



Whenuapai Plan Change

Stage 1 Technical Inputs

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TRANSPORTATION SPECIALISTS



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Prepared by: Qing Li, Angie Crafer
Project Manager: Angie Crafer
Reviewed by: Angie Crafer

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EXECUTIVE SUMMARY

Flow Transportation Specialists Ltd has been commissioned by Auckland Transport to provide technical input to support the drafting of the Proposed Plan Change for Whenuapai. This builds on work that has been completed regarding the Whenuapai Structure Plan development process including an Integrated Transport Assessment that considers the traffic effects of the zoning of land within the Whenuapai Structure Plan area.

In this report, the proposed transport network associated with the Draft Whenuapai 3 Precinct Plan¹ has been reviewed and changes to the network are suggested with regard to Collector roads within the Trig Road south residential development area not connecting through to the Hobsonville business area, the alignment of the Whenuapai-Marina View Drive link being through to Spedding Road and some minor changes to the alignment of other roads.

The transport investment requirement and stage 1 land use zoning have been reviewed taking into account revised land use scenarios from Auckland Transport, including the Regional model (ART) Scenario I10. This includes faster growth in land use than previously assumed and also includes different travel patterns. Transport provisions considered necessary for a Base Scenario have been identified, as well as those associated with six staged land use scenarios. A refined land use-transport investment trigger table has been prepared and the types of improvements identified.

Sensitivity tests relating to yield assumptions and independence of stages have been considered and these indicate that the transport network has some flexibility to accommodate additional yields and that the order of the staged release of land is not important provided that RTN is provided and results in lower vehicle trip rates for development, including for development that has already occurred. The risk of not implementing RTN with suitable walking, cycling and local bus connections in place prior to development occurring is that developers may design neighbourhoods around a dominant car mode and residents will be accustomed to using their cars, which could prove difficult to change once RTN is provided.

¹ Draft Whenuapai 3 Precinct Plan 1, Auckland Council, 15 March 2017

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1 INTRODUCTION

Flow Transportation Specialists (Flow) has been commissioned by Auckland Transport to provide transport planning and traffic engineering support in relation to the proposed Whenuapai Plan Change. In this report, the proposed transport network associated with the Draft Whenuapai 3 Precinct Plan² has been reviewed and the transport investment requirement and stage 1 land use zoning have been reviewed. A refined trigger table has been prepared and the types of improvements identified. Two sensitivity tests each relating to yield assumptions and independence of stages have been considered

2 ARTERIAL AND COLLECTOR ROAD NETWORK PLAN REVIEW

The Draft Whenuapai 3 Precinct Plan² has been provided by Auckland Transport and included in Appendix A of this report. The transport network shown in this plan has been reviewed taking into account expected origins and destinations, land uses and densities associated the Whenuapai proposed Plan Change and Structure Plan. Suggested modifications to this transport network plan are provided in [Figure 1](#), based on the comments provided below.

- ◆ An indicative collector road should be provided in the Trig Road south area providing access to Trig Road for the residential development anticipated to the east of Trig Road. This area (bounded by Trig Road, Hobsonville Road and the Precinct boundary may contain up to 800 dwellings and a primary school, generating some 5,000 vehicle movements per day³. This collector road is suggested to form a loop, and could provide for a local bus service.
- ◆ To prevent industrial traffic to/from the Hobsonville Road business light industry zone (formerly Waitakere Plan Change 14) travelling through the Trig Road south residential area, it is suggested that no direct connection be made between these areas, other than for pedestrians/cyclists, allowing them direct access to employment areas and also to bus services on Hobsonville Road.
- ◆ If possible, it is suggested that the realignment of Trig Road south to Luckens Road has greater curvature even though this may mean bridging a stream, unless the curves shown comply with design standards for an arterial road.
- ◆ An indicative arterial road is proposed in the Council's plan that crosses SH18 between Trig Road and Brigham Creek Road interchange. The road was initially identified through Auckland Transport's Transport in Future Growth Areas (TFGA) study and later supported by the Whenuapai Structure Plan Integrated Transport Assessment⁴ (ITA) to provide connectivity and additional capacity between Whenuapai and Hobsonville and to provide a more direct route for bus services between Whenuapai and the West Harbour Ferry. A review of the traffic using this link in the traffic models indicates that it will mainly be those living in Hobsonville and living and

² Draft Whenuapai 3 Precinct Plan 1, Auckland Council, 15 March 2017

³ Based on Guide to Traffic Generating Developments (RTA Guide), Daily vehicle trips for Dwelling Houses: 9.0 per dwelling, Daily vehicle trips for Medium Density Residential Flat Building: 4 to 5 per dwelling

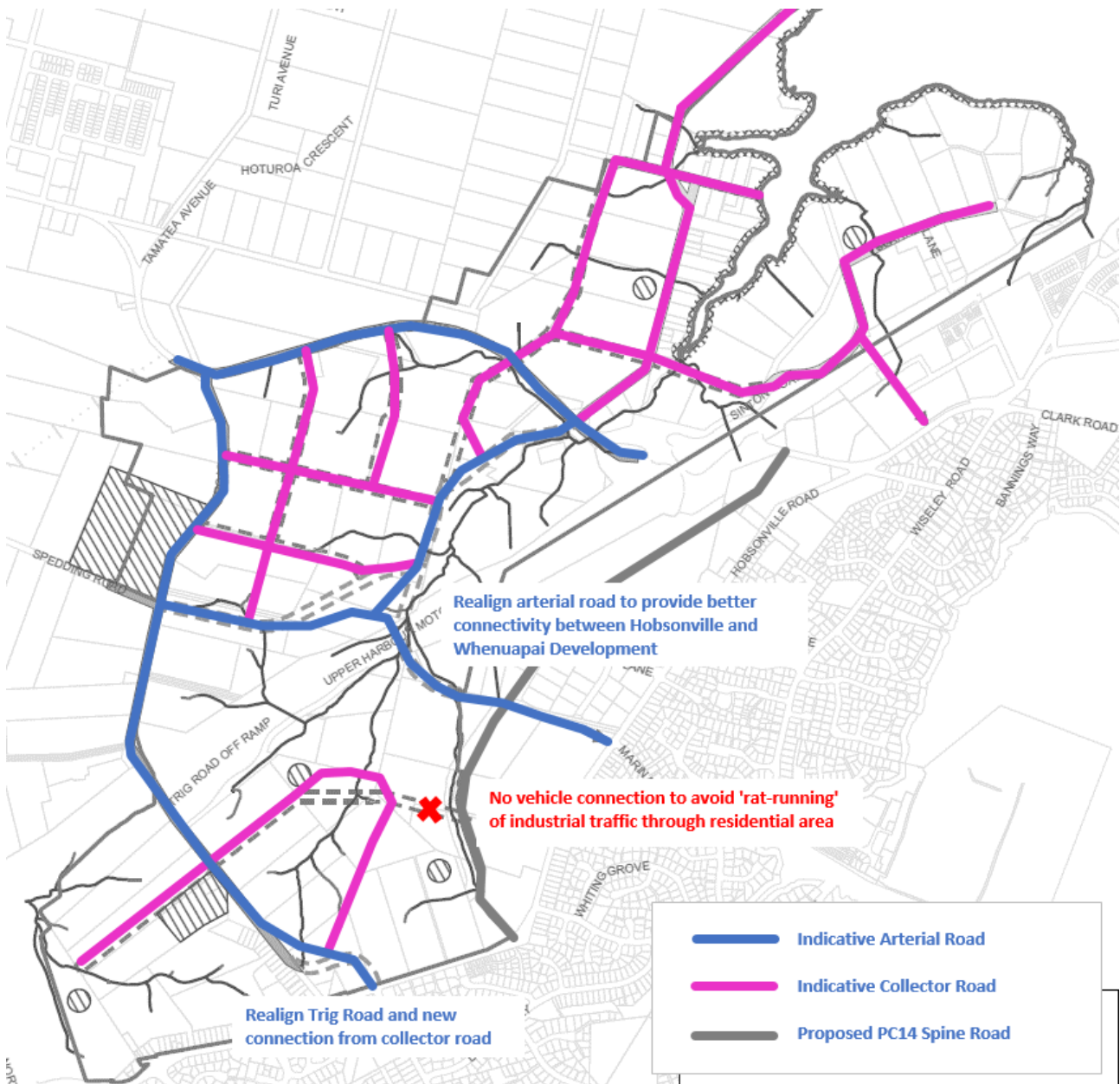
⁴ Whenuapai Structure Plan Integrated Transport Assessment, Flow Transportation Specialists, June 2016

working in the Whenuapai business and residential areas. Based on the distribution of this traffic and that bus services are anticipated to include a loop⁵ via Hobsonville Road, Hobsonville Marina, Marina View-Whenuapai link, Spedding Road, Mamari Road, Totara Road, Puriri Road, Kauri Road, Brigham Creek Road, it is suggested that the Whenuapai-Marina View link and Spedding Road form the priority at an intersection with the new arterial extending southwest from the intersection of Brigham Creek Road/Kauri Road.

- ◆ It is noted that three north south collector roads have been proposed in the draft Precinct Plan connecting business areas to Brigham Creek Road. Traffic modelling indicates that due to the large traffic volumes on Brigham Creek Road, these intersections are likely to need to be signalised to provide sufficient capacity for side road traffic, or they may need to be limited to left in-left out movements only (although this may affect accessibility unless U-turns can be accommodated elsewhere). With approximately 1.3 km between the Brigham Creek Road intersections with Kauri Road and Trig Road, there will typically be a gap of 325 m between these key intersections. Phasing can be programmed to optimise signal performance and given expected traffic volumes on Brigham Creek Road, it is considered appropriate to provide regular signalised pedestrian crossing facilities at these intersections. However, flight path issues may affect the ability to provide some of these intersections, and consideration may need to be given to facilitate rear access lanes rather than vehicle crossings being allowed on Brigham Creek Road.
- ◆ An indicative Connector opposite one of these business area Connectors provides an additional connection to the residential development to the northeast of Brigham Creek Road. This will help spread the traffic generated in these areas where it joins onto Brigham Creek Road, as well as providing direct routes between the residential and employment areas.
- ◆ A new local connection across SH18 between Brigham Creek Road and Squadron Drive has been included in the draft Precinct Plan. The link would provide a vehicle connection between Sinton Road and Sinton Road east, in addition to the existing pedestrian/cyclist bridge crossing between Clarks Lane and Memorial Park Lane. This link will provide resilience and greater accessibility to the Sinton Road area, which otherwise will only have one road connecting it to Kauri Road and beyond. Based on traffic modelling (reported on later in this report), it is anticipated that the link will reduce traffic volumes that would otherwise eventuate at the SH18/Brigham Creek Interchange and it will be required to support the residential yield anticipated for the Sinton Road area.

⁵ Ibid, Figure ES2, page iii

Figure 1: Suggested Transport Network Plan



3 REVIEW OF STAGE 1 TRANSPORT INVESTMENT AND LAND USE ZONING

3.1 Assessment Methodology

The SATURN models developed for the investigations associated with the Whenuapai Structure Plan have been used in this study to help determine what transport investment is required to support the proposed land use zoning. The SATURN models were originally developed for the TFGA study for the Northwest Area, with zones disaggregated to represent smaller areas in Whenuapai. For this study, only Stage 1 of the Whenuapai proposed Plan Change has been considered. Details regarding updates to the land use assumptions in the SATURN models are included in Section 3.2 below. The assumed number and type of dwellings and the number of full time equivalent (FTE) jobs within the proposed

Plan Change area have been amended based on advice from Auckland Transport and Auckland Council.⁶ This is discussed in Section 0.

