Rotokauri Strategic Infrastructure Designation

Integrated Transport Assessment Report

Prepared for Hamilton City Council

Prepared by Beca Limited

19 September 2024

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Contents

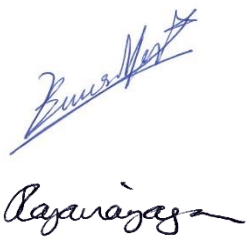
Appendices

Appendix A – Modelling Outputs

Revision History

Revision Nº	Prepared by	Description	Date
A	Skip Fourie	Draft Report	06/04/2022
B	Bevis Ye & Shania Rajanayagam	Draft Report Update	31/05/2023
C	Bevis Ye & Shania Rajanayagam	Draft Report Update	12/07/2023
D	Bevis Ye & Shania Rajanayagam	Final Draft	26/07/2023
E	Craig Richards	Final	04/08/2023
F	Bevis Ye	Final Report Update	17/08/2023
G	Craig Richards	Minor updates S92	10/04/2024
H	Ryan Ainsworth – Project Manager	Update to Figure 5-1 to reflect latest drawing revision	19/09/2024

Document Acceptance

Action	Name	Signed	Date
Prepared by	Bevis Ye & Shania Rajanayagam		26/07/2023
Reviewed by	Craig Richards		19/09/2024
Approved by	Craig Sharman		19/09/2024
on behalf of	Beca Limited		

Executive Summary

Beca Limited (**Beca**) has been commissioned by Hamilton City Council (**HCC**) to prepare an Integrated Transport Assessment (**ITA**) for a Notice of Requirement (**NOR**) application for the Rotokauri Strategic Infrastructure Designation. This NOR application seeks designation of a proposed 5.8km transport network and associated three waters in Northwest Hamilton. This road will support future urban growth in the Rotokauri Growth Cell. The Rotokauri Structure Plan enables anticipated urban growth that supports sustainable travel options by providing appropriate densities, locations and a variety of land uses.

Importantly the NOR is protecting a corridor to enable the construction and operation of a multi-modal transport network in the future. An appropriately designed corridor enables the ability to provide for a range of transport choices, and quality amenity features, prior to or as demand requires, not simply a road for cars.

The purpose of the ITA is to ensure that the transportation effects of the designation are well considered, that there is an emphasis on safety and accessibility by all transport modes and that any adverse transport effects are avoided, remedied or mitigated through sound design principles.

The assessment of traffic effects includes traffic modelling undertaken using the Signalised & Unsignalised Intersection Design and Research Aid (**SIDRA**) software package for analysing traffic flow at road intersections in the designation area. The modelling analysis utilises Waikato Regional Transportation Model (**WRTM**) data for the future year 2051.

The traffic modelling assessment illustrates the proposed corridor intersections operate satisfactorily in the 2051 future year. SIDRA intersection results have informed the civil design layouts of the modelled intersections as part of the designation process.

The Project includes an extensive network of separated pedestrian, cycleway and micro-mobility pathways across all of the transport corridors, these vary from 1.8m – 2.8m. Provisions are made to support bus movements and the network supports future bus service planning (design of routes, frequencies and bus stops etc that will occur as part of subsequent planning and design stages).

The transport network outlined in this report aims to meet overarching national and local transport policy guidelines and achieve the outcomes set out by transportation specific documents, such as Ministry of Transport Outcomes Framework, Government Policy Statement on Land Transport (**GPS**), National Policy Statement on Urban Development (**NPS-UD**) and Hamilton City Council Operative District Plan (**District Plan**). This is achieved by the designation facilitating the use of multi-modal transport options including public transport, cycling and walking.

An assessment of compliance against the District Plan, which also refers to the Regional Infrastructure Technical Specifications (**RITS**) in terms of road design requirements, has been undertaken as part of this ITA. The designation transport network is generally in line with the District Plan and RITS.

The ITA concludes that the design suitably accommodates anticipated travel volumes by a range of modes. With these networks in place the transport system is expected to sufficiently accommodate the proposed land use for the Rotokauri area. The ITA confirms that the cross-sections prepared can accommodate the expected future traffic volumes, allow for buses, and provide for active modes. In the event that travel demand volumes are higher than assumed in the ITA, changes can be made to facilitate higher public transport uptake i.e. more frequent buses, or support mode shift to walking and cycling (behaviour change campaigns etc). It is not desirable to widen the corridor further to accommodate additional private vehicle travel demand as this has associated severance and potential environmental effects (emission etc).

Future planning and design stages, e.g., resource consent, will further develop the design and staging of transport infrastructure to support the development of land within the Rotokauri area.

1 Introduction

Beca has been engaged by Hamilton City Council (**HCC**) to prepare an Integrated Transport Assessment (**ITA**) to accompany the Notice of Requirement (**NOR**) application for the Rotokauri Strategic Infrastructure Designation (the Project). The transport assessment supports the NOR for a new road designation under Section 168 of the Resource Management Act 1991. The proposed designation includes a 5.8km new transport corridor and associated three waters infrastructure which will support future urban development in Rotokauri, Hamilton.

This report provides analysis on the proposed designation and design of the corridor with a focus on transport safety and multimodal accessibility in the subject area.

1.1 Overview

Situated to the northwest of Hamilton, Rotokauri is a high-priority future growth cell of Hamilton City. An existing structure plan for the Rotokauri area (**Figure 2-3**) is incorporated within the District Plan which provides a high-level framework for development. The Rotokauri Structure Plan enables anticipated urban growth and supports sustainable travel options by providing appropriate densities, locations and a variety of land uses.

To facilitate the development of this area, there is an urgent need to invest in transport stormwater, and wastewater infrastructure networks that will support growth within Rotokauri and integrate into the surrounding networks. HCC is therefore proposing to designate key infrastructure within the Rotokauri Arterial Network Designation Project. This includes higher classification transport links (Arterial Roads) that provide a strategic function within the Rotokauri area.

The Project will support the overall vision for the Rotokauri Structure Plan which is:

"The sustainable expansion of the City into Rotokauri, through a coherent, integrated and people focused mixed use development based on best practice urban design principles."

1.2 Transport Assessment Scope

The scope for this transport assessment includes consideration of the following key topics:

- Existing transport conditions, traffic patterns, property access and crash records
- Predicted traffic flows and impacts on the surrounding network
- Proposed road network against the transport elements of the District Plan including intersection and corridor form, and provisions for public transport, walking and cycling
- The appropriateness of the NOR from a transport engineering perspective.

2 Context

2.1 Location

Rotokauri is a proposed residential greenfield and industrial growth area which is situated in the northwest fringe of Hamilton. Rotokauri is one of four greenfield locations that has been identified by HCC's Growth Model as a targeted area to help meet the City's housing and employment needs.

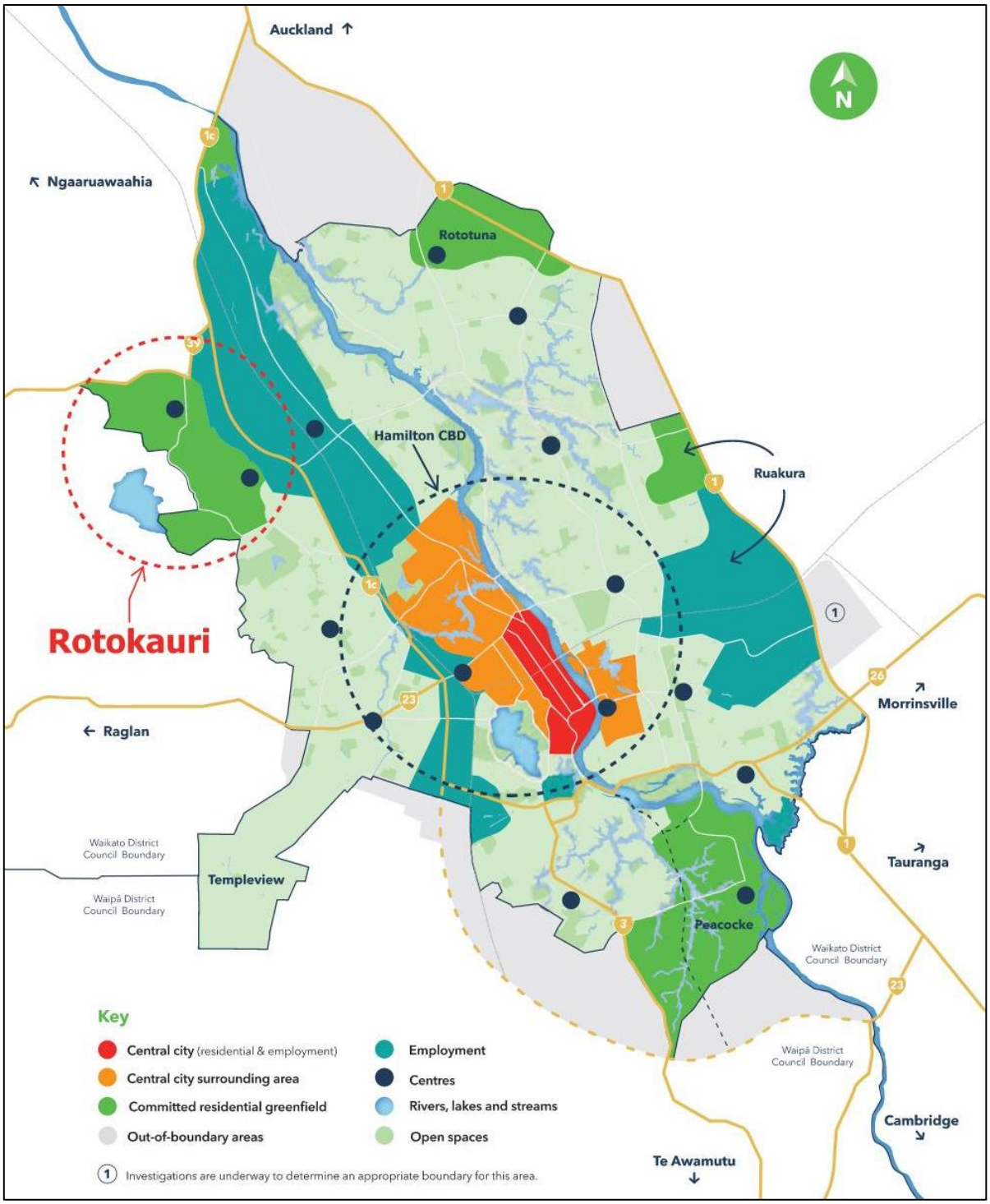


Figure 2-1: Rotokauri Growth Cell Location

The growth area is approximately 788 hectares in size and will predominantly be used for residential development. Within this area a total of 280 hectares will be developed for industrial use, employment areas and a neighbourhood centre which will act as the community focus point around a suburban shopping centre. The mix of land uses will support local living and reduce the need for residents to travel longer distances by car, short trips are more likely to be made by walking, cycling or public transport and the proposed multimodal design of transport facilities further supports this outcome.

2.2 Rotokauri Structure Plan

The Rotokauri development area forms a key part of the future urban growth strategy for Hamilton and will provide for an eventual population of between 16,000 and 20,000 people.

The District Plan includes a Structure Plan that outlines the eventual pattern of development for Rotokauri (refer to **Figure 2-3**). The vision for the area seeks to 'serve the sustainable expansion of the City, through a coherent, integrated and people-focused mixed-use development based on best practice urban design principles.'

The District Plan includes key structural guidance on the development of transportation, reserves, and open space.

The Projects vision, objectives and urban design principles are largely driven by the Structure Plan and Access Hamilton. The Project also integrates with surrounding projects including adjacent Greenway, Rotokauri North Sports Park, and the existing masterplans need to integrate with the Rotokauri Arterials Designation within Rotokauri Structure Plan area.

The Project consists of existing roads which require designation and upgrades to new roads, stormwater, drinking water, and wastewater, both designed as part of this Project.

The guiding principles for the Structure Plan are:

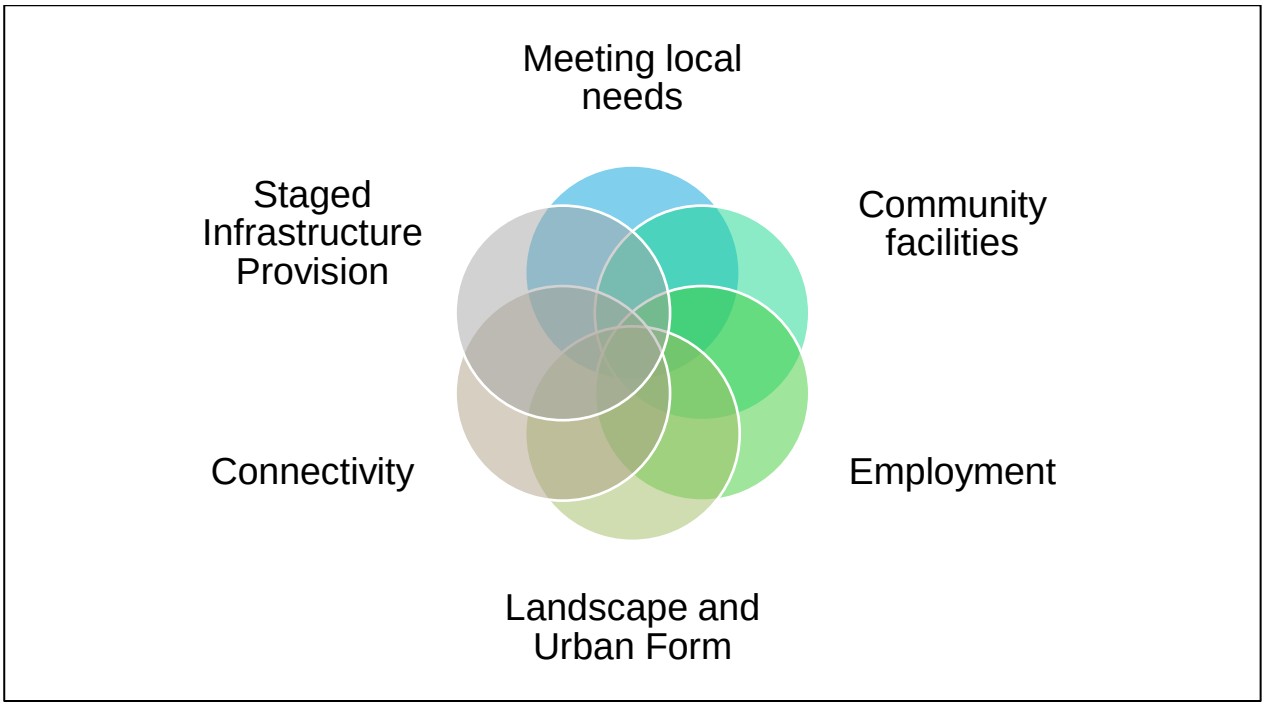


Figure 2-2: Structure Plan Guiding Principles

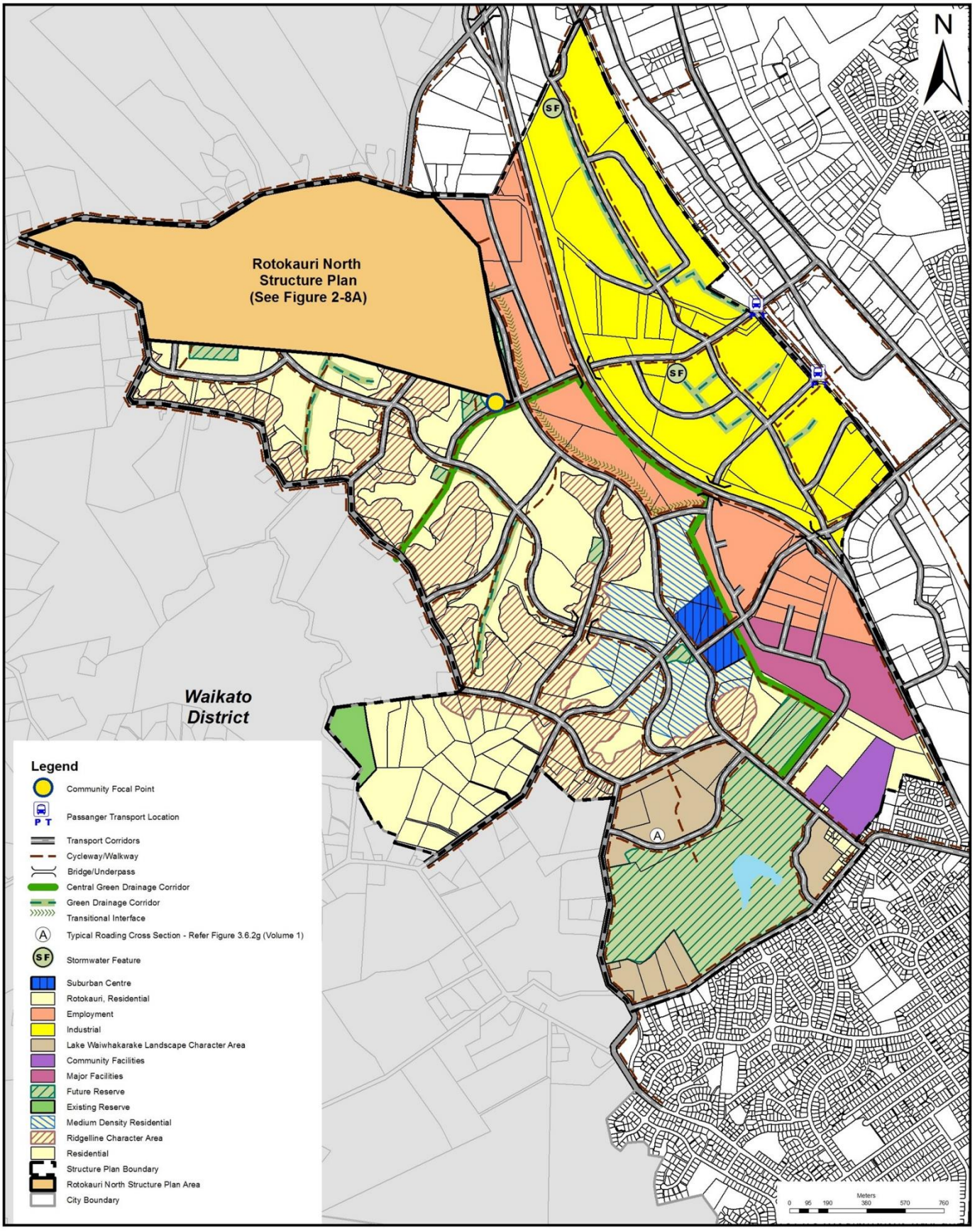


Figure 2-3 - Rotokauri Structure Plan– Land Use (Source: Hamilton City Operative District Plan Figure 2-8)

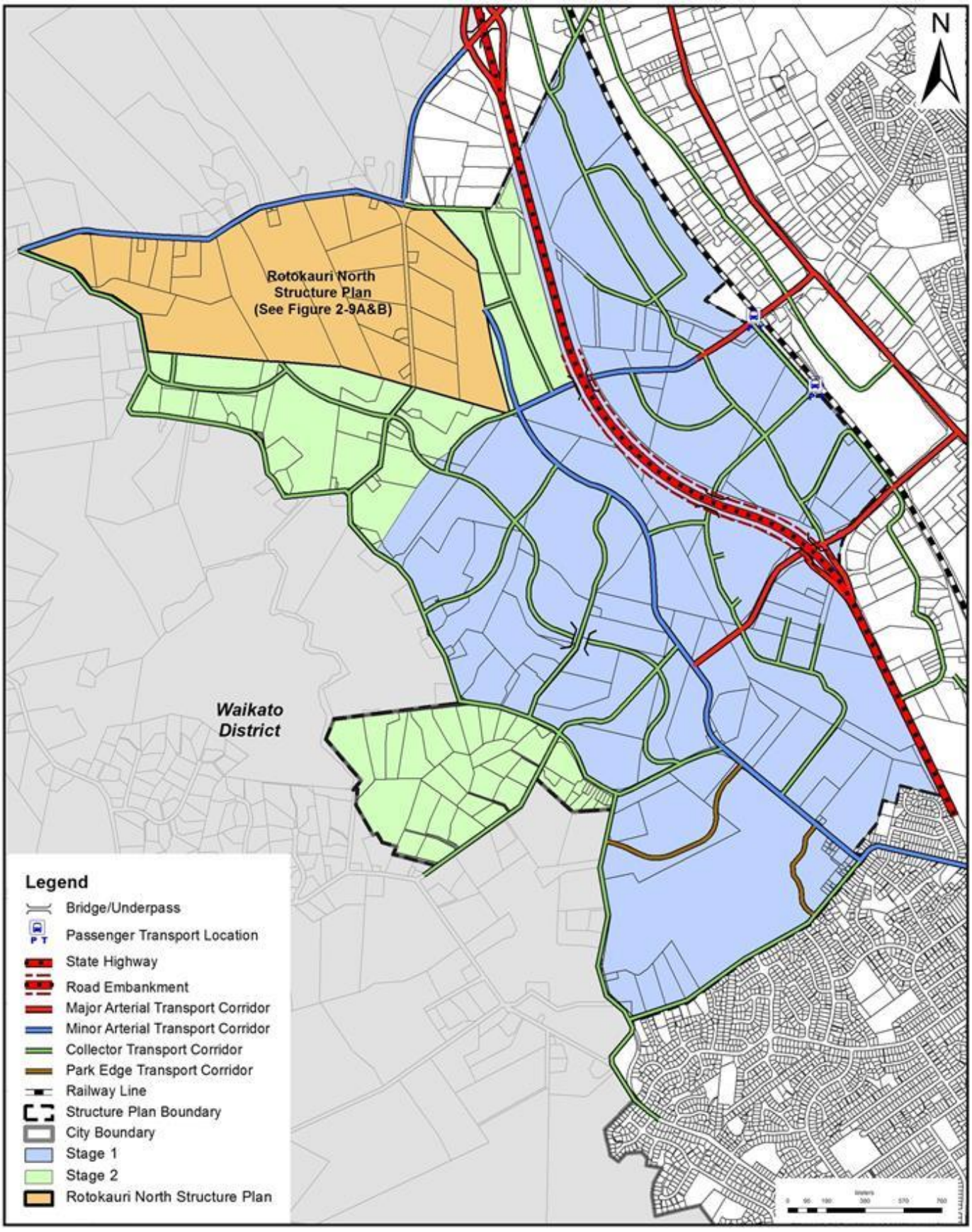


Figure 2-4 - Rotokauri Structure Plan - Staging and Transport Network (Source: Hamilton City Operative District Plan Figure 2-8A)

2.3 Network Operating Framework

The Hamilton Network Operating Framework (**NOF**) sets out a vision for level of service within the structure plan area for public transport, walking, cycling and freight.

Figure 2-5 shows the proposed NOF provided by HCC and used as a key input for the transport context which informs design decisions and functionality of the network. The Structure Plan provides a network hierarchy of major and minor Arterial Roads, collector, and local roads as well as cycleways that cross over key intersections. This creates opportunities for gateways and hierarchy throughout all road corridors.

The NOF framework helps drive the location and level of walking and cycling functionality, where amenity is focused as well as consideration to corridor widths to service vehicle types and balance walking and cycling aspirations.

The proposed layout and connections to the existing road network provide several opportunities to create gateways into the residential development area. This is especially important at Te Wetini Drive, which will be the main entrance to the town centre.

The State Highway creates a visual and physical barrier between industry and the commercial area to the east, and residential and employment to the west. Safe connections between the two for multiple modes requires consideration. Connectivity and a legible network will be important in creating an integrated multi-modal network.

