years.

2 Benefits Analysis and Discussion

The benefits analysed for the South FTN DBC economic assessment are discussed below, and the outcome is enumerated in **Section 4**.

2.1 Public Transport Users Benefits

The PT user benefits are estimated by multiplying the VoT (as obtained from the MBCM) of each trip purpose to the passenger hours obtained from MSM. The VoT used for HBW purpose is \$7.80 per hour, for work travel purpose is \$23.85 per hour, and for other nonwork travel purpose is \$6.90 per hour; these were then updated to year 2021 by applying the update factor of 1.59.

Compared to the reference DM, the reference option scenario has higher PT services in terms of frequency along the GSR FTN and Takaanini FTN routes. The new bus lanes and bus priority provide better PT accessibility and enable increased frequent transit services.

2.2 Public Transport Reliability Benefits

The provision of bus lanes and intersection upgrades along the GSR FTN and Takaanini FTN routes is expected to improve overall network PT reliability by reducing congestion to PT and allowing PT services to operate promptly, increasing mobility for people who cannot or do not want to drive and reducing reliance on private vehicle travel.

The PT reliability was estimated as a percentage of PT user benefits. The MBCM provides guidance where reliability is a function of the estimated minutes late of existing services, as follows:

$$\text{Reliability benefit} = \text{EL} \times (\text{VTT}/60) \times \text{AML} \times \text{NPT}$$

where:

EL is the equivalent time to a minute late ratio

VTT is the vehicle travel time (\$/h)

AML is the reduction in average minutes late (minutes)

NPT is the number of passengers affected.

This method was used as a basis to calculate a percentage increase that could be applied to the PT user benefits assessed, as consistent with the Rail DBC. Data from 2022 was obtained from AT and indicated that bus travel time variability on the existing route on GSR between Manukau and Papakura was approximately 15 minutes in both directions in the AM and PM peaks.

The AML was tested as different proportions of the bus travel time variability, and the EL of 4.8 was applied to get reliability benefits (in minutes per person). The estimated reliability benefits were then divided by the modelled journey time savings (along GSR between Manukau and Papakura) from the 2048+ MSM reference models to estimate PT reliability percentages. The MBCM restricts reliability benefits to being not greater than the travel time benefits, hence a cap of 100% was applied.

The range of calculated PT reliability percentages are indicated in Error! Reference source not found., Error! Reference source not found., showing that the percentages are generally 100%, with some instances closer to 75% (**Appendix 2** provides a more detailed analysis). However, to be

conservative, a PT reliability percentage of 80% was adopted for AM and PM peaks, and half of that (i.e. 40%) for other peaks.

Table 2-1: Summary of Estimation of PT Reliability Percentages

		Inbound					Outbound				
AML factor		0.1	0.2	0.3	0.4	0.5	0.1	0.2	0.3	0.4	0.5
AM	Reliability/Time Savings Ratio	100%	201%	301%	402%	502%	152%	303%	455%	607%	759%
	Capped Ratio	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PM	Reliability/Time Savings Ratio	74%	148%	222%	296%	371%	76%	152%	228%	304%	381%
	Capped Ratio	74%	100%	100%	100%	100%	76%	100%	100%	100%	100%

2.3 Public Transport Health Benefits

In addition to the health benefits obtained using SAMM as described in **Section Error! Reference source not found.**, a certain amount of health benefits was also obtained from the PT walk trips (trips that walk to the stops or stations to access PT services) predicted from MSM. These are estimated by applying the health factor of \$4.40 to the walk-km uplift and then updated to year 2021 by applying the update factor of 1.06. These PT health benefits are summarised in **Table 2-2**.

Table 2-2: PT Stop/Station Walk Trips Health Benefits from MSM (Reference Option vs. Reference DM)

Year	Daily km Increase	Annual Health Benefits (\$M)
2038	792	1.3
2048	271	0.5
2048+	756	1.3

2.4 Active Modes Benefits

The active modes benefits were calculated from SAMM based on the change in demand and generalised costs (the same method used for PT benefits from MSM). The road sections where cycling facilities are upgraded and designated as protected cycle lanes in the reference option scenario are shown in the cycle facility map in **Figure 2-2****Error! Reference source not found.****Error! Reference source not found.** below and are measured against the reference DM scenario where the new cycle facilities are excluded (i.e. except those present in the base year) as in **Figure 2-1**.

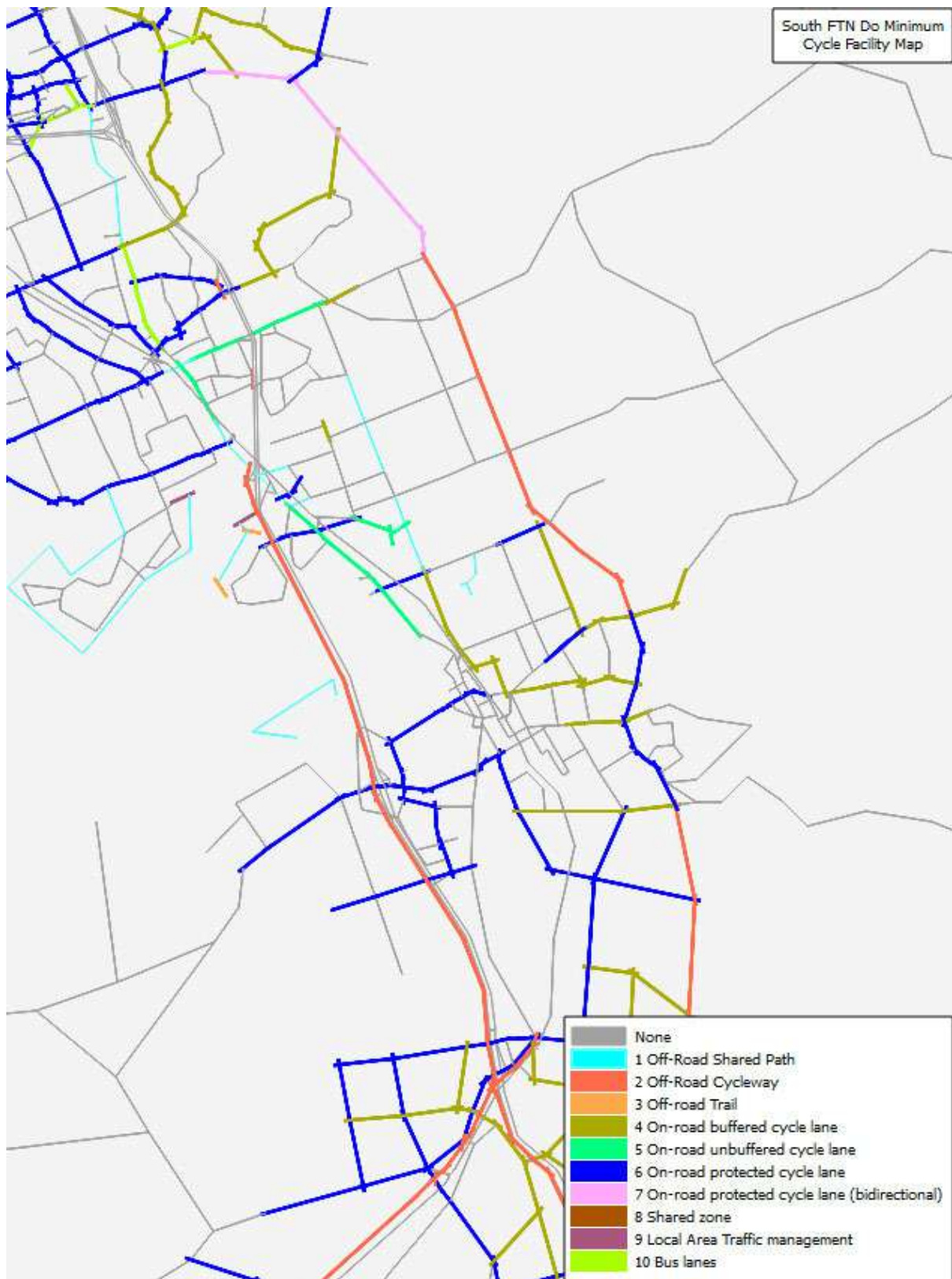


Figure 2-1: Cycle Facilities for Reference Do Minimum Scenario in 2048+

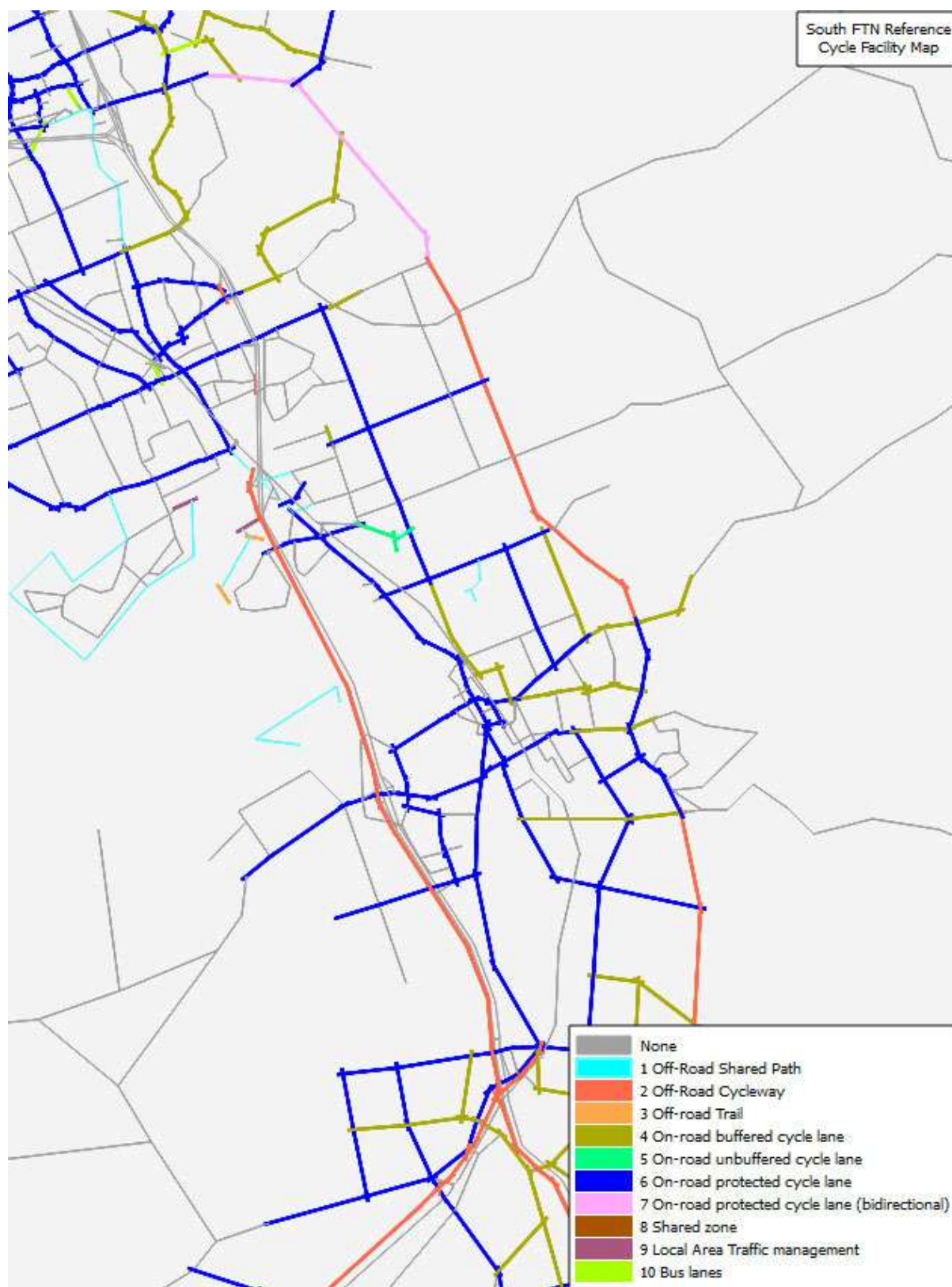


Figure 2-2: Cycle Facilities for Reference Option Scenario in 2048+

The key difference in cycling facilities between the reference option and DM is that the reference option includes protected cycle lanes along the GSR FTN and Takaanini FTN routes, Popes Road, and Croskery Road. Moreover, Popes Road is upgraded to have a footpath in the reference option whilst none exists in the reference DM.

There are various components to the active modes benefits as shown below:

2.4.1 Travel Time Benefits

The user travel cost benefits were assessed using the demand and perceived cost matrices in SAMM. They are split into two purposes: homebased work (HBW) and other (including homebased education (HBE), homebased other (HBO), and nonhomebased). The VoT used for the HBW purpose is \$7.80 per hour and for nonwork travel purpose is \$6.90 per hour, which are then multiplied with the update factor of 1.59 (year 2021).

The provision of upgraded active mode facilities on the South FTN DBC corridors and their exclusivity to active modes leads to travel time savings for the cyclists and pedestrians. It is expected to obtain reasonable travel time savings for the active mode users in South Auckland, provided the better active mode connectivity. The active modes travel time benefits are shown in **Table 2-3**. Differences in the quality of routes are reflected in the attributes incorporated in SAMM which are similar to those included in the MBCM.

Table 2-3: Active Modes Travel Time Benefit – Year 2048+ (Reference Option vs. Reference DM)

Mode	Base	Option	Benefits (generalised minutes)		VoT (\$/hr)		Update Factor	Annual Factor	Annual TT Benefit (\$M)		
			HBW	Other	HBW	Other			HBW	Other	TOTAL
Cycle	Ref DM	Ref Opt	1,424	2,548	\$7.80	\$6.90	1.59	365	0.11	0.17	0.28
Walk	Ref DM	Ref Opt	5,969	96,353	\$7.80	\$4.49	1.59	365	0.45	4.18	4.63

Note: The value of time for the Walk Other trips has been reduced by 35% of the MBCM recommended to account for the travel demand management (TDM) effect in MSM (conversion of a proportion of mechanised short trips (shorter than 3 km) to active mode trips in MSM) turned off for HBO trips. This has been agreed during the Drury local peer review process as the reviewer considered Walk Other purpose benefits to be potentially overstated relative to HBW purpose. Additionally, for evaluation purposes the walk trips beyond 6 km and cycle trips beyond 30 km were removed to avoid particularly long trips.

2.4.2 Health, Safety and Decongestion Benefits

Road traffic reduction and health benefits were estimated from the change in the amount of walk- and cycle-km as obtained from SAMM. The walk- and cycle-km were calculated in SAMM by multiplying the walk and cycle trips with the walk and cycle distance travelled, respectively. The change in predicted walk and cycle-km is multiplied with the cyclist (\$2.20 per cyclist per km) and pedestrian (\$4.40 per pedestrian per km) composite benefit factors, as obtained from the MBCM. These are updated to year 2021 by applying the update factor of 1.06.

The decongestion benefits obtained due to cycling are calculated by multiplying the change in cycle-km by the road reduction factor and the number of car users who experience mode shift. It is calculated as the ratio of car diversion rate for cycle (65%) and car occupancy (1.2 persons). The road traffic reduction factor of \$1.54 per vehicle per km was obtained from the MBCM, but because SAMM only provides daily demand this was reduced by 50% to make allowance for lower decongestion outside the peak periods. The decongestion benefits were updated to year 2021 by applying the update factor of 1.28. The safety benefits for cyclists are obtained by multiplying the

cyclekm with the safety factor of \$0.05 as obtained from MBCM SP11³, and updated to year 2021 by applying the update factor of 1.10. The South FTN DBC active modes health, safety and decongestion benefits are shown in **Table 2-4** Error! Reference source not found. Error! Reference source not found..

Table 2-4: Active Modes Health, Safety and Decongestion Benefit – Year 2048+ (Reference Option vs. Reference DM)

Mode	Base	Option	km Increase	Health factor	Safety factor	Benefits (\$M)		
						Health	Safety	Decongestion
Cycle	Ref DM	Ref Opt	1,444	2.2	0.05	1.23	1.03	0.28
Walk	Ref DM	Ref Opt	2,909	4.4	-	4.95	-	-

The active modes benefits were assessed from SAMM for year 2048+, with benefits of earlier years being assessed as a proportion of the 2048+ benefits, based on the population data of zones (using land use scenario i11.6) affected by the active modes network. The assumed proportions for the interim years are as follows:

- 2038: 75%
- 2048: 85%
- 2048+: 100%

These assumed proportions are approximately consistent with the assumed staging and construction schedule of the projects, given that about 79% of the total project corridor length is expected to be constructed by year 2038.

2.5 Traffic Travel Time and Congestion Savings

The travel time costs have been calculated based on the matrix-based SATURN outputs. The travel time components include:

- Base travel time; and
- Congested travel time (defined as 'CRV' in the MBCM).

The base travel time applies to the total travel times, whereas the CRV has been applied to the mean delay time from the transport model outputs. In theory, CRV should be applied to where the CRV value has been applied to sections of road deemed congested, such as:

- Urban roads in the model which use the methodology for urban roads, whereby CRV only applies to links with a volume to capacity (V/C) ratio greater than 70%; and
- All bottleneck delay, such as intersections.

However, due to the nature of the matrix-based outputs, the CRV has been applied to all the mean delay time calculated by the transport models, due to the inability to distinguish individual V/C on each

³ The safety factor has no reference in the MBCM but is present in the SP11 calculation worksheet.

section of road for each origin-destination pair. This is deemed to be acceptable given minimal delays at V/C ratios lower than 70%.

2.6 Traffic Reliability Benefits

Travel time reliability can generally be improved by upgrading the road network, improving connectivity and improving PT services. Travel reliability was assumed to be 8% of the travel time benefits, as per the standard approach with other South Te Tupu Ngātahi business cases. However, it is acknowledged that with increased levels of congestion this may underestimate the full reliability benefits.

2.7 Vehicle Operating Costs

VOC for private travel were estimated based on applying running costs (from the MBCM) to the SATURN model outputs. PT operating costs were included as a system cost item (rather than user cost).

2.8 Resilience Benefits

The GSR Gap project is expected to provide resilience to flood events impacting South Auckland, particularly near Hingaia Stream. The flood resilience benefits estimated from the GSR Gap resilience model scenarios. Floods were assumed to be a 1 in 10-year event and affect 3 days each time, therefore to account for adjustments to the annualisation factors only 0.08% of the flood resilience benefits were claimed.

2.9 Crash Cost Savings

Crash reduction benefits were estimated using average crash costs per vehicle kilometres travelled (VKT) for different road categories, as used in the IBC. This captures both changes in the total VKT (e.g. from mode shift) and from shifting traffic between different road categories. The crash rates used were calculated based on the total recorded crashes in the Auckland region between 2013 and 2017 and the VKT by road type and speed from the 2016 MSM regional model which are outlined below in Table 2-5.

Table 2-5: Crash Costs by Road Type and Speed

Road Type	Speed	Veh-km (millions/year)	Crash Cost (\$M/year)	Cents/Veh-km
Motorway	All speeds	4,687.6	126.2	2.69
Arterial	<80	4,659.8	525.7	11.28
	≥80	68.97	10.0	14.56
Local	All speeds	1,698.8	139.6	8.22
Rural	<80	486	21.5	4.43
	≥80	1,390	242.7	17.46

Road Type	Speed	Veh-km (millions/year)	Crash Cost (\$M/year)	Cents/Veh-km
All categories		12,991.3	1065.9	8.20

The network-wide crash cost savings are obtained by multiplying the veh-km savings from the MSM models with the crash rate and then updated to year 2021 by applying the update factor of 1.10. It is expected to have crash cost savings due to reduced VKT with mode shifts from private vehicles to PT in the reference option. The veh-km savings is translated to crash cost savings as shown in **Table 2-6**. A lower crash rate was not applied to improved roads given that the South FTN DBC is not proposing “brand new” roads and is rather proposing widening and/or the reallocation of existing general traffic lanes to bus lanes which does not necessarily increase safety.

Table 2-6: Crash Cost Savings for the Modelled Years (Reference Option vs. Reference DM)

Year	Crash Cost Savings (\$M)
2038	2.01
2048	2.77
2048+	3.02

2.10 Carbon Dioxide Emissions

The CO₂-equivalent emissions are calculated from SATURN models using the VEPM 6.3 emission rates. The difference between the reference option and reference DM gives the emission impact due to the project.

The South FTN DBC schemes are expected to obtain CO₂ savings due to mode shift from private vehicle to PT. The CO₂ savings are shown in **Table 2-7**. The economic benefit of the emissions is calculated by multiplying the social cost per CO₂ tonne emitted as per the higher values in the range provided in the MBCM⁴.

Table 2-7: Annual Emission Benefits for the Modelled Years (Reference Option vs. Reference DM)

Year	Social Cost of CO ₂ (\$/tonne)	Annual CO ₂ -equivalent Emission Savings (tonnes)	Annual Emission Cost Savings (\$M)
2038	178	7.60	0.44
2048	222	5.08	0.37
2048+	246	3.83	0.31

⁴ The social cost of CO₂ used for 2048+ is the upper bound value for year 2053, extrapolated from the values provided in the MBCM.

Other emissions like volatile organic compounds, NO_x and particulates were assessed and it was found that the emission savings were comparatively insignificant (less than 5kg savings).

2.11 Wider Economic Benefits

Given the scale of the proposed improvements and its impact in the future urban mobility in the area, it was deemed likely that there would be significant WEBs. The WEBs were initially assessed using the MBCM procedures from the 2048+ MSM models. After consideration of the results, a method was adopted that involved a fixed uplift in the conventional transport benefits.

The analysis is done for three principal types of WEBs:

- Agglomeration impact;
- Imperfect competition impact; and
- Labour supply impact and more productive jobs impact.

The total WEBs evaluated for the South FTN DBC are shown in **Table 2-8**.

Table 2-8: WEBs by Type Determined from MSM Models 2048+ (Reference Option vs. Reference DM)

Item	Benefits (\$M)
Agglomeration impact	17.46
Imperfect competition impact	-0.32
Labour market impact	0.12
Total WEBs	17.26
WEBs percentage	53%

As shown above, the WEBs were estimated as 53% but, as discussed with the peer reviewer, although WEBs are likely to be generated by the South FTN DBC by improving PT and accessibility to major employment centres like Manukau, high estimates of WEBs could be produced and may be unrealistic. Therefore, as agreed with the peer reviewer, the present economic appraisal adopted 15% uplift over the conventional benefits (for each year) in the sensitivity tests for including WEBs.