The road network within and connecting to the Proposed Plan Change area has been based on the plans provided in the Draft Whenuapai Land Development Assessment (LDA) document⁷. The future transport network assessment assumes the existing transport network as a start point, and new transport infrastructure has been added into the network as more land development has been included. Assumptions with regard to the new transport infrastructure have been guided by the consultation material produced through the TFGA study, modified as per the Structure Plan ITA process, except in relation to the location of the link between Whenuapai and Hobsonville Road over SH18, which has been assumed to connect to Marina View Drive rather than further east on Hobsonville Road.

SIDRA intersection models have been developed for key intersections to help guide when changes to the transport network may be needed. This has included testing scenarios of various development yields to gain an understanding of what transport investment may be needed and when. It is noted that this assumes some form of independence from development elsewhere. Assumptions around background growth, public transport provisions and complementary land uses that help to reduce traffic demands, for example, new local schools, are critical in predicting origin-destinations, travel choices, traffic demands and travel routes. Accordingly, further investigation will be needed to provide more complete advice, which may need iterations around what is feasibly able to be accommodated by the transport provisions.

Whilst the Proposed Plan Change will not be so detailed to define all of the facilities needed within the road reserves, relatively directive detail has been provided to identify typical cross sections, for example, the number of traffic lanes and where bus lanes, cycle lanes etc need to be provided, and intersection controls and lane arrangements.

3.2 Background Transport Investment and Land Use Assumptions

The previously developed Whenuapai Structure Plan SATURN models included assumptions from Auckland Transport's regional transport model ("ART") Scenario I9. Models representing nominal years 2021, 2026, 2036 and 2046 were used to iteratively assess what transport investments might be needed to support land use zoning and associated development within Whenuapai. ART Scenario I10 is now available and has been incorporated within the 2021 and 2026 models for assessing Whenuapai Stage 1.

The updates associated with ART I10 include the assumed accelerated development of greenfield areas, which is expected to increase the number of dwellings in the Redhills area from approximately 4,000 households in I9 to 5,800 households in I10, in 2026. The total number of households expected in 2046, are however, consistent between Scenarios I9 and I10. Based on the discussion with the Auckland Forecast Centre (formally Joint Modelling Application Centre), it is understood that ART I10 is

⁶ Information provided from Auckland Transport and Auckland Council by email on Friday, 12 May 2017

⁷ Volume 1, Whenuapai Land Development Assessment by Condor³, February 2017

preferred as an input to be used for future transport strategic development assessments. A comparison between ART I9 and I10 outputs also indicates that I10 has different trip distributions across the network, resulting in more traffic in certain parts of the network, such as the Upper Harbour Bridge in 2026.

Background traffic demands in 2021 have been interpolated based on the predicted ART growth between 2016 and 2026, guided by the predicted Scenario I10 land use in 2021.

The Scenario I10 land use predictions associated with Northwest Auckland area are summarised in [Table 1](#), with [Figure 2](#) showing the relevant ART zones.

Figure 2: Northwest Auckland Zones – ART3

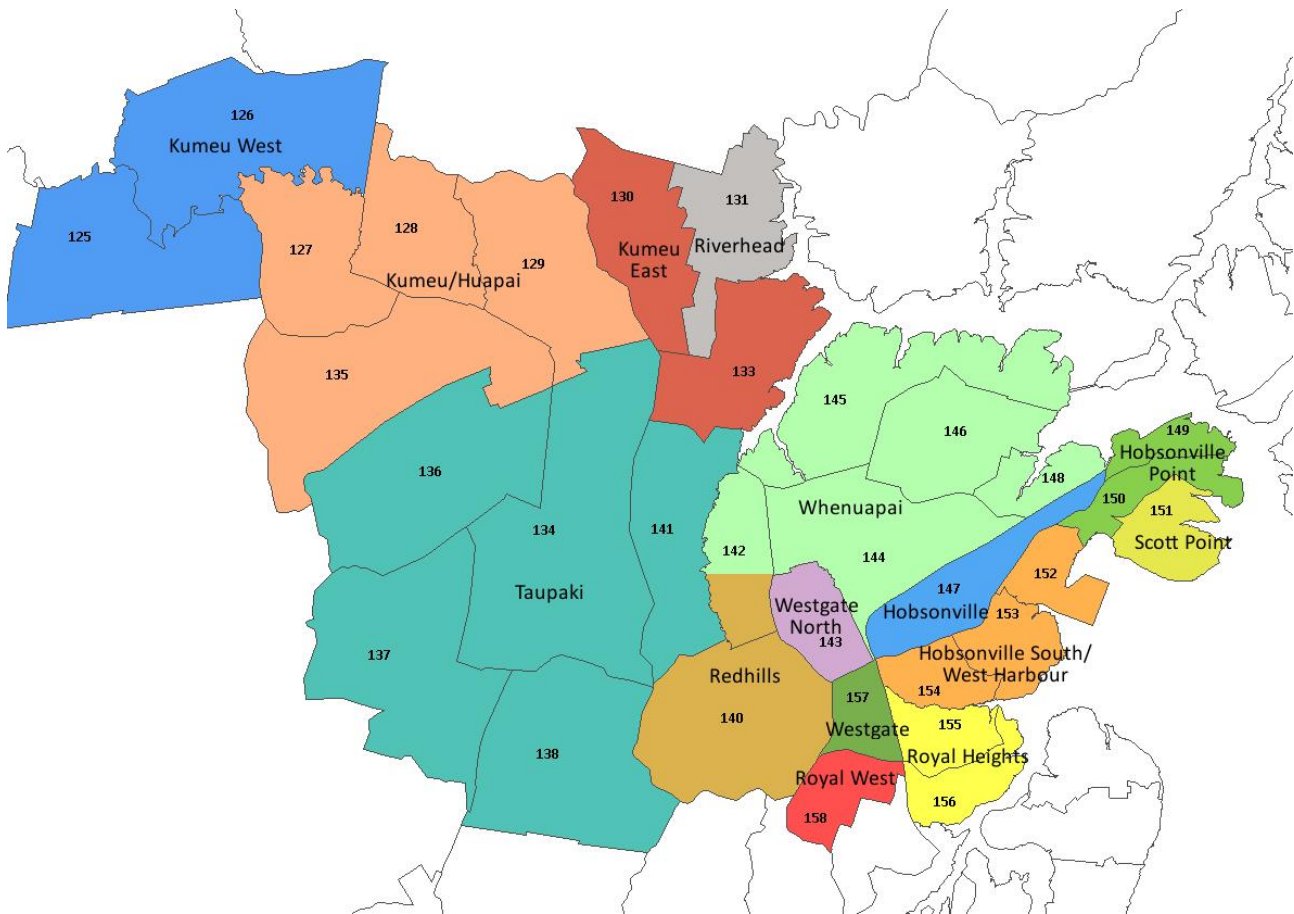


Table 1: Predicted Land Use in NW Area – ART Scenario I10

Location	Households			Employment (FTE)		
	2016	2021	2026	2016	2021	2026
Hobsonville Point	1,535	3,412	4,359	644	1,246	1,485
West Harbour	4,078	4,321	4,560	1,334	1,365	1,386
Kumeu East	234	235	242	378	382	383
Kumeu West	563	568	601	545	574	662

Table 1: Predicted Land Use in NW Area – ART Scenario I10

Location	Households			Employment (FTE)		
	2016	2021	2026	2016	2021	2026
Taupaki	844	841	853	744	758	777
Kumeu/Huapai	1,207	1,397	2,798	1,658	1,754	1,835
Redhills	263	3,027	5,781	438	666	890
Riverhead	999	1,172	1,211	745	798	812
Royal Heights	2,445	2,461	2,476	677	692	701
Royal Road West	1,734	1,720	1,706	361	365	366
Scott Point	50	1,560	3,056	54	441	830
Westgate	667	938	1,206	1,049	1,178	1,299
Westgate North	335	852	1,364	1,008	2,681	4,353

The transport assessment relies on the traffic demands predicted by the ART model, which assumes Rapid Transit will be provided along SH16 to Westgate by 2026 and to Kumeu and along SH18 by 2036. If the Rapid Transit Network (RTN) were to be provided earlier, the characteristics of the ART model in terms of trip rates and distribution would be different, with likely reductions in the capacity requirements or the timing of private vehicle-orientated transport investment. Similarly, assumptions regarding other major transport infrastructure will change trip characteristics. Assumptions regarding the wider transport network relevant to the study area, included in the ART Scenario I10 model, are summarised below.

Table 2: Wider Transport Network Assumptions in the ART Model ⁸

Changes to Existing Transport Network	2016	2026	2036	2046
Frequent Transit Network (FTN) bus services along Hobsonville Road		✓	✓	✓
RTN along Northwestern Motorway		✓	✓	✓
RTN along SH18 Motorway			✓	✓
Bus interchange at Westgate		✓	✓	✓
Increased frequency of existing bus services in northwest Auckland		✓	✓	✓

⁸ Based on spreadsheet provided by AFC: Auckland Transport Alignment Project (ATAP) Lists_v14, December 2016

Table 2: Wider Transport Network Assumptions in the ART Model ⁸

Changes to Existing Transport Network	2016	2026	2036	2046
NorSGA ⁹ transport infrastructure improvements, including Fred-Taylor Drive upgrade, Brigham Creek Road upgrade, Hobsonville Interchange, Trig Road upgrade, Hobsonville Road upgrade, Buckley Avenue upgrade, Scott Road link ¹⁰		✓	✓	✓
New road connection between Redhills development and Coatesville Riverhead Highway/SH16 Intersection		✓	✓	✓
Widening of SH16 between Hobsonville Road and Royal Road	✓	✓	✓	✓
SH16/18 connection including Northside Drive south-facing ramps		✓	✓	✓
SH18 Squadron Drive west-facing ramps		✓	✓	✓
Widening of SH18 Upper Harbour Bridge westbound between Tauhinu Road and Squadron Drive		✓	✓	✓
New SH18 road crossing between Trig Road and Brigham Creek Road		✓	✓	✓
New four lane bypass of SH16 between Brigham Creek Road and west of Kumeu			✓	✓
Widen Coatesville-Riverhead Highway to four lanes			✓	✓

3.3 Whenuapai Stage 1 Land Use

The land use scenarios considered in the assessment for Stage 1 of the Whenuapai proposed Plan Change are outlined below.