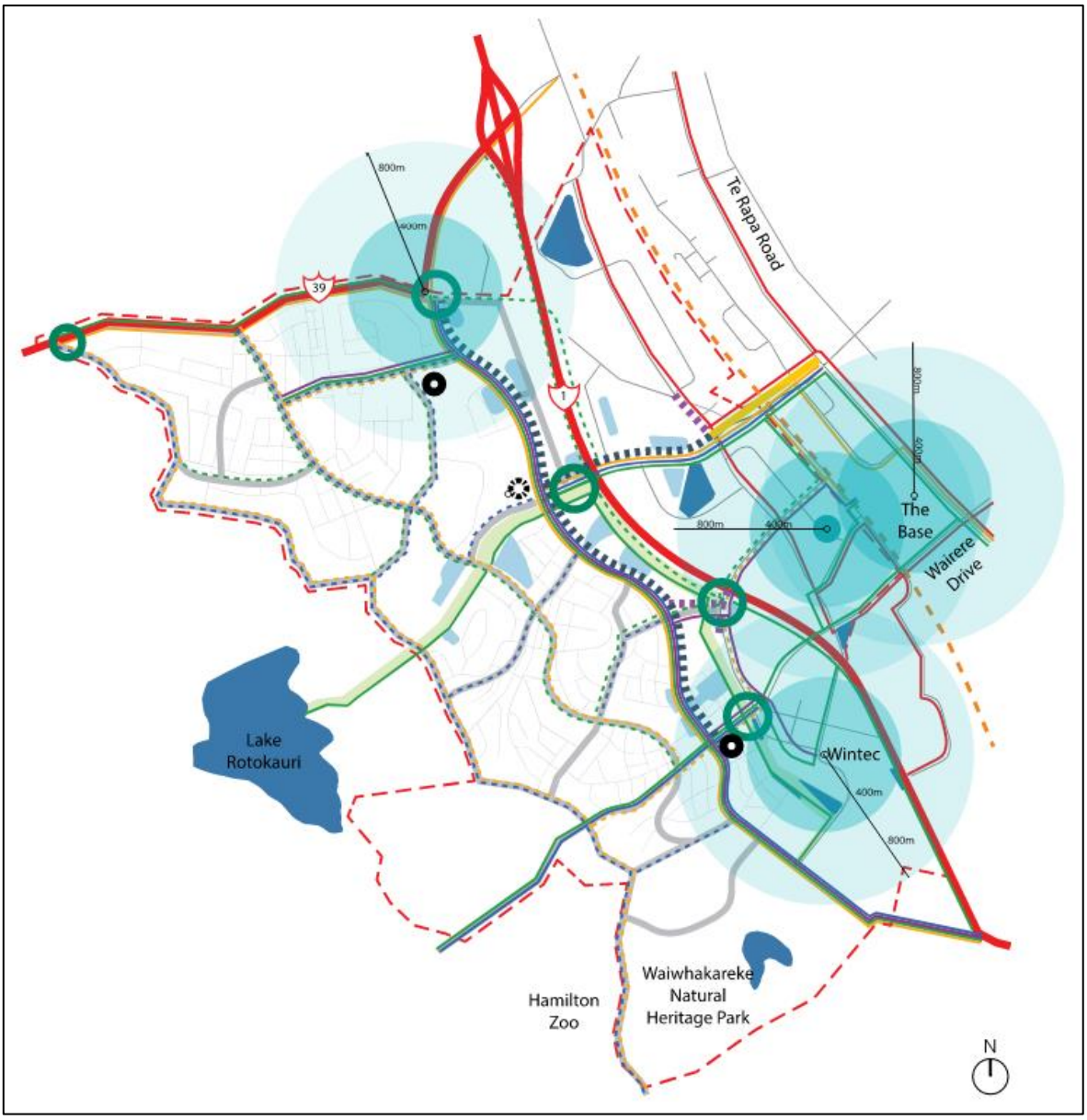


Figure 2-5: Transport and Connectivity Analysis Map (Source: Beca Urban Design and Landscape Framework 2023)

3 Designation and NOR

3.1 Objectives, Purpose and Function

HCC commissioned Beca in 2021 to write the Rotokauri Detailed Business Case (**DBC**) specifically to present the case for infrastructure investment for the Project.

The DBC demonstrates value for money and other benefits (including Waka Kotahi's investment in the DBC and NoR) and a clear rationale for:

- The selection of the preferred option.
- Lodging the NoR to secure the preferred option now.

The DBC identifies the following desired aims and outcomes.

3.1.1 Objectives

The objectives of the project as summarised in Section 2.4 of the NOR. These reflect the Detailed Business Case investment objectives which are as follows:

- Investment Objective One: Provide and secure strategic infrastructure corridors within the next three years (2024).
- Investment Objective Two: Prioritise active modes and public transport facilities in the corridor to achieve 10% active and public transport mode share by 2038.
- Investment Objective Three: Provide a range of opportunities within the infrastructure corridors to support a coherent, integrated and people-focused mixed-use development urban community by 2038.

3.1.2 Purpose

The purpose of the proposed designation is to protect land for the development of an integrated transport and land use solution for the Rotokauri Structure Plan area. This includes setting proposed boundaries to designate 5.8 km of Major & Minor Arterial and Collector roads as well as strategic walking and cycling, and stormwater infrastructure to support the future development of Rotokauri.

3.1.3 Network and Function

The proposed designation will provide a well-integrated multi modal transportation network that promotes a wide range of responsive, efficient and sustainable transport modes including prioritising walking, cycling, and public transport and makes suitable allowance for adaptive change in the future.

The network should support improved accessibility and connectivity into Hamilton City that is consistent with the land use spatial framework, Rotokauri Structure Plan and achieves the strategic direction established by Access Hamilton.

3.1.4 Integration

Through the design of the network, enhance accessibility for people and cohesion between the proposed and existing communities in a well-planned and legible way will be achieved. By applying urban design principles, the network should:

- Integrate to the future urban land use context, and
- Promote strong people focused connections to the street environment.

3.1.5 Infrastructure

To support the sustainable future urban land use development of Rotokauri in accordance with the Rotokauri Structure Plan by requiring sufficient land through the designation process and manage the risk of spatial

conflicts between land use and the provision of affordable, robust, and efficient infrastructure. The designation shall facilitate:

- An integrated transport system including the coherent form of intersections
- Three waters infrastructure network
- The provision of key stormwater and flood management infrastructure and secondary flow corridors in accordance with local catchments and associated Integrated Catchment Management Plans
- Provision for other network utilities.

3.2 Notice of Requirement

HCC proposes to lodge a NOR application for the designation of a proposed 5.8km corridor within the Rotokauri development area. All roads and proposed improvements as part of the NOR are a combination of new build through greenfield areas and upgrade of existing roads and tie-ins to existing.

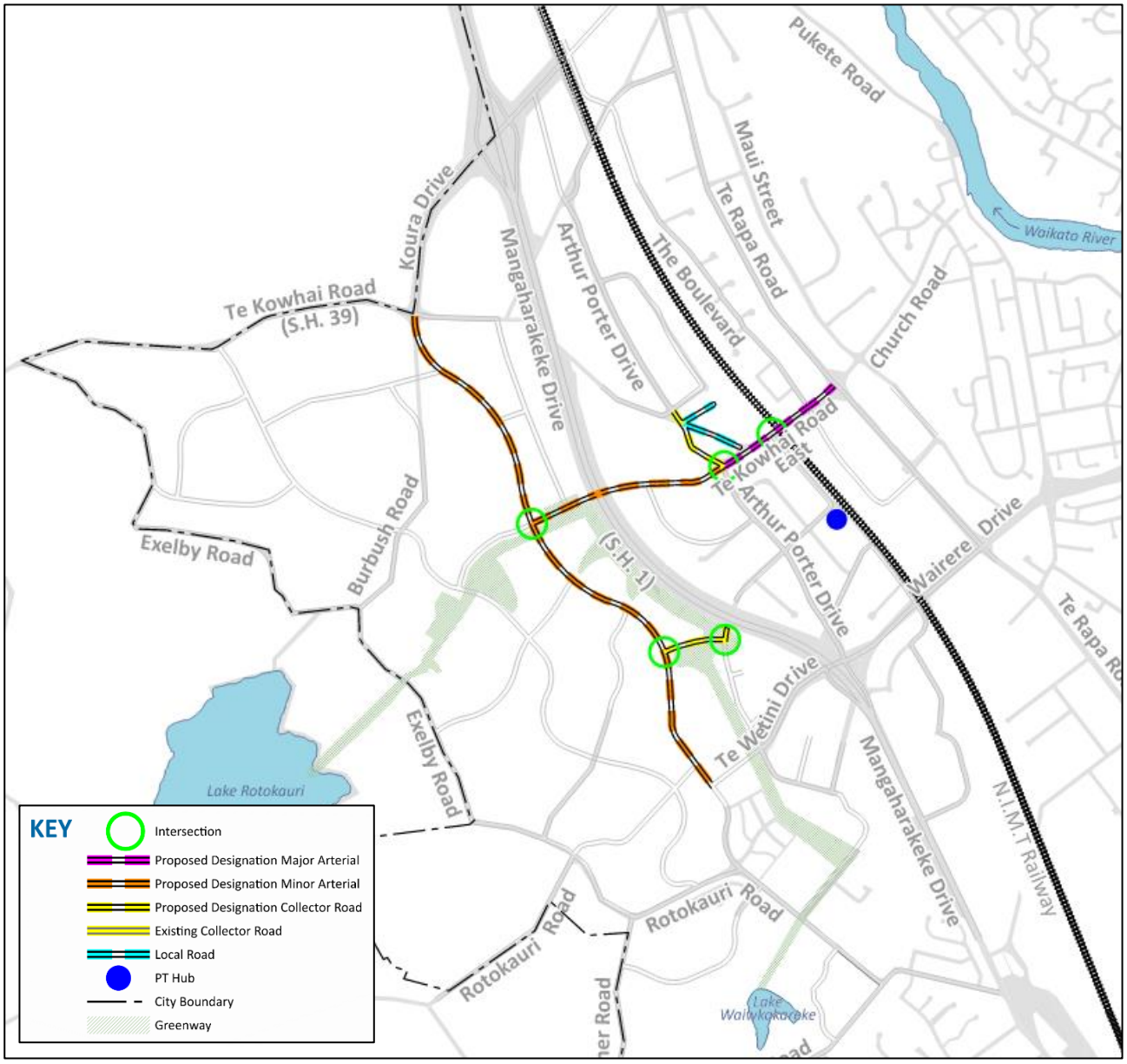


Figure 3-1: Proposed Designation Corridor (Source Hamilton City Council)

Included in the NOR application are the following transport features:

- An extensive network of separated pedestrian, cycleway and micro-mobility pathways across all of the transport corridors, these vary from 1.8m – 2.8m.
- Provisions for bus priority at intersections, where there could be potential delay to buses, to support and encourage use of public transport.

Major Roads

- Proposed Minor Arterials
- Proposed Major Arterials
- Proposed Collector Roads
- Proposed Local Roads

Intersections

1. Te Kowhai and Minor Arterial (signalised)
2. Arthur Porter Drive – Te Kowhai Road (signalised)
3. Tasman Road – Te Kowhai Road (signalised)
4. The Boulevard – Te Kowhai Road (signalised)
5. Minor Arterial and Chalmers Road (signalised)
6. Chalmers Road and Collector Road (priority)
7. SH39, Te Kowhai Road / Burbush Road (connection to existing roundabout)
8. Existing intersection, tie in only
9. Arthur Porter Drive – new Local Road(s) (priority)
10. Existing intersection, tie in only

Figure 3-2 below shows the locations of the abovementioned intersections.

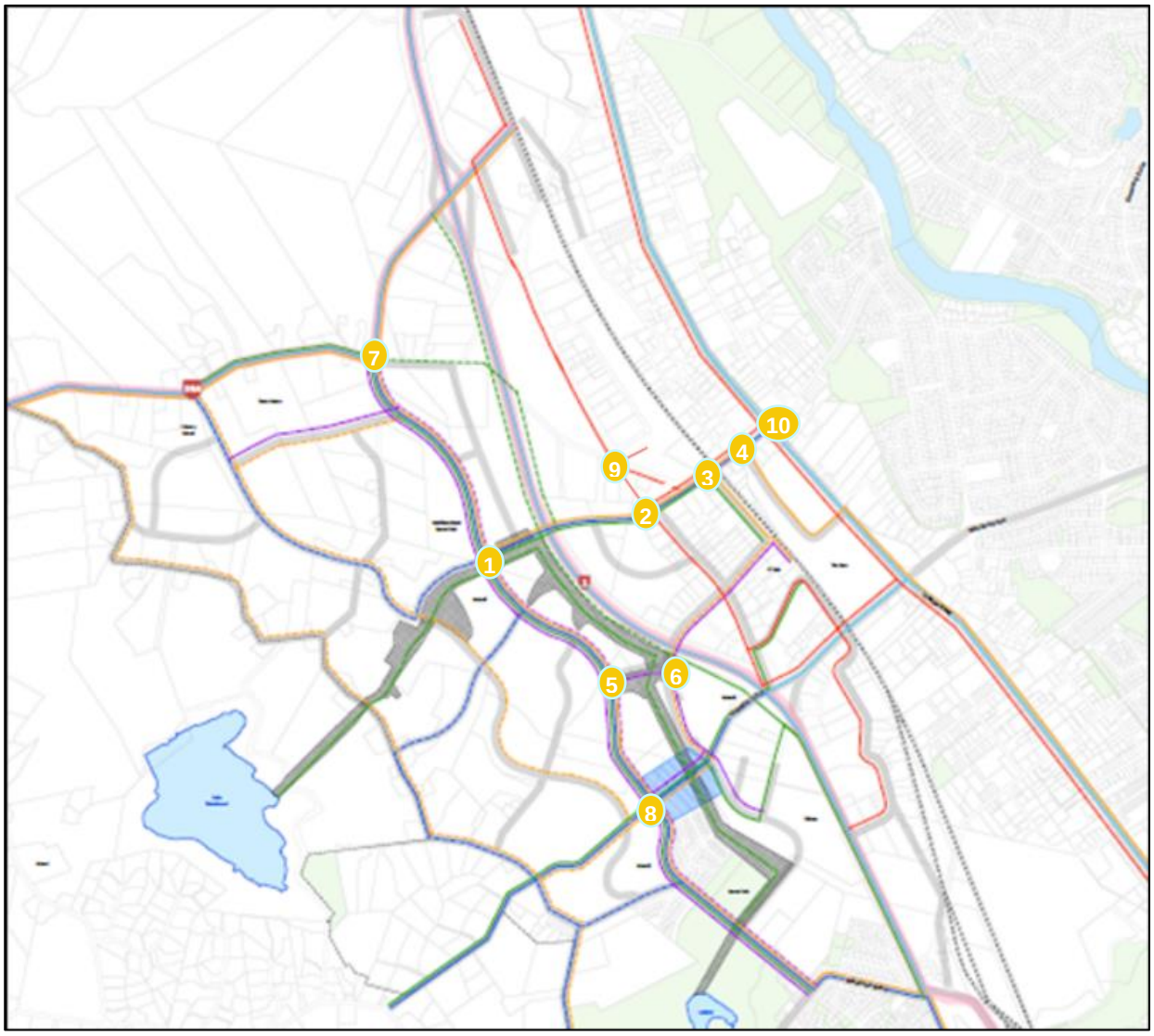


Figure 3-2: Designation Intersection Locations

4 Project History and Context

The NOR preparations process was originally started in 2019 and has been ongoing since. The following key matters have shaped the designation, cross sections, intersections, and infrastructure provision over the last three years:

4.1 Anticipated stages of delivery

- Rationale would be to establish the Greenway first and the stormwater management areas (wetlands) and associated drainage, starting at the downstream end. The Arterial Roads link in with the drainage for the Greenway. The arterials are expected to be developed at a similar time, but this will be subject to funding and so may be phased. This could influence design and costs and will need further consideration. Further development of the detailed phasing is likely to be at later stage during the Pre-Implementation phase.
- The northern section of the Arterial Road is beyond the Greenway and the drainage will need to be considered based on that catchment ICMP. The Arterial Road routes are close to the catchment

boundary meaning less development flows need to pass under the road. This may make a design solution for the NOR more straight forward with less constraints and interfaces.
- Developer involvement is expected in the development of the project, and they could be involved in part of, or all of the delivery.
- Consideration is to be given to how fill material from the Greenway may affect the Arterial Roads and surrounding land (Greenway scope, not Arterial NOR). This is a commercial decision that is likely to be beyond the initial scope of the Arterial NOR but will influence funding and staging.

4.2 Designation Alignment

- HCC, as a client, has a general acceptance that the alignment reflected in the structure plan is the one which will be progressed. The NOR will need to test this but recognise that this route has been established for some time and has been broadly accepted by the developers, so significant changes are unlikely and would require justification. The NOR will test this and provide a general view on the cross sections along the NOR route to meet Access Hamilton and other policies.
- The Te Kowhai Road extension intention is to focus on travel and limit accessibility to adjacent properties, the existing section is four lanes. The main arterial has more interaction with developers.
- Te Wetini Drive is intended to be four lanes:
  - Potential to utilise developer design as the general basis for the land requirements but this would need to be tested – HCC has the potential to engage with developers to deliver.
  - There is general confidence that the land provisions in the design will be adequate. The form of this road would be reviewed as part of the NOR process and subsequent detailed design.
  - There will be an exercise to test the transport model in relation to the potential for densities to change. This exercise would need to be scoped and limited to avoid overreaching the requirements of the NOR process. HCC will need to consider if additional work and future proofing is necessary.

4.3 Decisions

To encourage growth in public transport patronage to reduce carbon emissions and minimise traffic congestion on transport corridors and demand for parking spaces by:

- Upgrading public transport facilities and services, particularly on congested transport corridors.
- Supporting the transition to a rapid and frequent public transport network.
- Improving the operational efficiency of the public transport network to make public transport faster, more reliable, and easier to use.
- Providing safe, secure, and covered parking for bicycles and micro mobility devices at Key Public Transport Interchanges.
- Ensuring good walking, cycling, and micro mobility connectivity with public transport facilities.
- Providing public transport infrastructure as part of developing a new, or upgrading an existing, transport corridor.

Key decisions agreed with HCC are also summarised below:

- All cycleways on the minor arterial and collector road corridors will be separated and 2.2m width except for the 1.8m section on both sides of the minor arterial where the new commercial centre will be, to encourage less passing and a slower movement zone.
- Te Kowhai East Road will have a bi-directional cycle path on the south side of the road to provide connection to The Base and PT Hub through this industrial area. This will be a total width of 2.8m and provides the following benefits:
  - Combined pedestrian and cyclists crossing points to reduce the risk of intersection collision for cyclists while consolidating to one side of the road, minimising the number of driveway conflicts along the corridor and reducing the number of times people walking and cycling need to cross the corridor.

- A bi-directional cycle path approach reduces the overall width of an already constrained corridor in comparison to having a one-way separated cycleway on both sides.
- Condensing the cycleway to one side of the road responds directly to the industrial land use and focuses amenity space which increases user experience. This generates a higher mode share for cycling and e-mobility in an area that typically has limited ‘activation’. These areas typically have larger land holdings that experience larger vehicles and less cycle access in comparison to residential areas or key destinations.
- Reducing number of intersections along north/south minor arterial.

4.4 Other Considerations

Other considerations for the design of the corridor have been identified, including:

- Where working within the existing corridor of the major arterial Te Kowhai East Road widening, the design is constrained to the existing corridor width. This influences the urban design and landscape outcomes that can be achieved with limited space.
- There have been 3 developer masterplans developed for the Rotokauri areas that create risk of ‘ad-hoc’ design where the approach may not meet the desired outcomes and guiding principles set out in the Urban and Landscape Design Framework (ULDF) as a result of there being no framework in place to guide good urban and landscape design outcomes. Developer masterplans all need to reflect NOR and its project objectives.
- The existing town centre design on Te Wetini Drive limits the framework to provide only recommendations for integration into the proposed network but cannot determine the urban design and landscape outcomes for this area directly.

5 Transport Network Elements

This section provides an account of the proposed designated transport network. Including comments on the following key elements:

The assessment uses the UDLF layouts for ease of reference**,** including some more detailed cross section and intersection form layouts.

Provision for future vehicle access and active mode provisions has been considered throughout the corridor design. Specific detail is not considered within this ITA, this level of detail will be considered at a later stage.

5.1 Design Standards & Guidance

The following key design standards (not excluding others) have informed the development of the cross sections, intersections, and transport infrastructure:

- The Regional Infrastructure Technical Standards (RITS)
- District Plan – Design Guides
- HCC Urban Design and Landscape Guides
- Network Operations Framework (NOF)
- AUSTROADS standards - geometric road design, pedestrian, and cycle paths
- NZTA Pedestrian Planning and Design Guide
- AS/NZS 1428.1: 2009 Design for Access and Mobility.

5.2 Transport Network Corridors

The general road arrangement is shown in **Figure 5-1**. This identifies the following key designation corridors descriptions and likely Waka Kotahi One Network Framework - Movement and Place classification (proposed):

- **Rotokauri Minor Arterial North** (3100.4, 3100.5) (new road)
  - High movement function (ONF M3) and a moderate place function (ONF P3)
- **Minor Arterial, Te Kowhai West Extension** (3101.3) (new road)
  - High movement function (ONF M3) and high place function (ONF P2)
- **Collector Road** (3121.1)
  - Moderate movement function (ONF M4), moderate place function (ONF P3)
- **Chalmers Road Extension** (3122.1)
  - High movement function (ONF M3), low place function (ONF P3)
- **Minor Arterial, Te Kowhai Road West Extension** (3101.3)
  - High movement function (ONF M3), moderate place function (ONF P3)
- **Collector Road, Arthur Porter Drive** (3102.2)
  - Low movement function (ONF M5), low place function (ONF P4)
- **Major Arterial, Te Kowhai Road East Upgrade** (3101.1, 3101.2)
  - High movement function (ONF M3), low place function (ONF P4)
- **Rotokauri Minor Arterial North, Commercial Centre** (3100.2)
  - High movement function (ONF M3), high place function (ONF P3)

- **Local Roads** (3125.1 & 3125.2)
  - ONF categorisation to be confirmed

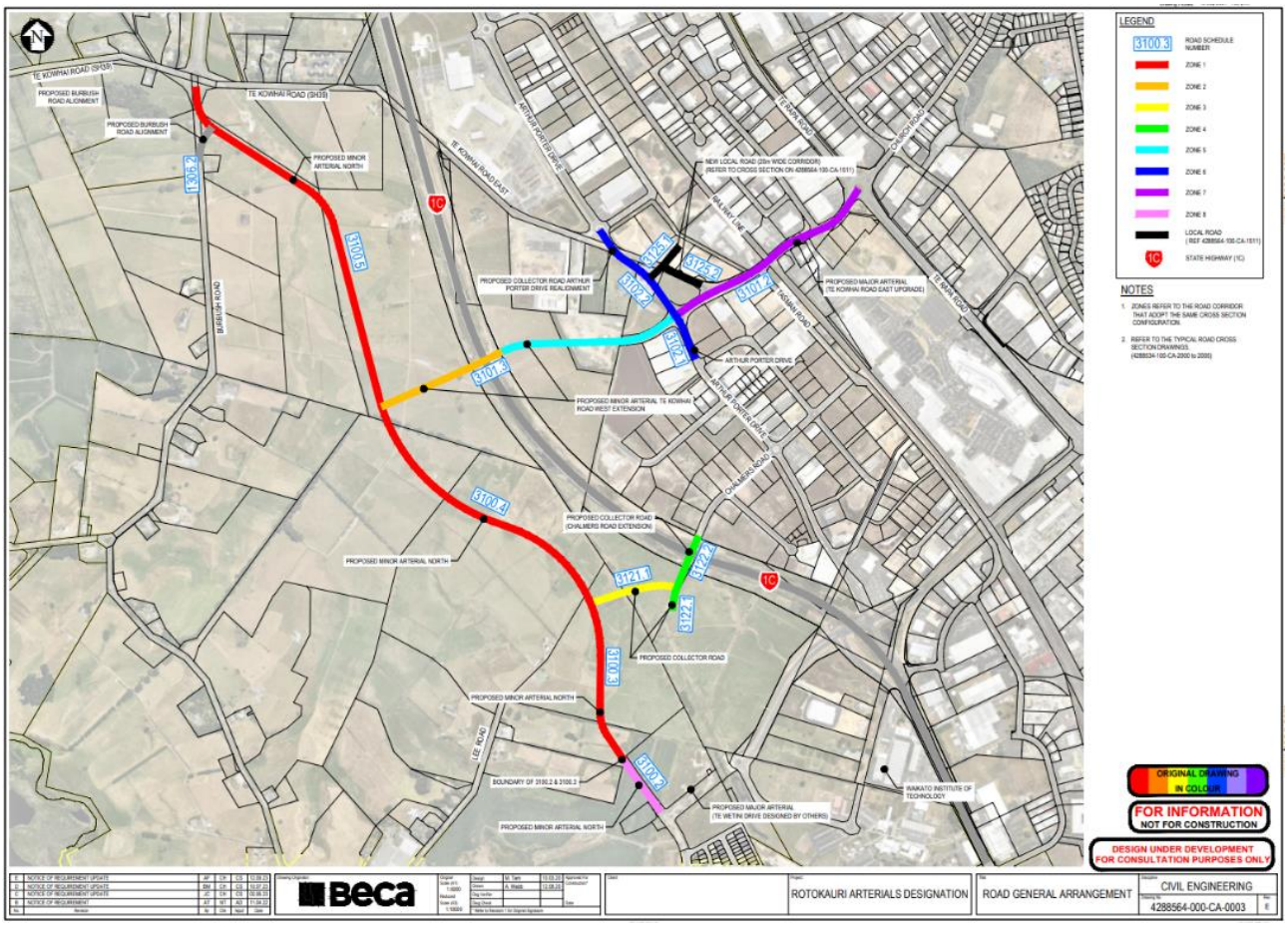


Figure 5-1: Designation Arrangement

5.3 Urban Design and Landscape Framework

As part of the Rotokauri Arterials designation, a UDLF has been developed for HCC. The document's purpose is to provide measurable guidance for outcomes-based urban design and landscape decisions for the project's design in conjunction with the Structure Plan. The UDLF provides a range of visuals that are split into sheets and sub-sectors as shown below.