For simplicity, the same WEBs percentage of 15% was considered for the individual projects; this means that some of the projects will have higher or lower WEBs than expected.

3 Project Costs

3.1 Capital Cost

The economic analysis used the expected costs (P50) as a base estimate, but sensitivity tested with P95 costs as reported in **Section 4.2.2**. **Table 3-1** and **Table 3-2** summarise the P50 and P95 cost estimates for the South FTN DBC, respectively.

The contingency assumptions for the capital costs are detailed in **Appendix J** of the DBC but a summary is provided here:

- [REDACTED]
- [REDACTED]

3.2 Operation and Maintenance Costs

[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]
[REDACTED]	[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

Operation and Maintenance Costs Summary

[REDACTED]

[REDACTED]

[REDACTED]

3.3 Public Transport Operating Costs

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

3.4 Summary of Costs

[REDACTED]



4 Benefits-Cost Ratio (BCR)

4.1 National BCR Outputs

Based on the methodology described above, the NPV of benefits were evaluated and summarised in **Table 4-1**. The core results for the South FTN DBC package components were generated from a set of 'core' assumptions.

Table 4-1: Summary of Core Benefits and BCRs for South FTN DBC

Item	NPV (\$M)		
	GSR FTN ⁵	Takaanini FTN ⁶	South FTN DBC
Traffic – Travel Time Benefits	-18	-13	-31
Traffic – Congestion Benefits	-9	-5	-14
Traffic – Trip Reliability	-1	-1	-2
Traffic – Vehicle Operating Costs	-1	7	5
Traffic – Resilience	0.2	0	0
Active Modes	13	109	122
Crash savings	10	21	31
PT - Travel Time Benefits	73	59	132
PT – Reliability	39	32	70
PT - Health benefits	8	7	15
CO ₂	2	2	4
PV total net benefits excluding WEBs	115	217	332
PV of total net costs	256	294	550
National BCR Excluding WEBs	0.5	0.7	0.6
WEBs Benefits (15%)	17	33	50
PV Benefits Including WEBs	132	250	382
National BCR Including WEBs⁷	0.5	0.8	0.7

⁵ The core BCR for GST FTN includes the costs and benefits from the GSR Gap, if any.

⁶ The core BCR for Takaanini FTN includes the costs and benefits from the urbanisation of Popes Road and Croskery Road, if any.

⁷ The BCR including WEBs was calculated as a sensitivity test.

4.1.1 Key Observations

- A major portion of the benefits are comprised of PT benefits which is reasonable given that the majority of the South FTN DBC recommended network involves PT improvements, i.e. approximately 21 kilometres of bus lanes across both FTN routes.
- There are also significant benefits for active mode users which is also reasonable given the addition of a footpath on Popes Road and the upgraded active modes facilities in the South FTN DBC recommended network, i.e. approximately 54 kilometres of new and improved cycle facilities.
- The bulk of the active modes benefits, particularly the walk benefits, are associated with the Takaanini FTN BCR given that addition of footpaths on Popes Road in combination with the new active mode facilities on the Takaanini FTN route, improving access for those in the Takaanini FUZ.
- The South FTN DBC recommended network causes disbenefit to general traffic, which is reasonable given the reallocation of some existing general traffic lanes into bus lanes or active mode facilities.
- A small amount of flood resilience benefits from the GSR Gap project was claimed. The underwhelming amount of flood resilience benefits is reasonable given the underlying model assumptions of which links are assumed in the future reference network. The GSR Gap resilience models assumed that several alternative connections into Drury East were in place, such as the Ōpāheke north-south arterial, the direct motorway link (link between SH1 interchange and Creek Road), the Drury South interchange, Mill Road South, and the Brookfield Quarry link, giving more route choice in the area to avoid the bridges assumed to be impacted by flooding.

4.2 Sensitivity Tests

The key purpose of the sensitivity tests is to understand the relative impact of key assumptions on the BCR. The sensitivity tests were carried out as per the MBCM.

The sensitivity tests are split into analysis framework and parameter sensitivity tests. The analysis framework includes discount rate and analysis period, whilst parameter sensitivity includes WEBs, cost, and active modes, traffic and PT benefits variability. Additional sensitivity tests were performed, as agreed with the peer reviewer.

4.2.1 Analysis Framework Sensitivity Tests

The analysis framework includes discount rate and analysis year:

Discount Rate and Analysis Period

The discount rate recommended in the MBCM is 4% with sensitivity tests for 3% and 6%. A range of discount rates was tested, being 3%, 4%, 6%. The analysis period used for testing is 40 years and 60 years. The longer analysis period is relevant for long-lived strategic infrastructure projects such as the upgraded bridges along the FTN routes in the South FTN DBC.

Table 4-2 and **Figure 4-1** shows the BCR range (excluding WEBs) for the above analysis parameters.

Table 4-2: BCR Variation with Different Discount Rate and Analysis Period

Analysis period	Discount rate	BCR		
		GSR FTN	Takaanini FTN	South FTN DBC
40 years	3%	0.5	0.9	0.7
	4% (core)	0.5	0.7	0.6
	6%	0.3	0.6	0.5
60 years	3%	0.7	1.1	0.9
	4%	0.5	0.9	0.7
	6%	0.4	0.6	0.5

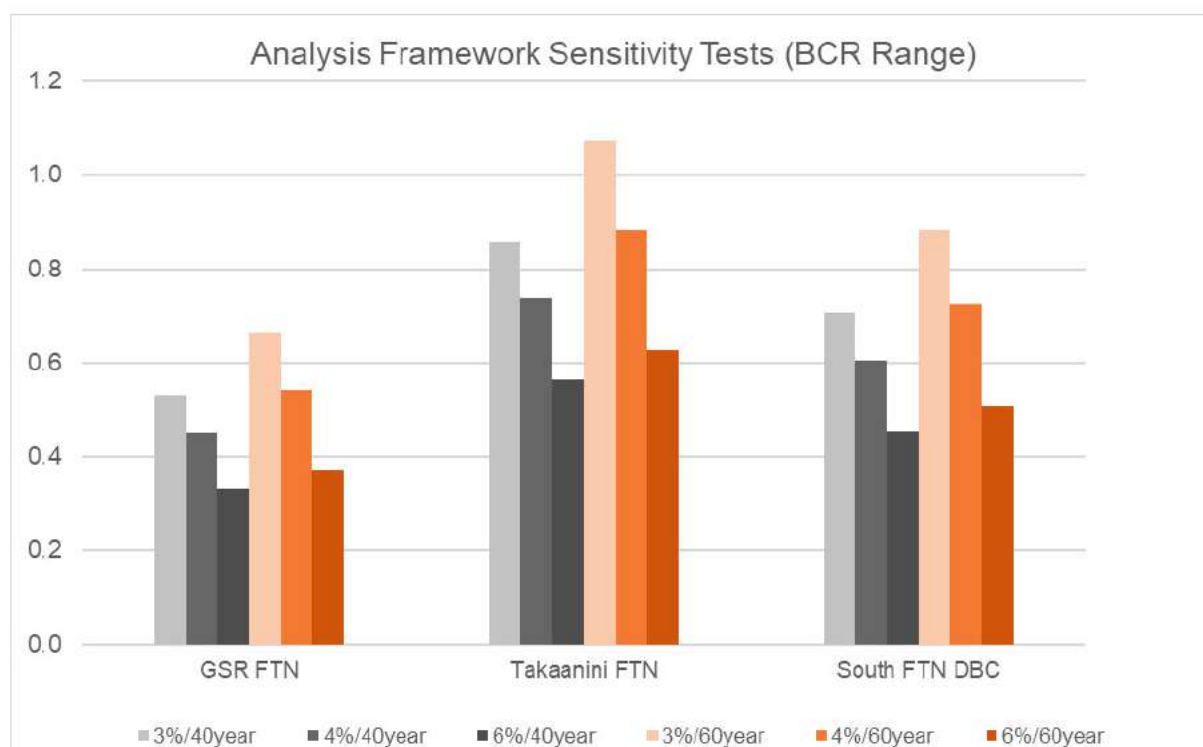


Figure 4-1: Analysis Framework – BCR Variation for the South FTN DBC

The above analysis shows that:

- Using the recommended 4% discount rate and 40-year analysis period as per the MBCM, the BCR for GSR FTN and Takaanini FTN are 0.5 and 0.7, respectively, giving a combined BCR of 0.6 for the South FTN DBC package.
- The sensitivity tests with a 60-year analysis period uplifts the Takaanini FTN BCR to 0.9, whilst the GSR FTN BCR remains at 0.5. The BCR for the South FTN DBC package increases slightly to 0.7.

- Across the sensitivity tests with the discount rate and analysis period, the GSR FTN BCR lies between 0.3 and 0.7, the Takaanini FTN BCR lies between 0.6 and 1.1, and the South FTN DBC BCR lies between 0.5 and 0.9.

4.2.2 Parameter Sensitivity Tests

These sensitivity tests are performed by altering one parameter at a time while maintaining the rest of the core assumptions, including the 4% discount rate and 40-year analysis period. The following parameter sensitivity tests were carried out:

- Including WEBs: +15%
- Active modes benefits variability:
 - $\pm 25\%$
 - 50% reduction of the VoT for the Walk Other trips, as agreed with the peer reviewer and as per the North appraisal
- Traffic benefits variability: $\pm 25\%$
- PT benefits variability: $\pm 25\%$
- PT reliability benefits: $\pm 20\%$ for commuter peak and $\pm 10\%$ for IP
- Costs variability: P95 costs
- MBCM version 1.6

WEBs Sensitivity Test

As discussed in **Section 2.11**, a sensitivity test was performed to include WEBs benefits as 15% uplift over the conventional benefits. The results are shown in **Table 4-3**.

Table 4-3: BCR Variation including WEBs

WEBs %	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
0% (core)	0.5	0.7	0.6
15%	0.5	0.8	0.7

Active Mode Benefits Sensitivity Test

During the Drury Local peer review, extensive modelling methodology checks were carried out to better understand the walk benefits predicted by the model, especially for the “Other” trip purpose. These were found to align with expected daily travel by each mode and purpose. However, the greenfield nature of the location and the extensive future population growth make it more difficult to independently check the scale of benefits. It was therefore agreed to test with $\pm 25\%$ active mode benefits. The same tests have been carried out for the South FTN DBC economics.

Moreover, during the North DBC peer review, a comment was made on the imbalance between the benefits for HBW and Other walk trips, hence a sensitivity test was undertaken to only consider 50% of the ‘Walk Other’ travel time benefits. The same test has been carried out for the South FTN DBC economics.

The variation in active mode benefits cause some variance to the overall BCRs, as shown in **Table 4-4**, particularly for the Takaanini FTN BCR as it was assumed to claim all the walk benefits.

Table 4-4: BCR Variation with Active Mode Benefits Change

Active Mode Benefit %	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
-25%	0.4	0.6	0.5
0% (core)	0.5	0.7	0.6
25%	0.5	0.8	0.7
50% 'Walk Other' VoT	0.5	0.7	0.6

Traffic Benefits Sensitivity Test

The traffic benefits variability was tested for robustness. The travel time, congestion, vehicle operating cost and trip reliability was tested for $\pm 25\%$. The results in **Table 4-5** show that the BCR is relatively insensitive to changes in traffic benefits. There is a slight drop in the GSR FTN BCR with 25% more traffic impacts, given that a greater proportion of the traffic disbenefits from the South FTN DBC is associated with it.

Table 4-5: BCR Variation with Traffic Benefits Change

Traffic Benefit %	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
-25%	0.5	0.7	0.6
0% (core)	0.5	0.7	0.6
25%	0.4	0.7	0.6

PT Benefits Sensitivity Test

Table 4-8 shows the BCR variation from testing with $\pm 25\%$ of the PT travel time, reliability, and health benefits. Given that the South FTN DBC projects are predominantly PT schemes, it is reasonable that the BCR is relatively sensitive to changes in PT benefits. There is a slight drop in the GSR FTN BCR with 25% less PT benefits, given that a greater proportion of the PT benefits from the South FTN DBC is associated with it.

Table 4-6: BCR Variation with PT Benefits Change

PT Benefit %	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
-25%	0.3	0.7	0.5
0% (core)	0.5	0.7	0.6
25%	0.6	0.8	0.7

PT Reliability Percentage

The PT reliability benefits variability was tested for robustness. **Table 4-7** shows that deviating the PT reliability percentage from the core assumptions of 80% and 40% in the peak and interpeak periods, respectively, have negligible effect on the South FTN DBC BCR and minor effects on the individual GSR FTN and Takaanini FTN BCRs.

Table 4-7: BCR Variation with PT Reliability Percentage

PT Reliability % (AM/PM & IP)	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
60% & 30%	0.4	0.7	0.6
80% & 40% (core)	0.5	0.7	0.6
100% & 50%	0.5	0.8	0.6

Cost Sensitivity Test

The cost variability was tested for robustness by applying the P95 cost estimates. The results are shown in **Table 4-8**.

Table 4-8: BCR Variation with Capital Cost Change

Cost Scenario	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
P50 (core)	0.5	0.7	0.6
P95	0.4	0.6	0.5
Without Popes Road and Croskery Road urbanisation costs	No impact	0.8	0.6

Latest MBCM (version 1.6) Test

The BCR was also calculated using the most recent MBCM (version 1.6), which generally uses higher VoT, VOC, and rates than those used in the core evaluation. The results are shown in **Table 4-9**.

Table 4-9: BCR Variation with MBCM Version

MBCM Version	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
v1.5 (core)	0.5	0.7	0.6
v1.6	0.7	1.4	1.1

4.2.3 Land Use Sensitivity

There is particular uncertainty around the extent and timing of the land use development in the South growth area over the years. The core BCR has been calculated with the assumption of 2048+ land use allocated to 2053, and benefit growth dampened over 10 years and thereafter assumed to remain constant with no further benefit growth, for the purpose of economic assessment. The core BCR also assumes the greenfield growth based on the FULSS; however, the Future Development Strategy (FDS) indicates the potential removal or down-zoning of growth areas. These assumptions were sensitivity tested (independently) as follows:

- Allocating 2048+ benefits to year 2058 – to reflect the alternative assumption to when the 2048+ benefits will commence considering the long-term benefits from the project
- No benefit growth after 2048+ – benefits beyond year 2048+ will remain constant at year 2048+ levels
- FDS impact – to consider the effects of the FDS proposing the removal or down-zoning of Takaanini FUZ and Ōpāheke Slippery Creek in the FDS. Based on a zone-to-zone benefit analysis, the Takaanini FUZ and Ōpāheke Slippery Creek zones impacted by the FDS were found to contribute to 79% of walk travel time benefits, 23% of cycle travel time benefits, 2% of PT user benefits, and 7% of general traffic benefits in year 2048+. The sensitivity for the removal or down-zoning of these growth areas was undertaken by only claiming 21% of walk, 77% of cycle, 98% of PT and 93% of general traffic benefits. This test is relatively conservative as it assumes the removal of all benefits from these FDS-impacted model zones, even those only proposed to be down-zoned or shifted in the expected timing of its growth (and the FDS impacted areas are only a sub-set of the MSM zones removed).

To further examine the possible effects of alternative land use forecasts, a test on the effects of delayed growth was undertaken. This test ascribes the benefits estimated for the base case to different years to reflect slower rates of land use development. The year 2038 benefits were assumed to remain the same as the base case with no growth until 2048, then 2048 benefits occur in 2048+, and the 2048+ benefits occur after year 2058.

The effect of these land use sensitivity tests on the benefits profile is illustrated in **Figure 4-2**.

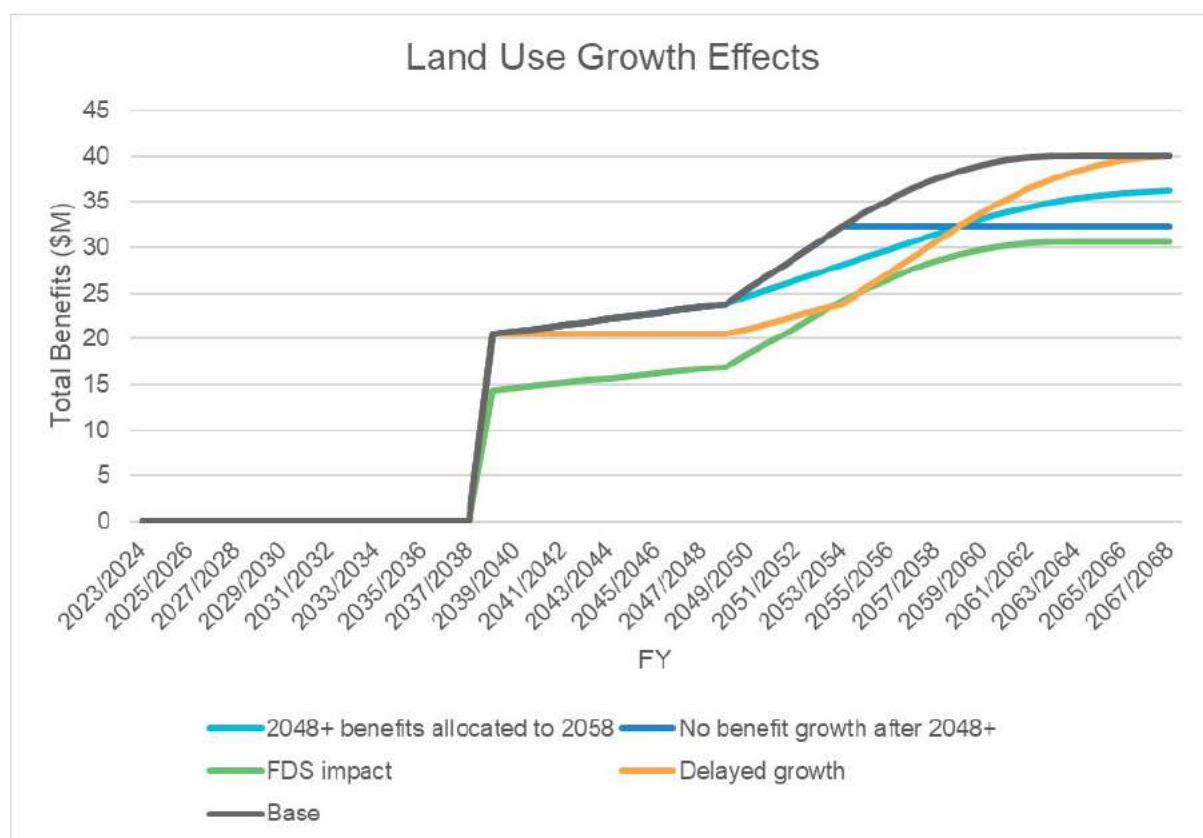


Figure 4-2: Delayed Land Use Growth Effects on Total Benefits (\$M)

Table 4-10 below summarises the BCRs with different land use growth scenarios.

Table 4-10: BCR Variation with Land Use Changes

Land Use Scenario	BCR		
	GSR FTN	Takaanini FTN	South FTN DBC
2048+ benefits allocated to 2058	0.4	0.7	0.6
No benefit growth after 2048+	0.4	0.7	0.6
FDS growth area removal or down-zoning	0.4	0.5	0.4
Decelerated growth	0.4	0.7	0.5
Base	0.5	0.7	0.6

The project is reasonably sensitive to growth and therefore project implementation to match the growth is important. Route protection at an early stage will be required to help ensure that changes in the timing of development either accelerated or delayed can be easily accommodated.

4.2.3.1 COVID-19 Scenario

The land use growth might slow down due to COVID-19 or any other unknown reasons in long term and hence the project start date might need to be delayed to meet the changed transport needs. It was assumed that if such a situation arises, it will not have a significant impact on the economic returns from the project as the costs and benefits timestreams will be shifted with the project start date. However, to some extent, the COVID-19 scenario is covered by the reduced traffic benefits sensitivity test in Table 4-5.

5 Summary

The core results for the economic evaluation of the South FTN DBC are set out in Table 5-1.

Table 5-1: BCR Summary

Item	PV total benefits (\$M PV)	PV total net costs (\$M PV)	BCR excluding WEBs	WEBs (\$M PV)	BCR including WEBs
GSR FTN	115	256	0.5	17	0.5
Takaanini FTN	217	294	0.7	33	0.8
South FTN DBC	332	550	0.6	50	0.7

Key conclusions were noted as follows:

- The core BCRs for GSR FTN and Takaanini FTN are 0.5 and 0.7, respectively, without WEBs, and would change to 0.5 and 0.8 if WEBs are included. As a combined package, the BCR for the South FTN DBC is 0.6 without WEBs and increases to 0.7 with WEBs.
- Sensitivity testing on many of the assumptions or parameters used in the analysis indicates that the BCRs obtained are relatively insensitive to changes in these and the results can therefore be considered robust. The sensitivity test results are summarised in Table 5-2.
- In general, the upper bounds on the BCR ranges were from the tests adopting the latest MBCM (version 1.6). The lower bound on the BCR range for GSR FTN was from the reduced PT benefit test and the test with a 6% discount rate and 40-year analysis period, whilst the lower bound on the BCR ranges for Takaanini FTN and the combined South FTN DBC were from the FDS impact test.
- The analysis framework tests produce similar a BCR range for the GSR FTN as the parameter and land use sensitivity tests, with the BCR expected to fall below 1. The BCR for the Takaanini FTN is expected to lie between 0.5 and 1.4. As a combined package, the BCR for the South FTN DBC is expected to lie between 0.4 and 1.1.
- It is noted that the PT benefits may be understated as the PT resilience benefits from the FTN project elements were not quantified. Likewise, the benefits attributed to the GSR Gap may be understated given its potential to provide improved connectivity and resilience if other alternative connections into Drury East are not implemented as assumed.

Table 5-2: BCR Range Summary

Type of Sensitivity Test	BCR Range		
	GSR FTN	Takaanini FTN	South FTN DBC
Analysis framework	0.3 – 0.7	0.6 – 1.1	0.5 – 0.9
Parameter and land use sensitivity	0.3 – 0.7	0.5 – 1.4	0.4 – 1.1

1 Appendix 1 – Sector-to-Sector Benefits

The sector system considered for the benefit analysis is shown below; it comprises of all the regions in Auckland as in MSM. **Figure 5-1** shows the sectors from MSM.