- ◆ **Scenario 1a:** 4,350 dwellings in Whenuapai, including some 850 existing dwellings, 1,150 dwellings in the consented Whenuapai SHAs, and 2,350 new dwellings in the Trig Road area south of SH18. A new primary school in the Trig Road south area and a new secondary school in

⁹ Northern Strategic Growth Area

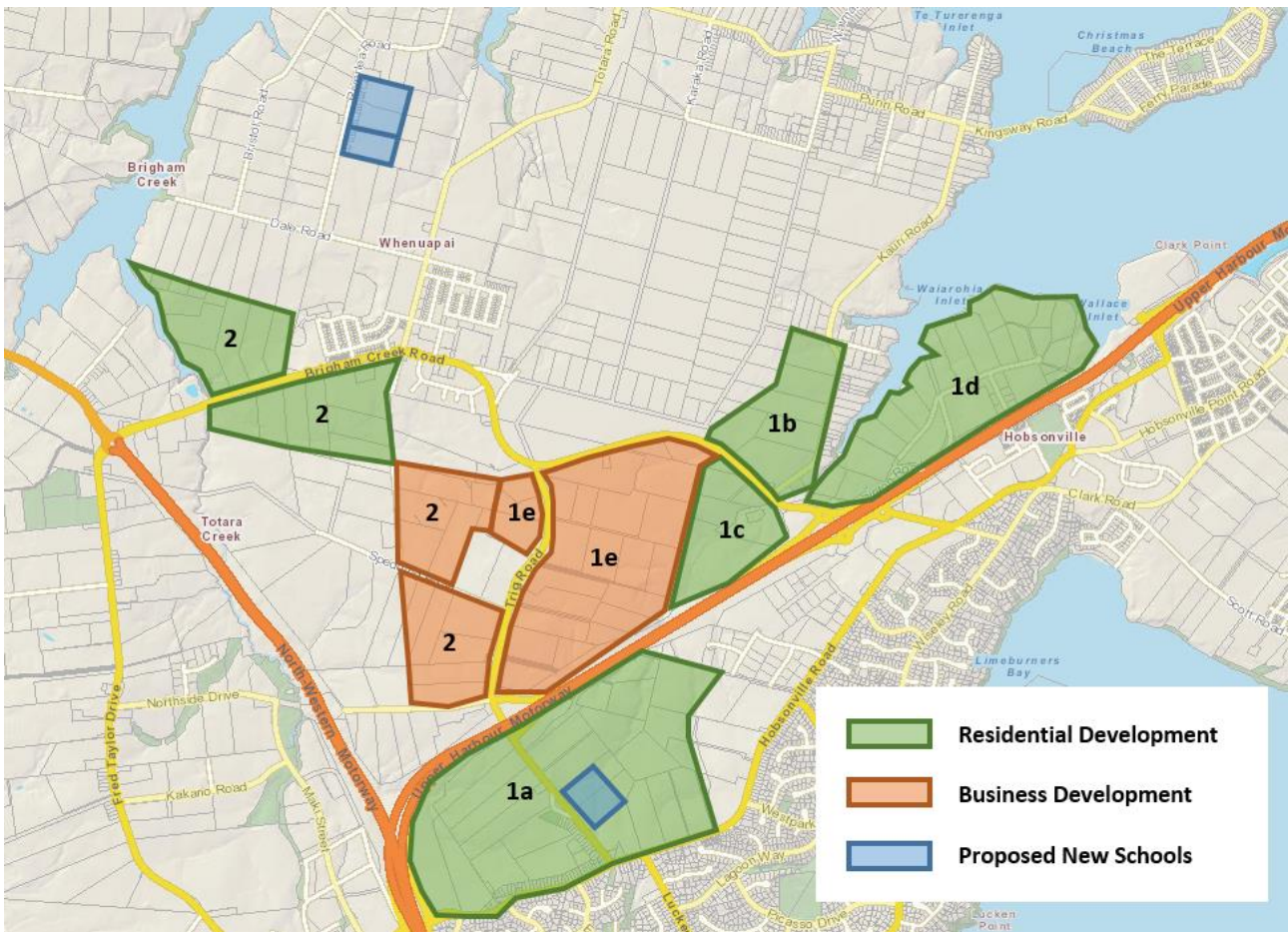
¹⁰ As per ATAP project list spreadsheet v14, December 2016

the Riverlea Road area have also been assumed. This scenario has been modelled using 2021 ART background traffic

- ◆ **Scenario 1b:** 5,100 dwellings in Whenuapai, including dwellings as per Scenario 1a plus 755 dwellings in the Kauri Road area, north of Brigham Creek Road. A new primary school in the Riverlea Road area has been assumed. This scenario has been modelled using 2021 ART background traffic
- ◆ **Scenario 1c:** 5,470 dwellings in Whenuapai, including dwellings as per Scenario 1b plus 365 dwellings in the area northwest of the SH18/Brigham Creek Road interchange. This scenario has been modelled using 2021 ART background traffic
- ◆ **Scenario 1d:** 6,670 dwellings in Whenuapai, including dwellings as per Scenario 1c plus 1,200 dwellings in the Sinton Road area. This scenario has been modelled using 2021 ART background traffic
- ◆ **Scenario 1e:** 6,670 dwellings in Whenuapai, including dwellings as per Scenario 1d plus 2,800 FTEs in the area between Brigham Creek Road, Trig Road and SH18. This scenario has been modelled using 2021 ART background traffic
- ◆ **Scenario 2:** 8,140 dwellings in Whenuapai, including dwellings as per Scenario 1e plus 1,400 new dwellings in the Brigham Creek Road/Mamari Road and Brigham Creek Road/Riverlea Road area, plus 1,400 FTEs in the business area, assumed to be along Brigham Creek Road and Trig Road, with side roads providing access to the development areas. This scenario has been modelled using 2026 ART background traffic

[Figure 3](#) below indicates the approximate locations of the above land use developments.

Figure 3: Whenuapai Proposed Plan Change – Indicative Staging Land Use Locations



3.4 Vehicle Trip Rates for Whenuapai Land Uses

Development areas within the Whenuapai Plan Change area have had specific vehicle trip rates applied to them for the purposes of including them in the SATURN traffic models.

The vehicle trip rates assumed for development within Whenuapai Plan Change area are consistent with those applied in the Whenuapai Structure Plan ITA. With regard to the residential land uses, vehicle trip rates have been applied based on the proximity to RTN stations and FTN/Connector bus stops, with higher vehicle trip rates assumed to apply to more isolated residential areas. In the short term where residential development is expected to occur prior to the RTN being completed, higher vehicle trip rates have been assumed to apply irrespective of location.

Table 3: Applied Vehicle Trip Rates for Whenuapai Plan Change Traffic Model (vehicle trips per peak hour)

Land Use	Morning Peak Hour	Evening Peak Hour
For isolated developments without access to RTN Stations or FTN/Connector stops		
All Types of Residential Developments	0.85	1.0
For developments in vicinity of RTN Stations or FTN/Connector stops		
Single Family Detached/Low Density	0.85	1.00
Townhouse/Medium Density	0.65	0.65
Apartment/Higher Density	0.55	0.55
Apartment/Higher Density within approx. 800 m of RTN/FTN stop	0.45	0.55

The above vehicle trip rates are based on the residential trip rates suggested by the Institute of Traffic Engineering (ITE) Guide and the Guide to Traffic Generating Developments¹¹ (RTA), as detailed in the Whenuapai Structure Plan ITA. These are summarised in [Table 4](#) below:

Table 4: Vehicle Trip Rates from ITE and RTA (vehicle trips per peak hour)

Residential Land Use	Morning Peak Hour		Evening Peak Hour	
	ITE	RTA	ITE	RTA
Single Family Detached/Low Density	0.75	0.95	1.01	0.99
Townhouse/Medium Density	0.44	0.4 to 0.65	0.52	0.4 to 0.65
Apartment/Higher Density	0.55	n/a ¹²	0.67	n/a

3.5 Base Scenario

A Base Scenario that assumes the existing traffic network and 2021 background traffic demands has been modelled. It includes a total of 2,000 dwellings in the Whenuapai Plan Change area, comprising 850 existing dwellings outside of the future urban zone and 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road.

The following regional network upgrades have been assumed in the Base Scenario model, based on the previous transport network assessment completed in the area:

- ♦ Widening of SH16 between Hobsonville Road and Lincoln Road, as part of the West Ring Route project
- ♦ Re-alignment and urbanisation (50 km/hr) of Trig Road south of SH18 to connect to Luckens Road and traffic signals at the Trig Road/Hobsonville Road/Luckens Road intersection, as identified in the Northern Strategic Growth Area (NorSGA) project

¹¹ Guide to Traffic Generating Developments, Regional Transport Authority of New South Wales, October 2002

¹² The RTA Guide provides rates for high density dwellings over six storeys high, which is not considered appropriate for application to Whenuapai

- ◆ Traffic signals at the following intersections as identified in NorSGA:
 - Hobsonville Road/Sinton Road
 - Hobsonville Road/Brigham Creek Road
 - Hobsonville Road/Clark Road
 - Hobsonville Road/Marina View Road
 - Hobsonville Road/Westpark Drive
 - Hobsonville Road/Suncrest Drive
- ◆ New roundabout at SH16/Coatesville-Riverhead Highway intersection, as identified in TFGA

The transport provisions anticipated to be required for all development scenarios, with the capacity improvement and intersection control provisions determined from the modelled traffic predictions in the Base Scenario are as follows:

- ◆ A comprehensive network of pedestrian footpaths and appropriate cyclist infrastructure commensurate with development but in line with ultimate provisions. Any development fronting an existing road will need to upgrade it to an appropriate urban standard
- ◆ Traffic signals at the following intersections
 - Brigham Creek Road/Totara Road/Mamari Road
 - Brigham Creek Road/Tamatea Avenue
 - Brigham Creek Road/Kauri Road
 - Brigham Creek Road/Trig Road
- ◆ Brigham Creek Road urbanisation with 50 km/hr speed restriction between SH16 and SH18 interchanges and widening of Brigham Creek to four lanes between Totara Road and Trig Road, and between Kauri Road and SH18/Brigham Creek Road interchange. Required to accommodate anticipated additional traffic and to limit growth in through traffic along Brigham Creek Road

Further to the above, the SH16/Brigham Creek Road intersection and SH18 Upper Harbour Bridge are close to operating at capacity during peak modelled times in 2021. Accordingly, the following will likely be necessary with further development within the Whenuapai Plan Change and they have been assumed to be in place prior to development associated with the development scenarios tested.

- ◆ SH16/Brigham Creek Road roundabout capacity improvements comprising a longer northbound short lane on the SH16 north approach.
- ◆ Widening of SH18 Upper Harbour Bridge in the westbound direction to three lanes between Tauhinu Road on ramp and Squadron Drive off ramp.

3.6 Assessment of Scenario 1a

The proposed transport network and land use proposed in Scenario 1a has been assessed using 2021 background traffic and the transport provisions identified for the Base Scenario. Traffic associated with a total of 4,350 dwellings supported by at a new primary school in the Trig Road south area and a

new secondary school in the Riverlea Road area as detailed in Section 3.3, are included in the SATURN models.

Of the new 2,350 dwellings, two thirds (1,570 households) have been assumed to be located in the area west of Trig Road and one third (780 households) have been assumed in the Trig Road east area, in accordance with the density anticipated in the Whenuapai Structure Plan ITA. Due to the predicted population growth, a new primary school and a new secondary school will be needed to support the increased population, and these have been assumed to be located in the Trig Road area for the primary school with a new secondary school on Riverlea Road, serving a wider catchment in Whenuapai North. To be able to accommodate the expected travel demands from this area, the lower vehicle trip rates identified in Section 3.4 have been assumed for these dwellings, which requires at least FTN services and bus priority on Hobsonville Road.

In addition to the transport investment identified for the Base Scenario, the proposed transport provisions assessed to be required for Scenario 1a include the following.

- ◆ Bus connector route through Trig Road south area, connecting with FTN services and bus priority on Hobsonville Road and RTN at Westgate. Required for any development in Trig Road south to enable a lower vehicle trip generation to be assumed, which is essential to be able to accommodate expected traffic volumes associated with development
- ◆ Extension of Riverlea Road to meet Brigham Creek Road and traffic signals at Brigham Creek Road/Riverlea Road. Required as part of the new Secondary School in Riverlea Road,
- ◆ New collector road extending from Trig Road through the Trig Road west area south of SH18 that can accommodate local bus services. Required with any additional development west of Trig Road
- ◆ New collector road extending from Trig Road through the Trig Road east area south of SH18 that can accommodate local bus services. Required with any additional development east of Trig Road
- ◆ Traffic signals at Trig Road/New Collector road intersections. This should be assessed for each application as affected by the location of development. Indicatively required with 400 dwellings on either side of Trig Road.

3.7 Assessment of Scenario 1b

Scenario 1b is based on 2021 land use growth predictions and has the same residential development profile as Scenario 1a, with an additional 750 dwellings in the Kauri Road area. Traffic associated with these dwellings and a new primary school in the Riverlea Road area as detailed in Section 3.3, are included in the SATURN traffic models. The vehicle trip rates for new residential development assume the higher vehicle trip rates identified in Section 3.4 as no RTN or FTN is anticipated in the near vicinity.