The key zones (as per the sheet layouts) of the project are shown in **Figure 5-2** on the next page. This ITA makes use of the same sectors and sheet references in order to maintain unity within the overall project appraisal. Larger copies of the images are attached to the UDLF report accompanying the NOR application.

Sheet 1

- Zone 1 - Minor arterial (residential interface)

Sheet 2

- Zone 1 - Minor arterial (residential interface) & Employment
- Zone 2 - Te Kowhai Road West minor arterial extension west of Waikato Expressway (Employment interface)
- Zone 3 – Proposed Collector Road (residential interface) & Employment
- Zone 4 - Chalmers Road extension (residential interface) - Employment

- Zone 5 - Te Kowhai Road West minor arterial extension east of Waikato Expressway (industrial interface)

Sheet 3

- Zone 5 – Te Kowhai Road West minor arterial extension north of Waikato Expressway (industrial interface)
- Zone 6 - Arthur Porter Drive extension (industrial interface)
- Zone 7 – Te Kowhai Road East major arterial (industrial interface – existing)

Sheet 4

- Zone 8 – Minor arterial (residential and commercial interface).

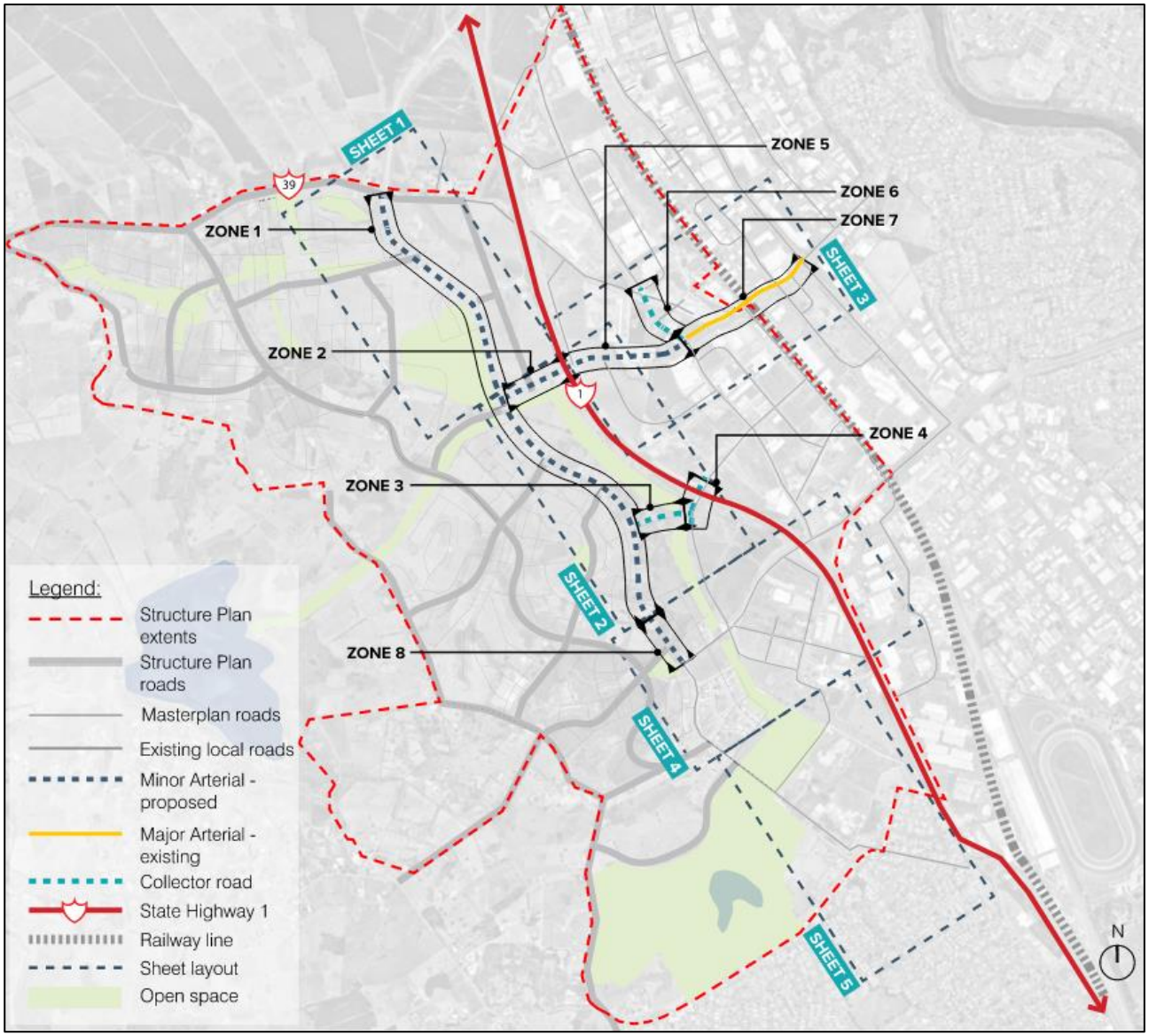


Figure 5-2 - Urban design and landscape framework (Source: Beca Urban Design and Landscape Framework 2023)

5.3.1 Sheet 1 - Zone 1

Description

Sheet 1 displays the northern most section of the Rotokauri development which is characterised by the existing Koura Drive / Te Kowhai Road roundabout and a proposed minor Arterial Road named Rotokauri

Road. Adjacent land-uses to be serviced by the road include employment, residential, sports and recreation. A future residential and town centre development is located south-west of the roundabout.

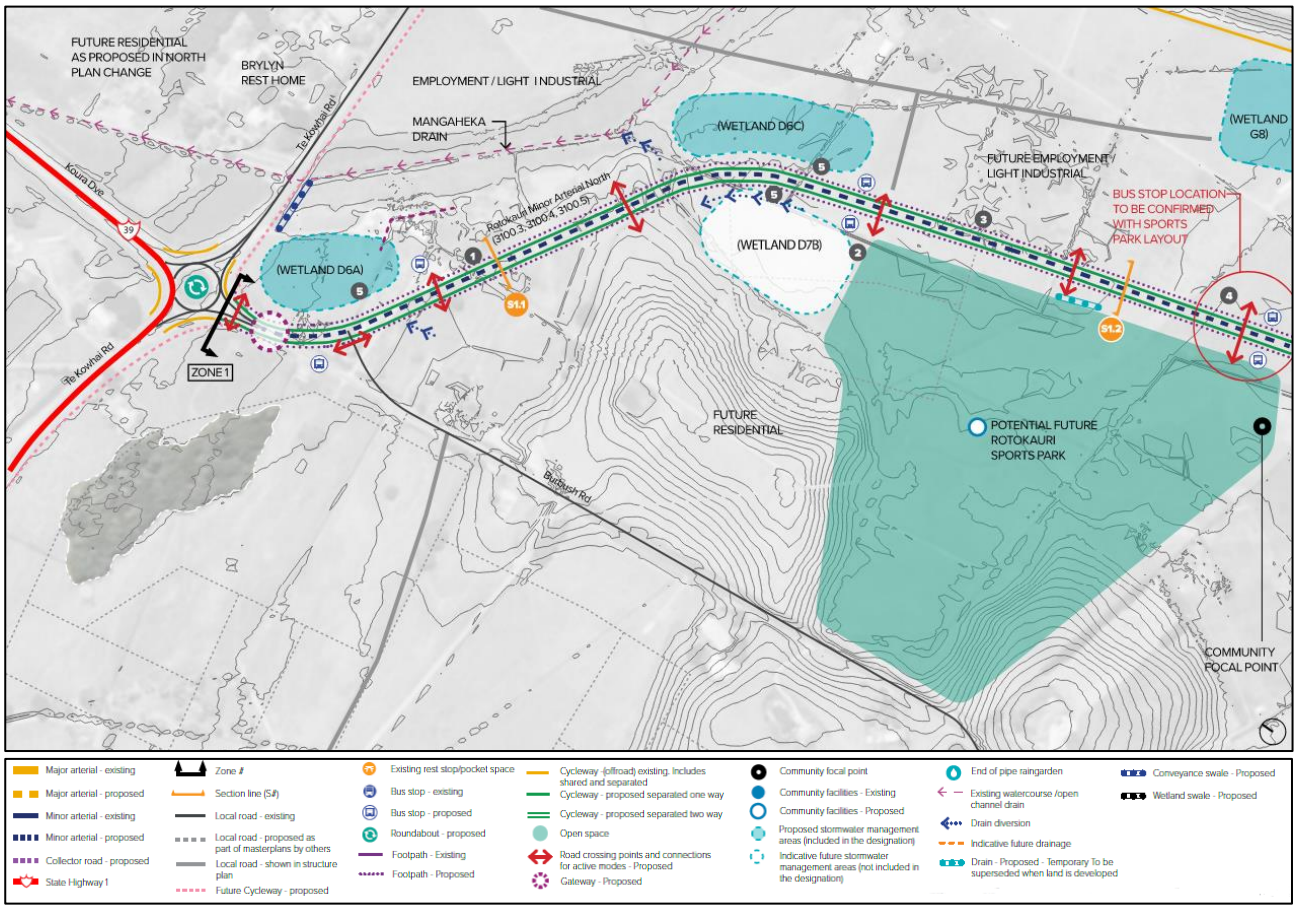


Figure 5-3: Sheet 1 - Zone 1

Intersection and Corridor Form

The road corridor is classified as a minor arterial and will link the entire development's residential and employment areas over a 3.75km length in its entirety. The road will connect to a minor Arterial Road at the southern end of the development that connects to State Highway 39. Several local roads are proposed and will provide internal connections within the development.

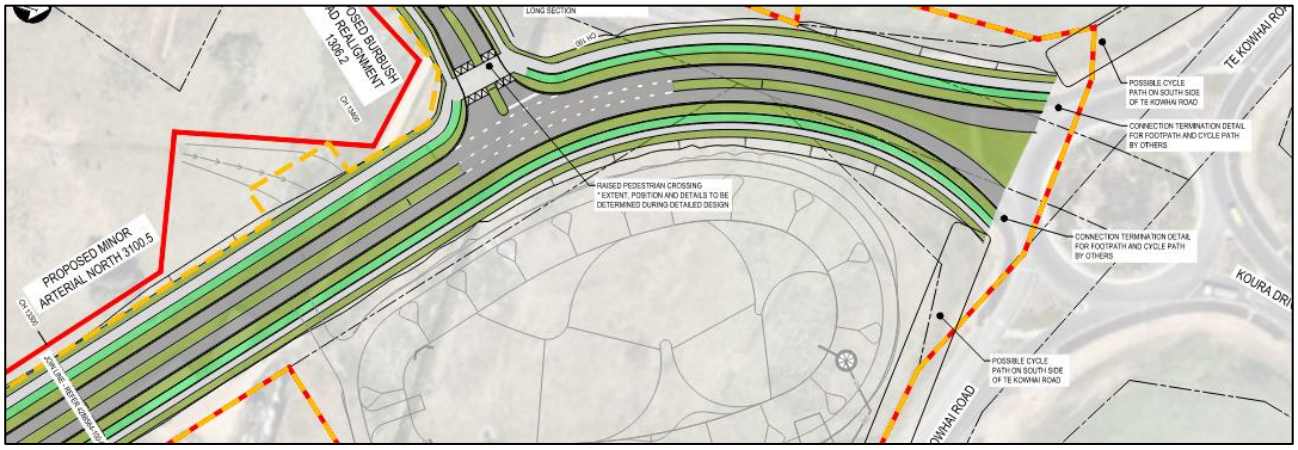


Figure 5-4: SH39 Connection and Burbush Priority Intersection

The proposed Minor Arterial/Burbush Road intersection and the Burbush Road/Te Kowhai Road/Koura Drive roundabout is approximately 71m apart. According to Waka Kotahi's National Speed Limit Register, the current speed limit (2023) on Burbush Road is 80km/hr which would require a minimum separation distance of 100m. However, if the Minor Arterial is established as 50km/hr, the design will comply. HCC's Speed Management Plan projects future speed limits for Burbush Road and the minor arterial will be between 40 and 50km/hr by 2030, resulting in a new minimum separation distance of 30m between each intersection. This change means that the proposed intersection separation distance of 71m will be in compliance with the design standard.

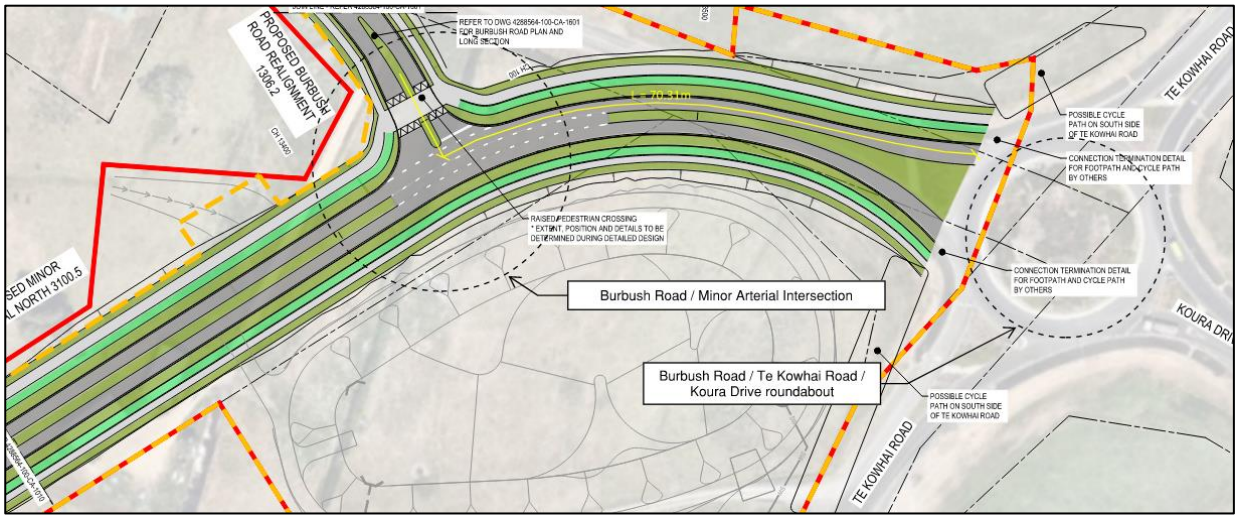


Figure 5-5: Distance between Minor Arterial/Burbush Road Intersection and Burbush Road/Te Kowhai Road/Koura Drive roundabout

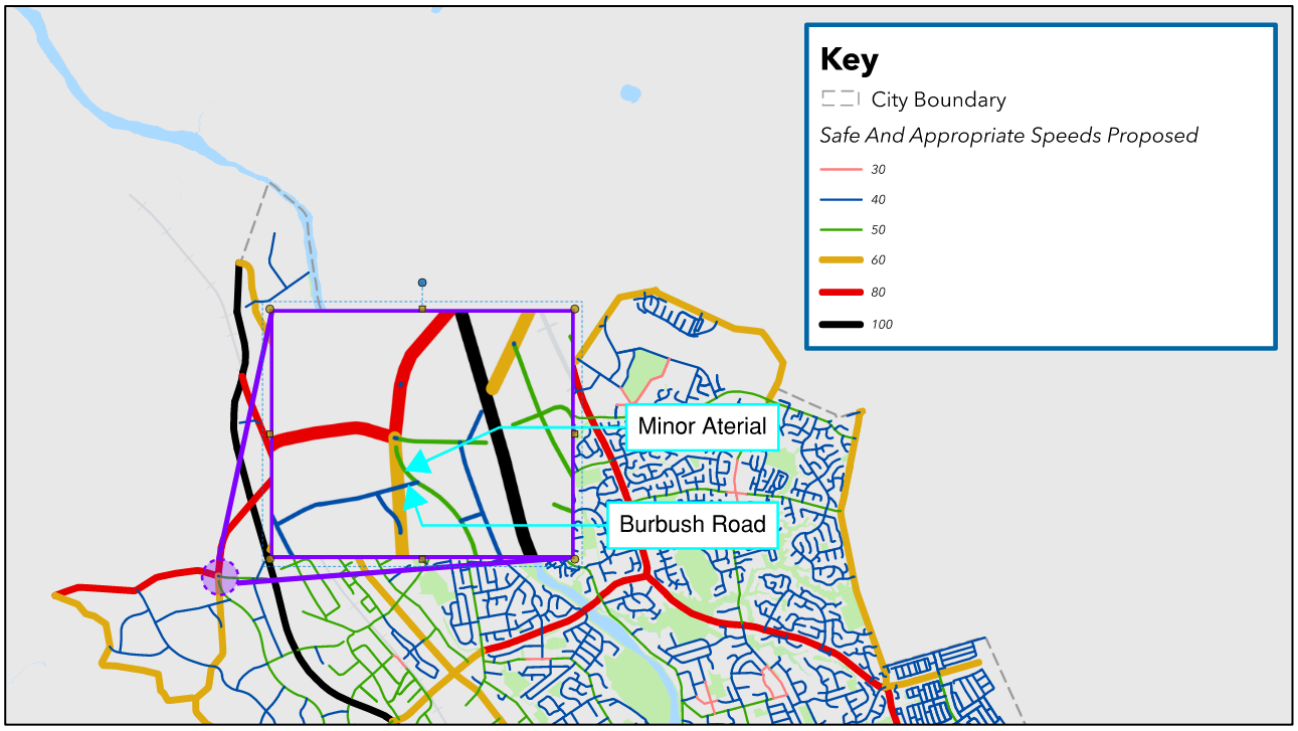


Figure 5-6: Future safe and appropriate speeds from Hamilton City Council

Active Modes and Public Transport

Active mode provision is catered for through one-way cycle path and footpath on both sides of the road, and multiple crossing facilities that are evenly spaced at a maximum distance of 400m. Similarly, multiple bus

stops are provided for on both sides of the corridor and are located close to community facilities at equal distances. Bus stop design, considering the one-way cycle facility, will need to be addressed in detailed design stages.

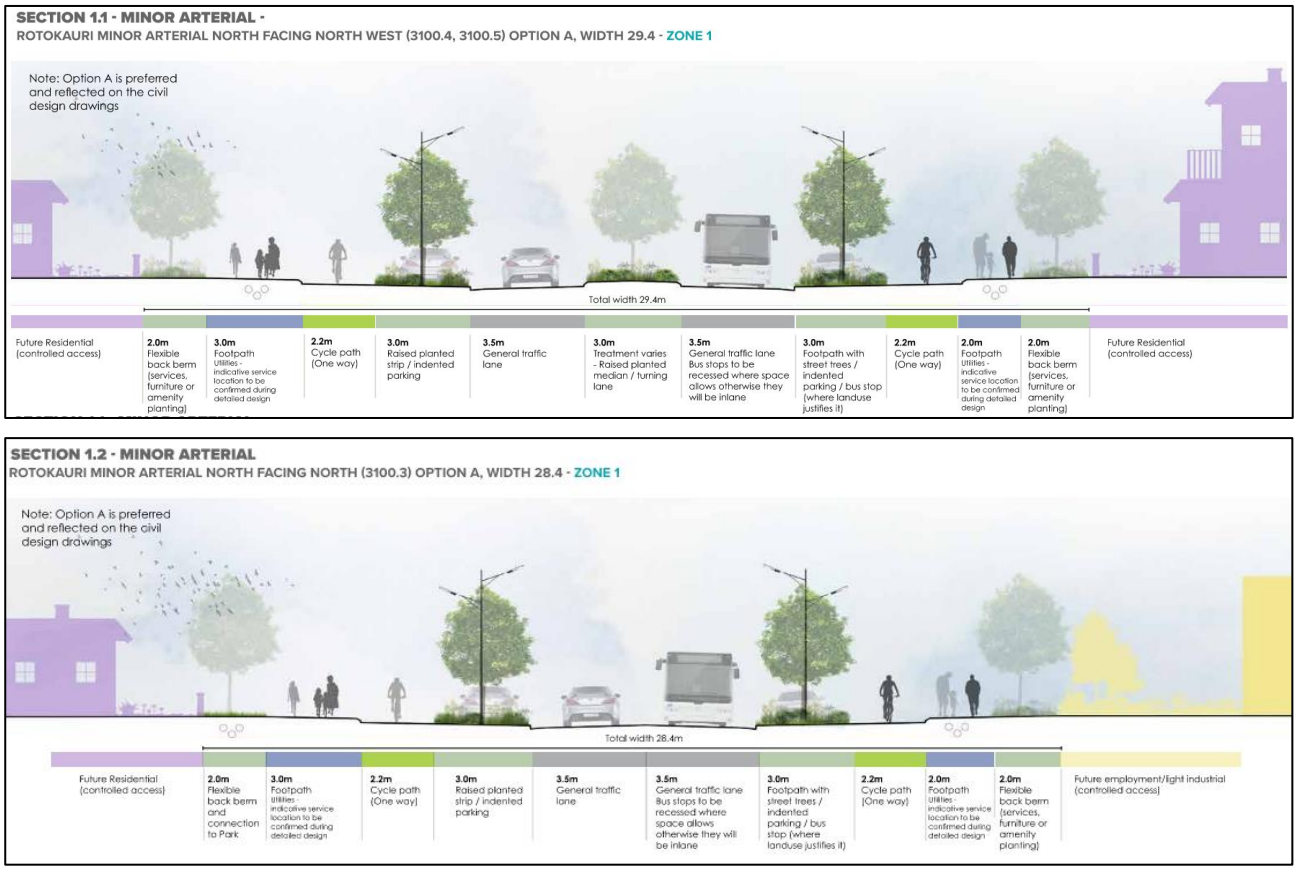


Figure 5-7: Zone 1 Indicative Cross Sections

5.3.2 Sheet 2 – Zones 1, 2, 3, 4 and 5

Description

Sheet 2 follows the minor Arterial Road southbound and is characterised by two intersecting roads, Te Kowhai Road West (proposed extension connecting to the Te Kowhai Road East) and a new Collector Road connecting to the proposed Chalmers Road extension, which both provide access from the east. An underpass is proposed for both roads to pass SH1 (Waikato Expressway). Adjacent land-uses include residential and employment development adjacent to the minor Arterial Road, open space (Zone 2) and industrial (Zone 5) for Te Kowhai Road West, residential for the new Collector Road and greenways/wetlands for the extension of Chalmers Road.