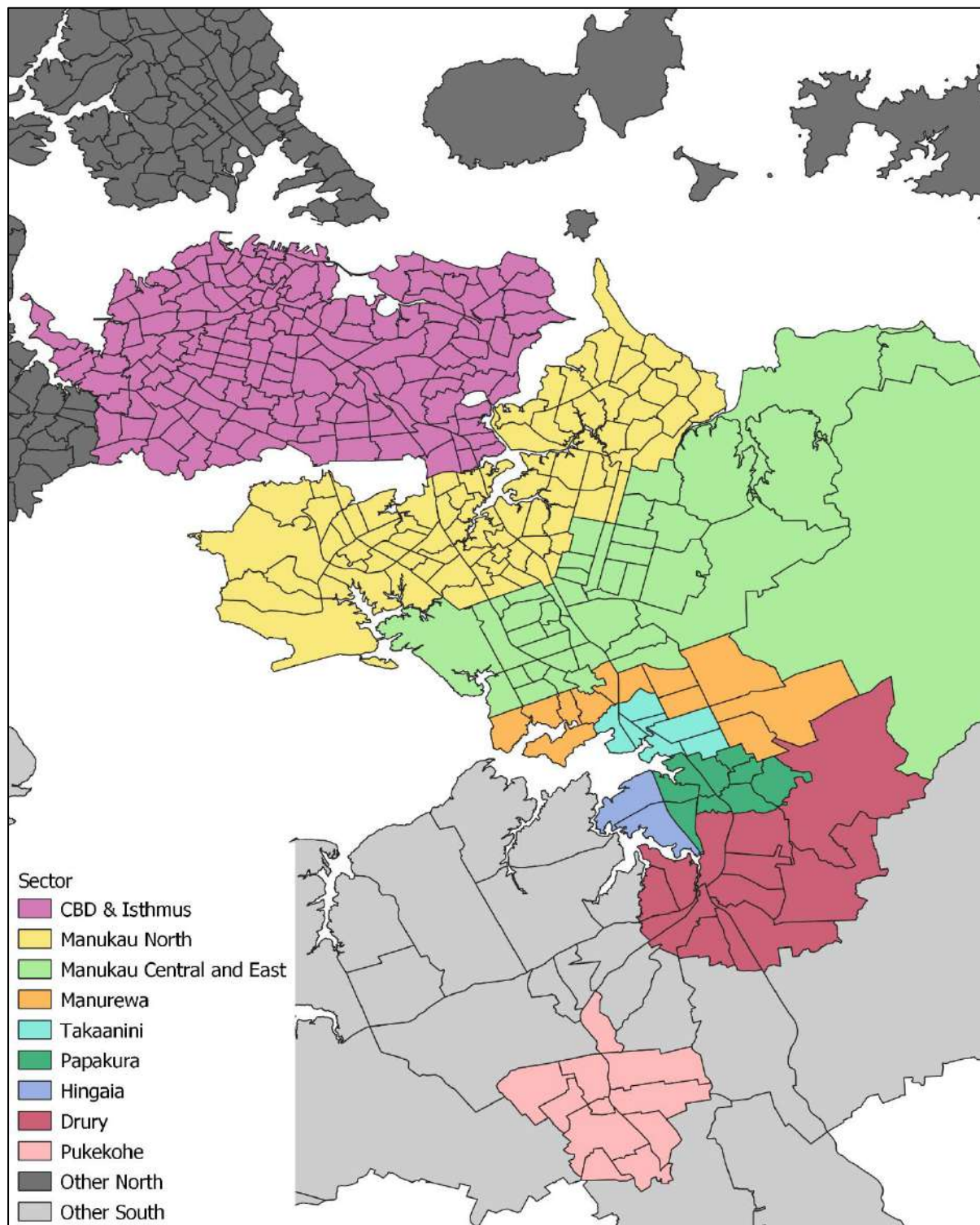


Figure 5-1: Economics Sector Map

1.1 Sector-to-Sector Traffic Benefits

The sector-to-sector analysis of general traffic benefits derived from MSM is shown in **Table 5-3**.

Table 5-3: MSM Sector-to-sector Traffic Benefit (veh-hr) Analysis – Year 2048+ AM Peak

Sector	Other North	CBD & Isthmus	Manukau North	Manukau Central and East	Manurewa	Takaanini	Papakura	Hingaia	Drury	Other South	Pukekohe	Total
Other North	4	-3	-5	-2	0	3	1	1	1	1	1	1
CBD & Isthmus	7	0	-1	5	0	1	1	0	2	2	1	19
Manukau North	8	7	16	-5	0	1	1	0	3	3	2	37
Manukau Central and East	0	-1	-25	-75	-5	-10	-5	-1	-2	-1	-1	-125
Manurewa	-2	-5	-18	-33	-2	-4	-5	-1	-2	-1	0	-73
Takaanini	1	0	0	-6	1	7	3	1	3	1	0	9
Papakura	-1	-1	-6	-10	-3	2	-3	-1	1	0	0	-23
Hingaia	0	-1	-4	-7	-1	-1	-2	0	0	0	0	-17
Drury	-1	-2	-13	-17	-2	-2	-4	2	-1	0	0	-38
Other South	-1	-2	-7	-12	-1	0	0	0	0	0	0	-23
Pukekohe	0	-1	-4	-7	0	2	1	0	0	0	0	-10
Total	15	-8	-68	-170	-14	0	-13	3	4	4	3	-243

All sectors were included in the general traffic benefits/disbenefits in the present economic appraisal due to the wider network effects of the proposals. This was deemed reasonable as the benefits from the 'Other North' sector are relatively small.

1.2 Sector-to-Sector PT Benefits

The sector-to-sector analysis of PT benefits derived from MSM is shown in **Table 5-4**.

Table 5-4: MSM Sector-to-sector PT Benefit (pax-hr) Analysis – Year 2048+ AM Peak

Sector	Other North	CBD & Isthmus	Manukau North	Manukau Central and East	Manurewa	Takaanini	Papakura	Hingaiia	Drury	Other South	Pukekohe	Total
Other North	6	16	3	2	3	3	0	0	0	0	0	32
CBD & Isthmus	-1	-5	2	6	7	7	1	0	1	0	0	18
Manukau North	-1	-3	12	22	9	7	1	0	1	0	0	50
Manukau Central and East	1	16	43	54	14	16	4	0	2	0	0	150
Manurewa	12	84	57	70	10	22	8	1	6	1	2	271
Takaanini	10	68	24	19	6	12	9	1	7	1	2	158
Papakura	1	7	4	2	4	9	1	0	3	0	0	32
Hingaiia	2	17	5	-3	1	1	2	0	3	0	0	29
Drury	-1	-6	1	2	5	11	9	1	13	0	0	37
Other South	-1	-4	1	1	3	7	1	0	2	0	0	12
Pukekohe	-1	-4	0	1	2	4	1	0	1	0	0	4
Total	27	187	153	176	64	99	36	3	40	3	5	793

PT benefits between the 'Other North' zones were not claimed in the present economic appraisal as these were considered noise and outside of the area most impacted by the PT improvements.

2 Appendix 2 – Public Transport Reliability

The assumptions tested to estimate PT reliability percentage and the results are in Table 5-5.

Table 5-5: Evaluation of PT Reliability Percentage Based on AML Assumptions

			Inbound					Outbound				
AML factor			0.1	0.2	0.3	0.4	0.5	0.1	0.2	0.3	0.4	0.5
EL parameter			4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
AM	2022 AT Travel Time (minutes)	Min	16	16	16	16	16	17	17	17	17	17
		Max	34	34	34	34	34	31	31	31	31	31
		Variability (range)	18	18	18	18	18	15	15	15	15	15
		AML	1.8	3.5	5.3	7.1	8.8	1.5	2.9	4.4	5.9	7.3
		Reliability (min/pax)	8	17	25	34	42	7	14	21	28	35
	2048+ MSM Travel Time	Ref Opt	47	47	47	47	47	46	46	46	46	46
		Ref DM	55	55	55	55	55	51	51	51	51	51
		Savings	8	8	8	8	8	5	5	5	5	5
	Reliability/Time Savings Ratio		100%	201%	301%	402%	502%	152%	303%	455%	607%	759%
	Capped Ratio		100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
PM	2022 AT Travel Time (minutes)	Min	17	17	17	17	17	21	21	21	21	21
		Max	30	30	30	30	30	36	36	36	36	36
		Variability (range)	12	12	12	12	12	16	16	16	16	16
		AML	1.2	2.5	3.7	4.9	6.2	1.6	3.2	4.8	6.4	8.0
		Reliability (min/pax)	6	12	18	24	30	8	15	23	31	38
	2048+ MSM Travel Time	Ref Opt	42	42	42	42	42	53	53	53	53	53
		Ref DM	50	50	50	50	50	63	63	63	63	63
		Savings	8	8	8	8	8	10	10	10	10	10
	Reliability/Time Savings Ratio		74%	148%	222%	296%	371%	76%	152%	228%	304%	381%
	Capped Ratio		74%	100%	100%	100%	100%	76%	100%	100%	100%	100%

South FTN and Key Connections

Appendix L: Route Protection Strategy

November 2023

Version 1.1

Document Status

Responsibility	Name
Author	██████████
Reviewer	██████████████████
Approver	██████████

Revision Status

Version	Date	Reason for Issue
1.0	23/6/2023	Draft for IQA review
1.1	9/11/2023	Final

Table of Contents

1	Introduction.....	3
1.1	Purpose and scope of this report	3
1.2	Project Description and Corridor Segmentation.....	3
1.3	Report Structure	5
2	The route protection requirement	6
2.1	The optioneering process.....	6
2.2	The value proposition for route protection in the South FTN Project context	7
2.2.1	The interim Rev A design	7
2.3	The preferred option and resultant route protection requirements	9
3	The strategic context for route protection	13
3.1	Determinants of the strategic merit of route protection.....	13
3.2	Route protection – strategic merits assessment	14
4	The recommended form of route protection.....	19
4.1	Context.....	19
4.2	Options for route protection methods.....	19
4.3	Recommended mechanism	20
4.4	Designation packaging and particulars	21
4.4.1	Packaging criteria	21
4.4.2	Recommendations	21

1 Introduction

1.1 Purpose and scope of this report

This report sets out the route protection strategy for the South Frequent Transit Network (**FTN**) Project (**the Project**) and is an appendix to the South FTN Detailed Business Case (**DBC**). The strategy is intended to be used as a guide for the owner-organisations, recognising that final decisions on proceeding with route protection (or not) sit with the owner-organisations. In providing this guidance, this route protection strategy comments on the following matters in particular:

- The optioneering process, and the extent to which the preferred option has evolved as a result of considering the strategic merits of route protection;
- The form of the preferred option, and the resultant extent of route protection required;
- The strategic merit and relative urgency of proceeding with route protection now, considering:
 - The benefits of route protection (and by extension the Project itself) relative to its costs and effects;
 - The existing and planned land use in the Project area, and the extent these conditions present opportunities to secure route protection and/or urgency to undertake route protection;
 - The foreseeable likelihood that the Project is prioritised for funding and implementation; and
 - Other projects that are adjacent/being concurrently planned, and the sufficiency of information regarding these projects to make sound route protection decisions at project interfaces; and
- The recommended form of route protection resulting from the above considerations, including the planning mechanism to be deployed, the segmentation of routes, and lapse periods.

1.2 Project Description and Corridor Segmentation

The South FTN Project is one of two long-term transport interventions (alongside the Takaanini Level Crossings (**TLC**) Project) proposed for the area of South Auckland between Manukau and Drury as part of the Te Tupu Ngātahi Supporting Growth Programme (**the Programme**)¹. These Projects are part of a wider planned multi-modal transport network intended to support growth and enable mode shift in South Auckland.

The Project proposes road upgrades intended to enable the operation of high-quality FTN bus services² along two routes – referred to as the Great South Road FTN, and the Takaanini FTN (see Table 1-1 and Figure 1-1). Active mode improvements are also proposed along both routes. In addition to the two FTN routes, the Project scope incorporates the urbanisation of three complementary (non-FTN) corridors – Popes Road, Croskery Road, and Great South Road to the south of Waihoehoe Road (see Figure 1-1). The Project extent in total is over 32km in length.

¹ The Programme is a collaboration between Auckland Transport (**AT**) and Waka Kotahi NZ Transport Agency (**Waka Kotahi**) to investigate, plan, and undertake route protection for the strategic transport networks needed to support Auckland's growth over the next 30 years.

² FTN services are defined in the Regional Public Transport Plan (RPTP) as bus routes operating at least every 15 minutes between 7am-7pm every day, supported by priority measures.

For the purposes of design and optioneering, the Project corridors have been divided into sections (see Table 1-1 and Figure 1-1) which are referred to as relevant throughout the report.

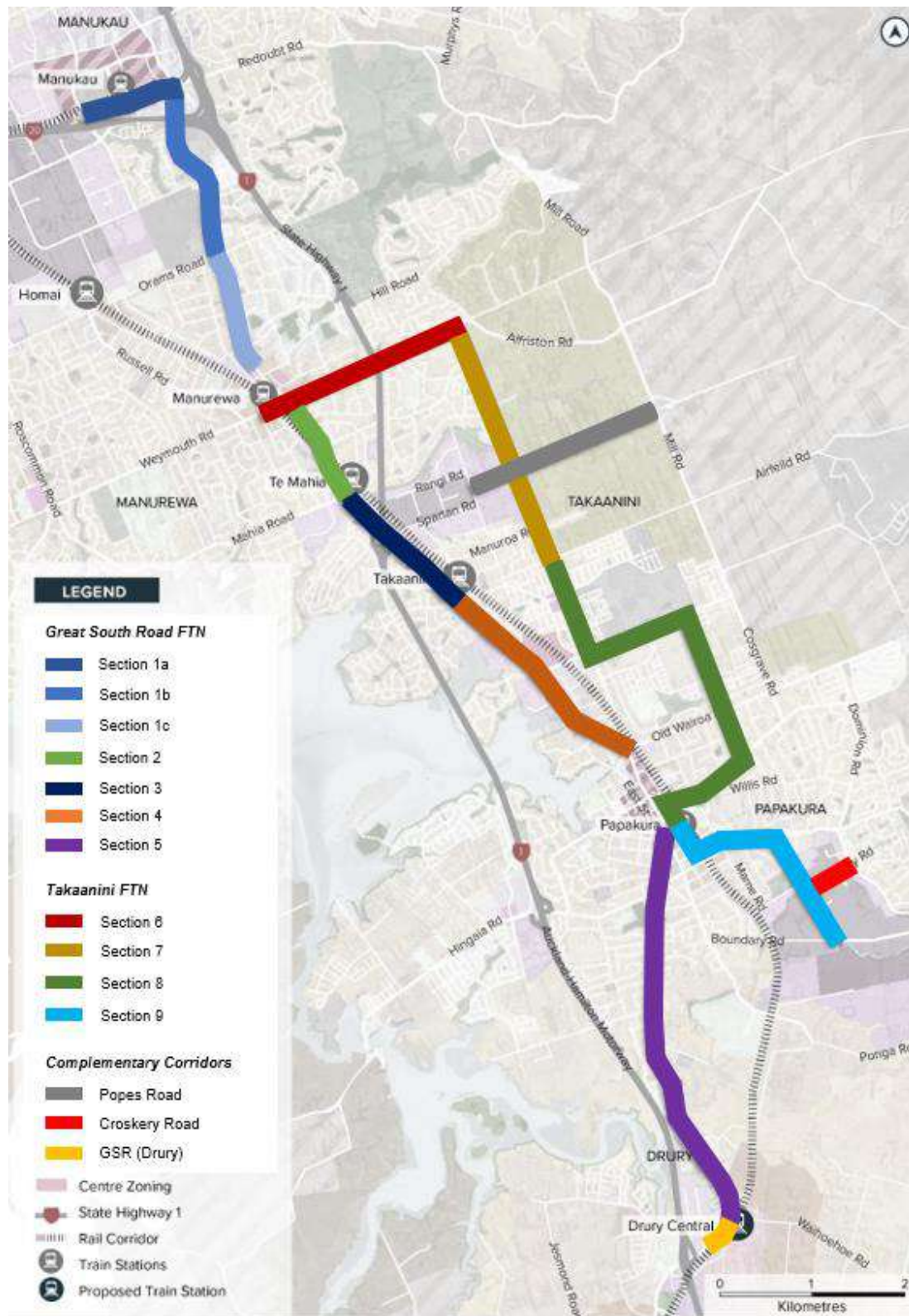


Figure 1-1 – South FTN Project corridors and sections

Table 1-1 – South FTN Project corridors and sections

Route	Section		Length
Great South Road FTN	1	Manukau to Manurewa <i>(n.b. divided into three sub-sections (1a, 1b, 1c) for the purposes of route protection assessment – see sections 2 and 3).</i>	4.8km
	2	Manurewa to Te Mahia	1.0km
	3	Te Mahia to Takaanini	1.6km
	4	Takaanini to Papakura	3.6km
	5	Papakura to Drury	4.5km
	Subtotal		15.5km
Takaanini FTN	6	Alfriston Road	2.3km
	7	Porchester Road (Alfriston to Manuroa Roads)	3.8km
	8	Porchester, Walters, Grove, Clevedon, Railway Roads	5.4km
	9	Chapel, Opaheke, Settlement, and Hunua Roads	2.5km
	Subtotal		14km
Popes Road urbanisation	Takanini School Road to Mill Road		2.2km
Croskery Road urbanisation	Hunua Road to Dominion Road		0.6km
Great South Road (Drury)	Waihoehoe Road to SH1 Drury Interchange		0.3km
Total Length			32.6km

1.3 Report Structure

The body of this report comprises four sections as follows:

- Section 2 outlines the physical form of the preferred option for the Project, and in doing so defines the resultant extent of route protection required. This includes discussion of the optioneering history for the Project, and in particular the extent to which the preferred option has changed as a result of considering the strategic merits of route protection;
- Section 3 outlines the strategic merit/relative urgency of proceeding with route protection for the various components of the Project by location; and
- Section 4 outlines key recommendations stemming from the previous two sections, setting out the recommended form of route protection including the planning mechanism to be deployed, the packaging of the various components, and recommended lapse periods.

2 The route protection requirement

2.1 The optioneering process

The route protection requirement for the Project is derived from the preferred option shown in the Revision A design (Rev A design). The preferred option in turn is derived from a comprehensive optioneering process. This process is covered in the **Appendix C: Options Assessment Report**. It is summarised here briefly to provide context for the route protection strategy, and to give context to how the preferred option has evolved as a result of considering the strategic merits of route protection.

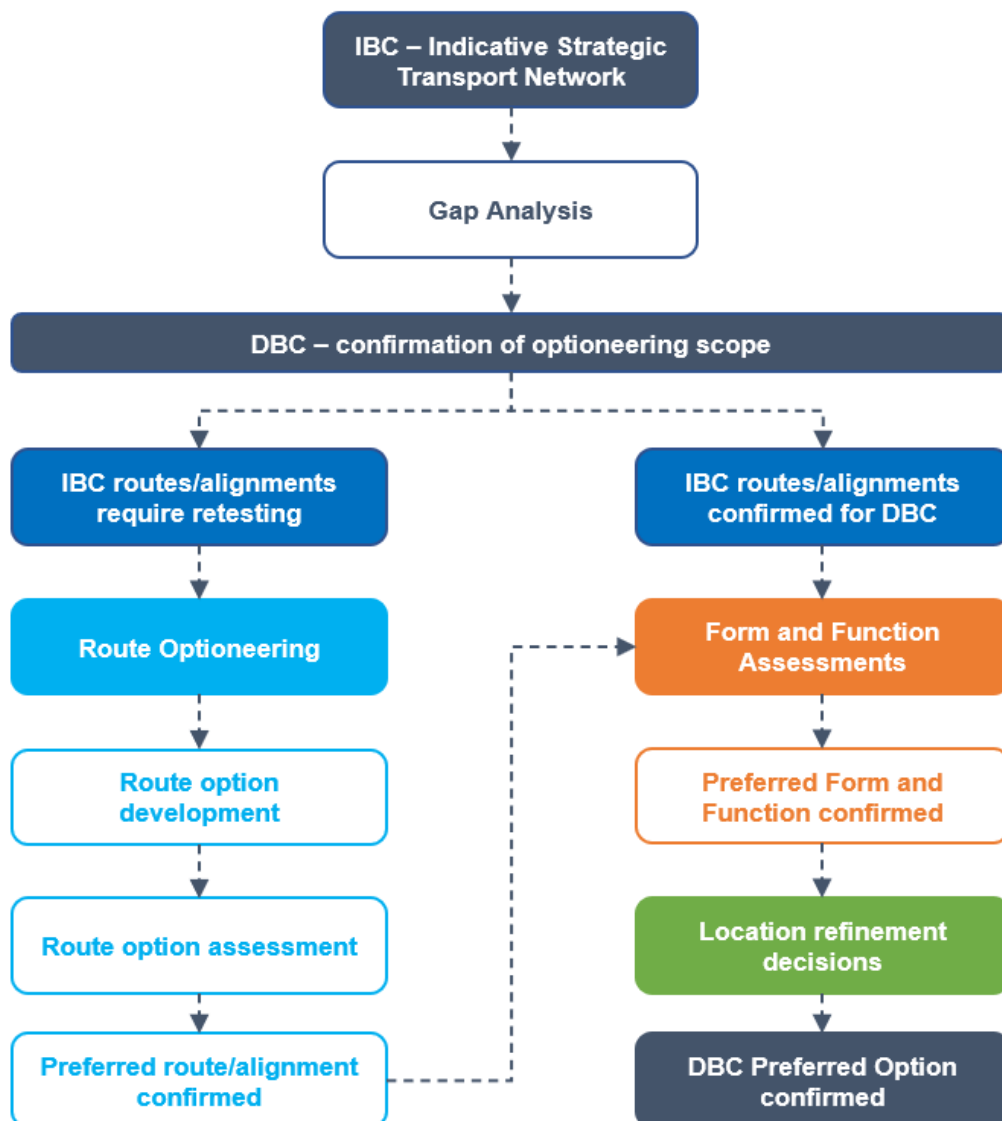


Figure 2-1 – South FTN optioneering process – simplified

The diagram at Figure 2-1 shows the optioneering process followed to reach the preferred option in simplified form. Briefly, the process comprised:

1. Steps to identify the preferred **routes** for the Project (as shown in Figure 1-1). In the case of the Great South Road, Popes Road, Croskery Road corridors, this step was satisfied by

- retesting and validating previous option assessment undertaken during the Indicative Business Case (IBC) phase. In the case of the Takaanini FTN, this included a new MCA process with multiple options for various components comprising the route;
2. Steps to identify the preferred **form and function** for the Project corridors. This is a process of identifying the required physical form for each section of the Project (with a focus on both the midblock, intersections, and ancillary components such as stormwater treatment devices) based on the transport functions (e.g. provision for public transport, active modes, general traffic) needed to meet the investment objectives; and
 3. The application of **route protection principles** and **constraints analysis** to identify preferred locations for corridor widening/realignment, and the resultant project boundaries denoting the route protection requirement.