In addition to the transport investment identified for Scenario 1a, the additional transport provisions associated with Scenario 1b include the following.

- ◆ Widening of Brigham Creek Road between the SH18 interchange roundabouts and changing the lane arrangements to provide a double right turn from the SH18 southbound off-ramp, with two

lanes provided through the southbound off-ramp roundabout. The timing for this would need to be assessed for each application within the Kauri Road development area, but indicatively it is considered to be required with 100 new dwellings in the Kauri Road area

- ◆ Capacity improvements at the traffic signal controlled intersection of Kauri Road/Brigham Creek Road identified in the Base Scenario, including double right turn lanes from Brigham Creek Road east. The timing for this upgrade would need to be assessed for each application within the Kauri Road development area, but indicatively it is considered to be required with 200 new dwellings in the Kauri Road area. It is noted that the lane arrangement for this intersection could be constructed initially at the Base Scenario stage, rather than when development occurs.

3.8 Assessment of Scenario 1c

In addition to the development assumed with Scenario 1b, Scenario 1c includes a further 365 households in the area west of the SH18/Brigham Creek Road interchange.

To enable access to this area, the modelling includes a fourth approach to the Kauri Road/Brigham Creek Road intersection into the development area.

When including the higher vehicle trip rates for new residential development in the Scenario 1b (Kauri Road) and Scenario 1c areas, the assessment of the modelling outputs identifies that a cross road intersection will not be able to accommodate the extra anticipated traffic. As identified in the Whenuapai Structure Plan ITA, the only way to accommodate residential development associated with Scenario 1c is to assume a lower traffic trip generation for the Kauri Road new residential development (Scenario 1b) by explicitly assuming that the RTN along SH18 has been constructed and that stations are accessible through walking, cycling and local/connector bus services. Accordingly, a link is also required to provide a shorter and more direct route from Kauri Road to a RTN station in the Sinton Road area. A second RTN station in the vicinity of the future Whenuapai/Marina View Drive link with a connection to the Scenario 1c development area would increase the accessibility of RTN travel options to this area.

The risk of not implementing RTN prior to development occurring in any of the development areas is that developers may design neighbourhoods around a dominant car mode and residents will be accustomed to using their cars, which could prove difficult to change once RTN is provided.

These assumptions regarding the RTN being implemented by 2021 should be included back through the ART models to allow an assessment of RTN for the wider area, likely reducing vehicle trips and changing travel patterns. However, given time constraints, this has not been possible, and the assessment therefore only assumes a lower vehicle trip generation for the Scenario 1b (Kauri Road) new residential area.

In addition to the transport investment identified for Scenario 1b, the additional transport provisions associated with Scenario 1c include the following.

- ◆ RTN/FTN along SH18 with a station at Sinton Road/Clarks Lane and a link between the Sinton Road RTN station and Kauri Road, providing as a minimum, access for pedestrians, cyclists and

buses. Required with any development in the area west of the SH18/Brigham Creek Road interchange for reducing vehicle trip generation

- ◆ Addition of fourth leg to Kauri Road/Brigham Creek Road intersection

3.9 Assessment of Scenario 1d

Scenario 1d is based on 2021 land use growth predictions and has the same residential development profile as Scenario 1c but includes an additional 1,200 dwellings in the Sinton Road area between SH18 and the Waiarohia Inlet. Given the assumptions regarding the RTN in Scenario 1c, the lower vehicle trip rate assumptions have been applied to residential development in the Sinton Road area.

In addition to the transport investment identified for Scenario 1c, the additional transport provisions associated with Scenario 1d include the following.

- ◆ Capacity upgrade at SH16/Brigham Creek Road roundabout comprising a signalised roundabout or a left turn slip lane on the SH16 south approach. Required for any development in Sinton Road area, although resulting from growth within all new development areas
- ◆ Removal of the existing Sinton Road connection to the Brigham Creek Road/SH18 Northbound on-ramp intersection, with a new connection provided between Sinton Road and Kauri Road. This link could follow the same alignment as the link identified for Scenario 1c. Needs to be assessed for each application but indicatively with 500 new dwellings in the Sinton Road area
- ◆ New local link crossing SH18 connecting the Sinton Road area via Sinton Road East to Hobsonville Road. Needs to be assessed for each application but indicatively with 900 new dwellings in the Sinton Road area. As well as being considered necessary to provide for travel options, this link also provides necessary resilience with regard to emergency access to and from the Sinton Road area.

3.10 Assessment of Scenario 1e

In addition to the land uses assumed with Scenario 1d, Scenario 1e includes an additional 2,800 FTEs in the area between Trig Road, Brigham Creek Road and SH18. For the purposes of assessment, it has been assumed that the industrial development will occur along the length of Brigham Creek Road and Trig Road, with side roads providing rear access to the development areas. No connection has been assumed between the industrial development and the Brigham Creek Road/Kauri Road intersection and business can access Brigham Creek Road using new local roads extending south from Brigham Creek Road.

The assessment includes the development associated with Scenarios 1a to 1d and the transport provisions associated with these scenarios and the Base Scenario. The additional transport provisions associated with Scenario 1e include the following.

- ◆ The provision of south facing ramps at the SH18/Squadron Drive interchange, as identified in TFGA. This would need to be assessed for each application but indicatively required with 1,000 new FTE in the area near Brigham Creek Road.

- ◆ Traffic signals at SH18/Trig Road interchange intersections (including allowing for future extension of Northside Drive at the on-ramp intersection). Likely required for any new development along Trig Road north of SH18
- ◆ Traffic signals at the Brigham Creek Road/Trig Road intersection, required for any development in Trig Road north area
- ◆ Construct new Collector and Local roads into industrial area from Brigham Creek Road east of Trig Road with signalised intersections on Brigham Creek Road with the Collector roads. Required for any development requiring access to avoid driveways onto Brigham Creek Road. Traffic signals on Brigham Creek Road indicatively required with 100 FTE along any roads connected to Brigham Creek Road
- ◆ Construct new Collector and Local roads into industrial area along the eastern side of Trig Road. Required for any development requiring access to avoid driveways onto Trig Road (assumes these do not joint Brigham Creek Road/Kauri Road intersection – otherwise could need further changes at Brigham Creek Road/SH18 Interchange)
- ◆ Construct new Collector and Local roads into industrial area along the western side of Trig Road. Required for any development requiring access to avoid driveways onto Trig Road
- ◆ Urbanisation of Trig Road between Brigham Creek Road and SH18 Interchange. Any development fronting an existing road will need to upgrade it to urban standard and enable separated cycle facilities

3.11 Assessment of Scenario 2

Scenario 2 is based on 2026 land use growth predictions and has the same residential and commercial development profile in Whenuapai as Scenario 1e but includes an additional 1,400 dwellings¹³ in the Brigham Creek Road/Mamari Road and Brigham Creek Road/Riverlea Road area, plus 1,400 FTEs in the business area, assumed to be along Brigham Creek Road, Trig Road, Spedding Road and Northside Drive extension, with side roads providing access to the development areas. The vehicle trip rate for the new residential component of Scenario 2 is assumed to be the higher rates identified in Section 3.4 based on the area being more than 800 m from any RTN extended north along SH16.

With the additional growth in traffic anticipated in 2026 as well as the traffic generated by the Scenario 1a to 1e and Scenario 2 land uses, additional regional transport provisions are necessary. It is noted that the New Zealand Transport Agency is currently investigating projects along SH16 and SH18 between Brigham Creek Road/SH16 and SH18/Squadron Drive. While such projects may affect the network improvement options considered necessary, for the purposes of this study, the projects identified in the TFGA study have been assumed where capacity improvements have been identified as being required. These include:

- ◆ Motorway to motorway connections between SH16 (north) and SH18

¹³ As per email from Auckland Council dated 23 May 2017 identifying 37.5 hectares for business use and 30 hectares for residential use. 280 FTE per hectare is assumed based on the proposed number of FTE in Stage 1e and 200 m² per dwelling is assumed based on the housing density of Stage 1b, 1c and 1d)

- ◆ Northside Drive connection to Trig Road interchange, tying in to signalised intersection at Trig Road/SH18 on-ramp
- ◆ Additional westbound lane on SH18 between Squadron Drive westbound off ramp and Trig Road westbound off ramp
- ◆ Capacity upgrades at SH16/Brigham Creek Road roundabout comprising a signalised roundabout or free left turn lanes on the SH16 north, Fred Taylor Drive west and Brigham Creek Road east approaches.
- ◆ Capacity upgrades at SH18/Brigham Creek Road interchange. Based on the Hobsonville Business Area masterplan, a spine road running parallel to Hobsonville Road south of SH18 will be connected to the existing SH18 westbound off-ramp/Brigham Creek Road roundabout as part of the development of that area. This is predicted to cause significant delays to the traffic on Brigham Creek Road and signalisation is considered not viable due to the short distance between intersections. We understood that options for the interchange will be included in the aforementioned SH16/18 corridor study and therefore the capacity at the roundabout has been manually adjusted in the SATURN traffic models so that the delays experienced by vehicles on Brigham Creek Road remain moderate.
- ◆ Widening of Hobsonville Road between Trig Road and Marina View Road

In addition, the following is considered necessary within the Whenuapai Plan Change area:

- ◆ Urbanisation of Mamari Road south of Brigham Creek Road; rear access is assumed to enable separated cycle facility
- ◆ Extend Mamari Road north and south as development occurs, eventually linking between Northside Drive extension and Brigham Creek Road
- ◆ Extend Riverlea Road into the residential development south of Brigham Creek Road with addition of fourth leg to Brigham Creek Road/Riverlea Road signalised intersection (no connection between Riverlea Road and Spedding Road necessary)
- ◆ New East West road extending from Brigham Creek Road/Trig Road intersection connecting Mamari Road north and Riverlea Road extension. Addition of fourth leg to Trig Road/Brigham Creek Road signalised intersection and include two right turn lanes from Brigham Creek Road east to Brigham Creek Road north
- ◆ Widening of Brigham Creek Road to two lanes per direction between SH16 and Riverlea Road
- ◆ Signalisation of Trig Road/Kauri Road extension intersection

4 STAGE 1 TRIGGER TABLE

A summary of the transportation provisions and triggers identified for developing areas in Whenuapai in the order identified in Section 3 is provided in the following table, with the suggested road cross sections and layouts of key intersections provided in Appendices B and C of this report.