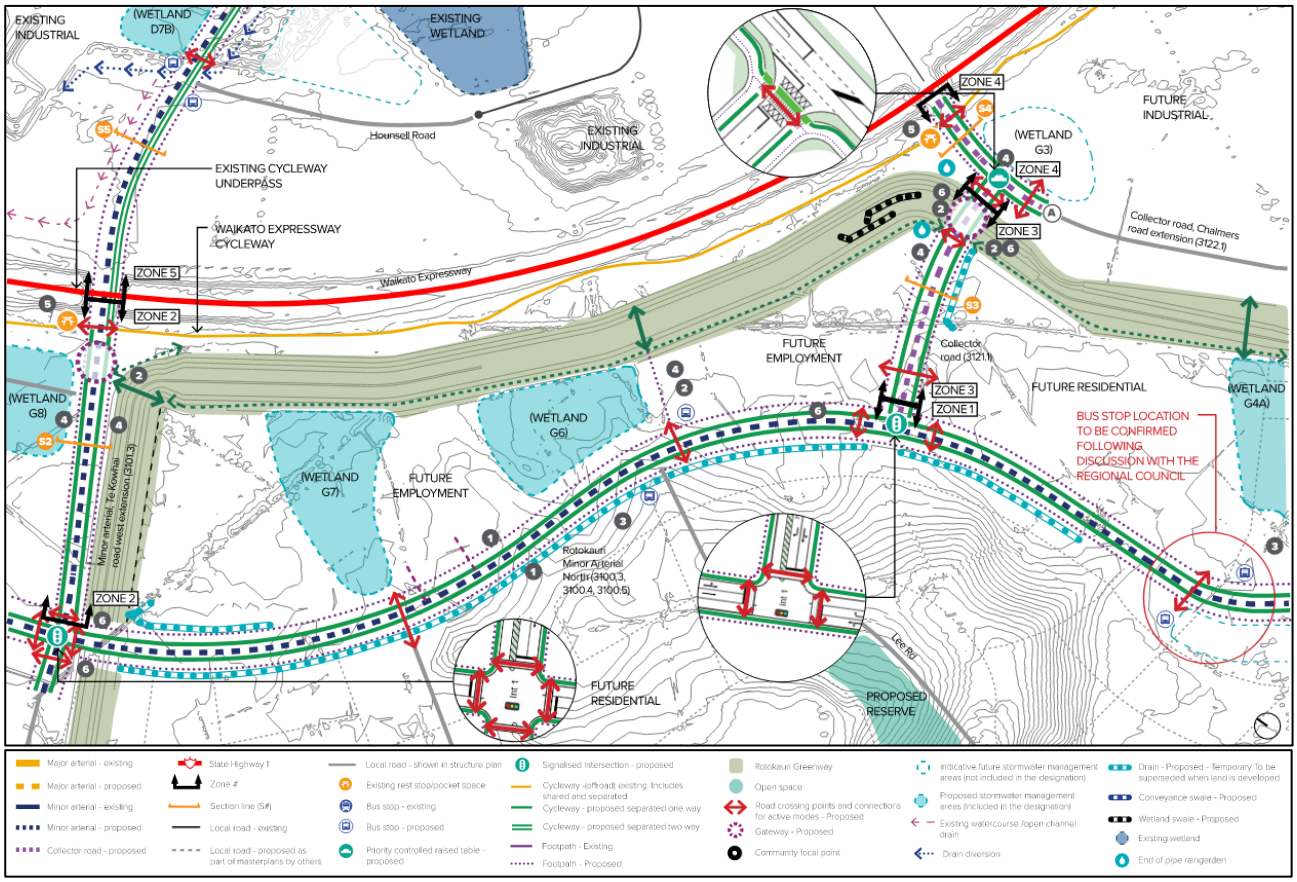


Figure 5-8: Sheet 2 – Zones 1, 2, 3, 4 and 5

Intersection and Corridor Form

Two new signalled intersections are proposed along the minor arterial corridor. A three-way (futureproofed for four-way) intersection is proposed at the Te Kowhai Road West intersection and the minor arterial and proposed Collector Road signalised intersection (**Figure 5-9**) while the new Collector Road will have a three-way priority-controlled intersection (**Figure 5-10**).

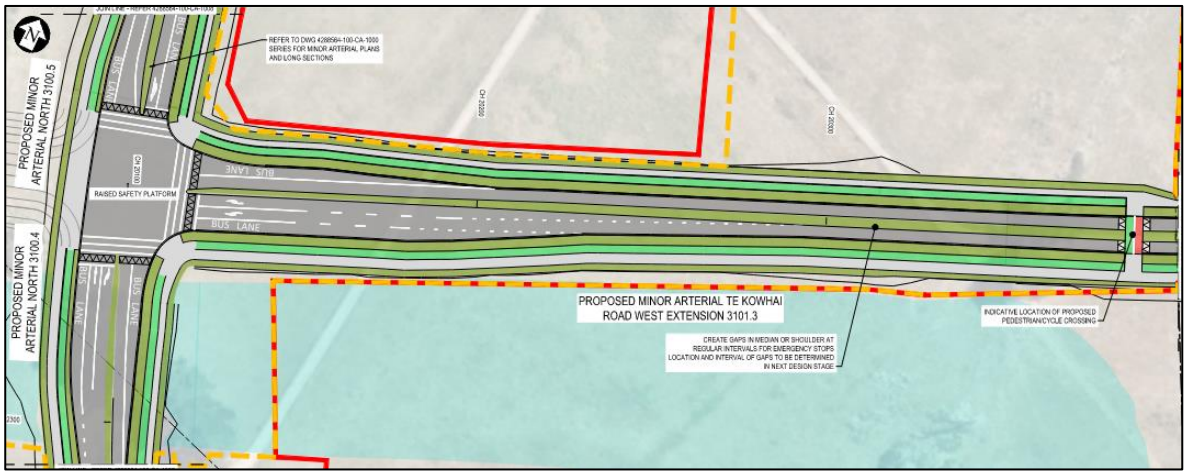


Figure 5-9: Indicative Te Kowhai Road West and Minor Arterial Signalised Intersection Layouts

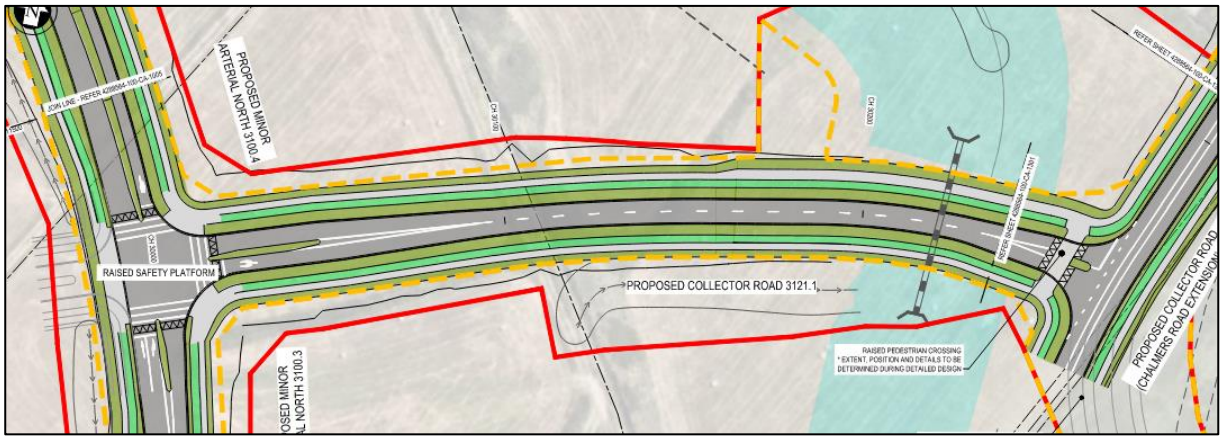


Figure 5-10: Indicative Collector Road Signalised and Priority Controlled Intersection Layouts

Active and Public Transport

Active mode provision is catered for through separate one-way cycle paths and footpaths, on both sides the road, where multiple crossing facilities are evenly spaced at a maximum distance of 400m. Crossing facilities are integrated within the two intersections in the corridor and provide active mode linkages with both Te Kowhai Road West and the new Collector Road.

Several cycleway connections are provided along the proposed greenway between the development and Waikato Expressway and are linked to the existing cycleway which runs adjacent to the State Highway. Active mode users will be able to travel across the Waikato Expressway via the existing underpass located next to Te Kowhai Road West.

Bus stops are provided for on both sides of the corridor and are located close to community facilities at equal distances. The future design phases should provide more detail on the exact positioning of the bus stops.

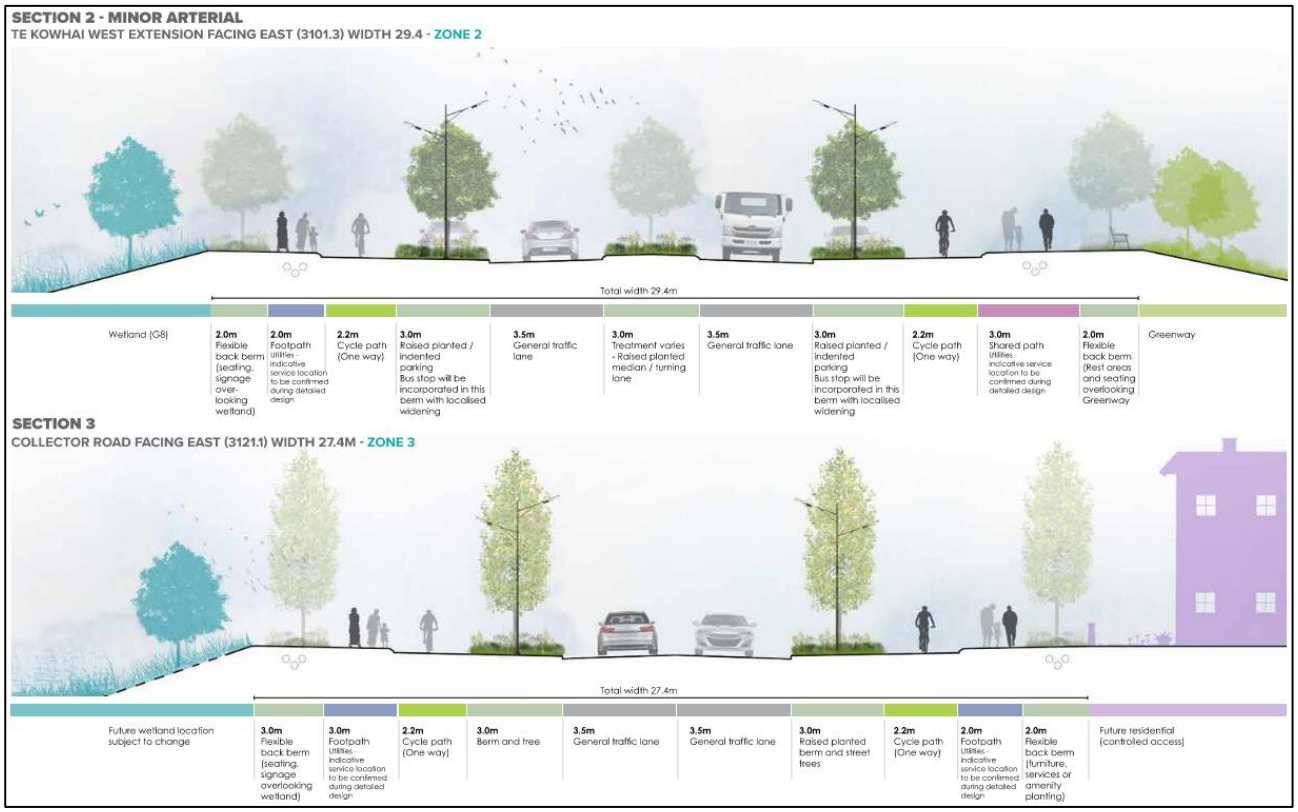


Figure 5-11: Zone 2 and 3 Indicative Cross Sections

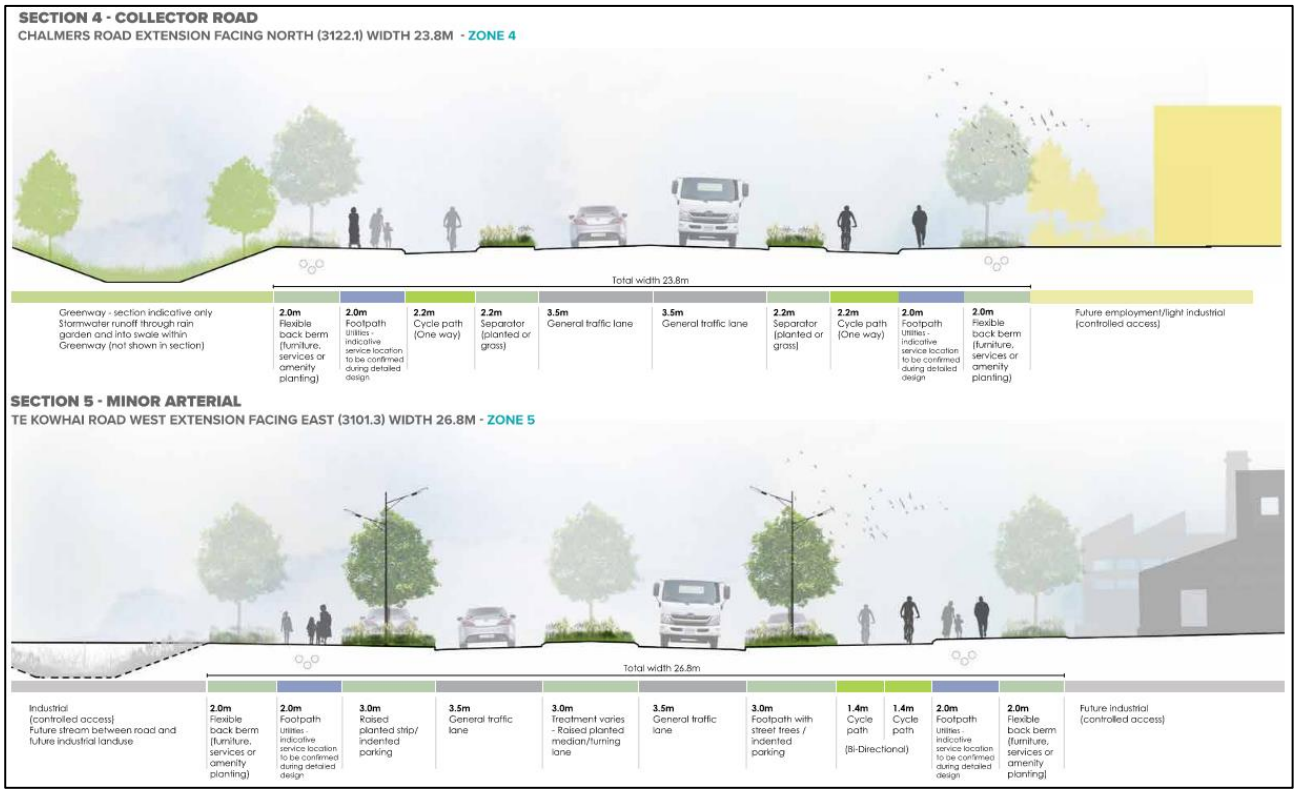


Figure 5-12: Zone 4 and 5 Indicative Cross Sections

5.3.3 Sheet 3 – Zones 5, 6 and 7

Description

Sheet 3 displays Te Kowhai Road West which connects the Rotokauri development (via the expressway underpass) to Te Rapa Road. The area is predominantly industrial and commercial in land use and features a range of existing local roads and an existing major Arterial Road which intersects with Te Rapa Road. A connection is also provided to the public transport hub via the major Arterial Road and pedestrian railway overbridge on Tasman Road as shown in **Figure 5-13, Figure 5-15, Figure 5-16**.

For the proposed realignment of Arthur Porter Drive, there will be a new local road connection leading into industrial areas with a cul-de-sac at the end. Several designs were examined when considering the right turn movement of vehicles towards the eastern cul-de-sac, which included a right turn bay and a constant median flush. Due to certain design constraints, both of the right turn facilities were not deemed feasible. Therefore, the final design is shown in **Figure 5-14**. The separation distance of this new intersection is approximately 120m away from Arthur Porter Drive / Te Kowhai Road East intersection, where the roads are classified as Collectors. The minimum separation distance according to the design standards by the District Plan is 15m. In which the new intersection satisfies the design requirement with separation distance greater than 100m.

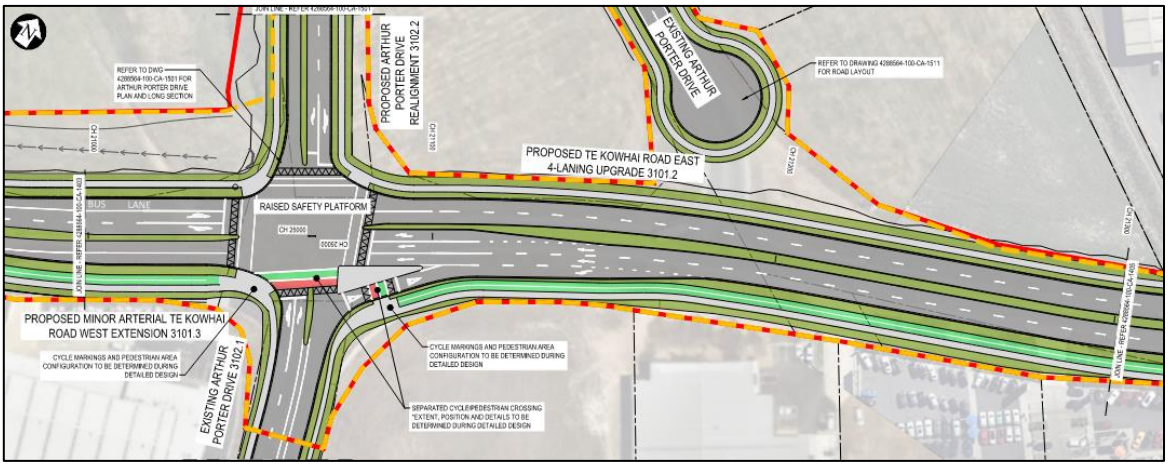


Figure 5-13: Arthur Porter and Te Kowhai West Intersection and Cross Section Form

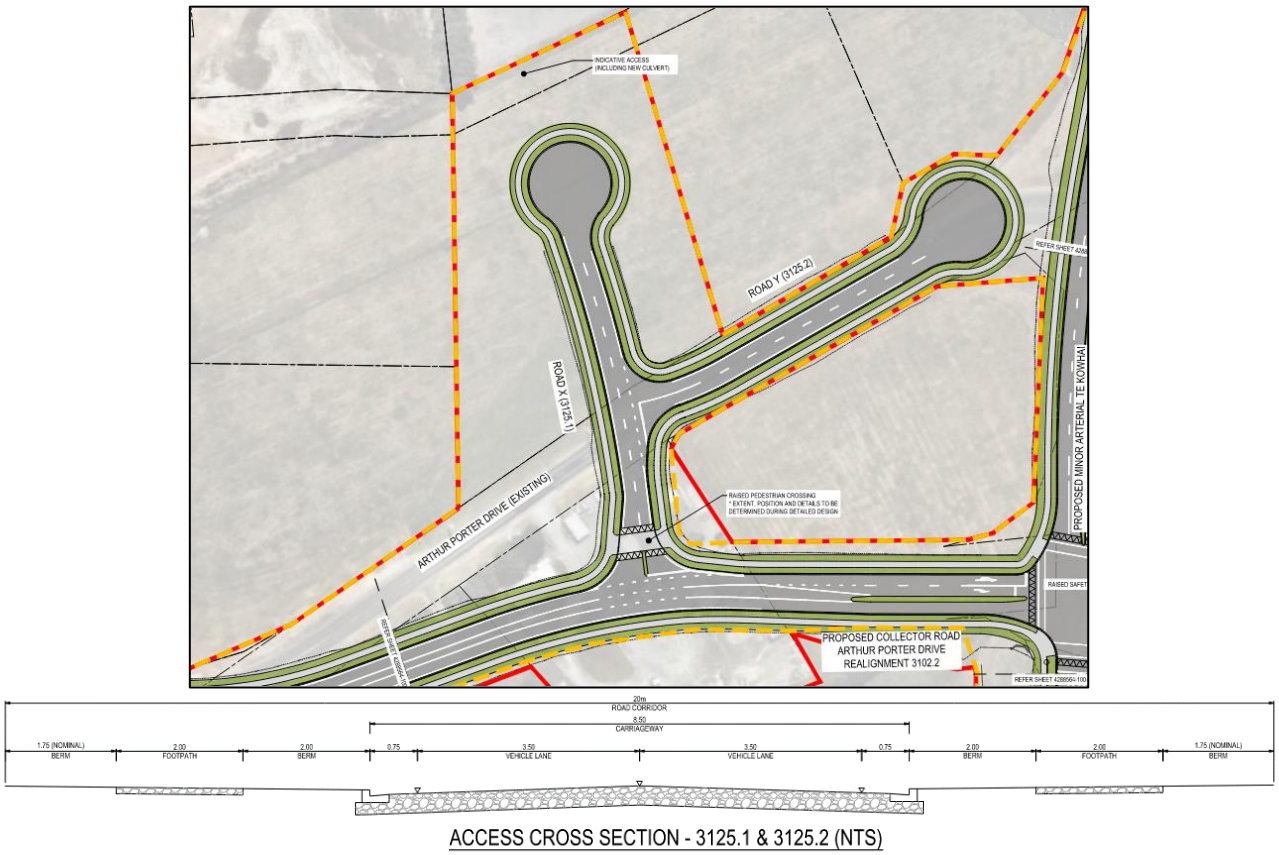


Figure 5-14: Arthur Porter Drive and New Local Road Intersection, including cross section diagram

To support residential development within Rotokauri new residential areas around Arthur Porter Drive have been proposed, where the existing alignment for Arthur Porter Drive will be realigned with a new local connection that branches into to two cul-del-sacs to support future population growth.