As shown in Figure 2-1, the form and functional requirements were retested and refined after the 'interim Revision A' (**interim Rev A**) design was issued. This process was initiated after considering the implications of the extensive property requirements associated with this design for the wider viability of the Project. Accordingly, opportunities to reduce the spatial footprint of the preferred option, whilst continuing to achieve the investment objectives, were considered. The resultant changes to the wider route protection philosophy for the Project are set out in further detail at section 2.2 below.

The Revision A design (**Rev A**) which incorporates the changes resulting from the retesting and refinement of the form and functional requirements for the Project is the preferred option which forms the basis of this strategy and its recommendations.

2.2 The value proposition for route protection in the South FTN Project context

2.2.1 The interim Rev A design

The third-party land requirements for the interim Rev A design were derived through applying the Programme-wide approach to corridor design and route protection (process summarised in Figure 2-1 above). In short:

- The routes that define the Project extent were identified through business case optioneering;
- Along each route, a transport form and function assessment was undertaken to identify a suitable corridor form to meet future functional requirements. This process identified suitable midblock cross-sections (see Table 2-1), and compatible intersection forms;
- The space required for these cross-sections and intersection forms in turn informed the space requirements for the whole design, including allowances for earthworks and stormwater treatment devices. In numerous locations, the required space exceeded the currently available road reserve space, thus resulting in third-party land requirements necessitating route protection; and
- The application of widening considerations and constraints analysis informed decisions regarding the location of widening/realignment, and the exact location of project boundaries proposed.

The interim Rev A design was found to require third-party land on over 2,000 properties over the Project extent, a large proportion of which would be full acquisitions. This scale of land requirement (and consequently cost) needs to be justified by compelling, transformational benefits. While the

outcomes provided for by the interim Rev A design delivers on the transport investment objectives set out in the DBC, the scale of the resultant benefits is inherently relatively modest and incremental given that:

- The Project area is already largely urbanised, meaning there is limited benefit attributable to the Project in terms of facilitating growth or shaping urban form;
- The benefits of route protection in this context are outweighed due to the complexity and disruption involved with delivering any intervention within the urban environment;
- FTN services do not seek to maximise patronage/mode shift at all costs, but rather balance patronage imperatives (e.g. speed, directness) with coverage and social service imperatives. Accordingly, the outright transport benefits of an FTN route will in most cases be less than (for example) a rapid transit network (RTN) route;
- Moreover, the transport benefits of individual FTN routes can be marginal given the complementary network role they can play – the Takaanini FTN for example is proposed in large part to provide ‘feeder’ access to rail services at Manurewa, Takaanini, and Papakura Stations; and
- While the reallocation of road space from private vehicles to public transport and active modes has clear benefits, any resultant predicted congestion can manifest as a disbenefit which accordingly contributes further to an unfavourable cost-benefit equation.

Given the above, it is considered that the strategic benefits of the Project are not sufficient to justify the cost and effects associated with the interim Rev A property requirements. Consequently, a bespoke approach was adopted for the Rev A design. The objectives of the redesign were to reduce the costs/spatial footprint of the Project to the extent that route protection can be made a viable proposition. In doing so, the Rev A design has deviated from the Programme-wide route protection approach through localised variations to the form and functional requirements which recognise contextual differences along the corridor extents. The route protection requirements of the Rev A design are described in section 2.3 below, and form the basis of the remainder of this strategy.

Table 2-1 – Interim Rev A cross-sections

Cross-section type / functionality	Generic example
Four-lane FTN arterial cross-section Incorporates one general traffic lane and one bus lane per direction, separated active mode facilities in both directions, and space for berms and a median.	
Two-lane FTN arterial cross-section Incorporates one mixed traffic lane per direction, separated active mode facilities in both directions, and space for berms and a median.	

2.3 The preferred option and resultant route protection requirements

The areas of route protection (third-party land) requirement, and the scale of the requirement associated with the preferred option (Rev A design) is set out in Table 2-3 below, and is mapped in Figure 2-4. Note that the transport form and function of the design is described in more detail in the DBC.

Table 2-2 – Route protection requirements associated with Rev A design

Section	Preferred option – scope / description	Third-party land required?				Scale of requirement (qualitative)
		Midblock	I/S	Bridges	S/W	
1a	Four-lane midblock, existing kerbs/active modes	No	No	No	No	None
1b	Four-lane midblock, separated kerbs/active modes; 4x intersections.	No	No	No	No	None
1c	Three-lane midblock, existing kerbs/active modes; 2x intersections.	No	Yes (x2)	No	No	Moderate
2	Four-lane midblock, revised kerbs/active modes (north of Myers); three-lane midblock, existing kerbs / active modes; 4x intersections.	Yes (north of Myers)	Yes (x2)	No	Yes (x1)	High
3	Four-lane midblock, existing kerbs/active modes; 4x intersections.	No	Yes (x1)	No	No	Low
4	Four-lane midblock (north of Tironui), three-lane midblock (south of Tironui), existing kerbs/active modes; 2x intersections.	No	Yes (x2)	No	No	Low
5	Three-lane midblock, existing/revised kerbs and active modes; 7x intersections.	No	Yes (x2)	Yes (x1)	Yes (x2)	Moderate
6	Four-lane midblock, revised kerbs/active modes; 8x intersections.	Yes (west of Magic)	Yes (x8)	Yes (x1)	Yes (x4)	High
7	Two-lane midblock, revised kerbs/active modes, 4x intersection.	Yes (north of Manuroa)	Yes (x4)	No	Yes (x2)	Moderate
8	Two-lane midblock, revised kerbs/active modes, 9x intersection.	Yes (Walters only)	Yes (x6)	No	No	Moderate
9	Two-lane midblock, revised kerbs/active modes, 5x intersection.	No	Yes (x4)	Yes (x1)	No	Moderate

Section	Preferred option – scope / description	Third-party land required?				Scale of requirement (qualitative)
		Midblock	I/S	Bridges	S/W	
Popes Road	Two-lane midblock, revised kerbs/active modes; 1x intersection.	Yes	No	No	Yes	Moderate
Croskery Road	Two-lane midblock, revised kerbs/active modes; no additional intersections.	No	No	No	No	None
Great South Road (Drury)	Four-lane midblock, revised kerbs/active modes, no additional intersections.	Yes	No	Yes	?	Moderate

The difference in the scale of route protection required by the interim Rev A and Rev A (preferred option) designs is summarised below in Table 2-3.

Table 2-3 – Features requiring route protection in the interim Rev A vs Rev A designs

	Interim Rev A design	Rev A design (preferred option)
Midblock widening required (approx. linear extent)	18.6km	7.5km
Number of intersection upgrades requiring third-party land	52	31
Number of bridge upgrades requiring third-party land	9	4
Number of stormwater treatment wetlands requiring third-party land	37	7

2.4 Implications of potential freight network changes

There is some uncertainty at the time of writing as to the strategic role of Popes Road in the future freight network relating to a range of factors, including:

- Uncertainty as to the implications of a potential Alfriston Plan Change (currently in pre-lodgement discussions) for freight routing from freight generators to the east such as the Brookby Quarry;
- Uncertainty as to the form, function, and sequencing of the proposed Mill Road Corridor; and
- Implications of decisions relating to the Rangī Road Viaduct (see **Appendix C – Options Assessment Report**).

Depending on the resolution of the above matters, the strategic significance of the Popes Road route as part of an east-west route connecting to Great South Road and SH1 via the proposed Manuia Road rail crossing (proposed as part of the TLC Project) may increase. This in turn may require further work to determine any future route protection requirements to provide a freight connection between Popes Road and Manuia Road. Given the above uncertainties, this work has not been undertaken as part of this business case, and so has not been considered in this route protection

strategy. It is recommended that this is considered further in future work when the implications of the above uncertainties become clearer.

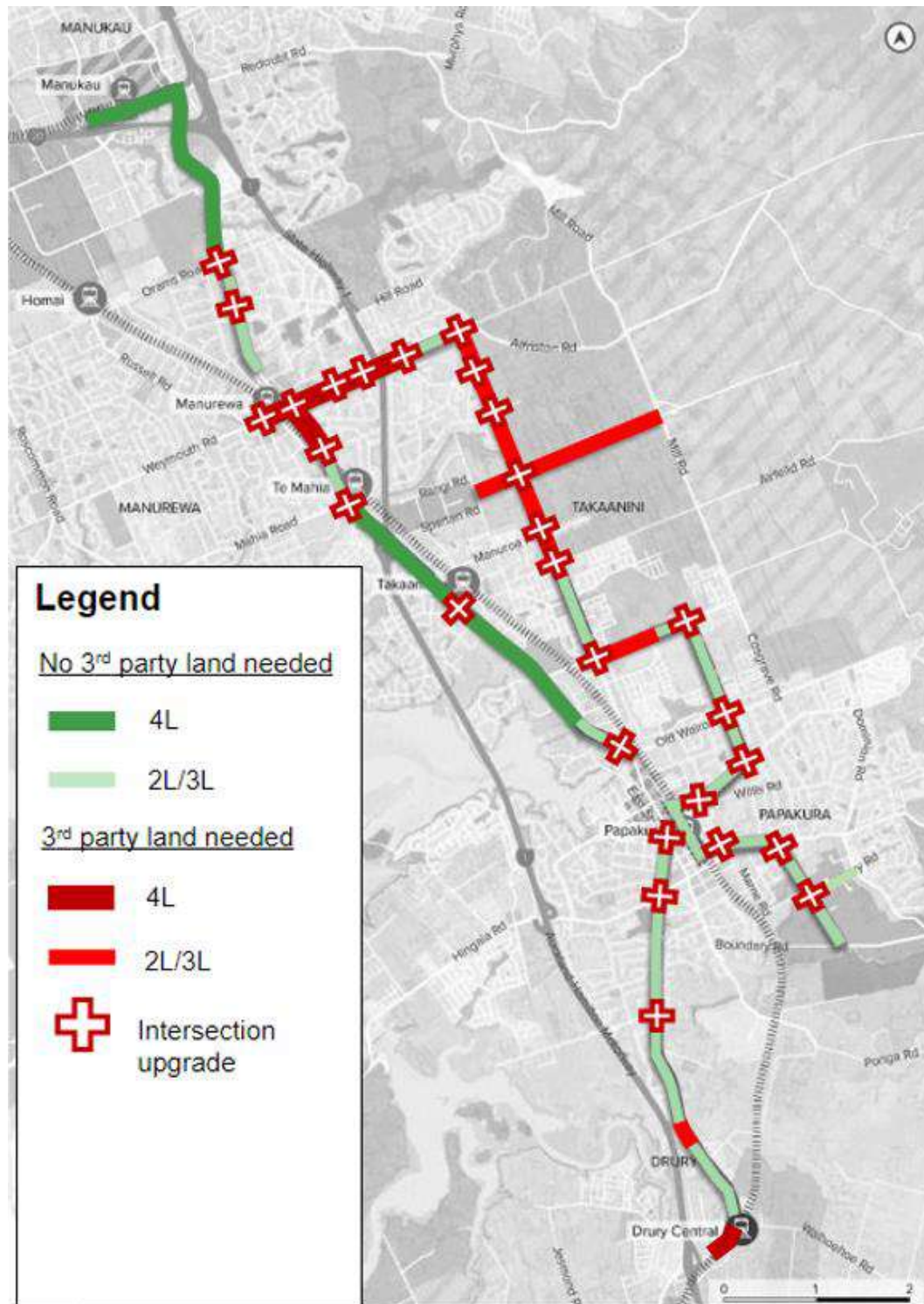


Figure 2-2 – Indicative map of locations where third-party land is still required for the Rev A design

3 The strategic context for route protection

3.1 Determinants of the strategic merit of route protection

The strategic merit of proceeding with route protection for the various sections of the preferred option has been assessed against a range of factors set out in Table 3-1 below. This table has been adapted from the Te Tupu Ngātahi Programme-wide route protection checklist to account for the contextual characteristics of the South FTN Project.

Table 3-1 – Determinants of the strategic merits of route protection for the South FTN

Factor	Explanation
Transport / urban form benefits of route protection	The benefits of route protection from a transport and urban form perspective will vary – the greater these benefits, the stronger the case for route protection (and vice versa).
Scale / cost of route protection	The third-party land requirements associated with the preferred option vary by location – the greater the scale/cost of the requirements relative to the transport/urban form benefits, the weaker the case for route protection (and vice versa).
Route protection benefit / development pressure	- Conventionally, route protection is proposed to ensure that no development precluding/hindering the proposed works can proceed and the South FTN is located in a largely urbanised context. - Notwithstanding the above, the zoning applying to the Project area (particularly under Plan Change 78) allows for a higher intensity of development than exists in many locations. Accordingly there is still an opportunity to ‘get in ahead’ of any further development/redevelopment – particularly where existing development is older/does not represent highest and best use of land.
Interdependent projects	- The South FTN Project interfaces numerous other planned transport projects. Concurrent planning activities can strengthen the case for route protection given the opportunity to integrate plans and future-proof for an integrated network. - Conversely, insufficient information on interfacing projects may present risks/difficulties for making sound route protection decisions.
Likelihood of funding prioritisation / implementation + land use certainty	- While route protection is premised on the likelihood of long-term implementation, the case for route protection is strengthened where the likelihood of earlier funding/implementation is higher. - The case for route protection is similarly strengthened with greater certainty that future land use will continue to necessitate the Project. This is particularly relevant in the case of the Takaanini FUZ where future land use remains uncertain.

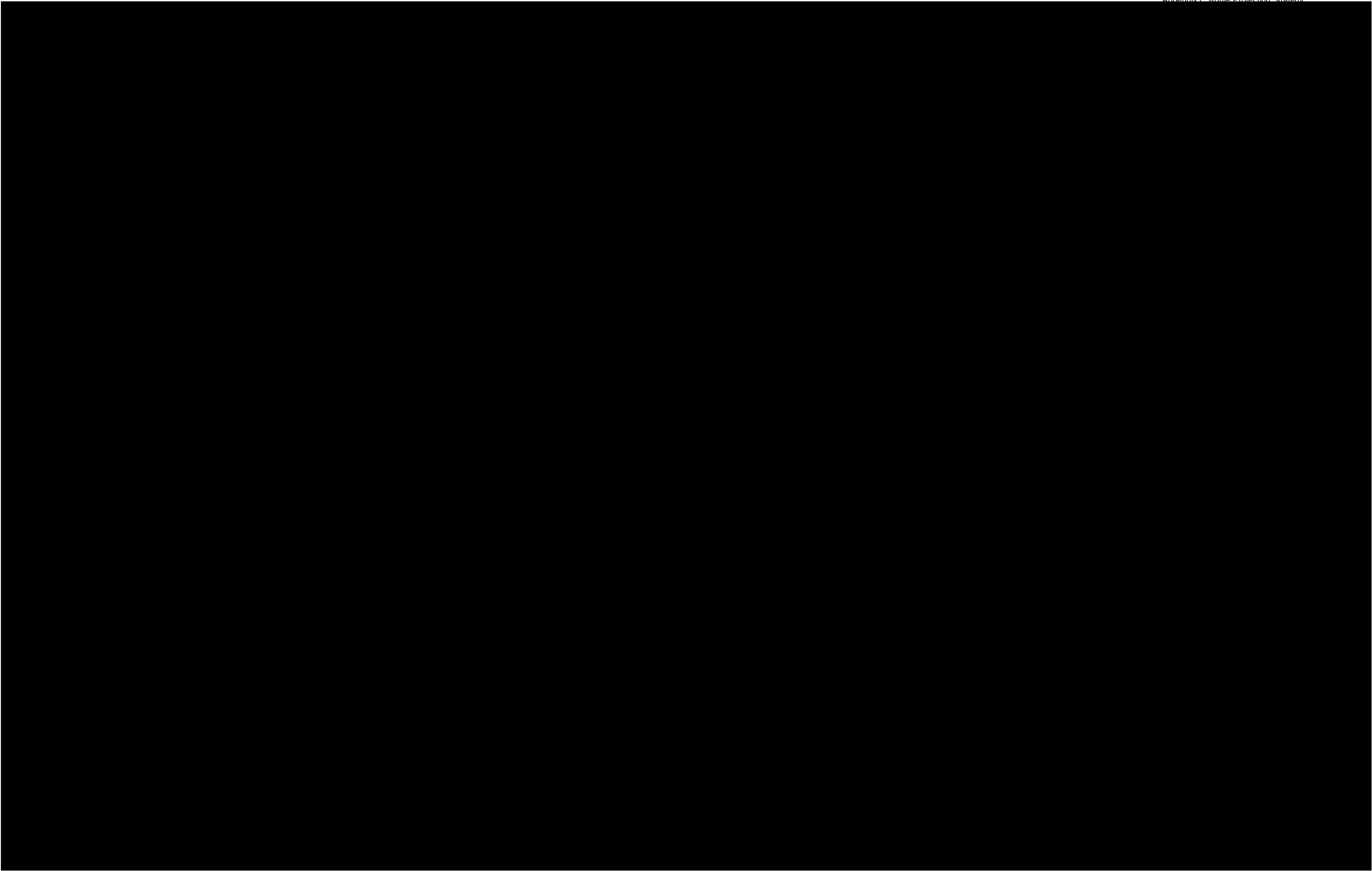
3.2 Route protection – strategic merits assessment

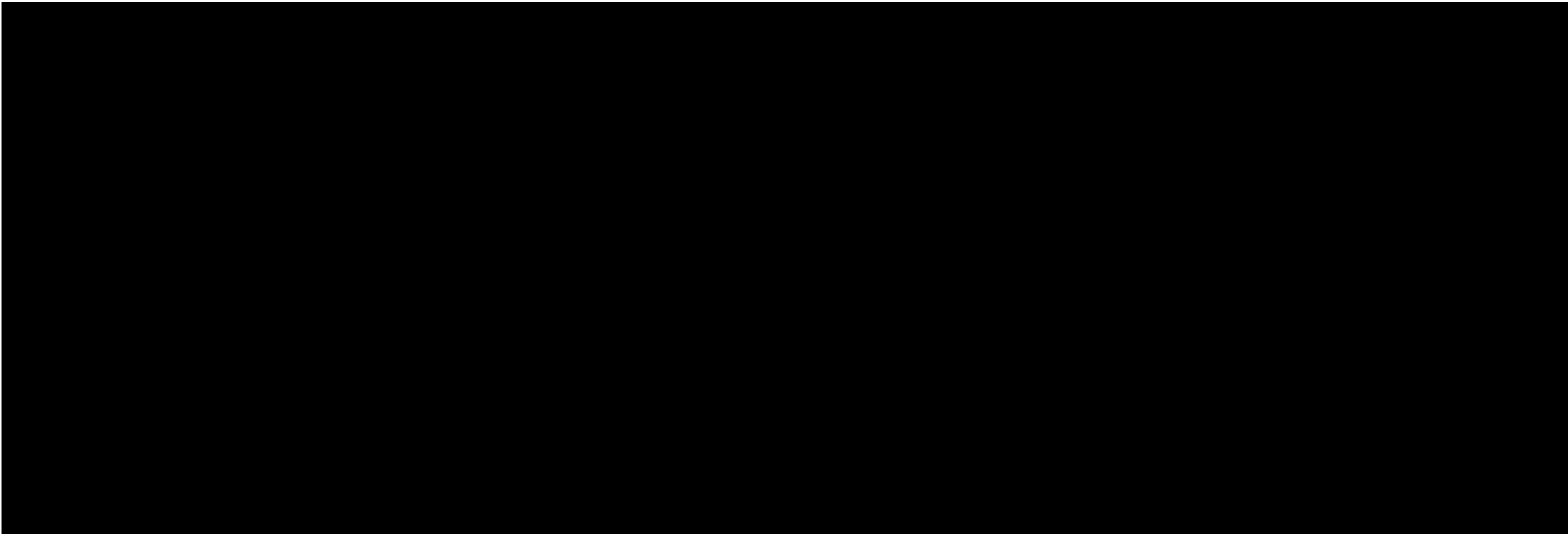
This section applies the criteria defined in Table 3-1 to the South FTN Project on a section-by-section basis to provide the owner organisations with a localised, high-level merits assessment of the case for (or against) route protection.

In short, the high-level recommendations resulting from the assessment are as follows:

- **Sections 2 and 6** present the strongest case for route protection given that they provide the clearest strategic transport benefits which justify their high property requirements;
- **Section 7** and the **Popes Road urbanisation** also present a strong case for route protection, on the proviso that the Takaanini FUZ remains and is not downzoned following Auckland Council's forthcoming Future Development Strategy (FDS). If/when downzoning is confirmed through a post-FDS Plan Change, this recommendation may change. It is noted from AT SME feedback that irrespective of the FDS implications for future urbanisation, the two corridors have different network roles and significance – Popes Road remains seen as a strategically important east-west connection, particularly in the context of the future Mill Road Project;
- **Great South Road (Drury)** presents a strong case for route protection given the clear need to integrate with three concurrently proceeding adjoining projects – i.e. SH1 Drury Interchange upgrade, Drury Central Station, and Waihoehoe Road urbanisation;
- **Sections 3, 4, and 5** are recommended to be route protected given that the property requirements for the Rev A design in these sections are localised and relatively minimal. However, owner appetite for route protecting a series of five intersections and a bridge upgrade over a ~10km distance is unclear;
- **Section 1c** is tentatively recommended to be route protected given the two intersection upgrades maximise the benefits of the northern part of the Great South Road FTN. However, full acquisitions of commercial property would be required at both intersections;
- **Sections 8, and 9** are not recommended to be route protected for the following reasons:
 - Of the eight intersection upgrades that comprise the route protection requirement in these sections, four require full acquisitions of residential or commercial property including multiple new builds.
 - Accordingly, the property impacts are relatively high, while the risk of further buildout is relatively low given buildings are relatively new and dense – in other words the case to designate from a route protection perspective is relatively weak given that the route cannot be 'protected' from development that has already occurred;
 - The transport benefits relative to the property costs/impacts are likely incremental in isolation. The full benefits of this section of the route rely on completing sections to the north, as well as the Ōpaheke North-South Arterial to the south. The latter is provided for by an operative designation with a 20-year lapse period, and traverses areas not planned to be urbanised until the 2040s; and
 - The staging considerations appendix (see **Appendix N** of the DBC) identifies this section as a very long-term requirement – identified as a 2048+ requirement. It would be challenging to justify a 20+ year lapse date in light of the above.
- **Sections 1a, 1b, and Croskery Road** do not require route protection as no third-party land is required.