Table 1: Whenuapai Proposed Plan Change – Draft Triggers for Transport Investment

Scenario	Land Use Assumptions		Associated Transport Infrastructure			
	Whenuapai	Adjacent Land Use Development	Regional Transport Network		Whenuapai Proposed Plan Change Transport Network	
			Investment	Triggers	Investment	Triggers
Base Scenario (background growth based on ART 2021)	<ul style="list-style-type: none"> ◆ Existing primary schools at Whenuapai and Hobsonville ◆ 2,000 dwellings in Whenuapai including: <ul style="list-style-type: none"> ▪ 850 existing outside future urban zone ▪ 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road ◆ No new business activity 	<ul style="list-style-type: none"> ◆ As per Scenario I10 predictions. 	FTN from Brigham Creek Road to Kumeu. ¹⁴	Inherent assumption in trip rates in surrounding areas.	A comprehensive network of pedestrian footpaths and appropriate cyclist infrastructure commensurate with development but in line with ultimate provisions.	Any development fronting an existing road will need to upgrade it to urban standard etc.
			FTN on Hobsonville Road which may require widening of Hobsonville Road to provide bus priority. ¹⁵			
			Bus shoulder running Auckland CBD to Westgate. ¹⁶			
			Re-alignment and urbanisation (50 km/hr) of Trig Road south of SH18 to connect to Luckens Road and traffic signals at the Trig Road/Hobsonville Road/Luckens Road intersection. ¹⁵	Inherent assumption complete by 2021.	Brigham Creek Road urbanisation with 50 km/hr speed restriction between SH16 and SH18 interchanges and widening of Brigham Creek Road to four lanes between SH16 and Totara Road, and between Kauri Road and SH18/Brigham Creek Road interchange.	Required to accommodate anticipated additional traffic and to limit growth in through traffic along Brigham Creek Road.
			Traffic signals on Hobsonville Road ¹⁵ at <ul style="list-style-type: none"> ▪ Brigham Creek Road ▪ Sinton Road ▪ Clark Road ▪ Marina View Road ▪ Westpark Drive ▪ Suncrest Drive 	Background traffic growth but further assessment may indicated needed earlier based on growth in Trig Road South.		
			SH16 widening between Hobsonville Road and Lincoln Road. ¹⁶	Inherent assumption complete by 2021.		
			New roundabout at SH16/Coatesville-Riverhead Highway intersection. ¹⁴	Background traffic growth.	Traffic signals at: <ul style="list-style-type: none"> ▪ Brigham Creek Road/Totara Road/Mamari Road ▪ Brigham Creek Road/Tamatea Avenue ▪ Brigham Creek Road/Kauri Road ▪ Brigham Creek Road/Trig Road 	Background traffic growth
			SH16/Brigham Creek Road roundabout capacity improvements comprising a longer northbound short lane on the SH16 north approach.	The SH16/Brigham Creek Road intersection and SH18 Upper Harbour Bridge are close to operating at capacity during peak modelled times in 2021. Accordingly, investment will likely be necessary with further development within the Whenuapai Plan Change and they have been assumed to be in place prior to development associated with the development scenarios tested.		
			Widening of SH18 Upper Harbour Bridge in the westbound direction.			

¹⁴ Identified in draft preferred Transport for Future Growth Area (TFGA) project

¹⁵ Identified in Northern Strategic Growth Area (NorSGA) project

¹⁶ Part of the Western Ring Route project

Scenario	Land Use Assumptions		Associated Transport Infrastructure			
	Whenuapai	Adjacent Land Use Development	Regional Transport Network		Whenuapai Proposed Plan Change Transport Network	
			Investment	Triggers	Investment	Triggers
Scenario 1a (background growth based on ART 2021)	<ul style="list-style-type: none"> ◆ Existing primary schools at Whenuapai and Hobsonville ◆ New primary school in south Trig Road area ◆ New secondary school on Riverlea Road ◆ 4,350 dwellings in Whenuapai including: <ul style="list-style-type: none"> ▪ 850 existing outside future urban zone ▪ 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road ▪ 2,350 new dwellings around Trig Road south of SH18 ◆ No new business activity 	◆ As above.	As above.	As above.	Bus connector route through Trig Road South area, connecting with FTN services and bus priority on Hobsonville Road and RTN at Westgate.	Inherent assumption in trip rates therefore needed for development in Trig Road South.
					Extension of Riverlea Road to meet Brigham Creek Road and traffic signals at Brigham Creek Road/Riverlea Road.	New Secondary School on Riverlea Road.
					New local road extending west from Trig Road into area south of SH18.	Any additional development west of Trig Road.
					New local road extending east from Trig Road into area south of SH18	Any additional development east of Trig Road
					Traffic signals at Trig Road/Connector road between SH18 and Hobsonville Road intersection.	Should be assessed for each application as affected by location of development – indicative requirement is at 400 dwellings each side.

Scenario	Land Use Assumptions		Associated Transport Infrastructure			
	Whenuapai	Adjacent Land Use Development	Regional Transport Network		Whenuapai Proposed Plan Change Transport Network	
			Investment	Triggers	Investment	Triggers
Scenario 1b (background growth based on ART 2021)	<ul style="list-style-type: none"> ◆ Primary schools at Whenuapai, Hobsonville and Trig Road south ◆ New primary school on Riverlea Road ◆ Secondary school on Riverlea Road ◆ 5,105 dwellings in Whenuapai including: <ul style="list-style-type: none"> ▪ 850 existing outside future urban zone ▪ 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road ▪ 2,350 new dwellings around Trig Road south of SH18 ▪ 755 new dwellings in the Kauri Road area ◆ No new business activity 	As above.	As above, plus widening of Brigham Creek Road between the SH18 interchange roundabouts and changing the lane arrangements to provide a double right turn from the SH18 southbound off-ramp, with two lanes provided through the southbound off-ramp roundabout.	Needs to be assessed for each application but indicatively with 100 new dwellings in the Kauri Road area.	Capacity improvements at the traffic signal controlled intersection of Kauri Road/Brigham Creek Road identified in the Base Scenario, including double right turn lanes from Brigham Creek Road east.	Needs to be assessed for each application but indicatively with 200 new dwellings in Kauri Road area. It is noted that the lane arrangement for this intersection could be constructed initially at the Base Scenario stage, rather than when development occurs.
Scenario 1c (background growth based on ART 2021)	<ul style="list-style-type: none"> ◆ Primary schools at Whenuapai, Hobsonville, Trig Road south and Riverlea Road ◆ Secondary school on Riverlea Road ◆ 5,470 dwellings in Whenuapai including: <ul style="list-style-type: none"> ▪ 850 existing outside future urban zone ▪ 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road ▪ 2,350 new dwellings around Trig Road south of SH18 ▪ 755 new dwellings in the Kauri Road area ▪ 365 new dwellings northwest of the SH18/Brigham Creek Road interchange ◆ No new business activity 	As above.	As above, plus RTN/FTN along SH18 with stations adjacent to SH18 ¹⁴ , with new link provided between the Sinton Road RTN station and Kauri Road, providing as a minimum, access for pedestrians, cyclists and buses.	Any new development northwest of the SH18/Brigham Creek Road interchange as included in vehicle trip rate predictions for the Kauri Road development.	As above, plus addition of fourth leg to Kauri Road/Brigham Creek Road intersection (assumes this does not connect through to Trig Road).	Any development northwest of the SH18/Brigham Creek Road interchange.

Scenario	Land Use Assumptions		Associated Transport Infrastructure			
	Whenuapai	Adjacent Land Use Development	Regional Transport Network		Whenuapai Proposed Plan Change Transport Network	
			Investment	Triggers	Investment	Triggers
Scenario 1d (background growth based on ART 2021)	<ul style="list-style-type: none"> ◆ Primary schools at Whenuapai, Hobsonville, Trig Road south and Riverlea Road ◆ Secondary school on Riverlea Road ◆ 6,670 dwellings in Whenuapai including: <ul style="list-style-type: none"> ▪ 850 existing outside future urban zone ▪ 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road ▪ 2,350 new dwellings around Trig Road south of SH18 ▪ 750 new dwellings in the Kauri Road area ▪ 365 new dwellings northwest of the SH18/Brigham Creek Road interchange ▪ 1200 new dwellings in the Sinton Road area ◆ No new business activity 	As above.	As above, plus capacity improvements at the SH16/Brigham Creek Road roundabout comprising a signalised roundabout or a left turn slip lane on the SH16 south approach.	Required for any development in Sinton Road area, although resulting from growth within all new development areas.	As above, plus removal of the existing Sinton Road connection to the Brigham Creek Road/SH18 Northbound on-ramp intersection, with a new connection provided between Sinton Road and Kauri Road. This link could follow the same alignment as the link identified for Scenario 1c.	Needs to be assessed for each application but indicatively with 500 new dwellings in the Sinton Road area.
					New local link crossing SH18 connecting the Sinton Road area via Sinton Road East to Hobsonville Road.	Needs to be assessed for each application but indicatively with 900 new dwellings in the Sinton Road area. As well as being considered necessary to provide for travel options, this link also provides necessary resilience with regard to emergency access to and from the Sinton Road area.

Scenario	Land Use Assumptions		Associated Transport Infrastructure			
	Whenuapai	Adjacent Land Use Development	Regional Transport Network		Whenuapai Proposed Plan Change Transport Network	
			Investment	Triggers	Investment	Triggers
Scenario 1e (background growth based on ART 2021)	<ul style="list-style-type: none"> ◆ Primary schools at Whenuapai, Hobsonville and Trig Road south ◆ Secondary school on Riverlea Road ◆ 6,670 dwellings in Whenuapai including: <ul style="list-style-type: none"> ▪ 850 existing outside future urban zone ▪ 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road ▪ 2,350 new dwellings around Trig Road south of SH18 ▪ 750 new dwellings in the Kauri Road area ▪ 365 new dwellings northwest of the SH18/Brigham Creek Road interchange ▪ 1200 new dwellings in the Sinton Road area ◆ New business activity including 2,800 employees in the vicinity of Brigham Creek Road East and Trig Road. 	As above.	As above, south facing ramps at the SH18/Squadron Drive interchange. ¹⁴	Needs to be assessed for each application but likely required with 1,000 FTE in the development area near Brigham Creek Road.	As above, plus construct new Collector and Local roads into business area from Brigham Creek Road east of Trig Road.	Any development requiring access to avoid driveways onto Brigham Creek Road (as these will have cycle facilities).
			Traffic signals at the intersections forming the SH18/Trig Road interchange (including allowing for future extension of Northside Drive at the on-ramp intersection).	Needs to be assessed for each application but likely required for any new development along Trig Road north of SH18.	Traffic signals at the intersection of the above proposed Collector roads and Brigham Creek Road.	Needs to be assessed for individual application but indicatively required with 100 FTE along any local roads connected to Brigham Creek Road
					Construct new Collector and Local roads east from Trig Road towards Kauri Road Extension (assumes these do not join Brigham Creek Road/Kauri Road intersection - otherwise could need further changes at Brigham Creek Road/SH18 interchange)	Any new development east of Trig Road and any development requiring access to avoid driveways onto Trig Road (as these will have cycle facilities).
					Construct new Collector and Local roads into business area from Trig Road to the west.	Any development requiring access to avoid driveways onto Trig Road (as these will have cycle facilities).
				Urbanisation of Trig Road between Brigham Creek Road and SH18 Interchange	Any development fronting an existing road will need to upgrade it to urban standard and enable separated cycle facilities.	