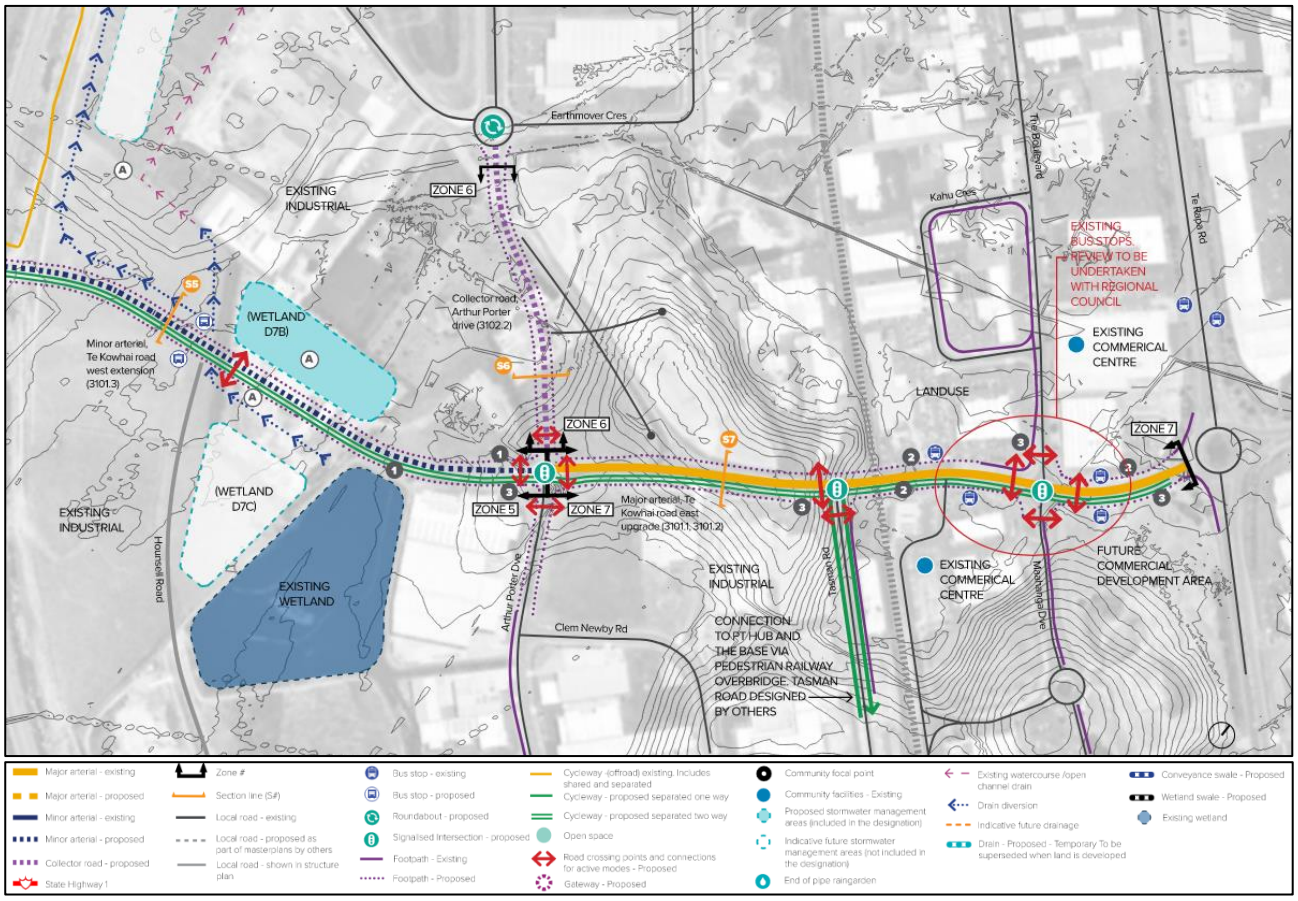


Figure 5-15: Sheet 3 - Zone 5, 6 and 7

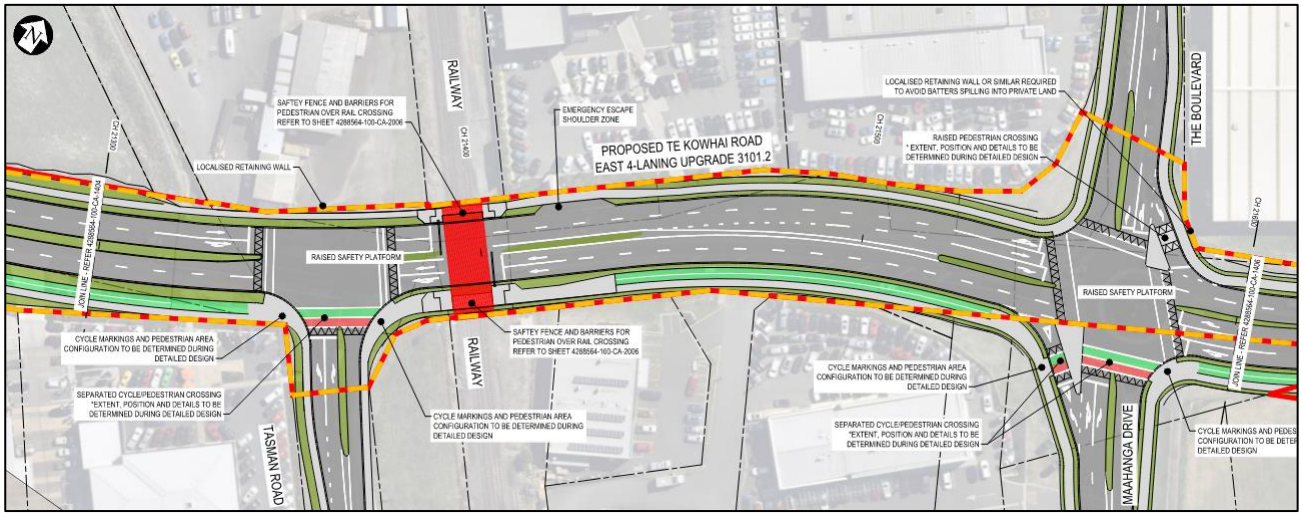


Figure 5-16: Indicative Te Kowhai East, Tasman Road and The Boulevard Intersections

Intersection and Corridor Form

Te Kowhai Road West is classified as a minor Arterial Road (westbound to Arthur Porter Drive) and Te Kowhai East Road is classified as a major arterial (Arthur Porter Drive to Te Rapa Road). Three existing intersections are located along the corridor, the future designs of the intersections involve signalisation. Arthur Porter Drive will be extended and connect to the roundabout intersecting Earthmover Crescent and Roger Kaui Place. The existing eastern located roundabout at Te Rapa Road is not part of the proposed improvements.

The proposed designation crosses the KiwiRail main trunk railway line at the existing level crossing on Te Kowhai East Rd. This level crossing currently has two traffic lanes and limited pedestrian protections. HCC has an existing Deed of Grant based on the Rotokauri Structure Plan and connections under the expressway capturing agreement to widen this level crossing to four lanes in the future – in line with the proposed designation. Initial communications with KiwiRail at the commencement of the project considered this as feasible with a level crossing safety impact assessment (LCSIA) to be undertaken during detailed design.

KiwiRail has since undertaken an LCSIA of this crossing in its current form and HCC has funded an assessment of the proposed designation solution with the intent that two reports will be produced and provide a clear direction covering both the existing layout and implementation of the designation solution, potentially updating the Deed of Grant. HCC has received draft audit reports and is waiting for the finalisation of these two reports by KiwiRail. It is likely that the report findings will indicate that the level crossing does not meet KiwiRail safety provisions and will recommend consideration of grade separation solution. Should the reports confirm this outcome then this will instigate the next phase of the KiwiRail level crossing assessment to check the viability and reasonable practicableness of a grade separated solution (SFARP). This consists of a high-level approach to ascertain what a grade separated solution would involve, and development of a cost estimate. The concept will have substantial structures and extensive implications on the built environment and will result in significant effects on the existing land development and its operations.

Using the draft audit documents, HCC has completed an in-house assessment following the KiwiRail SFARP exercise which shows that a grade separation solution will not meet the reasonably practicable approach. This will trigger the next step in the KiwiRail level crossing process where further negotiations between KiwiRail and HCC will be needed to recognise the level crossing solution and look to other safety improvements or measures elsewhere to support rail / traffic management.

On the basis of the above, the grade separation of the level crossing does not form part of the designation.

HCC has proposed several key risk mitigations to improve the safety of the at-grade level crossing, including but not limited to:

- Introducing splitter islands at the adjacent intersections to improve vehicle separations and use of the level crossing
- Integrating the Tasman Rd signalised intersection with the KiwiRail level crossing warning system (and KiwiRail progressing with improvements to this effect)
- Pedestrian / cycle paths to include automatic safety gates in line with KiwiRail guidance (highest level of protection for an at-grade crossing)
- Emergency escape shoulder introduced east of the level crossing

At the time of writing, HCC is in discussions with KiwiRail to agree a way forward.

Public and Active Transport

Active mode provision is catered for through a separate bi-directional cycleway which runs along the entire corridor on the southern side of Te Kowhai East Road and West. One-way cycle facilities are proposed on both sides of Tasman Road to connect to the Rotokauri public transport hub towards the south. Footpaths are provided along both sides of Te Kowhai Road East and West, including new footpaths along Arthur Porter Drive. Active mode crossing facilities are provided throughout the corridor predominantly at future signalised intersections.

Four existing bus stops are located along Te Kowhai East near the Maahanga Drive intersection. Two additional bus stops are provided for on the western end of Te Kowhai Road West near the expressway.

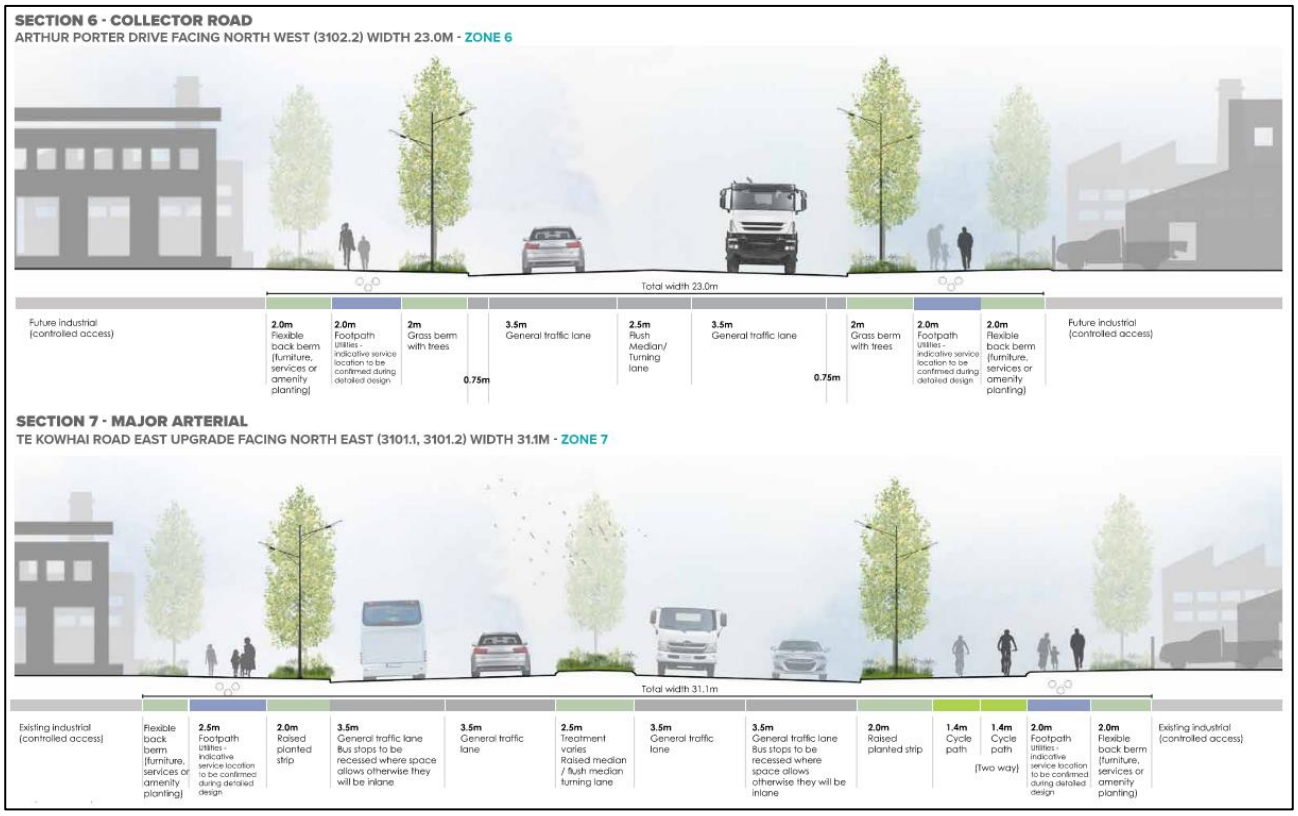


Figure 5-17: Zone 6 and 7 Indicative Cross Sections

5.3.4 Sheet 4 – Zone 8

Description

Sheet 4 displays Rotokauri Road which connects with Te Wetini Drive to the east and several existing local roads. Land use is mixed between commercial and industrial, with residential development located to the south. A greenway is positioned between the Rotokauri development and the existing industrial and commercial development to the east.

Intersection and Corridor Form

Rotokauri Road is classified as a minor arterial and will be connected by a signalised intersection to the partly established Te Wetini Drive which is of a major arterial classification. Te Wetini Drive provides eastern connections to local roads including Akoranga Road, Arthur Porter Drive, and Wairere Drive, and also provides an off-ramp facility for northbound traffic on the Waikato Expressway.

Active and Public Transport

Active mode provision is provided by one-way cycle facility that run along Rotokauri Road and along Te Wetini Drive. A continuous greenway cycleway is provided that intersects with Te Wetini Drive with a crossing provided at the gateway. Active mode crossing facilities are also provided at the Rotokauri Road signalised intersection, including an active street frontage along the future commercial development in Zone 8. Two new bus stops are proposed adjacent to the future commercial zones and footpath facilities are provided across both sides of minor and major Arterial Roads.

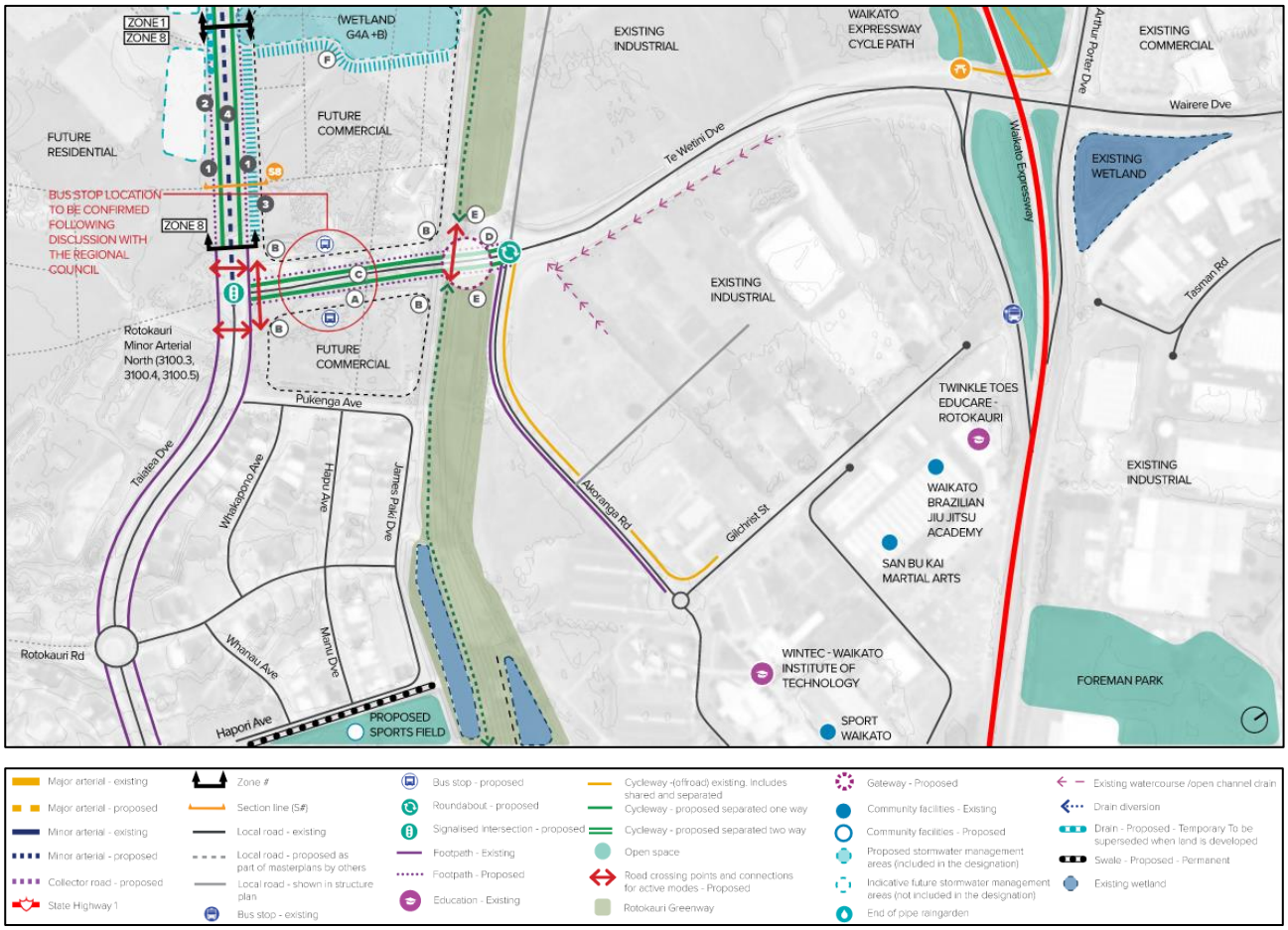


Figure 5-18: Sheet 3 – Zone 8

Figure 5-19: Zone 8 Indicative Cross Section

6 Assessment of Effects

6.1 Traffic Modelling

This section describes the traffic modelling undertaken for key intersections in the designation area which includes use of the Waikato Regional Transportation Model (WRTM) and SIDRA modelling.

It is important to note that during the data extraction for the ITA, the WRTM did not reflect the recent population growth in the surrounding area. To address this, an uplift/sensitivity test was conducted to consider the expected higher densities in the region. As a result, the overall traffic volume in the SIDRA models used for each intersection was increased by an additional 30%. Furthermore, a scenario was simulated to evaluate the potential effects of the Medium Density Residential Standards (MDRS), assuming a general increase in traffic volumes by 20-30% for the purpose of this assessment.

These tests were necessary to check that the model outputs reflect potential traffic volumes in the region and could be used for effective transportation planning. It is noted that there is a higher degree of uncertainty than typical due to the multiple layers of information available, including Plan Change 12 promoting intensification, that was not known at the time of the transport assessment, which has not been incorporated into an updated strategic model for input into this assessment. This should be reviewed in future when more reliable travel demand forecasts become available.

6.1.1 WRTM

The WRTM forecast year 2051 land use model, incorporating land use assumptions which includes Rotokauri, was used to obtain predicted traffic data for use in the SIDRA intersection modelling.

The intersection modelling is a key component to understand the intersection formation and has been used to test various intersection layouts and options. SIDRA intersection modelling software was used to model the intersections. The WRTM 2051 future model was requested from and supplied by HCC. The extracted WRTM model data was assessed in terms of usable traffic volumes, specifically for the Rotokauri area.

Estimated daily traffic volumes on key transport links in 2051 from WRTM +30% are shown below:

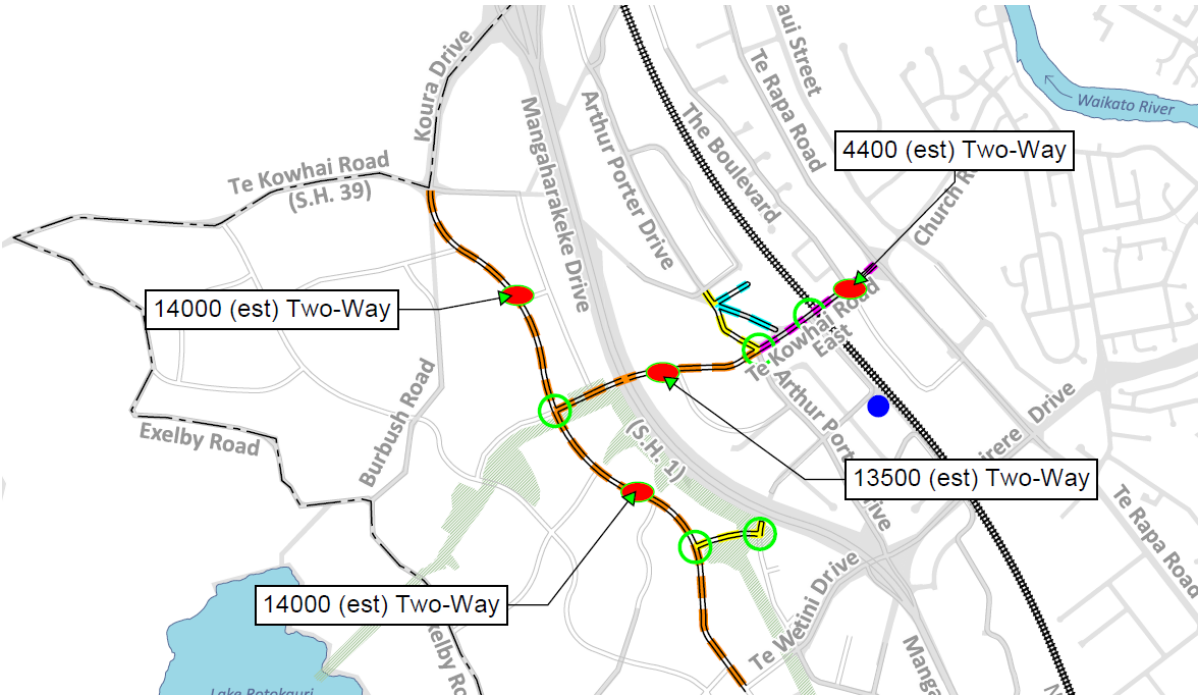


Figure 6-1: Daily Traffic Volumes 2051 (WRTM)

Model Data

Traffic data from the WRTM model was extracted for the 2051 future year. This includes:

- 2051 Annual Average Daily traffic (AADT) volumes
- 2051 Peak flows:
  - AM Peak, (BBAA – AM Peak model Land use)
  - Inter Peak, (BBIA – Inter Peak model Land use)
  - PM Peak, (BBPA – PM Peak model Land use).

The following outputs were extracted from the WRTM, shown in **Table 6-1** and **Table 6-2** that highlight the SIDRA model with and without the 30% uplift**.** This includes conversion of two-hourly peak period traffic data into peak hour traffic data.

Table 6-1: WRTM Traffic Flows Through Intersections

Intersection Description	AM Peak	Inter Peak	PM Peak	AADT
Te Kowhai and Minor Arterial	616	725	977	10,863
Arthur Porter Drive – Te Kowhai Road	688	666	1,110	10,038
Tasman Road – Te Kowhai Road East	888	745	1,548	3,287
The Boulevard – Te Kowhai Road East – Maahanga Drive	1,661	2,096	2,824	3,512
Minor Arterial and Collector Road	302	381	479	10,865
Chalmers Road and Collector Road	270	333	384	n/a

Table 6-2: WRTM Traffic Flows Through Intersections (30% Uplift)

Intersection Description	AM Peak	Inter Peak	PM Peak	AADT
Te Kowhai East Road – Minor Arterial	800.8	942.5	1270.1	14121.9
Te Kowhai East Road – Arthur Porter Drive	894.4	865.8	1443	13049.4
Te Kowhai East Road – Tasman Road	1154.4	968.5	2012.4	4273.1
The Boulevard – Te Kowhai Road East Road – Maahanga Drive	2159.3	2724.8	3671.2	4565.6
Minor Arterial – Collector Road	392.6	495.3	622.7	14124.5
Chalmers Road – Collector Road	351	432.9	499.2	n/a

From the traffic data, the PM peak has the highest demand flows across all intersections. Trip distribution and mode split between cars and trucks, has also been derived from the WRTM model. The heavy vehicle percentage is approximately 10% of all the modelled traffic volumes.