Figure 3-1 shows these recommendations spatially.





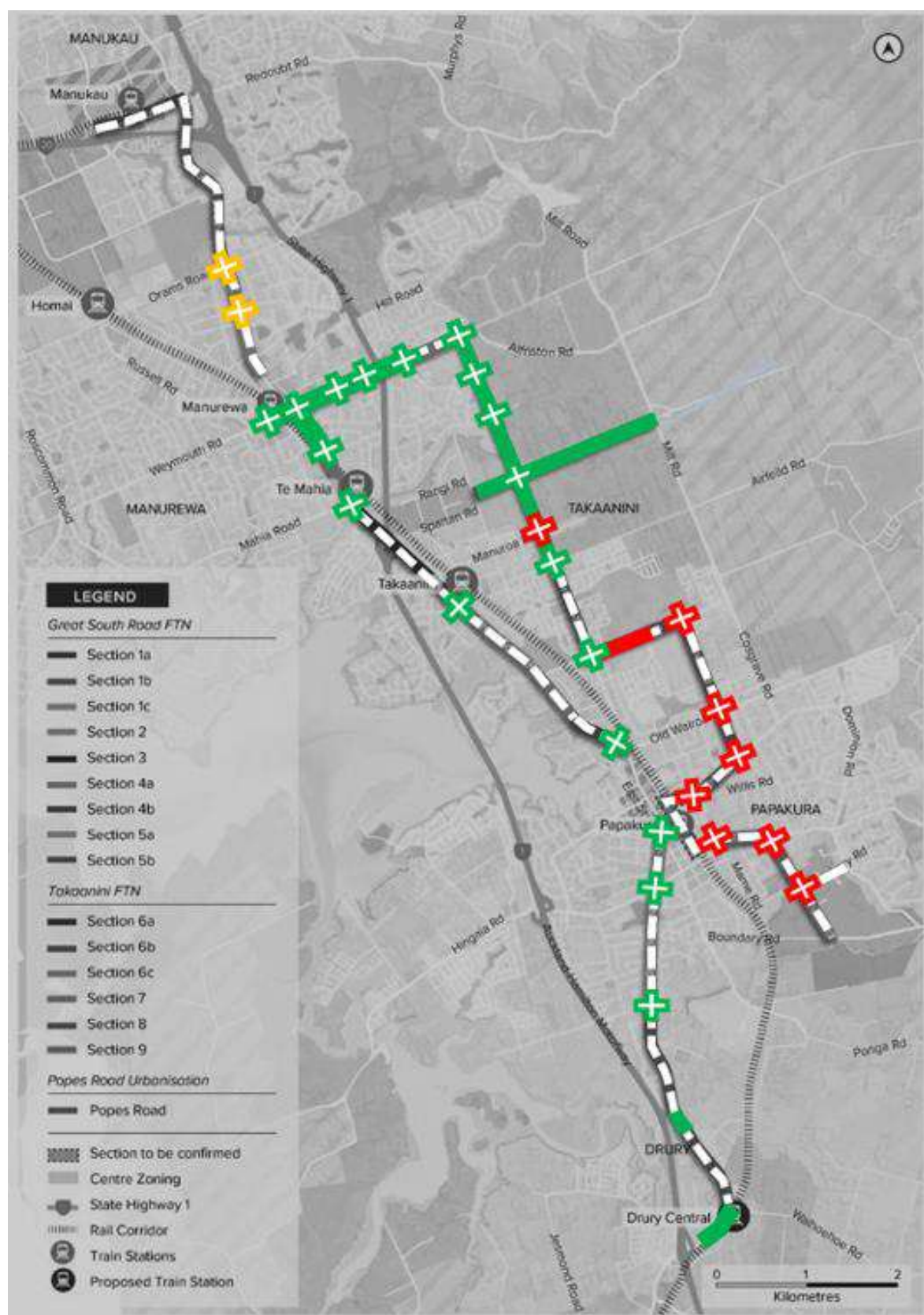


Figure 3-1 – Route protection recommendations – green extent denotes locations where route protection is recommended; orange where it is tentatively recommended; and red where it is not recommended.

4 The recommended form of route protection

4.1 Context

The recommendations set out in this section assume that the owners wish to proceed with route protection for the extent recommended in section 2 (see Figure 3-1). The actual extent of route protection ultimately undertaken may deviate from these recommendations depending on the owners' evaluation of the strategic merits assessment [REDACTED]. Accordingly, sections 3 and 4 should be read in conjunction.

4.2 Options for route protection methods

An assessment of the suitability of various route protection methods for the Project has been undertaken with a view to meeting the Resource Management Act 1991 (RMA) requirement to assess the alternative methods for undertaking the work as set out in section 171(1)(b) of the Act.

The possible mechanisms for achieving route protection for the South FTN Project assessed in this section are:

- Designations;
- Resource consents;
- Plan Changes/Precincts; and
- Landowner/developer agreements.

The comparative strengths, weaknesses of these mechanisms have been assessed and summarised below in Table 4-1.

Table 4-1 – Strengths and weaknesses of route protection mechanism options

Route Protection Mechanism	Summary of strengths and weaknesses within local context
Designation	• This provides longer term protection and maintains design flexibility. Typically, designations provide less detail upfront but as a consequence usually require additional assessment and design be provided prior to any works commencing as a condition of the designation. A secondary process, typically through provision of an Outline Plan of Works (OPW) to the territorial authority, is usually required. • Provides certainty to affected landowners and the ability to request early buy-out from the requiring authority. • Prevents development that would preclude/hinder the proposed works within the designation boundaries. • Additional areas required for construction can be rolled-back after works are completed. • Has interim effect from the time of lodgement. • Requiring authority retains decision making power. • Negates need for land use consents to implement works otherwise authorised by s9(3) of the RMA). • High level of information required to support.

Route Protection Mechanism	Summary of strengths and weaknesses within local context
	- Exposure to contingent liability and ultimately requires requiring authority to purchase land within footprint under the Public Works Act 1981 (PWA) – i.e. designation does not resolve property acquisition aspects of route protection. - Planning ‘blight’.
Resource Consents	- Not a route protection mechanism unless land is already under the ownership of the infrastructure provider – i.e. resource consents do not resolve the property acquisition aspects of route protection. - Not included in a District Plan and not able to utilise the OPW process.
AUP OIP ‘corridor overlay’	As per resource consents, this process would not resolve the property acquisition aspects of route protection.
Third-Party Input to Plan Changes	- Plan Changes do not authorise land acquisition and so individual negotiations would still be required. While provisions within Precincts such as road frontage setbacks and indicative roads can be negotiated as an ‘interim’ route protection measure (as was negotiated for operative Plan Changes 52 and 58), these are unlikely to be practical at a corridor-wide scale given the scale of the Project and the level of urbanisation/land ownership fragmentation. - Aside from the intensification streamlined planning process (i.e. Plan Change 78) there are no substantial new plan changes anticipated in these corridors beyond those already operative.
Developer negotiations / Infrastructure Funding Agreements	As above – while interim route protection measures can be negotiated with developers, ownership within the corridors is fragmented and so developer negotiations would be impractical for the Project at large given the number of parties involved.

4.3 Recommended mechanism

Having considered the relative strengths and weaknesses of the various route protection mechanisms outlined in Table 4-1, **designations** were identified as the preferred route protection method for the Project. Designations were considered the most logical and effective method to protect the route in an evolving environment for the following reasons:

- Provides certainty to all parties including the community, affected land owners, and developers;
- Well recognised and understood tool for route protection which links with future land acquisition processes through the PWA;
- Maximises flexibility for future implementation – provides for progression of detailed design and implementation at the appropriate time;
- Negates the need for additional land use consents to implement works otherwise authorised under section 9(3) of the RMA; and
- Reduces future cost risk in cases where route protection and associated land purchase can be undertaken prior to upzoning and/or development which induces a land value increment.

Balanced against the above benefits are costs. As noted in Table 4-1, these include exposure to contingent liability and costs associated with land purchase, the high level (and therefore application cost) of information required to be lodged with Notices of Requirement (**NoRs**), and the reputational risks associated with planning 'blight'. The process of reducing the footprint of the Project (see section 2.2) has reduced these risks.

4.4 Designation packaging and particulars

4.4.1 Packaging criteria

Having established the preference for designations as the route protection mechanism, this section elaborates on the recommended packaging and particulars of designations for the Project. The following criteria have been considered in determining the optimal packaging and particulars of designations:

- **Project context and transport outcomes** – A shared contextual basis (e.g. similar business case foundations, investment objectives, requiring authority, geographic context and project drivers) allows for efficiencies in base information which will be provided to support the NoR package / bundle;
- **Planning risk** – e.g. notification risk, likelihood of appeal, complexity of planning approval requirements. Splitting projects according to the level of planning risk limits the likelihood that projects are unnecessarily exposed to delays and added planning complexity, noting projects also need to be credible and be able to stand alone if required;
- **Phasing/ timing** – Similar programme timing (including design, assessment, project drivers) provides consistency in the urgency of route protection, the provision of information, key deadlines and delivery targets. The interconnectedness of the corridors also mean that the necessity of each project hangs on the completion of the other;
- **Project complexity** – A similar level of project complexity (such as design complexity and project scale) provides consistency in provision of information requirements and limits the likelihood that projects are unnecessarily exposed to added complexity;
- **Project interdependencies / logic** – Components of the Project with significant interdependencies (e.g. perpendicular corridors meeting at intersections) are generally grouped together; and
- **Ability to disaggregate/split out Project components** – there is benefit in being able to disaggregate the Project where the strategic context changes. The most obvious instance in the context of the South FTN Project is the potential implications of the draft FDS for the need to route protect the Popes and Porchester Road corridors.

4.4.2 Recommendations

The recommendations resulting from applying the above criteria are summarised in Table 4-2 and shown in Figure 4-1 below.

Table 4-2 – Recommended packaging and particulars for South FTN designations

NoR	Extent	Requiring authority	Probable lapse period	Rationale
1	Alfriston Road (section 6) west of Magic Way; and Great South Road (section 2) north of Myers Road.	AT	20 years	- Highest transport benefits / strategic significance. - Interdependencies between GSR and Alfriston where they form an intersection south of Manurewa – logical grouping. - The most significant property requirements are in these sections – elevated risk. - Requiring authority – falls within AT's remit. - Lapse period – 20 years provides for likely implementation timeframe.
2	Porchester Road (section 7) and Popes Road.	AT	20 years	- Largely residential/greenfield surroundings – lower sensitivity than other locations, relatively localised property risks. - Both Porchester and Popes a response to urbanisation of same Takaanini FUZ. In the event that the Takaanini FUZ is downzoned in response to the FDS, this NoR may not need to proceed and could be easily split out from the remainder of the Project and abandoned / surrendered as appropriate. - Notwithstanding the above, the Popes Road urbanisation may still have a future interaction with the Mill Road corridor irrespective of the outcome of the Takaanini FUZ downzoning. Interdependencies between Porchester and Alfriston where they form an intersection – logical grouping. - Requiring authority – falls within AT's remit. - Lapse period – 20 years provides for likely implementation timeframe, recognising very long-term/uncertain nature of Takaanini FUZ.
3	Great South Road intersections and Otūwairoa / Slippery Creek Bridge (sections 1c, 3, 4, 5).	AT	20 years	- Relatively localised/small-scale property requirements. - Intersections in their totality deliver cumulative improvements to the GSR route – equally, there is potential to implement them in stages (meaning implementing one gives effect to designation for all). - Requiring authority – falls within AT's remit. - Lapse period – 20 years provides for likely implementation timeframe.

NoR	Extent	Requiring authority	Probable lapse period	Rationale
4	Great South Road (Drury)	AT	20 years	A standalone designation recognises that there are different drivers for this section of GSR to the remainder – namely the opportunity to integrate with three adjoining/concurrently planned NZUP projects – Drury Central Station, SH1 Drury Interchange, and Waihoehoe Road urbanisation.

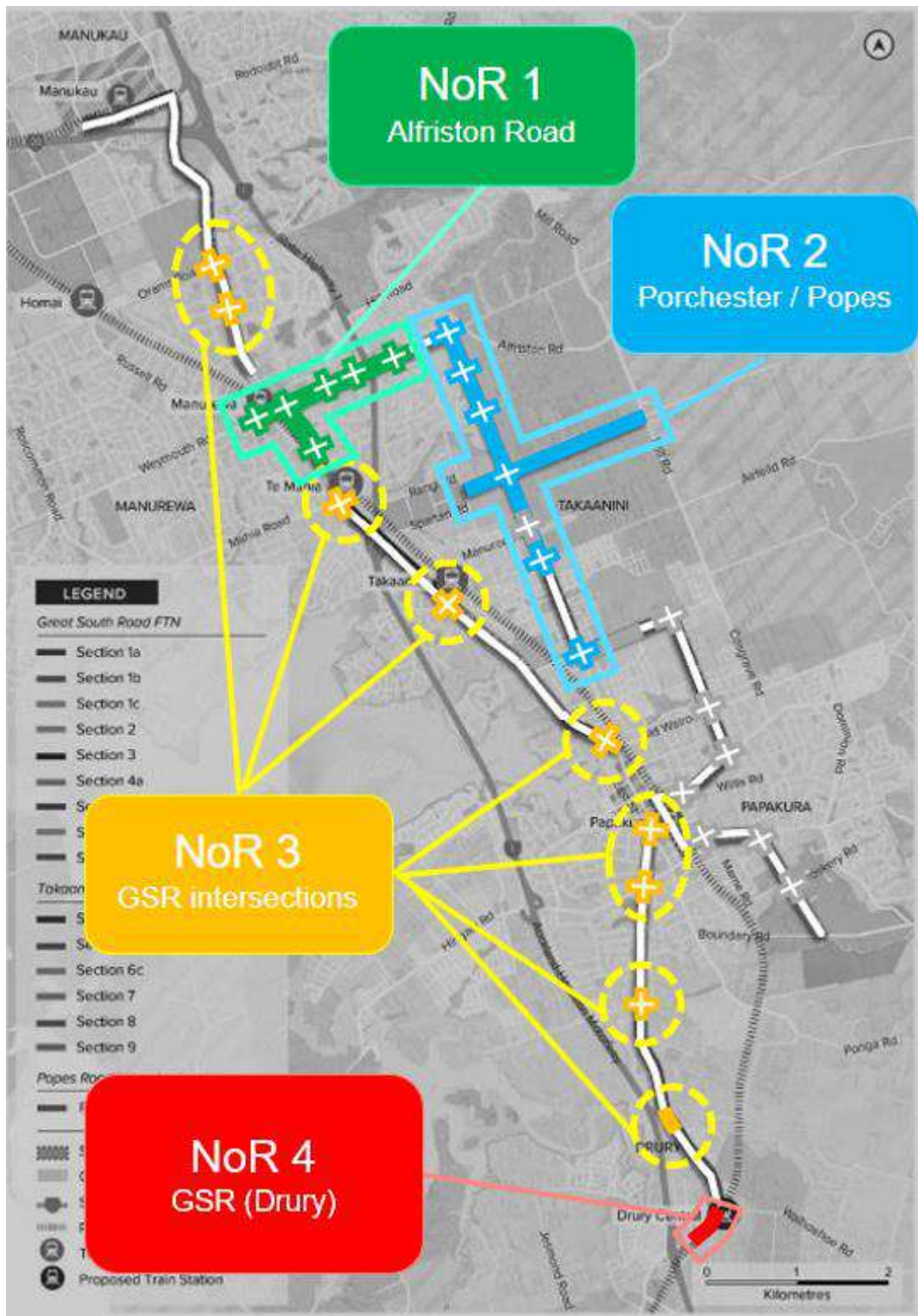


Figure 4-1 – Route protection packaging recommendations

South FTN and Key Connections

Appendix M - Risk register

November 2023

Version 1.1

Document Status

Responsibility	Name
Author	
Reviewer	
Approver	

Revision Status

Version	Date	Reason for Issue
0.1	07/06/23	Issue for Te Tupu Ngātahi Review and Verification
1.0	23/06/23	Issue for IQA Review
1.1	9/11/23	Final

Contents

1	Introduction.....	1
1.1	Risk management process	1
1.2	Identification.....	1
1.3	Analysis	1
1.4	Evaluation	3
1.5	Treatment.....	3
2	Programme-wide risks.....	3
3	Project specific risks	7

Tables

Table 1-1 : Likelihood risk or opportunity rating.....	1
Table 1-2 : Semi-quantitative threat criteria.....	2
Table 1-3: Threat rating matrix	3
Table 1-4: Opportunity rating matrix	3
Table 3-1: Project specific risks	7

1 Introduction

1.1 Risk management process

Risk management has been undertaken throughout the development of this South FTN and Key Connections Detailed Business Case (DBC) in accordance with the Te Tupu Ngātahi Supporting Growth Alliance's (SGA's) 'Risk and Opportunity Management Plan' which comprises of the following stages:

- Risk (threat and opportunity) identification – relative to context.
- Risk analysis – likelihood and consequences based upon current control measures.
- Risk evaluation – scoring of the risk to determine it's relative magnitude.
- Risk treatment – to eliminate or reduce the consequences or likelihood of the risk occurring.

The remainder of Section 1 of this Risk Register outlines the process that has been followed in each of these stages. Section 2 then summarises Programme-wide risks and Section 3 summarises Project-specific risks.

1.2 Identification

Threat and opportunity identification has been a continuing process throughout the development of the DBC and has included the following:

- Initial risk workshops to identify threat and opportunities at the start of the DBC.
- Regular identification (and update) at the project team meetings based upon the DBC's development and subsequent feedback from the team and partners/stakeholders.
- Specific risk workshops throughout the development of the design.
- Ad-hoc emails/conversations with team members.

Identified risks were captured within the Takaanini DBC SharePoint risk register, Risk Owner assigned and subsequent analysis undertaken (as detailed below).

1.3 Analysis

The likelihood of occurrence and consequence of the risks have been analysed using the criteria identified in Table 1-1 and Table 1-2 below based upon the current control measures.

Table 1-1 : Likelihood risk or opportunity rating

Likelihood Risk or Opportunity Rating		Likelihood of Risk or Opportunity Occurring	%
5	HIGHLY LIKELY	May occur in next 12 Months	> 85
4	LIKELY	May occur in the next >1 to 2 years	55 – 85
3	POSSIBLE	May occur in next >2 to 6 years	30 – 55
2	UNLIKELY	May occur once in >6 to 10 years	5 – 30
1	RARE	May occur once in 10 years	< 5

Table 1-2 : Semi-quantitative threat criteria

Semi-Quantitative Threat Criteria							
Rating Scale	Reputation			Performance			
	Stakeholders	Public / Media	Legal / Compliance	Project Delivery	Project Cost	Health & Safety	Environmental
Severe	Disruption to stakeholder relationship slowing progression of nationally strategic activity, and/or Loss of route availability of a national strategic high-volume highway	Sustained national and/or international media coverage AT/Waka Kotahi NZ Transport Agency and the PAB do not envisage any exposure in reputational risks at this level	High profile prosecution(s) with potential for custodial sentence	Programme slippage resulting in late delivery by more than 180 days	Negative financial impact of more than \$25M	Loss of life, permanent disability or injury, or multiple serious injuries	Permanent pollution damage or other environmental damage
Major	Disruption to stakeholder relationship slowing progression of regionally strategic activity, and/or Loss of route availability of a national strategic highway	Sustained media coverage (weeks) Possible Ministerial inquiry leading to loss of Ministerial confidence/formal enquiry by OAG or statutory agency Widespread and significant community concern and/or high-profile community concerns raised	Individual prosecution Potential prosecution with maximum fine / imprisonment High profile legal challenge or prosecution with heavy fines	Programme slippage resulting in late delivery by between 90 and 180 days	Negative financial impact between \$10M to \$25M	Serious injury (injuries) requiring specialist medical treatment or lost time greater than three weeks	Significant and widespread pollution or other environmental damage, with long term effects
Moderate	Disruption to stakeholder relationship slowing progression of regional activity, and/or Loss of route availability of a regional strategic highway	Short term (days) media coverage Parliamentary/Ministerial questions or 3rd party investigation Community complaints	Breach with legal rebuke / abatement notice/restrictions Some legal constraints imposed, minimal fines	Programme slippage resulting in late delivery by between 30 and 90 days	Negative financial impact between \$2M to \$10M	Injury requiring medical treatment or lost time of one day to three weeks	Pollution or other environmental damage at a localised level, with medium term effects
Minor	Disruption to stakeholder relationship slowing progression of site-specific activity, and/or Loss of route availability of a regional connector highway	Local media coverage for 1-5 days Official information request. Negative feedback from Minister Reputation within industry is damaged Some community complaints Marginal impact on stakeholder confidence.	Breach with letter from authority requesting action	Programme slippage resulting in late delivery by between 7 and 30 days	Negative financial impact between \$0.5M to \$2M	Injury requiring short term medical treatment and workplace absence less than one day	Minimum pollution or other environmental damage. Short term effects only
Insignificant	Disruption to stakeholder relationship, and/or Loss of route availability of a regional distributor highway	Local media coverage for 1-day Reputation intact Internal knowledge only Minimal impact on stakeholder confidence	Breach managed at a regional level	Programme slippage resulting in late delivery by less than 7 days	Negative financial impact of less than \$0.5M	Injury requiring short-term first-aid care and no absence from the workplace	Small scale pollution or other environmental damage is localised with no resultant effects. Contained locally

1.4 Evaluation

Based upon the likelihood and consequence outcomes from the risk analysis, the risks have been evaluated using Table 1-3 and Table 1-4 to identify their Class from A to E. The significance of a Class A threat is 'very high' to Class E which is considered 'very low'. Likewise, for opportunities.