Scenario	Land Use Assumptions		Associated Transport Infrastructure			
	Whenuapai	Adjacent Land Use Development	Regional Transport Network		Whenuapai Proposed Plan Change Transport Network	
			Investment	Triggers	Investment	Triggers
Scenario 2 (background growth based on ART 2026)	<ul style="list-style-type: none"> ◆ Primary schools at Whenuapai, Hobsonville and Trig Road south ◆ Secondary school on Riverlea Road ◆ 8,070 dwellings in Whenuapai including: <ul style="list-style-type: none"> ▪ 850 existing outside future urban zone ▪ 1,150 consented dwellings located either side of Totara Road between Brigham Creek Road and Dale Road ▪ 2,350 new dwellings around Trig Road south of SH18 ▪ 750 new dwellings in the Kauri Road area ▪ 365 new dwellings northwest of the SH18/Brigham Creek Road interchange ▪ 1,200 new dwellings in the Sinton Road area ▪ 700 new dwellings in the Brigham Creek Road/Mamari Road area ▪ 700 new dwellings in the Brigham Creek Road/Riverlea Road area ◆ Business activity including: <ul style="list-style-type: none"> ▪ 2,800 employees in the vicinity of Brigham Creek Road East and Trig Road ▪ 1,400 employees in the vicinity of Trig Road west and Brigham Creek Road extension 	Same as the 2026 Scenario I10 Land Use	As above, plus provide increased capacity at SH16/Brigham Creek Road roundabout comprising a signalised roundabout or free left turn lanes on the SH16 north, Fred Taylor Drive west and Brigham Creek Road east approaches.	Required due to background growth and accumulated growth in Whenuapai.	Extend Riverlea Road into the residential development south of Brigham Creek Road with addition of fourth leg to Brigham Creek Road/Riverlea Road signalised intersection (no connection between Riverlea Road and Spedding Road necessary).	Development south of Brigham Creek Road, to avoid driveways on to Brigham Creek Road.
			Motorway to motorway connections between SH16 (north) and SH18.		New East West road extending from Brigham Creek Road/Trig Road intersection connecting Mamari Road north and Riverlea Road extension. Addition of fourth leg to Trig Road/Brigham Creek Road signalised intersection and include two right turn lanes from Brigham Creek Road east to Brigham Creek Road north.	Assessed for individual application depending where development occurs
			Northside Drive connection to SH18/Trig Road interchange.			
			Additional westbound lane on SH18 between Squadron Drive westbound off ramp and Trig Road westbound off ramp.			
			Capacity upgrades at SH18/Brigham Creek Road interchange. Options to be assessed by the SH16/18 corridor improvement study		Widening of Brigham Creek Road to two lanes per direction between SH16 and Riverlea Road.	Need to be assessed for individual applications depending where development occurs
			Widening of Hobsonville Road between Trig Road and Marina View Road		Traffic signals at the Trig Road/Kauri Road Extension intersection.	Needs to be assessed for each application depending where employment occurs.
					Urbanisation of Mamari Road south of Brigham Creek Road; rear access is assumed to enable separated cycle facility	Needs to be assessed for each application depending where development occurs.
	Extend Mamari Road north and south as development occurs, eventually linking between Northside Drive extension and Brigham Creek Road.	Needs to be assessed for each application depending where development occurs.				

5 SENSITIVITY TESTS

5.1 Sensitivity on Development Sequence

An assessment of two alternative development sequences has been undertaken, with the land use Scenarios identified above occurring in the following order:

Test 1 – assumed order of development

- ◆ Scenario 1a
- ◆ Scenario 1b
- ◆ Scenario 1d
- ◆ Scenario 1c

Test 2 – assumed order of development

- ◆ Scenario 1a
- ◆ Scenario 1e
- ◆ Scenario 1b
- ◆ Scenario 1c

With both tests, the higher vehicle trip rates have been assumed for the 1b, 1c, 1d and 1e new residential areas as no FTN/RTN is assumed to be in place by 2021 that would serve these areas. Scenario 1a is assumed to benefit from FTN services along Hobsonville Road and to include complementary bus collector services through the development. The risk of not implementing RTN prior to development occurring is that developers will design the neighbourhood around a dominant car mode and residents will be accustomed to using their cars, which could prove difficult to change once RTN is provided. However, for the purposes of the assessment, the following has been determined.

Test 1

- ◆ Scenario 1a requires the same transport provisions as identified above (Section 3.6) including those identified for the Base Scenario (Section 3.5)
- ◆ New residential development in the Kauri Road area will require the transport provisions identified for Scenario 1b (Section 3.7)
- ◆ New residential development then occurring in the Sinton Road area (1d), rather than west of the SH18/Brigham Creek Road interchange (1c) can be accommodated as the Kauri Road/Brigham Creek Road intersection maintains the capacity of a T intersection, rather than a cross roads. Transport provisions necessary for Scenario 1d include the following:
 - Removal of the existing Sinton Road connection to the Brigham Creek Road/SH18 Northbound on-ramp intersection, with a new connection provided between Sinton Road and Kauri Road. Needs to be assessed for each application but indicatively with 200 new dwellings in the Sinton Road area

- New local link crossing SH18 connecting the Sinton Road area via Sinton Road East to Hobsonville Road. Needs to be assessed for each application but indicatively with 900 new dwellings in the Sinton Road area. As well as being considered necessary to provide for travel options, this link also provides necessary resilience with regard to emergency access to and from the Sinton Road area.
- ◆ No new residential dwellings in the area west of the SH18/Brigham Creek Road interchange (Scenario 1c) can occur without RTN being provided to reduce vehicle trip rates in areas associated with Scenario 1b and 1d. However, as noted above, travel patterns will already be established and the anticipated lower vehicle trip rates may not be achieved.

Test 2

- ◆ Scenario 1a requires the same transport provisions as identified above (Section 3.6) including those identified for the Base Scenario (Section 3.5)
- ◆ New commercial development in the area east of Trig Road (Scenario 1e) will require the following transport provisions:
 - Increased capacity at the SH16/Brigham Creek Road roundabout comprising a signalised roundabout or a left turn slip lane on the SH16 South approach. Indicatively required with 2,000 FTE within Whenuapai Business Development area
 - Traffic signals at the SH18 Trig Road Interchange, required for any new development along Trig Road north of SH18
 - Traffic signals at the Brigham Creek Road/Trig Road intersection, required for any new development in proximity of Trig Road north
 - Construct new collector roads into business area from Brigham Creek Road east of Trig Road, required by any new development requiring access to avoid driveways onto Brigham Creek Road
 - Traffic signals at the intersection of the above proposed collector roads and Brigham Creek Road. Needs to be assessed for individual application but indicatively required with 100 FTE along any local roads connected to Brigham Creek Road
 - Construct new collector roads into business area from Trig Road towards Kauri Road Extension (assume this does not join Brigham Creek Road/Kauri Road intersection), required with any new development requiring access to avoid driveways onto Trig Road
 - Additional through lanes on Brigham Creek Road approaches at the signalised Kauri Road/Brigham Creek Road intersection. Needs to be assessed for individual application but indicatively required with 400 FTE jobs in Brigham Creek Road area
- ◆ New residential development in the Kauri Road area (Scenario 1b), assuming the higher vehicle trip rates can be accommodated by including the following:
 - Widening of Brigham Creek Road between the SH18 interchange roundabouts and changing the lane arrangements to provide a double right turn from the SH18 southbound off-ramp, with two lanes provided through the southbound off-ramp roundabout. Required with any new development in Kauri Road area

- Capacity improvements at the traffic signal controlled intersection of Kauri Road/Brigham Creek Road identified in the Base Scenario, including widening of the Brigham Creek Road and Kauri Road approaches, including double right turn lanes from Brigham Creek Road east.
- ◆ No additional development eg in the Sinton Road area is possible without RTN being provided and a sufficient reduction in vehicle trip rates for existing developed areas being achieved.

The above tests indicate that the separate development areas can be developed in isolation but that there is a real risk that a delay in implementing RTN along SH18 to serve new development areas will result in an embedded higher vehicle trip rate than might otherwise occur, which could restrict the potential development scale of the Whenuapai Plan Change area.

5.2 Sensitivity on Yield

An assessment of additional yield by increasing densities by 10% has been tested and the following has been determined.

Scenario 1a plus 10% yield

- ◆ Scenario 1a requires the same transport provisions as identified above (Section 3.6) including those identified for the Base Scenario (Section 3.5)

Scenario 1b plus 10% yield

This scenario assumes Scenarios 1a also include an extra 10% yield.

- ◆ Scenario 1b requires the same transport provisions as identified above (Section 3.7) including those identified for the Base Scenario (Section 3.5) and Scenario 1a (Section 3.6)

Scenario 1c plus 10% yield

This scenario assumes Scenarios 1a and 1b also include an extra 10% yield.

- ◆ Scenario 1c requires the same transport provisions as identified above (Section 3.8) including those identified for the Base Scenario (Section 3.5), Scenario 1a (Section 3.6) and Scenario 1b (Section 3.7) plus:
 - Removal of the existing Sinton Road connection to the Brigham Creek Road/SH18 Northbound on-ramp intersection, with a new connection provided between Sinton Road and Kauri Road.
 - New local link crossing SH18 connecting the Sinton Road area via Sinton Road East to Hobsonville Road.

As per the previous assessment, this scenario inherently assumes that RTN is provided with a lower vehicle trip rate applied to the 1b new development area.**Scenario 1d plus 10% yield**

This scenario assumes Scenarios 1a, 1b and 1c also include an extra 10% yield.

- ◆ Scenario 1d requires the same transport provisions as identified above (Section 3.8) including those identified for the Base Scenario (Section 3.5), Scenario 1a (Section 3.6), Scenario 1b (Section 3.7) and Scenario 1c (Section 3.8)

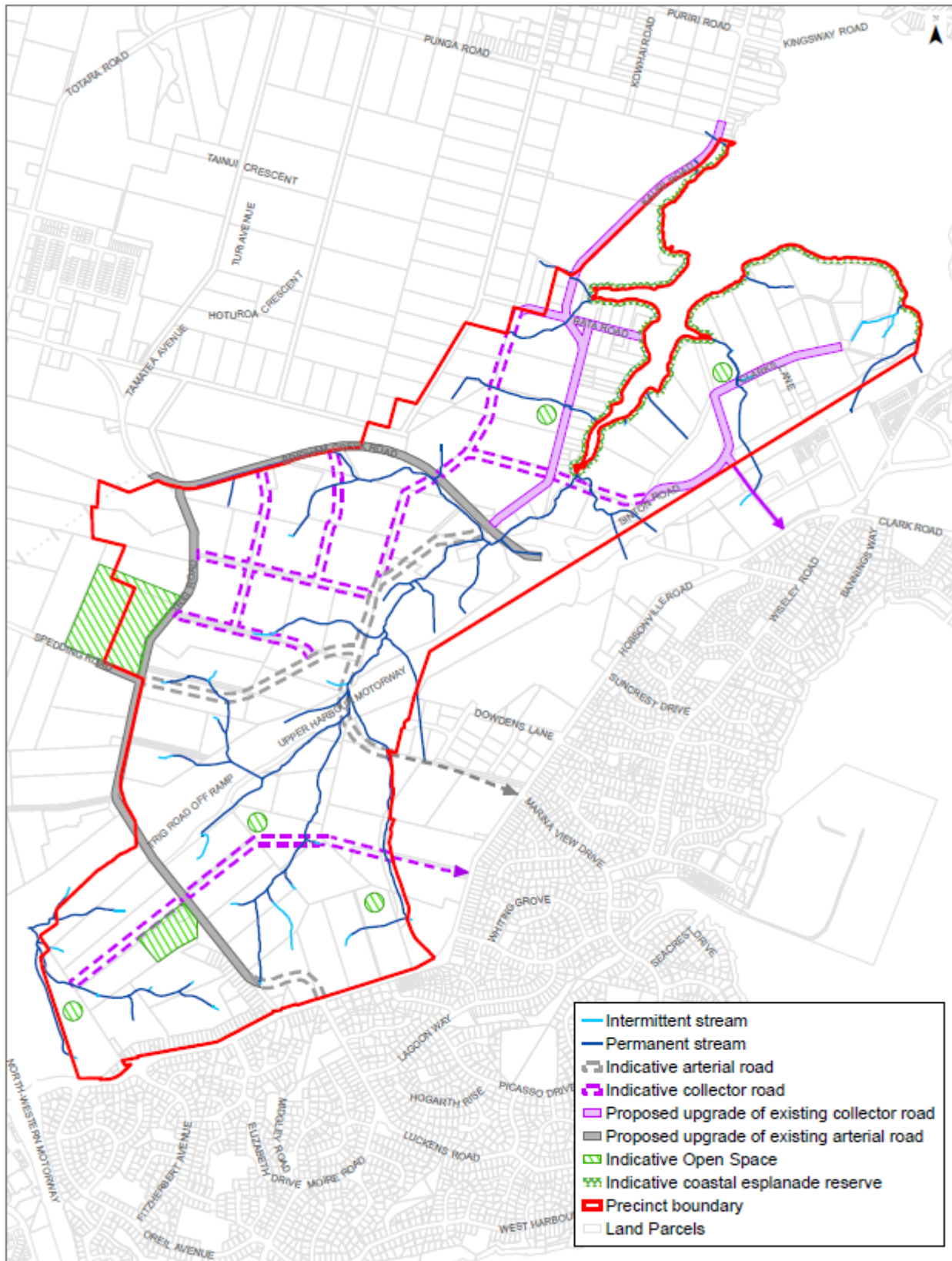
Scenario 1e plus 10% yield

This scenario assumes Scenarios 1a, 1b, 1c and 1d also include an extra 10% yield.