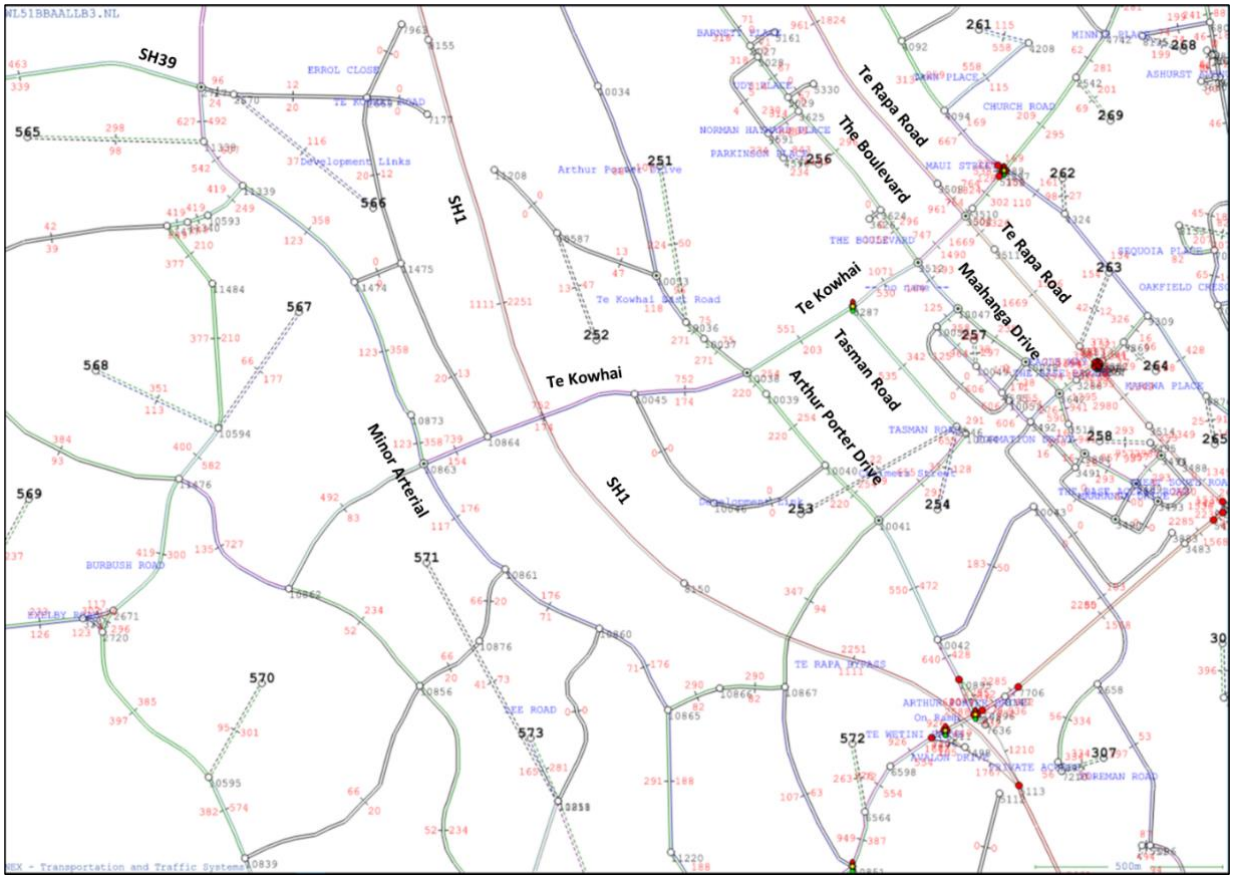


Figure 6-2: AM Peak WRTM Flows (2hour)

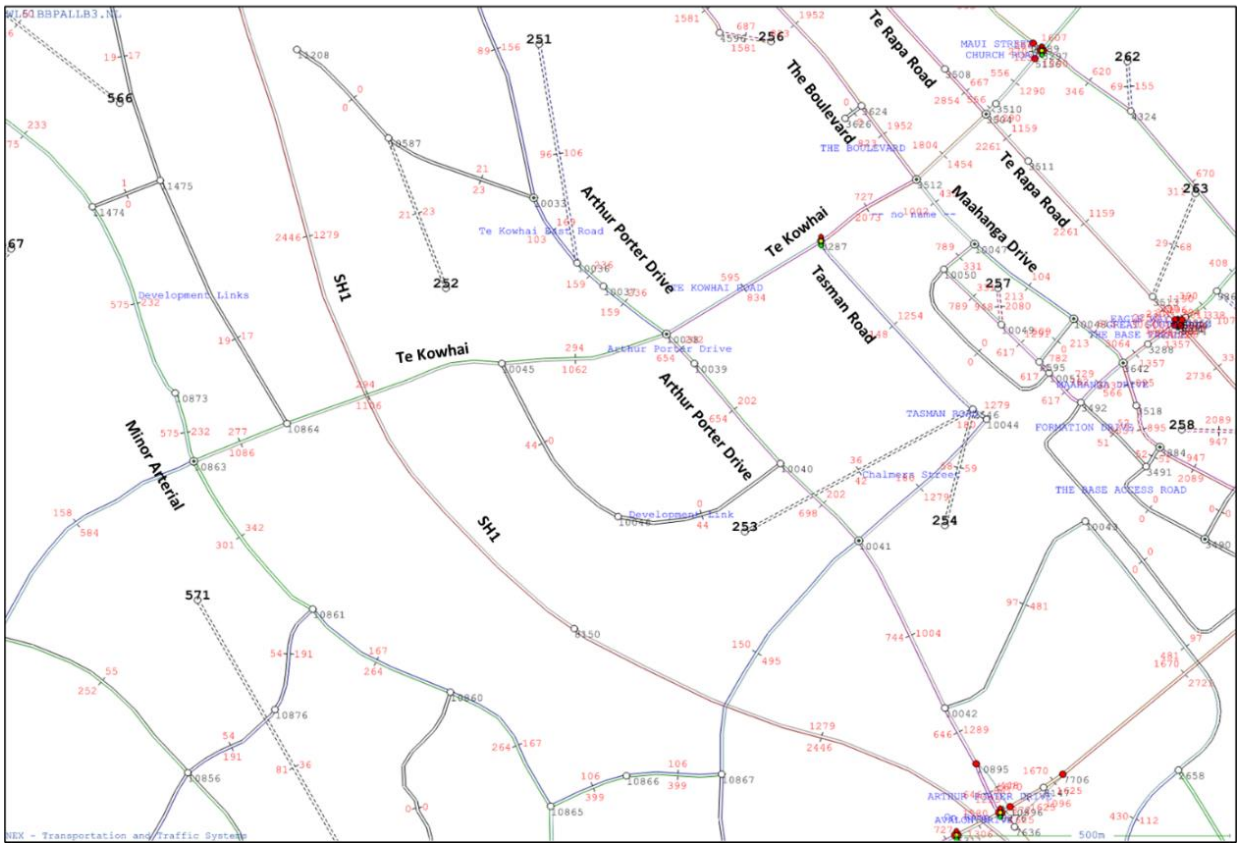


Figure 6-3: PM Peak WRTM Flows (2hour)

6.1.2 SIDRA Intersection Modelling

The following intersections were modelled:

- Signalised
  - Te Kowhai and Minor Arterial (T-junction)
  - Minor Arterial and Collector Road (T-junction)
  - Arthur Porter Drive and Te Kowhai Road (4-way crossing)
  - Tasman Road and Te Kowhai Road East (T-junction)
  - The Boulevard – Te Kowhai Road East - Maahanga Drive (4-way crossing).
- Priority Controlled
  - Chalmers Road and Collector Road (T-junction).

Modelling Scenarios

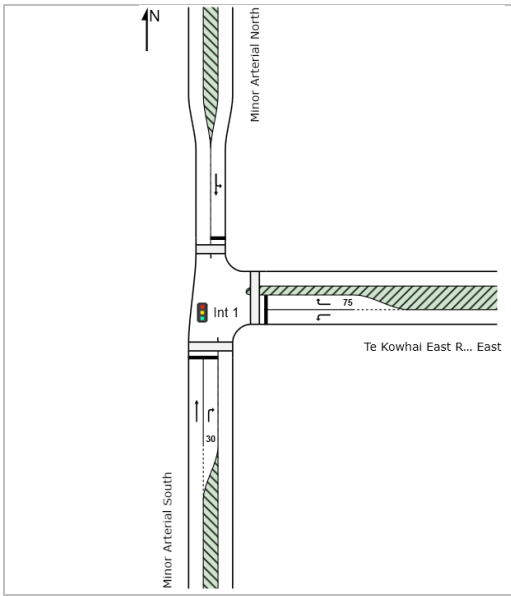
The scenarios tested included the following:

- 2051 Future Year
- PM peak period as the highest peak
  - Peak Hour Factor of 1.1
  - 10% HCV
  - Optimized signal phasing based on SIDRA software and manual adjustments.

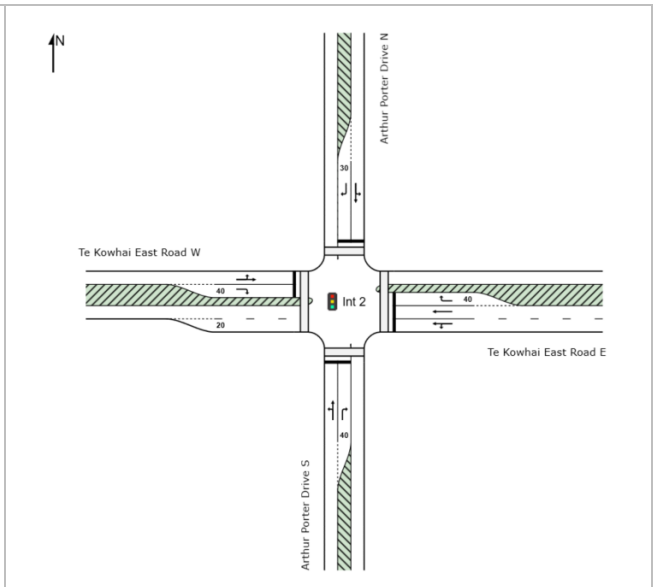
The SIDRA signalised intersections were optimised utilising lane configurations and signal phasing optimisation.

a. SIDRA Intersection Layouts

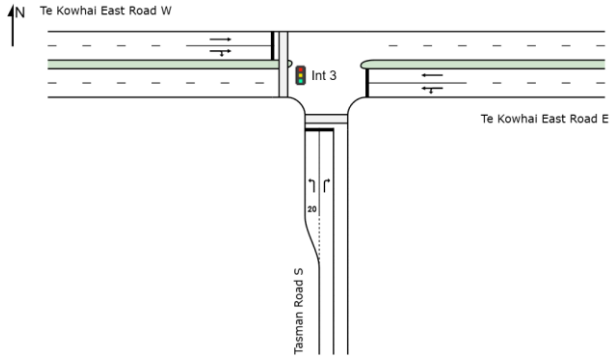
The schematic SIDRA intersection layouts that have been modelled are shown below. The layouts are subject to adjustments.



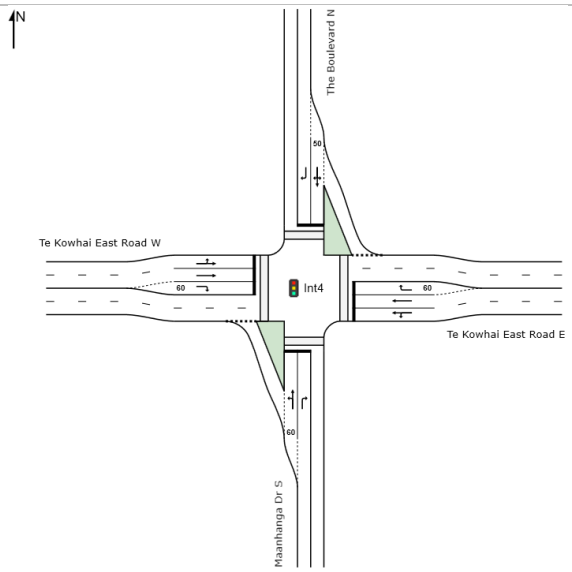
Te Kowhai Road and Minor Arterial



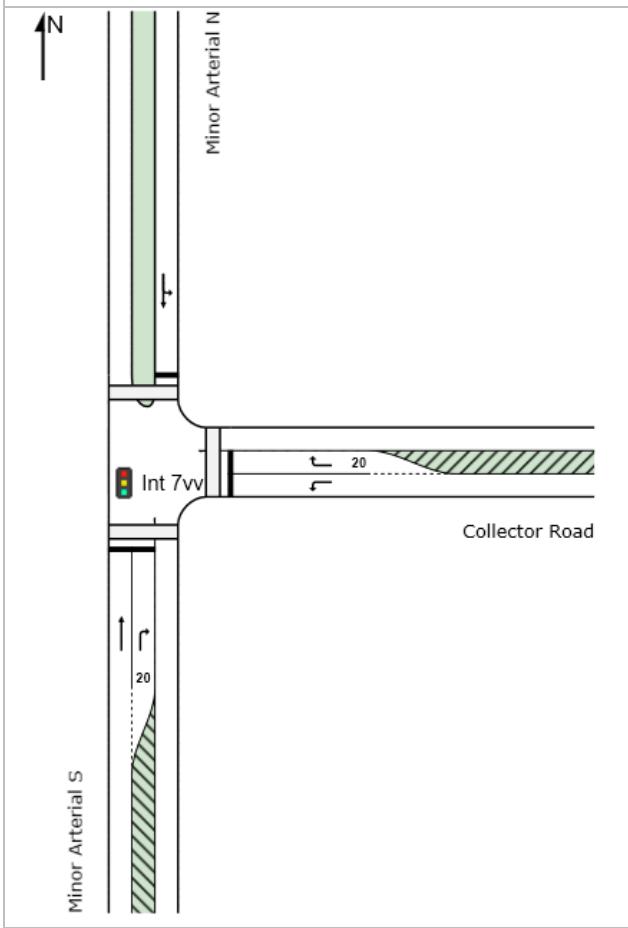
Arthur Porter Drive – Te Kowhai Road



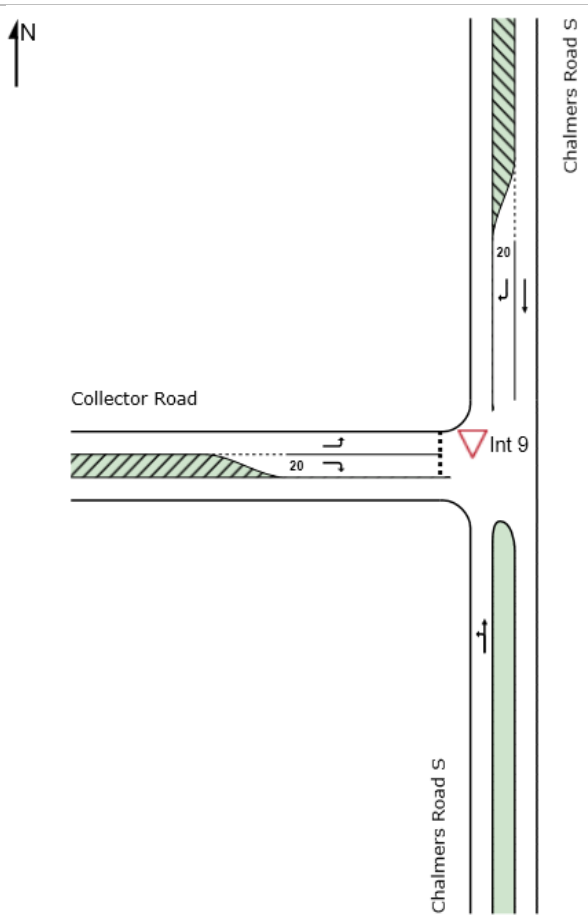
Tasman Road – Te Kowhai Road



The Boulevard – Te Kowhai Road – Maahanga Drive



Minor Arterial and Collector Road



Chalmers Road and Collector Road

Figure 6-4: SIDRA Intersection Layouts

6.1.3 Modelling Limitations

Modelling Years

Intersection modelling was agreed to only include the future year 2051 as the modelling scenario year. Interim modelling has not been undertaken due to the delivery timeframe uncertainty and that any interim modelling would possibly show a network modelling result before the designation can be constructed.

Predicted Traffic Volumes

The modelling data and modelling undertaken is limited to how the traffic volumes might differ due to the high provision for active modes. Traffic volumes in future might be lower if active and public transport provisions result in higher non car mode share.

a. Queue Bypass and HOV lanes

The modelling has not modelled PT or HOV queue bypass lanes at the signalised intersections along the designation. The form and extent of this would be determined during the next design stage.

b. Pedestrian and Cycle Volumes

Where possible we have included pedestrian crossing points at signalised intersections. The modelling is however not exhaustive in terms of cycle phasing. Pedestrian volumes have been assumed. Future design and assessment phases will include more detail on these elements.

6.1.4 Modelling Results

The intersection modelling summary results are detailed below for the 2051 future year scenario.

Table 6-3: Rotokauri Arterial Designation SIDRA Modelling Results – 2051 (Without 30% Uplift)

No	Intersection	PM Peak Operation			
		Deg Satn (v/c)	Avg Delay (s)	Level of Service	95% Max Queue (m)
1	Te Kowhai – Minor Arterial	0.80	32	LoS C	47m
2	Arthur Porter Drive – Te Kowhai Road	0.66	35	LoS C	64m
3	Tasman Road – Te Kowhai Road E	0.57	12	LoS B	92m
4	The Boulevard – Te Kowhai Road E – Maahanga Drive	1.1	69	LoS E	197m
5	Minor Arterial – Collector Road	0.29	18	LoS B	25m
6	Chalmers Road – Collector Road	0.12	4.3	LoS A	5m

Table 6-4: Rotokauri Arterial Designation SIDRA Modelling Results – 2051 (With 30% Uplift)

No	Intersection	PM Peak Operation			
		Deg Satn (v/c)	Avg Delay (s)	Level of Service	95% Max Queue (m)
1	Te Kowhai – Minor Arterial	0.75	35.0	LoS D	66m
2	Arthur Porter Drive – Te Kowhai Road	0.79	43.4	LoS D	116m
3	Tasman Road – Te Kowhai Road E	0.86	31.1	LoS C	296m
4	The Boulevard – Te Kowhai Road E – Maahanga Drive	1.09	84.7	LoS F	460m
5	Minor Arterial – Collector Road	0.37	18.5	LoS B	35m
6	Chalmers Road – Collector Road	0.17	4.3	LoS A	7m

Detailed modelling outputs for the individual intersections within the designation area are provided in **Appendix A**. The modelling shows most of the intersections to operate satisfactorily in the 2051 future year.

It is noted that The Boulevard / Te Kowhai Road East / Maahanga Drive intersection have over capacity constraints, which is influenced by the WRTM model predicting significantly high southbound traffic volumes from The Boulevard. A variety of layouts were tested for this intersection to improve the LoS by eliminating slip lanes in the northeast, southwest, or both. However, it was determined that retaining both slip lanes yielded the most favourable outcomes in terms of LoS for each leg. Once more accurate information is available it is anticipated that the signalised intersection could be optimised during the next design stage.

The SIDRA intersection results have facilitated the configuration of the civil design layouts (of the modelled intersections) as part of the designation.

6.2 Traffic Engineering Assessment

6.2.1 Cross Section Requirements

Typical cross sections have been developed in conjunction with HCC including the following default parameters:

- Minor Arterial will have two lanes, right turn lanes should be allowed for at key intersections, beyond that, developers will install their own
- 3.50m wide lane widths
- 0.75m wide shoulders
- A minimum 2.5m wide flush median to accommodate turning traffic
- A minimum 2.5m wide footpath, width to be maximised where practical and combined with cycles for shared spaces in commercial areas
- Footpaths will be widened at bus stops and must be minimum 3.0m wide in these areas
- Footpaths preferred to be separate from cycle paths
- Cycle facilities off road and protected.

The civil design report accompanying the NOR summarises the proposed carriageway cross-sectional dimensions adopted. These are to be read in conjunction with Typical Section Drawings 4288564-100-CA-2001-2005.

6.2.2 Vehicle Access

As part of the next design stage consideration will be given to ensure the accessibility to properties along the route is maintained, noting that several properties will be significantly affected and may require alternative access provision e.g. Property 27.

6.2.3 Intersection Design

Intersections shall consider all modes of travel depending on the nature of the intersecting links.

- Signalised intersections need to be weighed up against roundabout types with regards to vehicular traffic efficiency and active mode safety and their footprint.

The intersection types currently proposed are shown in **Figure 6-5**.

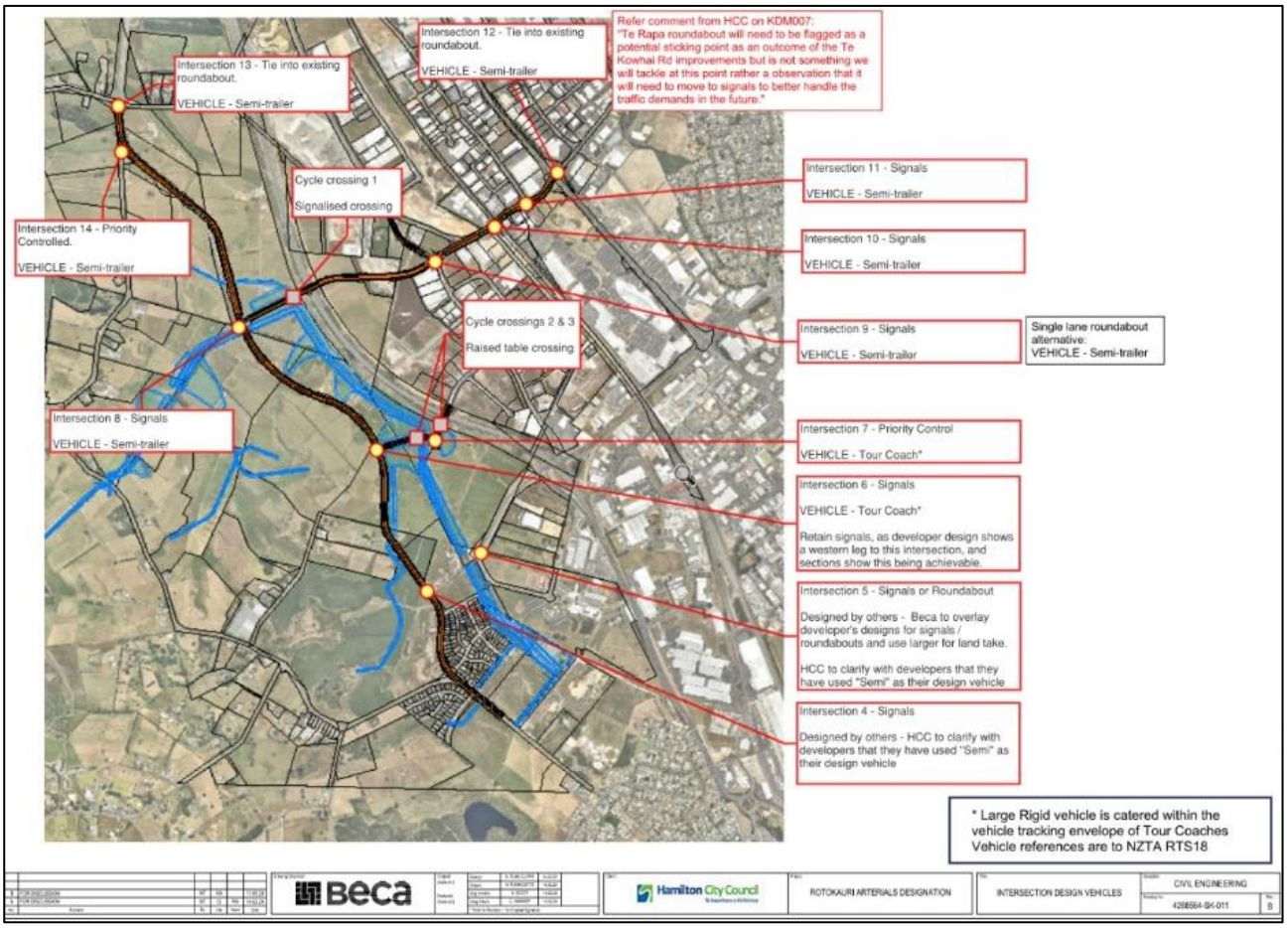


Figure 6-5: Intersection Forms & Design Vehicles

6.2.4 Design Vehicles

The design vehicle for intersection turning movements shall be designated vehicles defined in the RTS 18 – New Zealand on-road tracking curves for heavy motor vehicles. This includes the following vehicles shown in **Table 6-5**.