Table 1-3: Threat rating matrix

RISK RATINGS LIKELIHOOD x CONSEQUENCE						
Likelihood	5 Highly Likely (May occur this year) >85%	Class B (5)	Class B (10)	Class A (15)	Class A (20)	Class A (25)
	4 Likely (May occur once in the next 2 years) 55-85%	Class C (4)	Class C (8)	Class B (12)	Class A (16)	Class A (20)
	3 Possible (May occur once in the next 2-5 years) 30-55%	Class D (3)	Class C (6)	Class C (9)	Class B (12)	Class A (15)
	2 Unlikely (May occur once in 5-20 years) 5-30%	Class D (2)	Class D (4)	Class D (6)	Class C (8)	Class C (10)
	1 Rare (May occur once in 20 years) <5%	Class E (1)	Class E (2)	Class E (3)	Class D (4)	Class C (5)
		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Severe
		Consequence				

Table 1-4: Opportunity rating matrix

Likelihood	5 Highly Likely (May occur this year) >85%	Critical Opportunity (25)	Critical Opportunity (20)	High Opportunity (15)	Medium Opportunity (10)	Low Opportunity (5)
	4 Likely (May occur once in the next 2 years) 55-85%	Critical Opportunity (20)	Critical Opportunity (16)	High Opportunity (12)	Medium Opportunity (8)	Low Opportunity (4)
	3 Possible (May occur once in the next 2-5 years) 30-55%	Critical Opportunity (15)	High Opportunity (12)	Medium Opportunity (9)	Medium Opportunity (6)	Low Opportunity (3)
	2 Unlikely (May occur once in 5-20 years) 5-30%	High Opportunity (10)	Medium Opportunity (8)	Medium Opportunity (6)	Low Opportunity (4)	Low Opportunity (2)
	1 Rare (May occur once in 20 years) <5%	High Opportunity (5)	Low Opportunity (4)	Low Opportunity (3)	Low Opportunity (2)	Low Opportunity (1)
		5 Severe	4 Major	3 Moderate	2 Minor	1 Insignificant
		Consequence				

1.5 Treatment

Risk Owners were responsible for identifying and then undertaking 'planned risk treatment' actions appropriate to the risk score identified during the evaluation. These actions were reviewed regularly in project team meetings to capture updates and identify further treatment actions where appropriate. Risks were also closed once further investigation into the risk found that the initial threat or opportunity was no longer a consideration.

South FTN and Key Connections

Appendix N – Staging Considerations

October 2023

Version 1.1

Document Status

Responsibility	Name
Author	██████████
Reviewer	██████████████████
Approver	██████████

Revision Status

Version	Date	Reason for Issue
0.1	24.05.2023	Discipline Lead Review
0.2	08.06.2023	Interim issues for SME review
1.0	23.06.2023	Issue for IQA
1.1	31.10.2023	FINAL

Table of Contents

1	Introduction.....	5
1.1	Purpose.....	5
1.2	Background	5
1.3	Scope of Projects	6
2	Land Use and Transport Inputs	8
2.1	FULSS and Transport Assumptions	8
2.2	Auckland Future Development Strategy	11
2.3	Modelled Land Use Forecasts	12
2.4	Other Key South Projects	16
2.4.1	New Zealand Upgrade Programme (NZUP).....	17
3	Transport Staging Considerations	19
3.1	Outcomes and Key Principles	19
3.2	Proposed Staging	20
3.3	Interdependencies with other projects.....	30
3.4	What happens if the timing of land use or other key projects changes?	35
3.5	Priority opportunities	36
4	Summary	37

Acronym/Term	Description
ADT	Average Daily Traffic
AFC	Auckland Forecasting Centre
AT	Auckland Transport
ATAP	Auckland Transport Alignment Plan
ASH	Alternative State Highway
AUPOIP	Auckland Unitary Plan - Operative in Part
Council	Auckland Council
DBC	Detailed Business Case
Development ready	Bulk infrastructure is in place to service development, including three waters, transport, and social infrastructure
FDS	Future Development Strategy
FTN	Frequent Transit Network
FULSS	Future Urban Land Supply Strategy
FUZ	Future Urban Zone
GPS 2021	Draft Government Policy Statement on Land Transport 2021/22 – 2030/31
GSR	Great South Road
ha	hectare
IBC	Indicative Business Case
ITA	Integrated Transport Assessment
MDRS	Medium Density Residential Standards
MSM	Auckland Regional Transport Model (Macro Strategic Model)
NIMT	North Island Main Trunk Line
NoR	Notice of Requirement
NPS-UD	National Policy Statement for Urban Development 2020
NZUP	New Zealand Upgrade Programme
Partners	Collectively refers to Auckland Transport, Waka Kotahi NZ Transport Agency, manawhenua, Auckland Council and KiwiRail
PT	Public transport
RASF	Roads and Streets Framework
RLTP	Regional Land Transport Plan

Acronym/Term	Description
RTN	Rapid Transit Network
SGA	Supporting Growth Alliance (referred to as Te Tupu Ngātahi)
SH1	State Highway 1
SHA	Special Housing Area
Te Tupu Ngātahi	Supporting Growth Alliance
TFUG	Transport for Future Urban Growth
The Council	Auckland Council
The Programme	The Supporting Growth Programme
TOD	Transit Oriented Development
UDF	Te Tupu Ngātahi Urban Design Framework
Waka Kotahi	Waka Kotahi New Zealand Transport Agency

1 Introduction

1.1 Purpose

This report has been prepared to support the South Frequent Transit Network (**FTN**) Detailed Business Case (**DBC**) and sets out considerations relating to the potential implementation of the transport projects identified in the South FTN DBC. This report will inform the development of the Financial Case for the Takaanini FTN DBC.

The implementation of the FTN projects is largely within the existing urban area in the South. However, there are parts of the FTN projects which are adjacent to the Future Urban Zone (**FUZ**) and hence are dependent to an extent on the development of FUZ land and availability of funding to deliver the transport infrastructure. Critically, this assessment looks to identify interdependencies between transport projects and land use as opposed to providing an accurate implementation timeframe.

1.2 Background

The IBC and DBC have identified the need for significant transport infrastructure to support the next 30+ years of growth in South Auckland and wider regional growth. The scale of growth is significant, and projects will have extended delivery timeframes staged over three decades.

The South FTN corridors are largely situated in the existing urban environment, hence the project objectives do not solely aim to solve future growth issues but also consist of providing better PT connections for existing communities.

While the considerations relating to the implementation of the South FTN DBC transport projects will be driven by assumptions around the land use roll-out and other transport projects, there are various other factors that may impact the staging of the South FTN DBC projects. Specific triggers include legislation surrounding greenhouse gas emission reduction and adaptation to climate change, shift in investment priorities, cash-flow availability and protection and restoration of the natural environment. Due to the strategic nature of the South public transport network, triggers might range from local to regional.

The expected timeframes for the future land use roll-out in the Takaanini and the Ōpaheke-Drury Future Urban Zones have initially been guided by Auckland Council's Future Urban Land Supply Strategy(**FULSS**), released in July 2017.

Coupled with this land use context are the current expectations around the potential timing for key strategic transport projects in the South, which will have a transformational impact on the transport choices for the future communities in the Southern area.

It should be noted that at the time of preparing this document, Auckland Council are developing an updated Future Development Strategy (**FDS**) – intended to supersede the FULSS – which is currently under consultation. While this document is yet to be approved, it has been reviewed internally and identified that any amendments to development timing/ removal of Takaanini and the Ōpaheke-Drury FUZ may have an impact on parts of the FTNs. Sections of the FTN that are dependent on the outcomes of the FDS are at risk. However, the South FTN DBC has noted the uncertainty of these

future urban areas from the onset of the DBC stage and has taken this into consideration through the optioneering phase as well as the Notice of Requirement (**NoR**) phase with the packaging of the FTNs.

The above assumptions have been important considerations when developing the transport modelling used in the assessment process. Assumptions in relation to other key strategic transport projects have been made to inform the South FTN DBC transport modelling. These are outlined in **Section 2.4**.

The staging of the South FTN network aims to consider affordable implementation of the transport projects, whilst still supporting the Southern growth area, resolving existing poor PT connectivity, and enabling transformational change and travel choice.

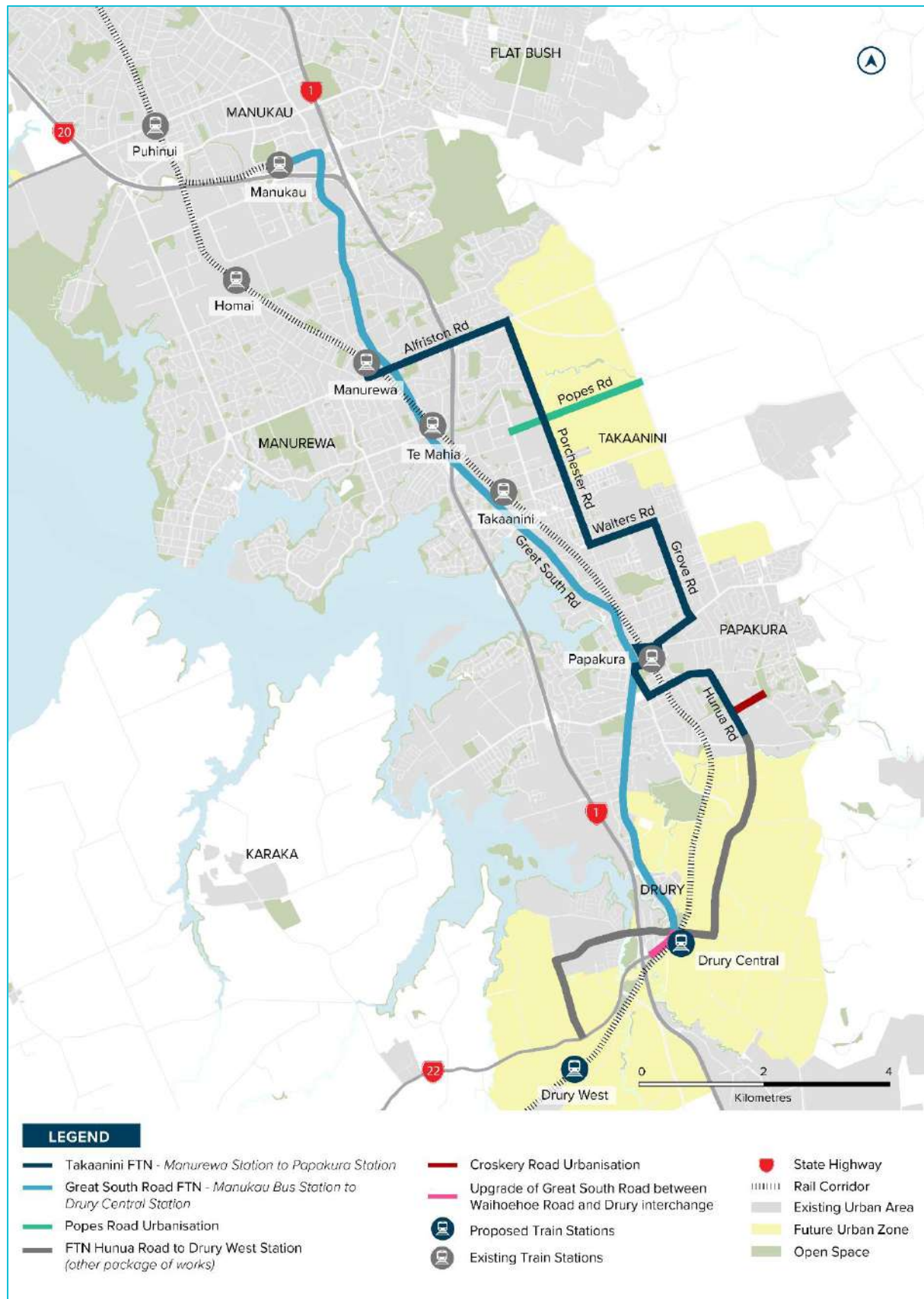
1.3 Scope of Projects

The corridors considered in the South FTN DBC are shown in Figure 1-1 below. The corridors included in the DBC are:

- Great South Road FTN between Drury Central Station and Manukau city centre
- Takaanini FTN between Drury West Station and Manurewa Station
- Upgrade of Great South Road between Waihoehoe Road and Drury interchange
- Urbanisation of Popes Road
- Urbanisation of Croskery Road

The staging of the above projects is indicative, and these are not definitive or committed projects. The ultimate staging will depend on future processes, including land use planning, funding options and national and regional prioritisation processes such as the RLTP and ATAP.

Figure 1-1: South FTN DBC corridors



2 Land Use and Transport Inputs

2.1 FULSS and Transport Assumptions

The FULSS was prepared by Council in 2017 and its primary purpose is to identify the sequencing and timing of future urban land for development readiness over 30 years. The FULSS for the southern growth area is illustrated on Figure 2-1. Table 2-1 provides the growth summary indicated in the FULSS.

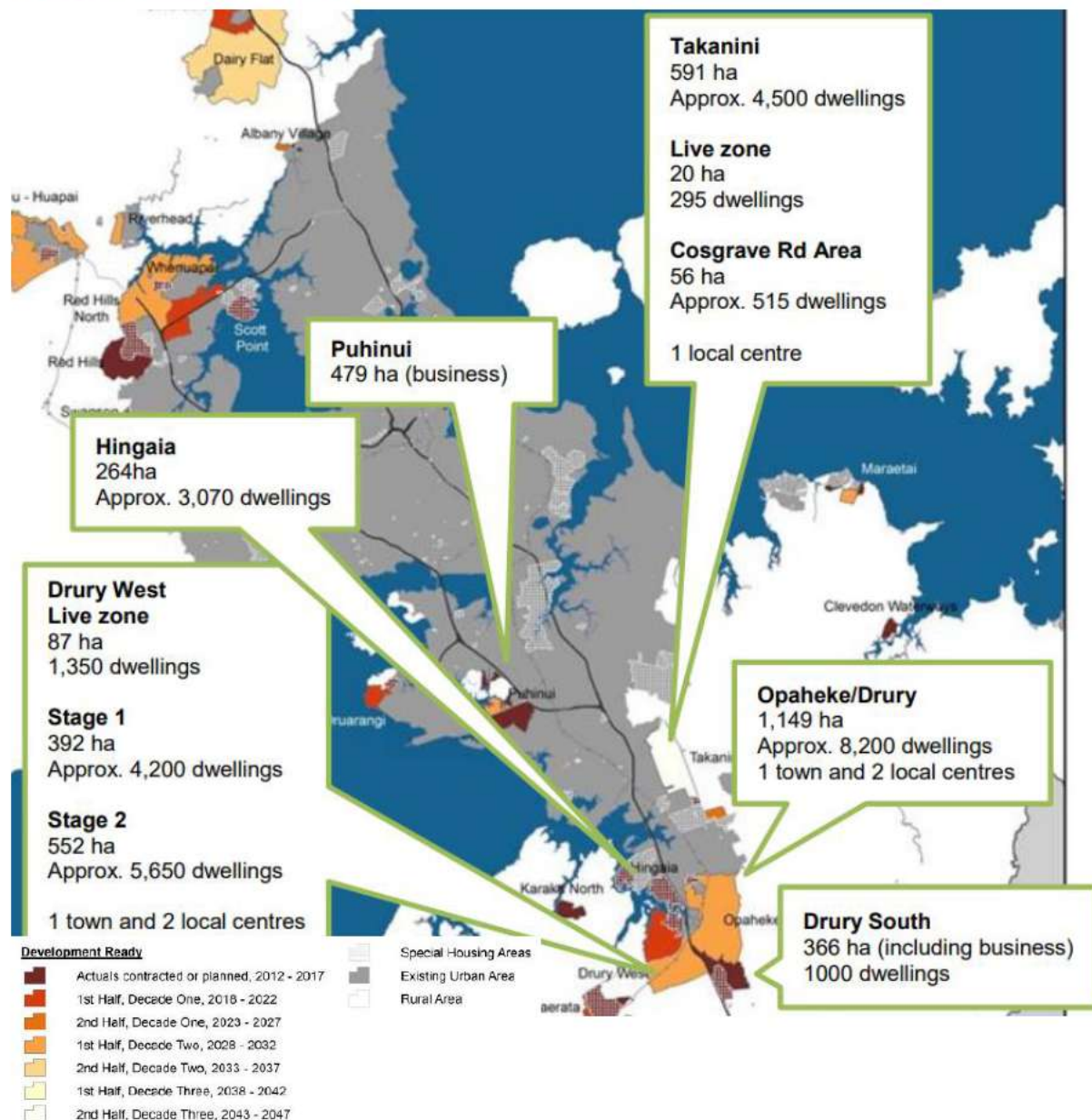
Within the greater Auckland area, growth is staged across 30+ years, with the Takaanini FUZ staged to be development ready in the second half of decade three (2043 - 2047). The FULSS has identified this area as having 'significant flooding and geotech constraints' and requires further technical investigations. This itself presents an uncertainty around whether the area will be developed as planned especially given its long-term horizon. It is possible that land use around the area could change to accommodate the projected growth instead. As such, these uncertainties have been considered during the optioneering process to develop an option that would provide the greatest outcome regardless of whether the uncertainties are realised in the future.

The Ōpaheke-Drury FUZ is staged to be development ready in the first half of decade two (2028 - 2032). FULSS has identified this area has significant hazard constraints due to the floodplain and requires complex inter-catchment floodplain interactions for development to occur. Although the Takaanini FTN corridor does not lie in the Ōpaheke-Drury FUZ, the FTN route does connect with the Drury FTN corridor which connects via Hunua Road in the south, to the proposed Drury West Station.

Given the long-term nature of this DBC, these uncertainties could change the forecast and predictions in growth and how it occurs. Hence, these uncertainties have been considered and noted as a risk through the DBC route optioneering process.

In addition, sensitivity testing to understand the potential impacts of the uncertainties were also undertaken. These include understanding whether the option will remain valid if the Takaanini FUZ and Ōpaheke-Drury FUZ does not eventuate as per the FULSS.

Figure 2-1: FULSS for South region



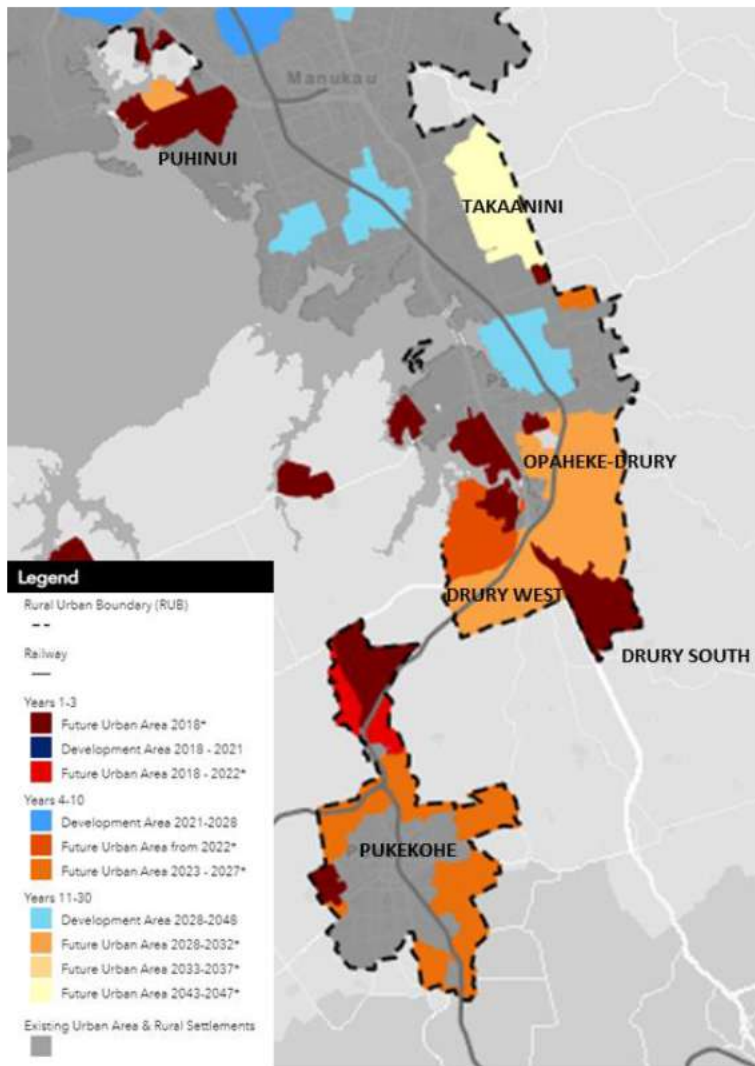


Table 2-1: Summary of South Planned Growth and Timing

Area	Growth Summary	Proposed Timing ¹ – Development Ready (Large Future Urban Areas)
Puhinui	480 hectares (business)	2012 – 2017
Hingaia	260 hectares Approx. 3,070 dwellings	2012 – 2017
Drury South	370 hectares (including business) 1,000 dwellings	2012 – 2017
Drury West (Stage 1)	Approx. 390 hectares 4,200 dwellings	2018 – 2022
Cosgrave Rd, Takaanini	Approx. 60 hectares 500 dwellings	2023 – 2027

¹ Based on Auckland Council Future Urban Land Supply Strategy

Area	Growth Summary	Proposed Timing ¹ – Development Ready (Large Future Urban Areas)
	1 local centre	
Pukekohe	Approx. 1,100 hectares 7,200 dwellings	2023 – 2027
Ōpaheke-Drury	7,900 dwellings 1 town and 2 local centres	2028 – 2032
Drury West (Stage 2)	Approx. 550 hectares 5,650 dwellings 1 town and 2 local centres	2028 – 2032
Takaanini	Approx. 590 hectares 4,500 dwellings	2043 – 2047

2.2 Auckland Future Development Strategy

Auckland Council is developing an updated Future Development Strategy which is currently under consultation. This document will supersede the existing Auckland Plan 2050 Development Strategy (2018) and the FULSS (2017). This document reviews Auckland's Development Strategy in relation to zoning and expected timeframes for development, resulting in associated amendments and impacts on programme.