- ◆ The following intersections have been identified as operating close to or above their theoretical capacity:
 - Brigham Creek Road/Kauri Road intersection
 - Trig Road/Hobsonville Road intersection is predicted to operate with Level of Service (LOS) E on the Luckens Road approach. However, LOS D can be achieved with an additional right turn lane provided on the Luckens Road approach

The above tests indicate that the transport provisions proposed for the Whenuapai Plan Change Stage 1 development have some flexibility to include some additional residential developments, provided that RTN/FTN can be provided to facilitate public transport travel and therefore lower vehicle trip rates throughout the area.

APPENDIX A Draft Whenuapai 3 Precinct Plan



Draft Whenuapai 3 Precinct Plan 1

Date: 15/03/2017

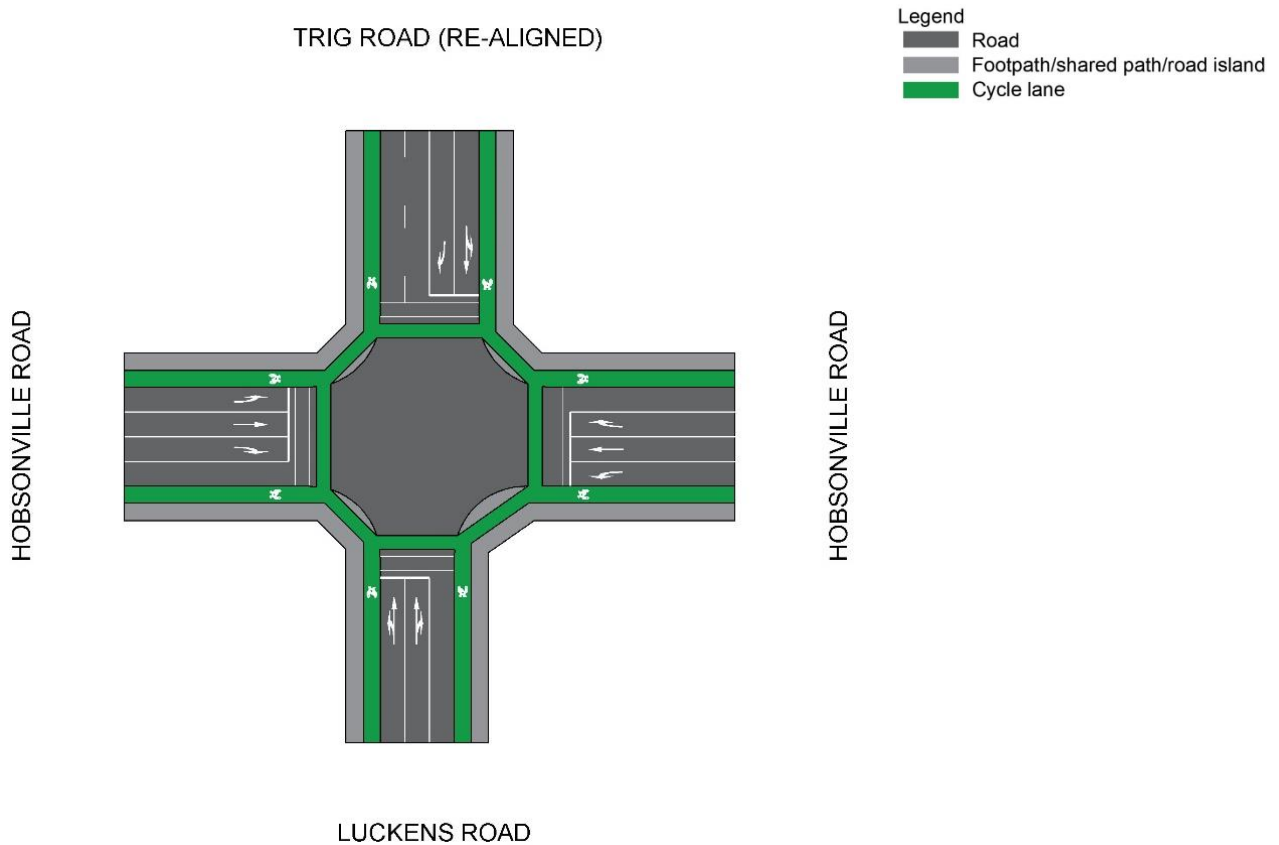
APPENDIX B

N/A

APPENDIX C Indicative Intersection Layouts

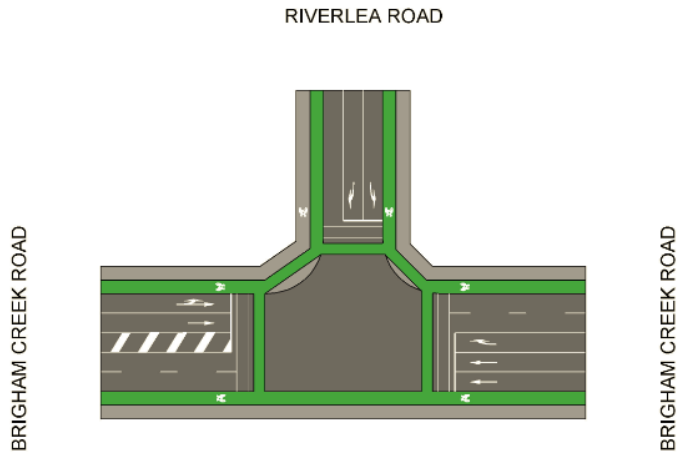
Trig Road/Hobsonville Road/Luckens Road

Layout anticipated to be provided in the Base Scenario. In addition to the layout shown, bus priority measures are likely to be required on Trig Road North and both Hobsonville Road approaches. Bus stops should be allowed for on Hobsonville Road, downstream of the traffic signals.

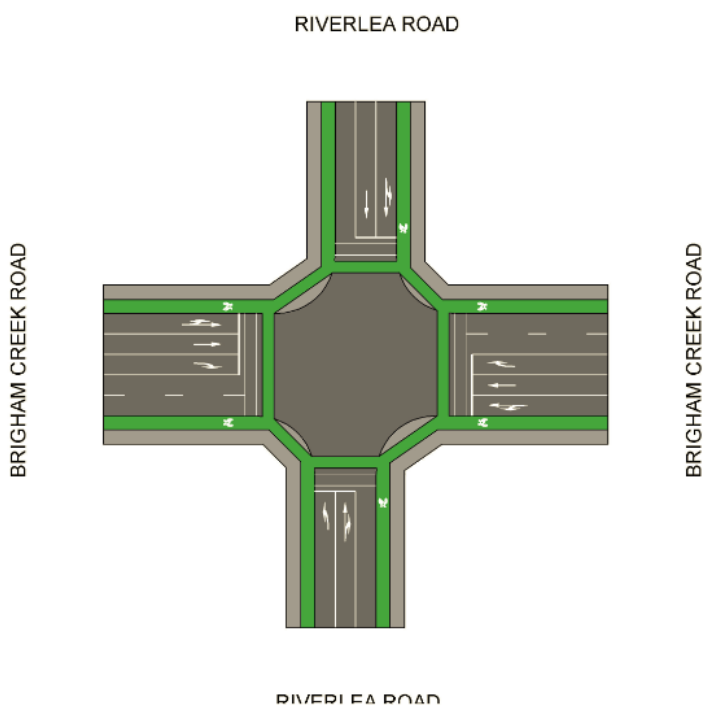


Brigham Creek Road/Riverlea Road Intersection

Required when the new Secondary School is provided on Riverlea Road - assumed to be in place with Scenarios 1a, 1b, 1c, 1d, and 1e. In addition to the layout shown, bus priority measures are likely to be required on Brigham Creek Road and Riverlea Road with bus stops allowed for downstream of the traffic signals.

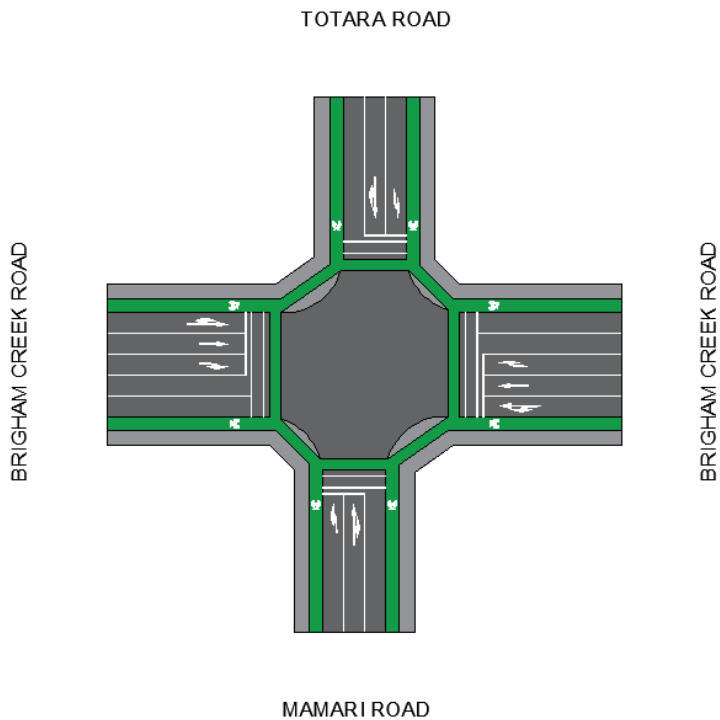


Scenario 2 layout includes development south of Brigham Creek Road, requiring Riverlea Road to extend south to avoid driveways onto Brigham Creek Road. In addition to the layout shown, bus priority measures are likely to be required on Brigham Creek Road and Riverlea Road with bus stops allowed for downstream of the traffic signals.



Brigham Creek Road/Totara Road/Mamari Road Intersection

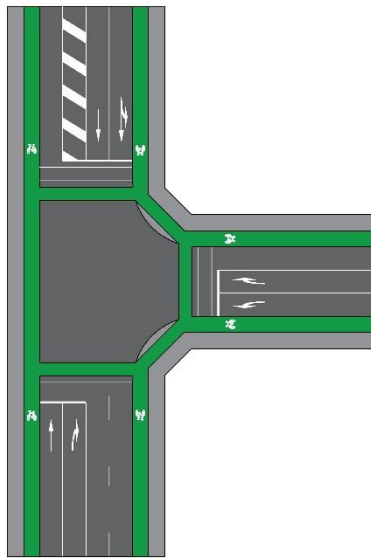
Layout as per ATOC design and therefore considered as part of the Base Scenario. Layout will need to be amended to include appropriate cycle infrastructure and bus priority measures. Bus priority measures likely to be required on Brigham Creek Road and Totara Road with bus stops allowed for downstream of the traffic signals.



Brigham Creek Road/Tamatea Avenue Intersection

Considered necessary as part of the Base Scenario and will need to include appropriate cycle infrastructure and bus priority measures. Bus priority measures likely to be required on Brigham Creek Road with bus stops allowed for downstream of the traffic signals.