Table 6-5 - Design Vehicles

Zone	Road Class	Traffic Lanes / shoulder / Median
8 m Truck	A medium rigid truck is larger than vans and small light trucks. These trucks are generally used to transport small to medium consignments and are similar in length to a rubbish truck.	10 to 25m radius
11.5 m Truck	A large rigid truck normally services large commercial and industrial retail operations.	12.5 to 25m radius
18 m Semi-Trailer	This vehicle will be required to access certain industrial and commercial localities	12 to 25m radius
12.6 m Tour Coach	At various connections for example the Wintec area.	12 to 25m radius

Notes: from RTS 18 – New Zealand on-road tracking curves for heavy motor vehicles

The road network has been assessed with regards to the most likely largest vehicle that will be encountered for each part of the network. These have been summarised in **Figure 6-5**. which shows for each intersection the design vehicle adopted and the location on each intersection these vehicles originate from.

6.2.5 Sight Distances

The sight distance requirements will be designed in accordance with AUSTROADS Part 3 and Part 4A. The following sight distance requirement applies for a 60 km/h design speed on a road with a 50 km/h posted speed limit:

Posted Speed limit requirements:

- Stopping Sight Distance (SSD) = 55 m (RT=2.0, d=0.36)
- Approach Sight Distance (ASD) = 55 m (RT=2.0, d=0.36)
- Safe Intersection Sight Distance (SISD) = 97 m (RT=2.0, d=0.36).

During detailed design, the standard reaction time and friction factors adopted may be re-evaluated to meet other design constraints.

6.3 Pedestrians and Cyclists

Continuous off road / protected cycle facilities are proposed, these connect to key destinations along the corridor and the adjacent neighbourhoods. Crossing facilities and vehicle accessways needs to be considered in future design stages.

Major Arterial and Te Kowhai Road West Extension

To provide safe movement for active modes, a bi-directional cycle path is included on the south side of the road to connect key destinations and limit crossings to and conflicts in this industrial portion of the corridor with controlled access.

Minor Arterial

Cycling and pedestrian access is proposed on both sides of the minor arterial corridor to enable connectivity between the residential catchment and key attractors such as possible education facilities, town centre, Wintec, and ‘The Base’. The shared paths on the Greenway will primarily function as a recreational route while the minor arterial will provide direct access to properties and destinations on the corridor. Local intersections and vehicle accesses will generally be limited, in order to protect and prioritise pedestrian and cycle modes.

Collector Road

Separated cycle paths on each side of the Collector Road with mountable kerb between footpaths are proposed.

Te Kowhai Road East

A bi-directional cycle path is proposed on the south side of the road to connect key destinations and limit crossings to signalised intersections only.

Summary

The pedestrian and active mode facilities and connections as described in this report and the UDLF will provide a good level of service for pedestrians and cycling in the growth area.

6.4 Public Transport

According to the Waikato Regional Public Plan, it is projected that there will be bus rapid transport (BRT) networks between Rotokauri and ‘The Base’ over the next 30 years (2022-2052).

Figure 6-6: Future frequent network and rapid lines to be implemented over 30 years (2022-2052)

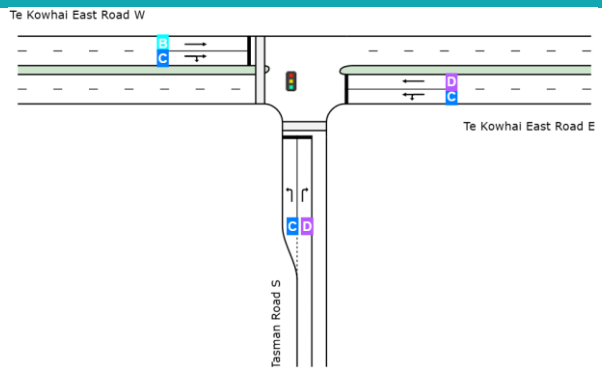
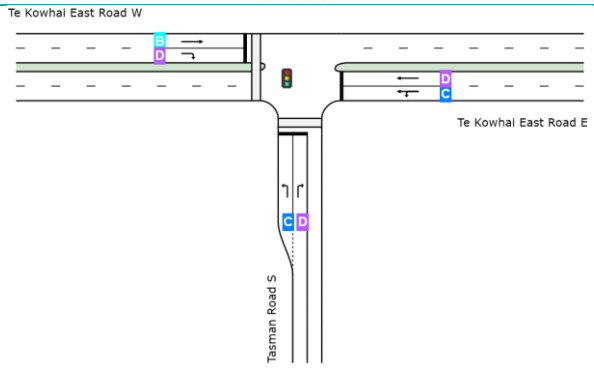
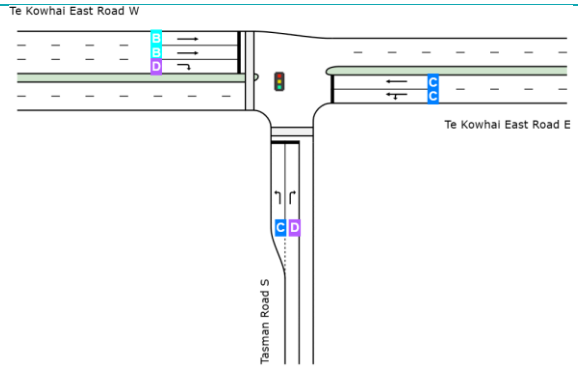
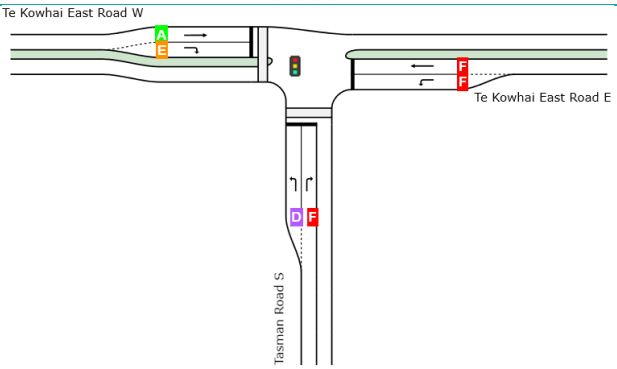
This new network will have frequent bus services operating on the new minor arterial which will travel through intersections 1, 2, 3, and 7 (the numbering of these intersections can be referenced back to **Figure 3-2**). Therefore, by assuming the potential routes of the future public transport network, the following intersections level of services were investigated using the 30% uplifted SIDRA models. Summary of the LoS of the aforementioned intersections is shown in **Table 6-6**.

Table 6-6: LoS summary of potential intersections intersecting with public transport

Intersection Description	LOS Range
1 - Te Kowhai and Minor Arterial	C – D
2 - Arthur Porter Drive – Te Kowhai Road	D - E
3 - Tasman Road – Te Kowhai Road	B - D
7 - SH39, Te Kowhai Road / Burbush Road	B - C

Based on the uplifted SIDRA models, the LOS for intersections 1 and 2 ranged between C and E, whereas for intersections 3 and 7 had a LOS between B and D. Intersection 3 is a signalized T intersection between Te Kowhai East Road and Tasman Road, was further investigated with a variety of different design scenarios on the western leg because Tasman Road provides a direct route for buses and private vehicles to access Rotokauri railway station and parking area. Which is essential when designing for optimal bus routes to service public transport demands.

Table 6-7: Different Lane Configurations for Te Kowhai East Road/ Tasman Road Intersection

Scenario #	Lane Configuration
1	
2	
3	
4	

Based on the provided LOS ratings for each intersection 3 configuration, scenario 1 performed the best in terms of LOS for each leg. Additionally, it is possible that private vehicles accessing the parking lot may utilise an alternative route that bypasses intersection 3, indicating that PT/HOV lanes may not be necessary for this intersection.

As a result, the following designs of PT/ HOV lanes for intersections 1 and 2 are described in Figure 6-7 and Figure 6-9 below.

Public Transport Facilities

A number of bus stops locations have been identified in the designation transport network. The final location and details surrounding these stops will be detailed during a future design stage. It is considered that more bus stops could possibly be added or relocated once details on passenger volumes and the regional bus network is known.

Major Arterial and Te Kowhai Road

Based on the analysis carried out above this section of the corridor has been proposed as four lanes which will be able to provide Bus or HOV lanes on the outside of the midblock and at intersections. Intersections could also be prioritised to provide queue bypass with the provision of additional lanes.

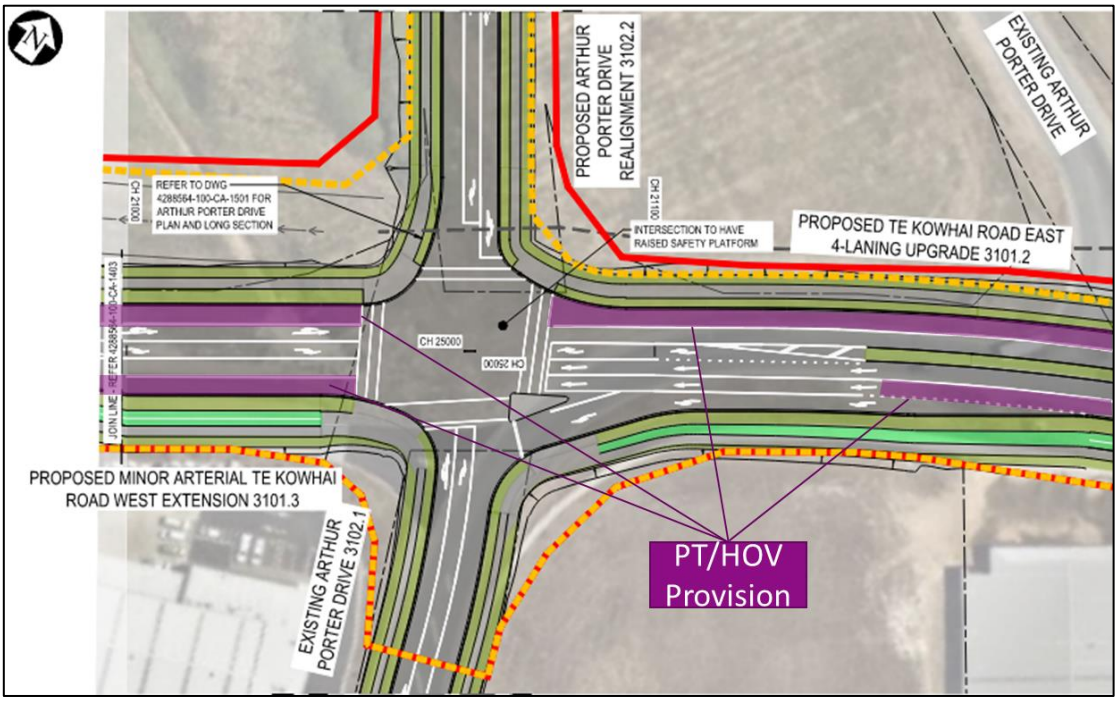


Figure 6-8: PT and HOV Provision at Arthur Porter Te Kowhai Intersection

Minor Arterial

The designation network provides public transport (or HOV) queue bypass lanes at the signalised intersections along the north south alignment of the Minor Arterial.

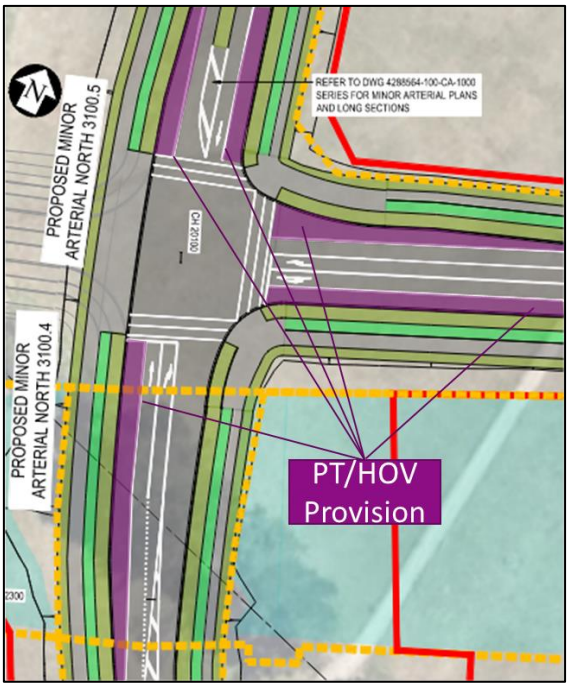


Figure 6-9: PT and HOV Provision at Minor Arterial and Te Kowhai West Intersection

Details of the PT and HOV lanes will be developed during future stages of the project.

6.5 Summary

When reviewing the designation and corridor design elements against the HCC Operative District Plan principles related to Integrated Transport and the Transport Network, we conclude the following based on the following key characteristics:

- Responsive
- Efficient
- Safe
- Accessible
- Sustainable
- Integrated with land use.

6.5.1 Responsiveness and Efficiency

The modelling results show that the transport network and most intersections will operate at an acceptable level of service for cars, HCV and buses, in the future year 2051.

Some intersection results have indicated higher delay times and low levels of service; however, it is anticipated that these intersections will still function satisfactorily and that the delay may encourage use of alternative modes.

6.5.2 Safety and Accessibility

The separated cycling and pedestrian facilities provide for safer environments. The designation transport network supports the safety of all users by providing a safe network, providing adequate travel choices, suitable networks and facilities for all modes.

6.5.3 Resilience

It is expected that the transport network will have the ability to move people and goods in the face of possible network disruptions. The designation has provided some alternative routes to the wider transport network as well as a multi-modal approach to facility provision.

6.5.4 Sustainability and Connected

The designation aims to enhance and facilitate connections from residential neighbourhoods to key destinations including recreational areas, suburban centres, schools and businesses.

It will provide legible, accessible and safe connections between residential neighborhoods, suburban centres, recreational areas and transit stops for pedestrians, cyclists and local road users. Provide a high level of cross corridor connectivity between the city and the suburb, identified activity nodes and residential neighborhoods.

Prioritise active modes and transport and provide choice in travel and the ability to connect at interchanges between modes.

6.5.5 Integrated Design

The design of the Arterial Roads responds to a need for cohesion of various land uses with the corridor to create an integrated, more sustainable transport network that provides modal choice for users and contributes to a higher level of amenity for neighbourhoods.

The treatment examples represent what a higher place function looks like as applied in areas of the network and contributes to a vibrant and active urban environment where streets themselves become public spaces of value.

7 Alignment to Relevant Transport Policy

The transport network outlined in the sections above aims to meet the guidelines and achieve the outcomes set out by the documents below. The designation aims to promote the use of multi-modal transport including public transport, cycling, and walking.

7.1 Ministry of Transport Outcomes Framework

The fives outcomes of the framework are inclusive access, healthy and safe people, economic prosperity, environmental sustainability and resilience and security.

- **Inclusive Access**
  - Inclusive access enables all to participate in society through access to social and economic opportunities such as work, education, and healthcare.
  - To be inclusive, the transport system must be accessible to all people in New Zealand including those with disabilities, low-income earners, and people of different ages, genders, and ethnicities.
- **Healthy and safe people**
  - The system:
    - Protects people from transport-related injuries and harmful pollution; and
    - Makes physically active travel an attractive option.
- **Economic prosperity**
  - The transport system supports activity via local, regional, and international connections, with efficient movement of people and products.
- **Environmental sustainability**

  - The transport system:
    - Transitions to net zero carbon emissions; and
    - Maintains or improves biodiversity, water quality and air quality
- **Resilience and security**
  - The transport system:
    - Minimises and manages the risks from natural and human-made hazards
    - Anticipates and adapts to emerging threats, and
    - Recovers effectively from disruptive events.

The Designation transport network supports these fives outcomes by providing a network that is suitable and safe for all users, supports economic prosperity through providing access to jobs, maintains or improves environmental sustainability and is resilient.

7.2 Government Policy Statement on Land Transport 2021 (GPS)

The following is based on the GPS 2021. At the time of writing GPS 2024 has not been published.

The GPS has four strategic priorities, these guide land transport investment from 2021/22 until 2030/31. These four strategic priorities are safety, better travel choices, improving freight connections and climate change.

- **Safety**: The primary focus of this priority is to develop a transport system that advances New Zealand's vision that no-one is killed or seriously injured while travelling. New Zealand roads will be made substantially safer.
- **Better Travel Options**: The primary focus of this priority is to improve people's transport choices in getting to places where they live, work and play, and to make sure our cities and towns have transport networks that are fit for purpose and fit for the future.
- **Improving Freight Connections**: Well-designed transport corridors with efficient, reliable and resilient connections will support productive economic activity.
- **Climate Change**: Investment decisions will support the rapid transition to a low carbon transport system and contribute to a resilient transport sector that reduces harmful emissions, giving effect to the emissions reductions target the Climate Change Commission recommended to Cabinet and emissions budgets released in 2021.

The designation network supports the four strategic priorities of the GPS by providing a safe network for all users, providing adequate travel choices by including provisions for active modes, providing suitable networks and facilities for all modes, improving strategic routes in the area.

We note that as a greenfield development, this project will be contributing additional emissions. However, the provisions made for PT and active modes should result in fewer emissions than would be expected from other comparable urban environments.

7.3 National Policy Statement on Urban Development (NPS-UD)

The NPS-UD 2020 sets out the objectives and policies for planning for well-functioning urban environments under Resource Management Act 1991. We have indicated where the designation road network supports the outcomes sought in the NPS. The objectives of the NPS-UD include:

Table 7-1: NPS-UD Objectives

NPS-UD Objectives	Supports Outcome
• New Zealand has well-functioning urban environments that enable all people all communities to provide for their social, economic, and cultural wellbeing, and for their health and safety, now and into the future.	✓

• Planning decisions improve housing affordability by supporting competitive land and development markets.	✓
• Regional policy statements and district plans enable more people to live in, and more businesses and community services to be located in, areas of an urban environment in which one or more of the following apply:	
– The area is in or near a centre zone or other area with many employment opportunities	✓
– The area is well-serviced by existing or planned public transport	✓
– There is high demand for housing or for business land in the area, relative to other areas within the urban environment	✓
• New Zealand's urban environments, including their amenity values, develop and change over time in response to the diverse and changing needs of people, communities, and future generations	
• Planning decisions relating to urban environments, and Future Development Strategies, take into account the principles of the Treaty of Waitangi	
• Local authority decisions on urban development that affect urban environments are:	
– Integrated with infrastructure planning and funding decisions; and	✓
– Strategic over the medium term and long term; and	✓
– Responsive, particularly in relation to proposals that would supply significant development capacity	✓
– Local authorities have robust and frequently updated information about their urban environments and use it to inform planning decisions	✓
• New Zealand's urban environment:	
– Support reductions in greenhouse gas emissions; and	✓
– Are resilient to the current and future effects of climate change	✓
• The key policies of the NPS-UD include:	
– Policy 1: Planning decisions contribute to well-functioning urban environments, which are urban environments, as a minimum:	
– Have or enable a variety or sites that are suitable for different business sectors in terms of location and site size; and	✓
– Have good accessibility for all people between housing, jobs, community services, natural spaces and open spaces, including by way of public or active transport.	✓

7.4 Hamilton City Council Operative District Plan

The HCC Operative District Plan has the following principles related to Integrated Transport and the Transport Network, namely:

7.4.1 Integrated Transport Network

An integrated multi-modal transport network that meets national, regional and local transport needs and is:

- Responsive
- Efficient
- Affordable
- Safe
- Accessible
- Sustainable
- Integrated with land use.

The designation addresses these principles, refer to Section 5.5 for the assessment of the designation against these principles.

7.4.2 Transport Network

The designation transport network supports the related infrastructure planning, design, and future construction in a manner that:

i. Recognises the affordability of providing new public infrastructure and other actions to increase the capacity of the transport network to accommodate growth
ii. Enables flexible management of transport corridors to allow them to perform their function within the City's transport corridor hierarchy
iii. Promotes energy conservation and efficiency
iv. Promotes a safe and efficient transport network
v. Allows for network utility infrastructure, and streetscape amenity
vi. Provides access to and has regard for the safety and needs of the mobility impaired, transport disadvantaged, cyclists, pedestrians, passenger transport users, and others using the transport corridor to move from place to place
vii. Contributes to the social, economic, cultural and environmental needs of current and future users of the transport network
viii. Takes account of the whole of life operational and maintenance costs of the transport network.

8 District Plan Transportation Review

The key design elements relevant to this Project are identified in the following table along with an assessment of compliance against District Plan requirements.

Table 8-1: District Plan: Volume 2: Appendix 15 Transportation: Table 15-6a)ii

Classification	District Plan legal width	Proposed legal width
Major Arterial		
Industrial land use	Specific design	Te Kowhai Road East – 27.0m
Minor Arterial		
Residential land use	Specific design	Proposed Minor Arterial North – 30.0m
Industrial land use	Specific design	Te Kowhai Road West – 29.0m Proposed Minor Arterial North – 30m
Business centres land use	Specific design	Proposed Minor Arterial North – 25.0m
Collector		
Residential land use	23m	Chalmers Road – 23.6m Arthur Porter Drive – 23.0m
Industrial land use	23m	Chalmers Road – 23.6m
Local		
Industrial land use	20m	New Local Road – 20.0m
Carriageway width	Specific design requires case by case consideration of the design elements in the local context. This will be undertaken with input from Council's City Infrastructure engineers during detailed design.	
Movement lane width	The proposed movement lane width ranges from 3.3-4.25m depending on the road function and classification. It is noted the Te Kowhai Road East movement lane does not widen when it passes through the Industrial Land use (to achieve Industrial Road movement lane widths), a consistent lane width is preferred.	
Berm requirements	The proposed cross-section provides approximately 5m to 8m of berm width to accommodate back berm / utilities, footpaths, separated shared paths, tree vegetation, and indented parking. Specific design requires case by case consideration of the design elements in the local context. This will be undertaken with input from Council's City Infrastructure engineers during detailed design.	
On street parking	Te Kowhai Road East provides a 3m wide space for recessed on street parking which meets the on-street parking requirements for industrial roads within the District Plan. Parking provision is only provided on the minor arterial section of Te Kowhai Road East, not the major arterial section.	
Footpath requirements	Footpath provisions are catered for across the entire arterials development and range from 1.8m to 2m in width.	
Cyclepath requirements	Cycle volumes are envisioned to be high due to the significant provision of active mode facilities including separate footpaths, cycleways, and greenway cycleways. Specifications of these features are as follows: • Footpaths – 1.8m to 2m • Cycleways (per directional lane) – generally 2.2m This achieves the requirement.	

	Provision for cyclists on and off the carriageway shall be subject to scheme plan approvals and designed in consultation with the Transportation Manager and, where appropriate, the Manager Parks & Gardens Unit.

The Rotokauri Arterial Network is generally in line with the District Plan.

9 Summary and Conclusions

This ITA has assessed the proposed designation transport network for the Rotokauri area. The purpose of the ITA is to ensure that the operational effects of the designation are well considered and that there is an emphasis on efficiency, safety and accessibility on the road network by all transport modes. Adverse Transport effects of the designation have been largely avoided, remedied or mitigated through sound design principles.

The ITA has identified that the designation design accommodates a range of travel modes. With these networks in place the transport system is expected to enable the proposed land use for the Rotokauri area.

The ITA has also identified that the cross-sections have been prepared and can accommodate the expected future traffic volumes, allow for buses and provide for active modes.

The relevant transport strategy documents have been reviewed and the proposed designation transport network is broadly consistent with the policies and objectives.

Future planning and design stages, e.g. resource consent, will develop the design and staging of transport infrastructure further to support the development of land within the designation area.