There are five key strategic principles being considered as part of the strategy:

- Support greenhouse gas reduction
- Adapt to the impacts of climate change
- Make efficient and equitable infrastructure investments
- Protect and restore the natural environment
- Ensure sufficient capacity for growth in the right place and at the right time

The scope of development and associated programme have been reviewed and changed in accordance with one of the below:

- **Removal:** rezoning of areas to an appropriate non-urban zoning
- **Further investigation:** Areas with moderate exposure to hazards, infrastructure capacity issues, unlikely to support VKT reduction. Further analysis is needed to confirm the appropriate land use response
- **Delay:** to timing of anticipated development (compared to the previous Future Urban Land Supply Strategy)

This document has been reviewed internally in relation to the South FTN DBC package and identified that any amendments to development timing/ removal of Takaanini and the Ōpaheke-Drury FUZ may have an impact on parts of the FTNs. Particular sections of the FTN that are dependent on the outcomes of the FDS are at risk. However, the South FTN DBC has noted the uncertainty of these future urban areas from the onset of the DBC stage and has taken this into consideration through the

optioneering phase as well as the Notice of Requirement (**NoR**) phase with the packaging of the FTNs.

2.3 Modelled Land Use Forecasts

The transport modelling for the South FTN DBC has been informed by the I11 version 6 land use forecasts agreed with Auckland Council. These have informed the transport modelling using the regional transport model (the Macro Strategic Model (MSM)), as well as the Strategic Active Modes Model (SAMM) used for the assessment of the active modes demands. The outputs from the MSM have then provided inputs to the SATURN based traffic models, which have more specifically considered the traffic effects.

A key input to the models is regional land use forecasts, which influence the future quantum and location of travel. Regionally agreed land use forecasts are prepared by Auckland Council via the Auckland Forecasting Centre (**AFC**), with the most recent available forecasts (at the time of this assessment), referred to as Scenario I11.6. Those forecasts are based on regional population forecasts from Statistics NZ, with spatial allocation to individual spatial areas based on the AFC's land use model and known detail around specific land use planning processes.

Table 2-2 and Table 2-3 summarise the assumed residential population and employment forecasts in the areas within an 800m catchment of the FTN corridors from I11v6. This includes a 2048+ forecast year, which represents the 'full' build-out of the growth areas sometime beyond 2048, depending on the longer-term rate of growth. The tables also show the population and employment forecasts across the interim years as a percentage of the full build-out expected. The percentages indicate that much of the development in the FTN corridor catchment has occurred in 2018.

Table 2-2: I11v6 population forecasts in 800m catchment of the FTN corridors

Population	2018	2028	2038	2048	2048+
800m catchment around FTN corridors	117,300	143,100	172,200	195,200	224,800
Percentage of Full Build-out					
% of full build-out in Southern FTN area	52%	64%	77%	87%	100%

Table 2-3: I11v6 employment forecasts in 800m catchment of the FTN corridors

Employment	2018	2028	2038	2048	2048+
800m catchment around FTN corridors	40,600	48,800	58,200	65,000	72,200
Percentage of Full Build-out					
% of full build-out in Southern FTN area	56%	68%	81%	90%	100%

Table 2-4 and Table 2-5 summarise the assumed residential population and employment forecasts for the southern growth areas from I11v6. This includes a 2048+ forecast year, which represents the 'full'

build-out of the growth areas sometime beyond 2048, depending on the longer-term rate of growth. The southern growth areas included in the tables below which are related to the South FTN network are Takaanini and Ōpaheke-Drury.

Table 2-4: I11v6 population forecasts – South growth areas

Population	2018	2023	2028	2031	2038	2041	2048	2048+
Takaanini growth area	900	800	800	800	800	800	1,000	10,600
Ōpaheke-Drury growth area	2,500	2,800	5,200	7,900	13,900	16,400	20,200	29,200
Percentage of Full Build-out								
% of Takaanini full build-out	8%	8%	8%	8%	8%	8%	9%	100%
% of Ōpaheke-Drury full build-out	9%	10%	18%	27%	48%	56%	69%	100%

Table 2-5: I11v6 Employment Forecasts – Takaanini Growth Areas

Jobs	2018	2023	2028	2031	2038	2041	2048	2048+
Takaanini growth area	200	200	200	200	200	200	300	1,100
Ōpaheke-Drury growth area	1,600	1,700	2,000	2,600	4,100	4,400	5,000	7,400
Percentage of Full Build-out								
% of Takaanini full build-out	17%	17%	18%	19%	21%	22%	23%	100%
% of Ōpaheke-Drury full build-out	22%	22%	28%	35%	55%	60%	68%	100%

This generally indicates the following in relation to the timing of the population and jobs within the Takaanini growth areas:

- The population in the **Takaanini FUZ** area is predicted to remain at approximately 8% of the full build-out (2048+) forecast population between 2018 and 2048 (i.e., 800 – 1,000 people). Likewise, only around 20% of the full build-out forecast number of jobs in Takaanini is predicted between 2018 and 2048 (i.e., 200 – 300 jobs). The majority of population and employment growth in Takaanini is predicted to occur between 2048 and the full build-out in 2048+, reaching an expected population of 10,600 and employment of 1,100 people in 2048+. It should be noted that this whole area is being proposed for removal due to the FDS.
- In the **Ōpaheke-Drury FUZ** area, the population is predicted to reach about 48% of the full build-out forecast population by 2038 (i.e., 13,900 people). Within the same timeframe, the number

of jobs in Ōpaheke-Drury is expected to reach around 55% of the full build-out forecast employment (i.e., 4,100 jobs) by 2038. By 2048, around 69% (20,200 people) and 68% (5,000 jobs) of the full build-out forecast population and employment, respectively, is expected in Ōpaheke-Drury. It should be noted that a part of this area (Slippery Creek) is being proposed for removal by the FDS, while another part is being deferred and the remaining area is live zoned. A breakdown of the Ōpaheke-Drury growth area is set out in Table 2-7 below.

Table 2-6 summarises the assumed employment growth forecasts in the Takaanini industrial area, adjacent to the Takaanini interchange, from i11v6. The forecasts show that much of the employment growth (75%) is expected in 2038. These forecasts are useful to understand suitable staging of the urbanisation of Popes Road as Popes Road will provide a key east-west connection to the Takaanini industrial area.

Table 2-6: I11v6 Employment Forecasts – Takaanini Industrial Area

Jobs	2018	2023	2028	2031	2038	2041	2048	2048+
Takaanini industrial area	1,700	2,800	4,300	5,300	7,100	7,900	9,300	9,600
Percentage of Full Build-out								
% of Takaanini industrial area full build-out	18%	29%	45%	55%	74%	82%	97%	100%

It is acknowledged that land use forecasts have inherent uncertainty, in terms of the rate of new growth in specific areas. Currently, there is additional uncertainty around the likely outcomes and rate and location of higher-density development sought through central Government policies such as the National Policy Statement on Urban Development (NPS-UD) and Auckland Council's Plan Change 78. A key intent of those policies is to enable higher density development, especially around high-quality public transport systems. The specific planning response to those policies is currently being progressed by Auckland Council, and revised land use forecasts reflecting any expected changes were not available at the time of preparing this assessment. Generally, it is considered that this Project is not inconsistent with such policy direction, regarding supporting higher density urban development via more sustainable travel modes. Given this context, the use of those available I11.6 forecasts is considered acceptable for this assessment.

Overall, the proposed transport infrastructure identified in the recommended network is expected to be sufficient to accommodate the projected growth and is flexible enough to respond to changes in land use projections including increased density and changes in timing. Table 2-7 shows the breakdown of the proposed FDS changes in the Ōpaheke-Drury FUZ area. The forecasted growth outcomes for this area have an impact on the viability/ timing/ staging of the southern section of the Takaanini FTN.

Table 2-7: Ōpaheke-Drury FUZ area - breakdown of proposed FDS changes

Population	2018	2028	2038	2048	2048+
Total Ōpaheke-Drury area (i11.6)	2,500	5,200	13,900	20,200	29,200
Ōpaheke-Drury (draft FDS proposed area for removal – Slippery Creek)	1,100	2,100	5,200	7,300	9,600
Ōpaheke-Drury (draft FDS area deferred)	300	800	2,800	4,400	6,500
New estimated Ōpaheke-Drury population (based on draft FDS)	1,400	3,100	8,700	12,900	19,600
Employment	2018	2028	2038	2048	2048+
Total Ōpaheke-Drury area (i11.6)	1,600	2,100	4,100	5,000	7,400
Ōpaheke-Drury (draft FDS proposed area for removal – Slippery Creek)	815	890	1,100	1,300	1,500
Ōpaheke-Drury (draft FDS area deferred)	36	72	764	1,545	1,805
New estimated Ōpaheke-Drury employment (based on draft FDS)	785	1,210	3,000	3,700	5,900

The above table shows that if the FDS changes are confirmed, the estimated population and employment numbers remain relatively high.

To summarise:

- There is already a high population and a high amount of jobs around the South FTN network.
- There is expected to be high growth in the surrounding network, however, this is a small proportion compared to the existing population and employment in the area.
- Uncertainty of growth due to the FDS has little impact on the overall Southern area which the project is looking to accommodate.
- Much of the FTN corridors are not triggered by growth areas along, but by existing urban areas adjacent to the corridors.

- Majority of employment growth (75%) in the Takaanini industrial area is expected in 2038. This has an implication on the timing of the urbanisation of Popes Road.

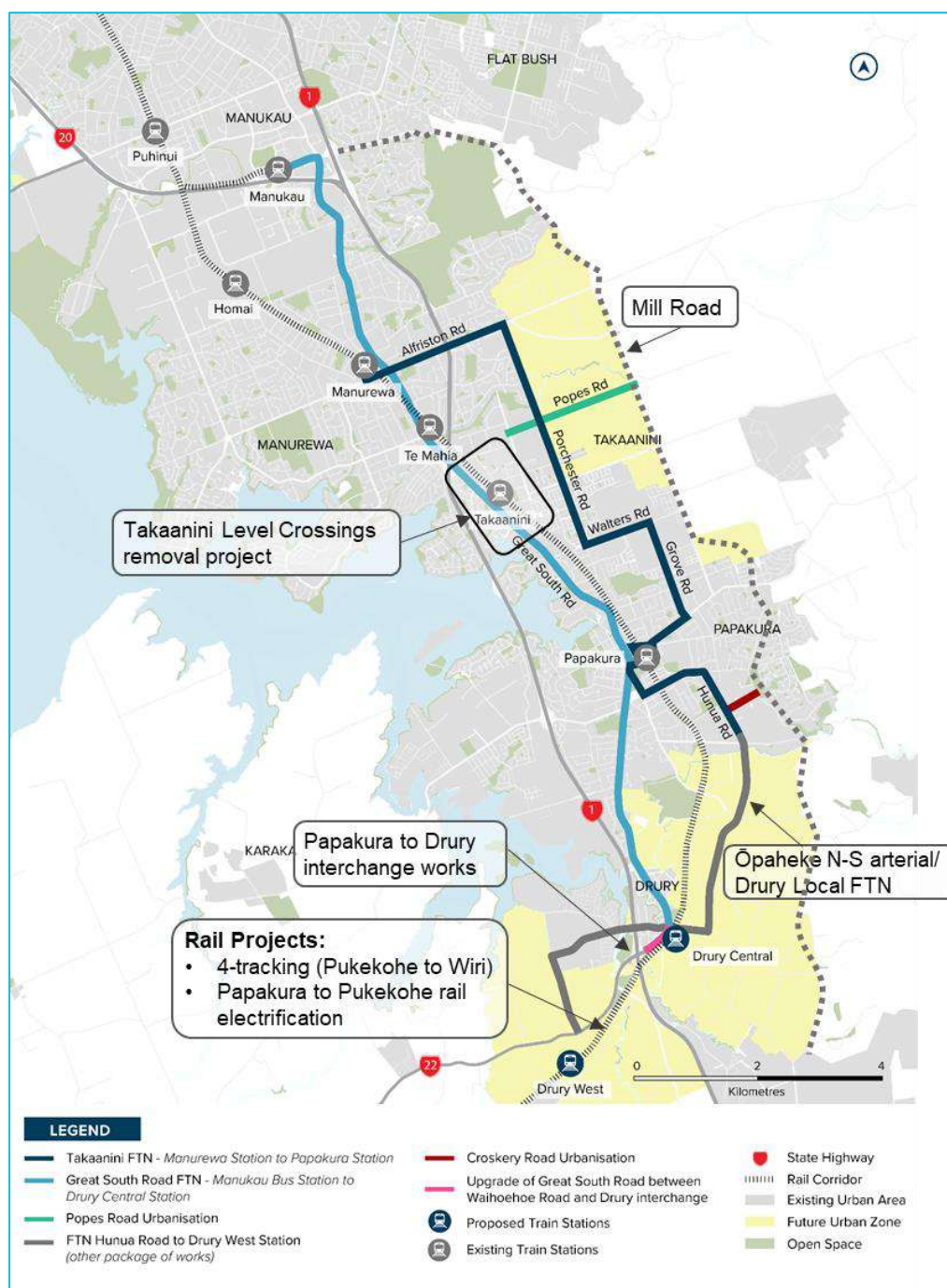
2.4 Other Key South Projects

For the purposes of the South FTN DBC transport modelling, assumptions have been provided by Waka Kotahi NZ Transport Agency (Waka Kotahi) and Auckland Transport (AT) in relation to these key strategic transport projects that have informed the modelling. Noting this is not related to current commitments for funding of these projects. In addition to the key strategic projects within the South FTN DBC, these include:

- Drury Central Station – committed and funded under NZUP
- Papakura to Drury (P2D) Interchange works – under delivery
- Mill Road four-lane strategic project – removed from NZUP scope, however, separate DBC underway
- Ōpaheke north-south arterial - consented
- Drury Local FTN - consented
- Additional track capacity (4-track) planned from Pukekohe to Wiri (longer-term) – DBC underway
- Electrification of the passenger rail services to Pukekohe – under delivery
- Takaanini Level Crossings removal project – DBC underway

These projects are shown in Figure 2-3.

Figure 2-3: Other key projects in the South



2.4.1 New Zealand Upgrade Programme (NZUP)

The New Zealand Upgrade Programme reflects the Government's transport policy for investment in road, rail, public transport and walking and cycling infrastructure across New Zealand. The upgrade programme includes transport infrastructure in six main growth areas – Auckland, Waikato, Bay of Plenty, Wellington, Canterbury, and Queenstown.

The package provides for more frequent and better public transport and building safe, new walking and cycling paths. The committed planned transport networks relevant to Takaanini DBC can be summarised as follows:

- Proposed rail stations in Drury Central, Drury West and Paerata. These rail stations are included in the New Zealand Upgrade Programme (NZUP) and construction is planned to start in 2023 and be completed by late 2024/25.
- SH1 Papakura-to-Bombay Upgrade providing more north-south regional capacity. The South Auckland Package includes upgrades on Waihoehoe Road and SH22 to support the urbanisation in Drury West and Drury East.

The New Zealand Upgrade Programme will trigger a range of different considerations linked to growth. More notable, accelerating the 'development ready' status of the future planned urban zones. The NZUP is also investigating a re-scoped South Auckland Package, focussed on safety near Manukau and supporting projects in Drury.

3 Transport Staging Considerations

3.1 Outcomes and Key Principles

Due to the uncertainty regarding the timing and form of specific land use activities, a principle-based approach is regarded as the best way to manage and deliver the desired transport and land use outcomes consistently. This recognises that staging in many cases will either be determined by regional, inter-regional and local priorities, which heavily rely on the scale and rate of growth. A set of principles has therefore been developed, which links staging decisions to broader strategic goals regarding travel demand management and modal shift.

Key principles for staging have been developed that seek to assist in delivering the desired transport and land use outcomes. These principles include supporting the following **outcomes**:

- Immediate shift to more sustainable travel choices.
- Manage adverse impacts of development on the wider system.
- Support the desired urban form, in particular higher density, quality urban environments.
- Recognise the need to support both place and movement function.
- Provide affordable staging plans that match expected land development.
- Protect space for longer term needs.
- Minimum impacts during construction.

The suggested **principles** which look to support the above outcomes for staging are:

- Time implementation of the South FTN network in a pragmatic approach with other AT projects in the network such as intersection upgrades, localised safety improvements.
- Provide a meaningful improvement to walking and cycling and public transport in the short to medium term to support the existing urban areas and portions of new growth already underway.
- Programme public transport and active mode facilities and services from the outset of urban development to support a shift to more sustainable travel.
- Prioritise PT and active mode facilities that support attractive access to the rail stations.
- Consider potential interrelationships between transport projects to achieve overall outcomes.
- Consider staging of elements of a project to match likely development stages and system needs, whilst also considering pathways to achieve the full-build elements.
- Consider the needs to support place-function, not solely movement function.
- Provide safe travel by all modes.
- Staging that can respond to the timing, scale, and form of urban development as defined by the Future Development Strategy work.
- Providing multimodal access to meet MOT inclusive access objective.
- Identify opportunities that reduce interruptions during construction.
- Identify opportunities where other projects help alleviate traffic pressure on the corridor which is to be upgraded.

The approach to staging for the South FTN project is different from other projects in the Te Tupu Ngātahi programme, given that the South FTN network is largely in the urban environment whilst other projects in the programme are serving greenfield growth.

3.2 Proposed Staging

The proposed staging is illustrated in the Figure 3-1 and followed by Table 3-1 which details the intended implementation timeframe, rationale and associated risks and opportunities. The proposed staging has been reflected in the transport modelling undertaken to inform the economics analysis and will also be used within the financial case of the South FTN DBC. The staging was considered with Auckland Transport and Waka Kotahi team members to ensure that any identified wider organisational considerations were accommodated. Overall, the land use staging is generally consistent with the Future Urban Land Supply Strategy and considers the uncertainties and risks associated with the FDS. The implementation and staging of transport projects within these forecasted timeframes have been adjusted to take advantage of opportunities to support desired outcomes.

Rail is the key PT infrastructure in the Southern network and has the capacity to carry many commuters. It is to be noted that 4-tracking of the rail line is expected in 2038, to increase rail capacity in the Southern network. The construction impacts of 4-tracking will likely involve rail closures for extended periods. This will have adverse effects on commuters in the South however, these effects may not be significant if the FTN infrastructure is in the network. Hence, much of the FTN network recommended staging for implementation is 2028 – 2038. It is recommended that the implementation of the FTN network is done progressively and alongside other projects to minimise construction disruption in the network. The implementation of the FTN network can be developed with a focus on:

- upgrades to key stations/ bus interchanges;
- upgrades on sections which will relieve traffic congestion that would otherwise affect PT services

The timing of works on the FTN network should be considered along with the timing of other key projects such as Mill Road and Ōpaheke N-S arterial. These projects can reduce traffic demand on Great South Road, hence should be implemented prior to works commencing on Great South Road to minimise disruption on the community.

Figure 3-1: Proposed Staging of South FTN Network

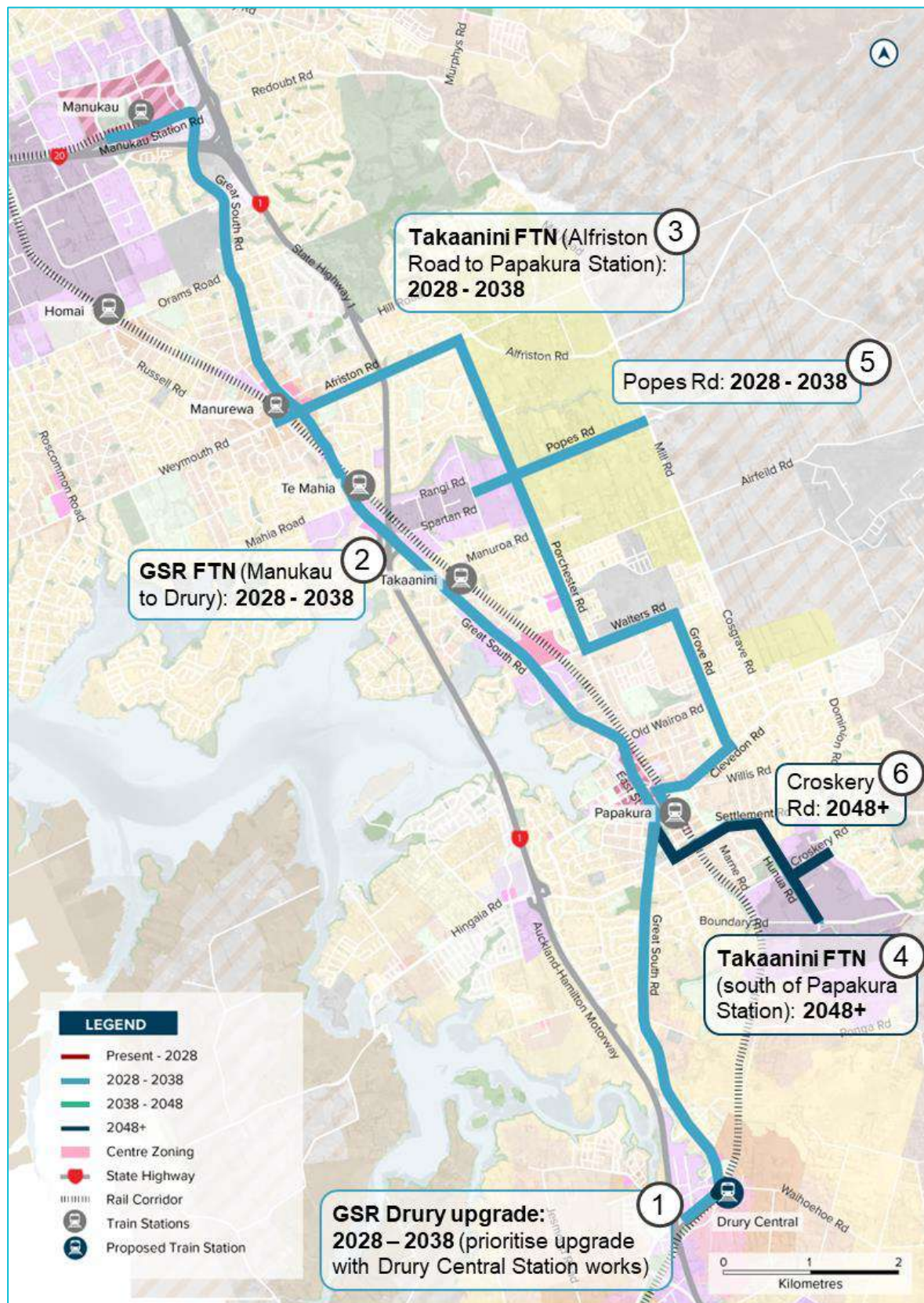


Table 3-1: Proposed staging for South FTN DBC

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
Corridor upgrade project (1)					
Upgrade of Great South Road, Drury between Waihoehoe Road and Drury interchange	2028-32 (1 st Half - Decade 2) Aligns with assumed growth in Ōpaheke - Drury	2028	2028-2038 (1 st half)	This timing allows alignment with the upgrade of Drury Central Station and provides: • access and integration with the implementation of the station and supports a shift to more sustainable travel. Enables buses to access the station easily. • This link provides good strategic access, connectivity and resilience for all modes. • Avoid disturbance on the community by timing construction of this upgrade with other surrounding projects. Growth in Drury and the following projects will trigger more demand on this corridor: • Completion of Papakura-to-Drury (P2D) interchange works • Completion of Waihoehoe Road and Waihoehoe intersection upgrade • Delivery of Drury Central Station	• Risk of traffic impact during construction as the main access to the station and the Drury area is affected. • Opportunity to upgrade this corridor with Drury Central Station works. This is an opportunity to integrate with the Station. • Drury Central Station project completion is subject to NZUP funding. • If this corridor upgrade is deferred, there is a risk of extended construction works which will cause disruption to the surrounding community. • Corridor upgrade increases station access benefits. • Engineering constraints with the Hingaia Stream bridge may be challenging causing construction delays.