BRIGHAM CREEK ROAD

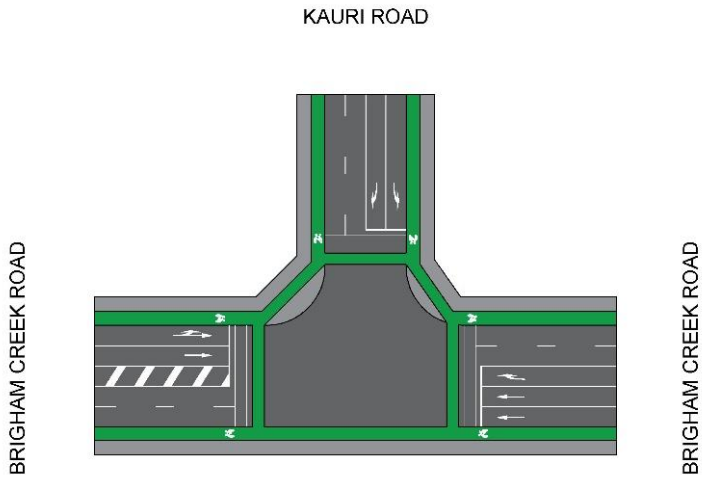


TAMATEA AVENUE

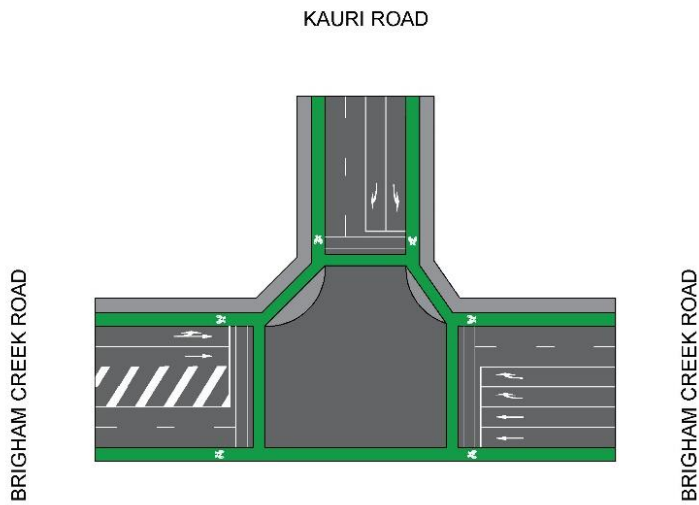
BRIGHAM CREEK ROAD

Brigham Creek Road/Kauri Road Intersection

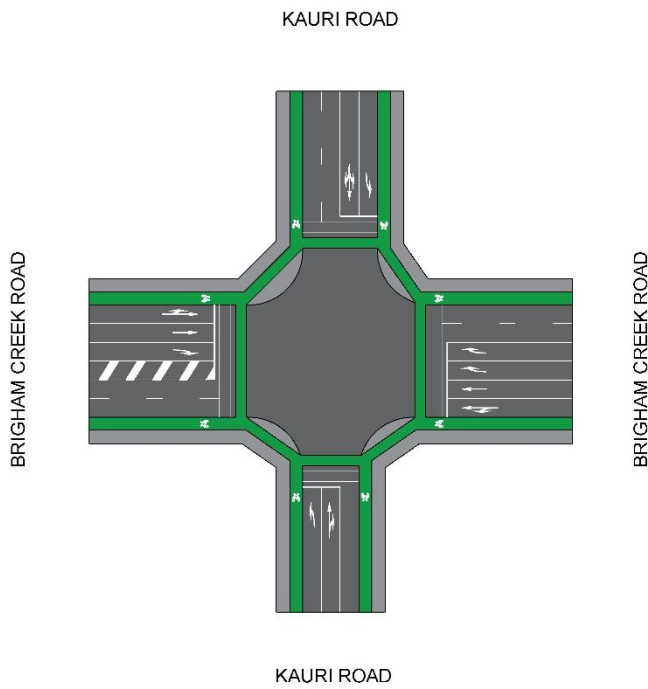
Considered necessary as part of the Base Scenario and will need to include appropriate cycle infrastructure and bus priority measures. Bus priority measures likely to be required on Brigham Creek Road and Kauri Road with bus stops allowed for downstream of the traffic signals.



Layout for Scenario 1b (indicatively required with 300 dwellings within Kauri Road development). Layout will need to be amended to include appropriate cycle infrastructure and bus priority measures.

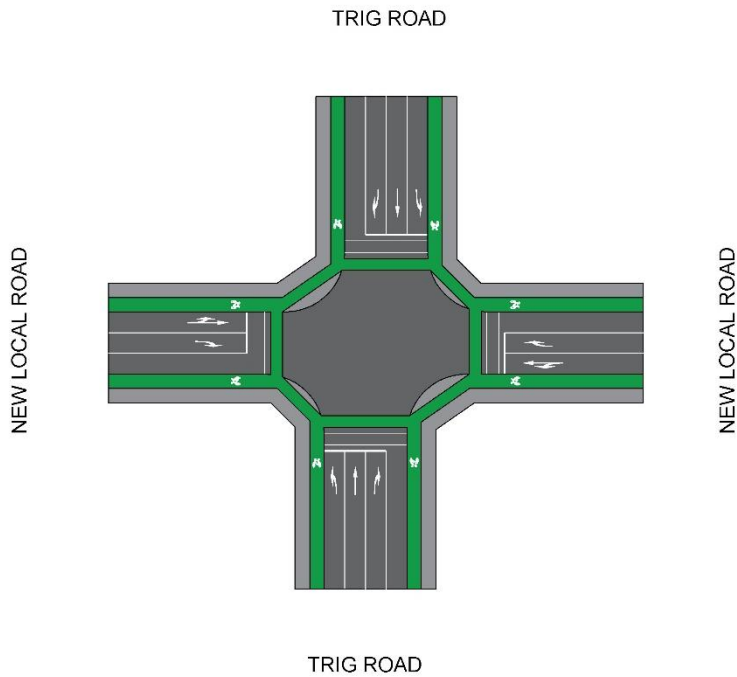


Layout for Scenarios 1c, 1d, 1e and 2 (required with any development in the area northwest of SH18 interchange). Layout to be amended to include appropriate cycle infrastructure and bus priority measures.



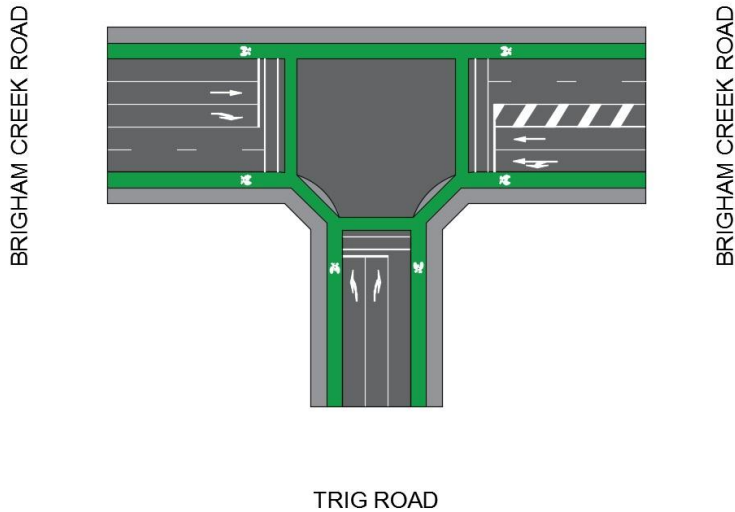
Trig Road/Residential Connector Road between SH18 and Hobsonville Road

Layout for Stage 1a (indicatively required with 400 dwellings either side of Trig Road). Layout will need to be amended to include appropriate cycle infrastructure and bus priority measures. Bus priority measures likely to be required on Trig Road with bus stops allowed for downstream of the traffic signals.

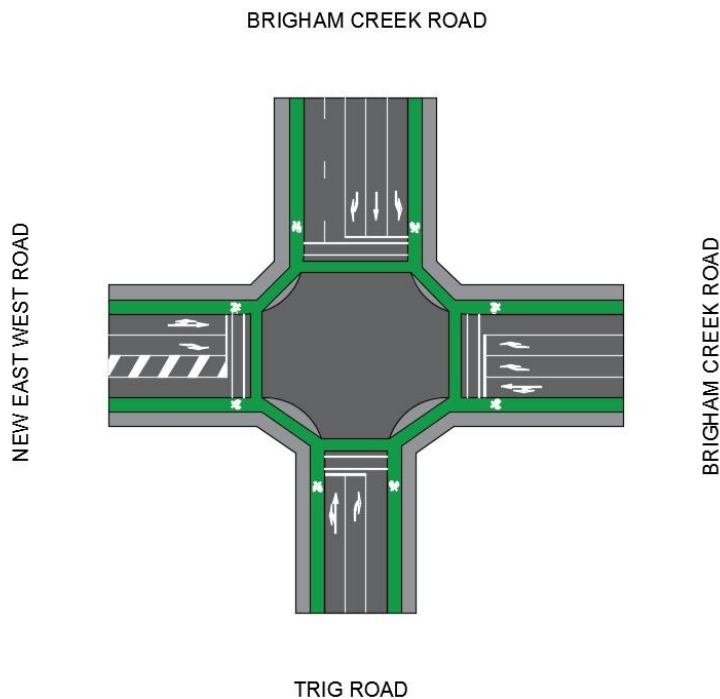


Brigham Creek Road/Trig Road Intersection

Considered necessary as part of the Base Scenario and will need to include appropriate cycle infrastructure and bus priority measures. Bus priority measures likely to be required on Brigham Creek Road and Trig Road with bus stops allowed for downstream of the traffic signals.

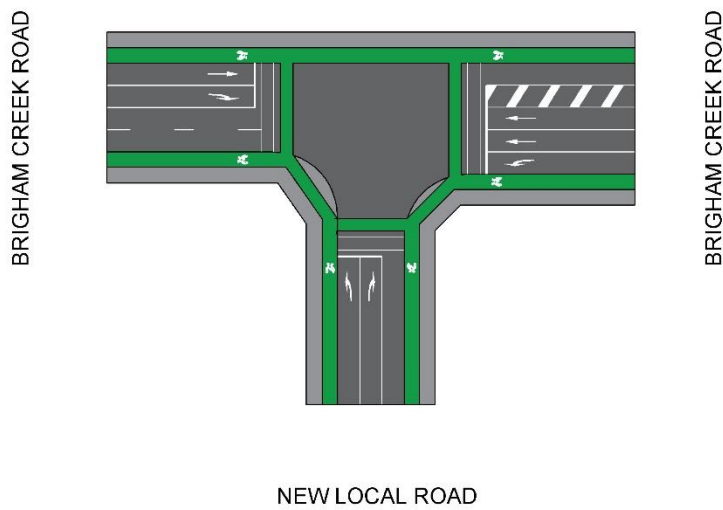


Fourth leg added for Stage 2 (need to be assessed for individual application depending where development occurs). Layout will need to be amended to include appropriate cycle infrastructure and bus priority measures and bus stops.



Brigham Creek Road/Collector Roads Intersection between Trig Road and Kauri Road

Layout for Scenarios 1e and 2 (indicatively required with 100 FTE along any local road connected to Brigham Creek Road). Layout will need to be amended to include appropriate cycle infrastructure and bus priority measures. Bus priority measures likely to be required on Brigham Creek Road with bus stops allowed for downstream of the traffic signals.



Trig Road/Spedding Road/Kauri Road Extension Intersection

Layout for Scenario 2 (to be assessed for each application depending when employment occurs). Layout will need to be amended to include appropriate cycle infrastructure and bus priority measures. Bus priority measures likely to be required on all approaches with bus stops allowed for downstream of the traffic signals.