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
				This project essentially closes the 'gap' in the network between other projects. Hence, if GSR, Drury remains two-lanes, it will cause a bottleneck in the traffic network. Construction of this section will cause disruption to station access and the Drury Centre and Drury East area if this corridor is upgraded after these developments. There would also be limited alternative access for these areas.	Opportunity to coordinate with other projects in the area.
Great South Road FTN (2)					
1. Manukau Station to Manurewa Station	Existing urban area	2038	2028 – 2038	- Earlier sequencing due to opportunity for reallocation of road space and limited property impacts - Staged for earlier implementation to enable effective connections to Manukau Metropolitan centre/ rail station for existing communities. - Support climate change and mode shift targets by early implementation of walking and cycling infrastructure and reallocation of traffic lanes to bus lanes.	- Eke Panuku (Auckland Council urban regeneration agency) has a Framework Plan (2016) looking to transform the Manukau area, increasing the residential population from 6,000 to 20,000. - Opportunity to integrate intersection works at Browns Road and Grand Vue Road with any future AT safety projects at these locations

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
2. Manurewa Station to Te Mahia Station	Existing urban area	2038	2028 – 2038	- Staged for earlier implementation to enable effective connections to Manurewa Town centre/ rail station for existing communities - Support climate change and mode shift targets by early implementation of walking and cycling infrastructure and reallocation of traffic lanes to bus lanes.	Opportunity for this work to assist the revitalisation of the Manurewa town centre which is outlined in the Manurewa, Takaanini, Papakura Integrated Area Plan (2018)²
3. Te Mahia Station to Takaanini Station	Existing urban area	2038	2028 – 2038	- Staged for earlier implementation to enable effective connections to Takaanini Town centre/ rail station and Te Mahia Station for existing communities. - Support climate change and mode shift targets by early implementation of walking and cycling infrastructure and reallocation of traffic lanes to bus lanes.	Opportunity for this work to assist the desired outcomes of the Takaanini town centre which is outlined in the Manurewa, Takaanini, Papakura Integrated Area Plan (2018)³
4. Takaanini Station to Papakura Station	Existing urban area	2038	2028 – 2038	Staged for earlier implementation to enable effective connections to Takaanini Town centre/ rail station for existing communities.	Opportunity for this work to assist the desired outcomes of the Papakura metropolitan centre which is outlined in the Manurewa, Takaanini,

² Manurewa, Takaanini, Papakura Integrated Area Plan, Auckland Council (2018)

³ Manurewa, Takaanini, Papakura Integrated Area Plan, Auckland Council (2018)

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
				Support climate change and mode shift targets by early implementation of walking and cycling infrastructure and reallocation of traffic lanes to bus lanes.	Papakura Integrated Area Plan (2018) ⁴
5. Papakura Station to Drury Central Station	2028-32 (1st Half - Decade 2) Aligns with assumed growth in Ōpaheke - Drury	2038	2028 – 2038	- Staged for earlier implementation to enable effective connections to Papakura Metropolitan centre/ rail station for existing communities. - Support climate change and mode shift targets by early implementation of walking and cycling infrastructure - Triggered by assumed growth of Ōpaheke - Drury. - The need for the corridor upgrades on this section and resilience in the network becomes more crucial if Ōpaheke N-S arterial is not delivered (assumed in 2048). This is now also dependent on the outcomes of the FDS. - Relieves urbanised areas from strategic traffic, enhancing resilience and allows alternative	- Upgrade of the Otūwairoa / Slippery Creek bridge - Opportunity to alleviate congestion off SH1 and improve connectivity between Papakura and Drury due to limited north-south routes through this area.

⁴ Manurewa, Takaanini, Papakura Integrated Area Plan, Auckland Council (2018)

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
				mode facilities to be enhanced and safety improved.	
Takaanini FTN (3 & 4)					
6. Alfriston Road (Manurewa Station to Porchester Road)	2043-47 (2 nd Half – Decade 3) Aligns with assumed growth in Takaanini	2038	2028 – 2038	- High east-west function for buses, general traffic and active modes. - This will be the key PT east-west connection in the network, hence this link should be upgraded to improve PT access to Manurewa Station and Takaanini Station.	- Works on Weymouth Road bridge could be timed with the implementation of four-tracking. - Widening of the bridge over SH1 may require full closure of the corridor. Constructability to be carefully considered as Alfriston Road is a key east-west connection. Should not be constructed simultaneously with the Takaanini grade-separated bridges. - Active development interests such as the Alfriston Village Plan Change by Windermere Holdings Ltd and Kāinga Ora may trigger the need for Alfriston Road earlier on - opportunity for integration

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
					with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects particularly related to developer contributions. • Opportunity to design intersection and entrance to the Manurewa bus interchange which integrates with any future plans for the Manurewa town centre/ bus interchange. • This upgrade should be considered in conjunction with the level crossings network.
7. Porchester Road to Takaanini Station	2043-47 (2 nd Half – Decade 3) Aligns with assumed growth in Takaanini	2038	2028 – 2038	• Support adjacent urbanisation and improved access to Takaanini Station. However, is not strongly linked to land released in the Takaanini FUZ. • If development is delayed or does not occur, there is still a case for this connection as it will support climate change and mode shift targets by early implementation of walking and cycling infrastructure.	• Opportunity for integration with developer plans to require infrastructure as part of the suite of mitigation effects. This is however, contingent on development occurring in the Takaanini FUZ.

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
8. Takaanini Station to Papakura Station	Existing urban area	2038	2028 – 2038	Upgrading active mode spine connecting to key land use activities Takaanini Station, Takaanini Town Centre, schools and employment opportunities	Active mode improvements on Clevedon Road/ Broadway can be timed with the upgrade of the Clevedon Road bridge (4-tracking project).
9. Papakura Station to Hunua Road (Drury Local FTN Project)	2028-2032 (1 st Half - Decade 2) Aligns with assumed growth in Ōpaheke - Drury	2048+	2048+ / dependent on FDS	- Implementation of the Ōpaheke N-S Arterial and the Drury Local FTN Project - Based on the outcomes of the FDS - Completes north-south link from Ōpaheke, providing access for all modes.	- Subject to implementation timing of the Drury FTN/ Ōpaheke N-S arterial - Opportunity to time active mode improvements on Settlement Road with the upgrade of the Settlement Road bridge (4-tracking project). - To be timed with the increasing of bus capacity at Papakura Station. Bus capacity at the station remains a constraint for operating additional buses to the station.
Corridor urbanisation projects (5 & 6)					
Popes Road	2043-47 (2nd Half – Decade 3)	2038/ 2048+	2028 – 2038	The infrastructure is triggered by the following:	Provision of this link will enhance freight resilience and connectivity

FTN Corridor Section	Adjacent land use FULSS Staging	South FTN DBC Model Scenario	Implementation	Rationale (triggers)	Risks/ Opportunities
	Aligns with assumed growth in Takaanini			- Delivery of Mill Road (Takaanini section) - Development of employment growth in the Takaanini industrial area (75% of growth in the area is expected by 2038) - Development of Takaanini FUZ The requirement for this infrastructure is strongly linked to the delivery and form of Mill Road as Popes Road forms a connection between Mill Road and the Takaanini industrial area. It is also strongly linked to the employment growth expected in the Takaanini industrial area. - Relieves safety pressure on rural roads - Still a case for Popes Road for active mode connections regardless of whether the Takaanini FUZ eventuates	- Opportunity for integration with developer or Plan Change plans to require infrastructure as part of the suite of mitigation effects - Opportunity to provide transport infrastructure at the onset of development in the Takaanini employment area.
Croskery Road	Existing industrial urban area	2048+	2048 - 2048+	- Triggered by the delivery of Mill Road (Papakura section) - Commissioned with the southern section of Takaanini FTN works on Hunua Road	There is uncertainty around the form of Mill Road in this section

3.3 Interdependencies with other projects

There are multiple potential combinations of how the staging of projects could be implemented to respond to the timing, scale and form of urban growth in Takaanini, Ōpaheke-Drury and achieve mode shift outcomes in the South.

There are inherent uncertainties linked to how the sections of the FTN routes which are adjacent to the FUZ will be staged (longitudinally and horizontally) in relation to both that land use and their interdependencies between other key strategic projects in the South such as Mill Road.

Table 3-2 provides an overview of the interdependencies and relationships with strategic projects in the South to provide further clarity about short and long-term integrated project planning.

The upgrade of Great South Road, Drury is adjacent to several funded projects underway in the area such as the Drury Central Station and the Papakura to Drury Interchange project. Private Plan Changes in Drury Centre, Drury East and Waihoehoe by developers have also been approved. The Drury Centre Precinct area which Kiwi Property wish to develop is of most influence on the need for the upgrade of Great South Road, Drury corridor. This precinct plan will include a new town centre and a commercial district. There will be a high number of vehicles accessing the area due to the Drury Centre development. If the corridor remains two-lanes, there will likely be a bottleneck in the network, affecting bus reliability and the ability for buses to access Drury Central Station.

The most suitable time to upgrade the Great South Road, Drury corridor is:

- With the implementation of Drury Central Station and the Waihoehoe Road west upgrade.
- Alternatively, with the implementation of the direct connection from SH1 to the Drury Centre (via a single lane slip lane from SH1 interchange to Creek Road) is implemented. Creek Road is within the Drury Centre Precinct plan.
- Alternatively, the corridor upgrade can be timed with the Mill Road southern connection between Fitzgerald Road and State Highway 1. This corridor is expected to provide four traffic lanes and separated active mode facilities, including a new SH1 Interchange at Drury South - the “Drury South interchange”.

Table 3-2: Key Strategic Project Interdependencies

Project	Relationships and Influences	Drury Local FTN/ Ōpaheke N-S Arterial	Drury Central Station	Takaanini Level Crossings	Mill Road	Waihoehoe Rd/ GSR intersection upgrade (NZUP)	Drury South Interchange	SH1 connection to Drury Centre
Corridor upgrade project								
Upgrade of Great South Road, Drury between Waihoehoe Road and Drury interchange	A four lane multi-modal primary arterial connection with dedicated walking and cycling facilities. This corridor provides a connection to the Drury Interchange and the strategic state highway network. This connection is adjacent to Drury Central Station and hence provides access to the station.		✓		✓ Southern connection (Fitzgerald Rd – Papakura)	✓	✓	✓
Great South Road FTN								
1. Manukau Station to Manurewa Station	Manukau Station Road – Browns Road: a four lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. Browns Road – Manurewa Station: A three lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There is a northbound bus lane within the recommended cross-section. Intersection upgrades at Browns Road and Grand Vue Road – should be timed with other AT projects				✓ (northern section near Redoubt Rd)			

Project	Relationships and Influences	Drury Local FTN/ Ōpaheke N-S Arterial	Drury Central Station	Takaanini Level Crossings	Mill Road	Waihoehoe Rd/ GSR intersection upgrade (NZUP)	Drury South Interchange	SH1 connection to Drury Centre
2. Manurewa Station to Te Mahia Station	A three lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There is a northbound bus lane within the recommended cross-section. Intersection upgrades at Mcannalley Street, Mahia Road.				✓ (Takaanini section)			
3. Te Mahia Station to Takaanini Station	No change through the interchange. Intersection upgrades at Manuroa Road and Taka Street.				✓			
4. Takaanini Station to Papakura Station	Taka Street – Tironui Road: a four lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. Tironui Road – Coles Cres: A three lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There is a northbound bus lane within the recommended cross-section.				✓			
5. Papakura Station to Drury Central Station	Wellington Street – Waihoehoe Road: A three lane multi-modal primary arterial connection with dedicated walking and cycling facilities. There is a northbound bus lane within the recommended cross-section. Intersection upgrades at Rosehill Drive, Beach Road, and Park Estate Road.	✓			✓			

Project	Relationships and Influences	Drury Local FTN/ Ōpaheke N-S Arterial	Drury Central Station	Takaanini Level Crossings	Mill Road	Waihoehoe Rd/ GSR intersection upgrade (NZUP)	Drury South Interchange	SH1 connection to Drury Centre
	Bridge upgrade at Slippery Creek							
Takaanini FTN								
6. Alfriston Road (Manurewa Station to Porchester Road)	A four lane multi-modal secondary arterial connection with dedicated walking and cycling facilities. Intersection upgrades at Manurewa bus interchange, Weymouth Road/ GSR, Claude Road, Scotts Road, Magic Way, Porchester Road Bridge upgrade at Weymouth Road/ rail line and SH1 bridge.			✓	✓			
7. Porchester Road to Takaanini Station	Dedicated walking and cycling facilities. Intersection upgrades at Popes Road and Manuroa Road.			✓	✓			
8. Takaanini Station to Papakura Station	Dedicated walking and cycling facilities. Intersection upgrades at Airfield Road, Walters Road, Grove Road, Old Wairoa Road, Clevedon Road, and Willis/ Marne Road.			✓	✓			
9. Papakura Station to Hunua Road	Dedicated walking and cycling facilities.	✓			✓			

Project	Relationships and Influences	Drury Local FTN/ Ōpaheke N-S Arterial	Drury Central Station	Takaanini Level Crossings	Mill Road	Waihoehoe Rd/ GSR intersection upgrade (NZUP)	Drury South Interchange	SH1 connection to Drury Centre
(Drury Local FTN Project)	Intersection upgrades at Ōpaheke / Settlement Road, Settlement/ Marne Rd, Settlement Rd/ Hunua Rd, and Croskery/ Hunua Rd.							
Corridor urbanisation projects								
Popes Road	Dedicated walking and cycling facilities/ urbanisation of the corridor. Intersection upgrade at Popes Road/ Takanini School Road.				✓			
Croskery Road	Dedicated walking and cycling facilities/ urbanisation of the corridor.	✓			✓			

3.4 What happens if the timing of land use or other key projects changes?

Table 3-3 sets out some consideration of changes to land use timing, considering both delay and acceleration to land use development and provides commentary on how this might influence staging of infrastructure. The table also sets out consideration of changes to the timing of other key projects in the area.

Table 3-3: Resilience of the proposed network to changes in land use or timing of other projects

Change	Commentary
Takaanini FUZ develops earlier than anticipated OR is further delayed/ does not eventuate	With growth in the Takaanini FUZ area developing earlier than anticipated, the timing of the northern section of Takaanini FTN and Popes Road will remain as 2028 – 2038. This FUZ area is currently staged to be development ready in the second half of decade three (2043-2047) in FULSS. If this is brought forward, then the current staging allows for the PT infrastructure to be in place from the onset of development. With growth in the Takaanini FUZ area delayed further or if it does not eventuate, the timing of the northern section of Takaanini FTN and Popes Road will remain as 2028 – 2038. These corridors will continue to serve the existing brownfield area adjacent to the route and provide key access to Manurewa Station. The timing of Popes Road is expected to not change as it will provide access from the east, Mill Road to the developing Takaanini industrial area.
Ōpaheke-Drury FUZ develops earlier than anticipated OR is further delayed/ does not eventuate	Part of the Drury FUZ area is already live zoned, and with growth in the area developing earlier than anticipated, it is expected that there may be a need for the southern section of Takaanini FTN (south of Papakura Station) to be brought forward, contingent on whether Ōpaheke N-S arterial is also brought forward. This will ensure the infrastructure is in place to provide a reliable PT network and accommodate the growth in the area. With growth in the Ōpaheke-Drury FUZ area being deferred or removed, the implementation of Ōpaheke N-S arterial may be impacted which will then impact the timing of the southern section of Takaanini FTN. However, there is the possibility where Ōpaheke N-S arterial is implemented despite the status of the FUZ area. In this case, the southern section of the Takaanini FTN continues to provide a PT route connecting Papakura to Drury.
Growth in Takaanini industrial area develops earlier than anticipated	With growth occurring in the Takaanini industrial area earlier than anticipated, there may be a need to bring the implementation of elements of Popes Road forward. This is contingent on the development of Mill Road and the wider strategic freight network. The key infrastructure required would be the intersection upgrades at Popes Road/ Porchester Road intersection and the Popes Road/ Takaanini School Road. These intersection upgrades will provide safer outcomes given that there would be an increase in heavy vehicle movement earlier than anticipated.
Growth in Takaanini industrial area is delayed	With growth in the Takaanini industrial area being delayed, the implementation of Popes Road can be delayed, however, will still be recommended to be timed with the delivery of Mill Road and the development of the Takaanini FUZ.

Change	Commentary
Implementation delay of infrastructure supporting Drury East area (i.e. Drury Central Station, Waihoehoe Road etc)	With delay of the implementation of key infrastructure, there is still an opportunity to maintain the current proposed timing (2028-2038) of the corridor upgrade of Great South Road, Drury. This corridor upgrade will continue to accommodate the growth and development in the Drury Centre, Drury East and Waihoehoe Precinct areas.
Implementation delay of four-tracking of the rail line	Four-tracking of the southern rail line is timed for 2038. If this is further delayed, the current timing of the FTN routes will accommodate some of the PT movement while construction of the four-tracking gets underway.
Four-tracking of the rail line is accelerated	Great South Road FTN route may be required to be brought forward to reduce any rail disruptions where bus replacements may be required.
Implementation delay of Mill Road	The uncertainty of the form, function and timing of the strategic Mill Road corridor may result in delayed implementation of this corridor. The current proposed implementation timing of Great South Road FTN will accommodate for people movement between Papakura and Drury until Mill Road is implemented.
Implementation of Mill Road is accelerated	If Mill Road South (Drury to Papakura) is implemented earlier, then there is an opportunity to Great South Road FTN (Drury to Papakura) sooner. As soon as Mill Road South is operational, works can commence on Great South Road FTN (Drury to Papakura) as traffic is expected to be alleviated of Great South Road during this time.
Implementation delay of Ōpaheke N-S arterial	Delayed timing of Ōpaheke N-S arterial will be accommodated by the current proposed implementation timing of Great South Road FTN as this will continue to provide for people movement between Papakura and Drury. There will be even less pressure on the timing of the southern section of Takaanini FTN (south of Papakura Station) as this will tie into the Drury FTN on the Ōpaheke N-S arterial.
Implementation delay of Takaanini grade-separated bridges	There is an inter-dependency of the grade-separation bridges and Alfriston Road. Simultaneous construction of both the Alfriston Road bridge and the grade-separation bridges should be avoided to ensure there is sufficient east-west connectivity in the network.

3.5 Priority opportunities

In the event where funding became available the below opportunities should be considered. These opportunities will depend on the infrastructure changes in the wider network:

- Works along **Alfriston Road** could be accelerated. This is a key east-west connection which provides for the Takaanini area. It should be noted that there would be significant works and property impacts relating to this project, however, Alfriston Road is a key part of the Takaanini network.
- Works along the section of **Manukau Station Road** and **Great South Road (north of Browns Road)** can be accelerated as this is relatively low-cost project which is expected to serve a high number of buses.

- Corridor upgrade of **Great South Road, Drury** can be accelerated as this is an opportunity to integrate with other projects and ‘close the gap’.
- Works along **Great South Road** through the **Takaanini** area could be accelerated as this is a critical part of the network for the local community where there are existing PT reliability issues.

4 Summary

In summary, there are a range of different drivers, parallel workstreams and triggers that will influence how network staging will be delivered over the next three decades.

Due to the uncertainty regarding the timing and form of specific land use activities, it is not feasible to develop a detailed stage-by-stage implementation plan. Further, this is not required for this Business Case, given its focus on identifying preferred long-term corridors, which will be subject to separate implementation decisions and project specific implementation business cases.

Therefore, a principle-based approach is regarded as the best way to manage and deliver the desired transport and land use outcomes consistently. There are multiple potential combinations of how the staging of projects could be implemented to respond to the timing, scale and form of urban development, so this assessment can only be considered as illustrative of the kind of staging that could be considered. Importantly, the tables summarise the key interdependencies of projects, so individual project decisions can be easily cross referenced and future decisions are not made in isolation.

The corridor upgrade of Great South Road, Drury is proposed to be aligned with the implementation of Drury Central Station to reduce construction disruption on the surrounding environment.

Implementation of the rest of the FTN should be developed progressively, focusing on upgrades to key stations and on areas which will relieve traffic pressure that would affect PT services. Any projects that can reduce traffic demand on Great South Road such as Mill Road and Ōpaheke N-S arterial, four-tracking of the rail line should be implemented so that works can begin on Great South Road and would minimise disruption on the community.