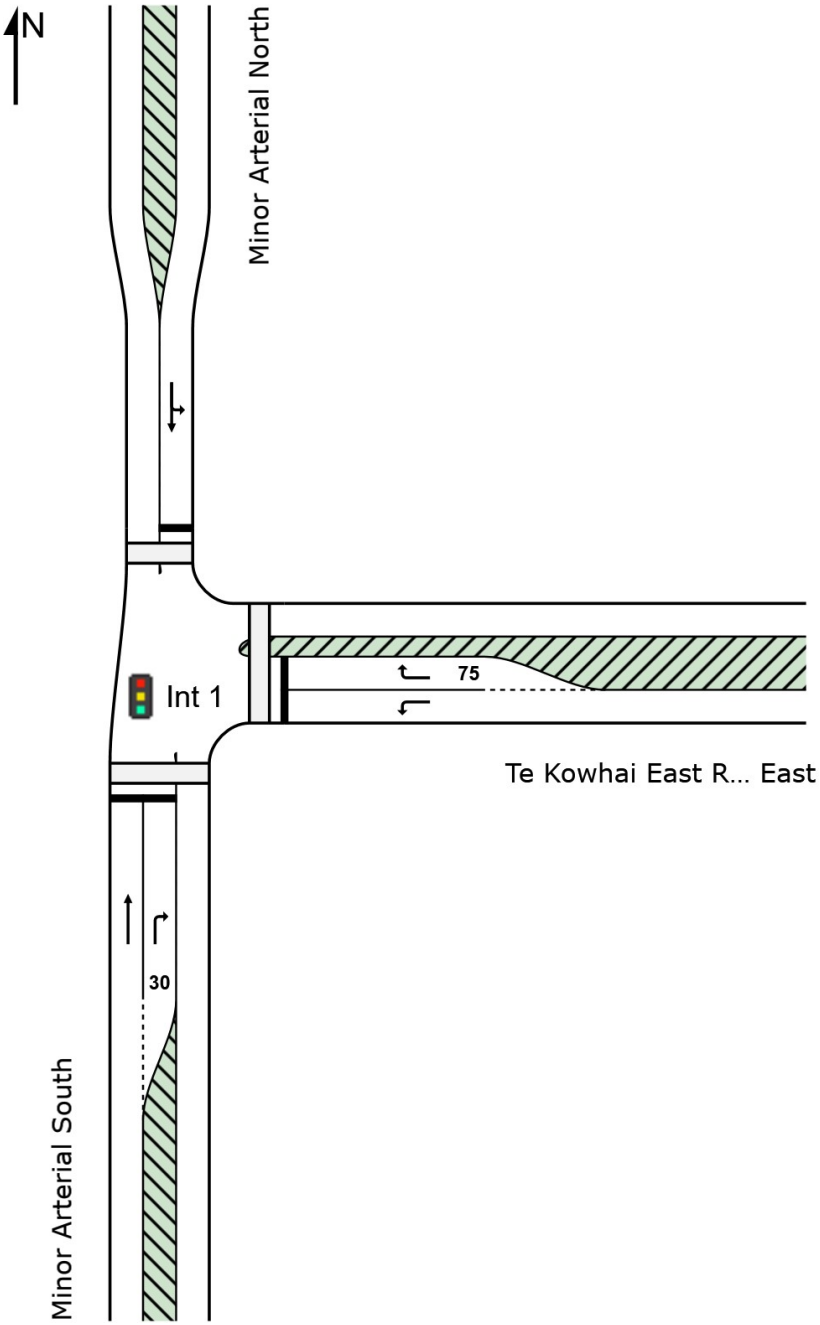
A

Appendix A – Modelling Outputs

SITE LAYOUT

Site: Int 1 [Int 1 PM - 30% ST]

Int 1: Te Kowhai East Road / Minor Arterial PM
Site Category: (None)
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: Int 1 [Int 1 PM - 30% ST]

Int 1: Te Kowhai East Road / Minor Arterial PM
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.
Flow Scale Analysis (Upper Limit): Results for Flow Scale (chosen as largest for any movement) = 130.0 %

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minor Arterial South												
2	T1	193	9.9	0.527	28.0	LOS C	6.1	46.6	0.94	0.77	0.94	41.1
3	R2	33	8.3	0.219	40.1	LOS D	1.1	8.4	0.96	0.72	0.96	35.3
Approach		226	9.7	0.527	29.8	LOS C	6.1	46.6	0.95	0.76	0.95	40.1
East: Te Kowhai East Road East												
4	L2	138	9.9	0.697	41.5	LOS D	5.0	38.2	1.00	0.86	1.17	35.0
6	R2	241	10.2	0.749	38.4	LOS D	8.6	65.6	1.00	0.89	1.17	35.7
Approach		379	10.1	0.749	39.5	LOS D	8.6	65.6	1.00	0.88	1.17	35.4
North: Minor Arterial North												
7	L2	56	9.8	0.585	36.0	LOS D	5.8	44.2	0.97	0.80	0.98	38.4
8	T1	119	10.3	0.585	30.3	LOS C	5.8	44.2	0.97	0.80	0.98	39.3
Approach		175	10.2	0.585	32.1	LOS C	5.8	44.2	0.97	0.80	0.98	39.0
All Vehicles		780	10.0	0.749	35.0	LOS D	8.6	65.6	0.98	0.83	1.06	37.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

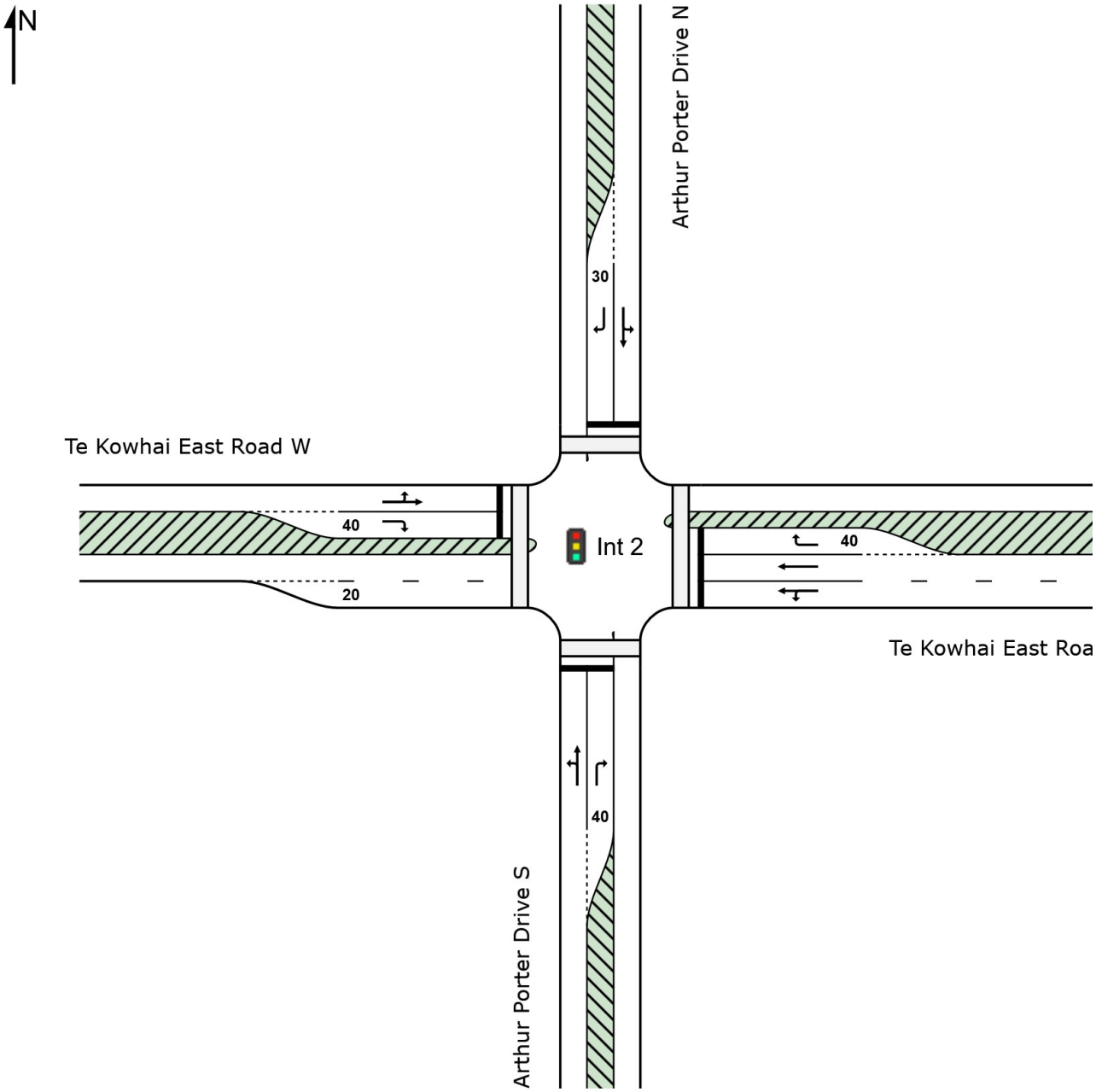
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	68	29.3	LOS C	0.1	0.1	0.92	0.92
P2	East Full Crossing	68	29.3	LOS C	0.1	0.1	0.92	0.92
P3	North Full Crossing	68	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		205	29.3	LOS C			0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Int 2 [Int 2 PM - 30% ST]

Int 2: Te Kowhai East Road / Arthur Porter Drive
Site Category: (None)
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: Int 2 [Int 2 PM - 30% ST]

Int 2: Te Kowhai East Road / Arthur Porter Drive
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 100 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.
Flow Scale Analysis (Upper Limit): Results for Flow Scale (chosen as largest for any movement) = 130.0 %

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Arthur Porter Drive S												
1	L2	201	10.2	0.783	46.5	LOS D	13.3	101.5	0.95	0.90	1.09	27.8
2	T1	78	10.5	0.783	40.8	LOS D	13.3	101.5	0.95	0.90	1.09	24.8
3	R2	215	10.2	0.428	36.9	LOS D	8.6	65.3	0.86	0.80	0.86	24.3
Approach		494	10.2	0.783	41.4	LOS D	13.3	101.5	0.91	0.86	0.99	26.0
East: Te Kowhai East Road E												
4	L2	1	0.0	0.794	50.5	LOS D	15.3	116.4	1.00	0.94	1.14	22.1
5	T1	588	10.0	0.794	44.8	LOS D	15.3	116.4	1.00	0.94	1.14	30.9
6	R2	40	10.3	0.382	58.1	LOS E[11]	2.0	15.3	1.00	0.73	1.00	23.3
Approach		629	10.0	0.794	45.6	LOS D	15.3	116.4	1.00	0.92	1.13	30.4
North: Arthur Porter Drive N												
7	L2	57	9.5	0.532	46.8	LOS D	7.6	57.6	0.96	0.79	0.96	27.3
8	T1	109	10.0	0.532	41.1	LOS D	7.6	57.6	0.96	0.79	0.96	25.4
9	R2	11	12.5	0.032	40.4	LOS D	0.4	3.3	0.83	0.68	0.83	32.8
Approach		178	10.0	0.532	42.9	LOS D	7.6	57.6	0.95	0.78	0.95	26.6
West: Te Kowhai East Road W												
10	L2	3	0.0	0.469	43.5	LOS D	7.8	59.4	0.93	0.76	0.93	33.9
11	T1	177	10.1	0.469	38.0	LOS D	7.8	59.4	0.93	0.76	0.93	33.3
12	R2	42	9.7	0.407	58.3	LOS E[11]	2.2	16.3	1.00	0.74	1.00	24.0
Approach		222	9.9	0.469	41.9	LOS D	7.8	59.4	0.94	0.76	0.94	31.3
All Vehicles		1523	10.1	0.794	43.4	LOS D	15.3	116.4	0.95	0.86	1.04	28.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

11 Level of Service is worse than the Level of Service Target specified in the Parameter Settings dialog.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	68	44.3	LOS E[12]	0.2	0.2	0.94	0.94
P2	East Full Crossing	68	44.3	LOS E[12]	0.2	0.2	0.94	0.94
P3	North Full Crossing	68	44.3	LOS E[12]	0.2	0.2	0.94	0.94
P4	West Full Crossing	68	44.3	LOS E[12]	0.2	0.2	0.94	0.94

All Pedestrians	274	44.3	LOS E[12]	0.94	0.94

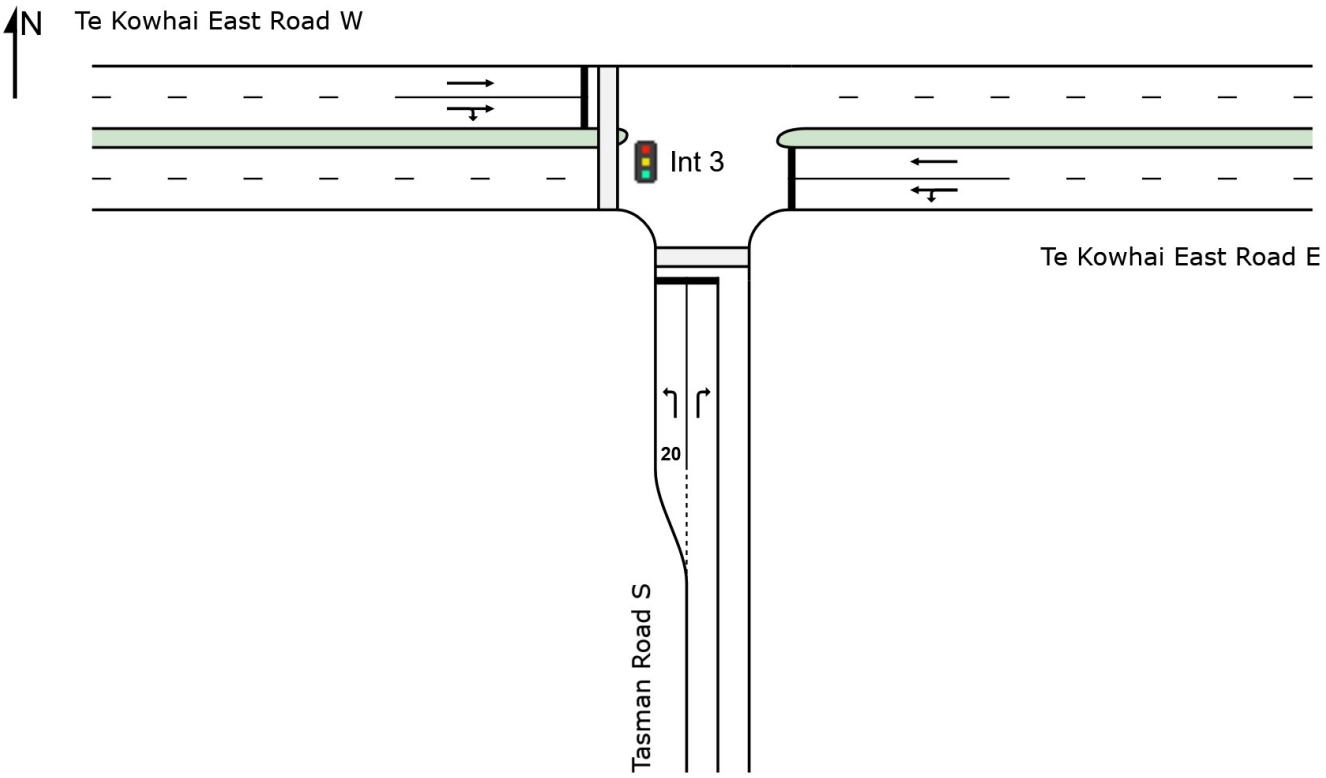
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

12 Level of Service is worse than the Pedestrian Level of Service Target specified in the Parameter Settings dialog.

SITE LAYOUT

Site: Int 3 [Int 3 PM - 30% ST]

Int 3: Te Kowhai East Road / Tasman Road PM
Site Category: (None)
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: Int 3 [Int 3 PM - 30% ST]

Int 3: Te Kowhai East Road / Tasman Road PM
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Site Practical Cycle Time)
Flow Scale Analysis (Upper Limit): Results for Flow Scale (chosen as largest for any movement) = 130.0 %

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Tasman Road S												
1	L2	3	0.0	0.004	24.5	LOS C	0.1	0.5	0.65	0.62	0.65	36.4
3	R2	108	10.1	0.312	47.6	LOS D	4.2	31.6	0.90	0.79	0.90	27.8
Approach		111	9.9	0.312	47.0	LOS D	4.2	31.6	0.89	0.79	0.89	28.0
East: Te Kowhai East Road E												
4	L2	935	10.0	0.863	33.8	LOS C	38.9	295.7	0.87	0.95	0.97	33.4
5	T1	625	10.1	0.863	35.6	LOS D	38.9	295.7	0.99	1.02	1.16	27.2
Approach		1560	10.0	0.863	34.5	LOS C	38.9	295.7	0.92	0.98	1.05	31.1
West: Te Kowhai East Road W												
11	T1	439	10.0	0.267	15.1	LOS B	6.2	46.9	0.63	0.53	0.63	39.6
12	R2	10	14.3	0.267	27.3	LOS C	5.5	41.6	0.74	0.62	0.74	38.6
Approach		449	10.1	0.267	15.4	LOS B	6.2	46.9	0.63	0.53	0.63	39.6
All Vehicles		2120	10.0	0.863	31.1	LOS C	38.9	295.7	0.86	0.87	0.95	32.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

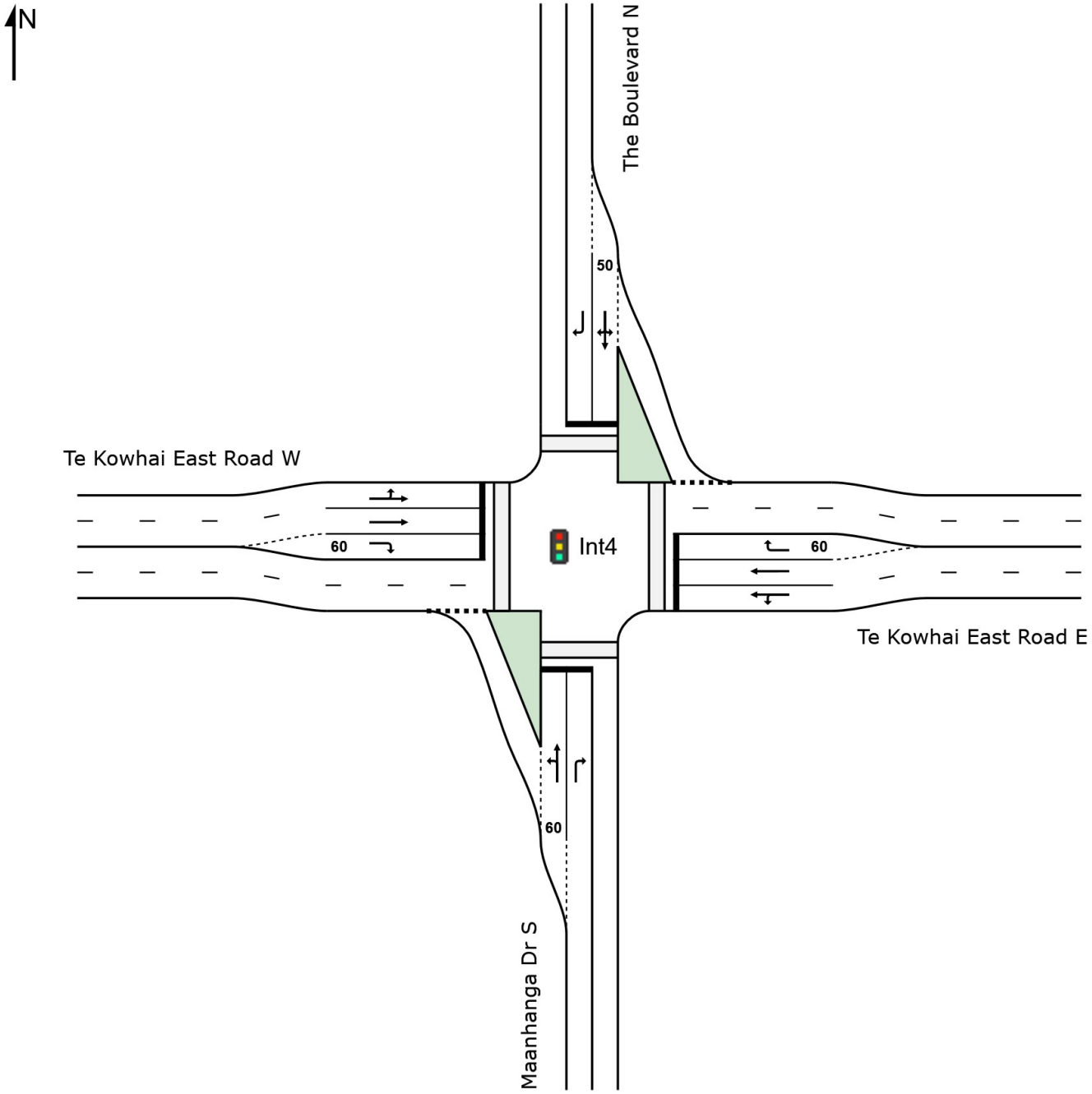
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	68	39.3	LOS D	0.2	0.2	0.94	0.94
P4	West Full Crossing	68	39.3	LOS D	0.2	0.2	0.94	0.94
All Pedestrians		137	39.3	LOS D			0.94	0.94

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Int4 [Int 4 PM - 30% ST]

Int 4: Te Kowhai East Road / The Boulevard PM
Site Category: (None)
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: Int4 [Int 4 PM - 30% ST]

Int 4: Te Kowhai East Road / The Boulevard PM
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.
Flow Scale Analysis (Upper Limit): Results for Flow Scale (chosen as largest for any movement) = 130.0 %

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Maanhanga Dr S												
1	L2	415	9.9	1.083	130.0	LOS F[11]	50.3	381.5	1.00	1.23	1.80	6.3
2	T1	44	9.4	1.083	124.2	LOS F[11]	50.3	381.5	1.00	1.23	1.80	6.0
3	R2	293	9.8	1.487	508.3	LOS F[11]	63.0	478.5	1.00	1.74	3.17	2.2
Approach		751	9.8	1.487	277.1	LOS F[11]	63.0	478.5	1.00	1.43	2.34	3.7
East: Te Kowhai East Road E												
4	L2	145	10.4	1.317	361.7	LOS F[11]	74.5	567.0	1.00	1.97	2.66	3.1
5	T1	593	9.9	1.317	357.0	LOS F[11]	74.5	567.0	1.00	1.95	2.68	2.9
6	R2	359	9.9	1.598	605.6	LOS F[11]	84.0	638.2	1.00	1.84	3.42	1.6
Approach		1096	10.0	1.598	439.0	LOS F[11]	84.0	638.2	1.00	1.92	2.92	2.3
North: The Boulevard N												
7	L2	859	10.0	1.254	284.6	LOS F[11]	149.4	1135.2	1.00	1.59	2.39	3.3
8	T1	59	9.3	1.254	278.9	LOS F[11]	149.4	1135.2	1.00	1.59	2.39	3.6
9	R2	551	9.9	1.254	309.3	LOS F[11]	149.4	1135.2	1.00	1.50	2.46	3.2
Approach		1470	10.0	1.254	293.7	LOS F[11]	149.4	1135.2	1.00	1.56	2.42	3.3
West: Te Kowhai East Road W												
10	L2	218	10.1	1.570	579.4	LOS F[11]	49.9	379.1	1.00	1.79	3.38	1.7
11	T1	207	9.9	1.410	435.9	LOS F[11]	41.3	314.1	1.00	1.83	2.98	2.4
12	R2	125	9.9	1.346	387.5	LOS F[11]	23.3	177.0	1.00	1.54	2.85	2.8
Approach		549	10.0	1.570	481.8	LOS F[11]	49.9	379.1	1.00	1.75	3.11	2.1
All Vehicles		3866	9.9	1.598	358.3	LOS F[11]	149.4	1135.2	1.00	1.66	2.64	2.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

11 Level of Service is worse than the Level of Service Target specified in the Parameter Settings dialog.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	68	69.3	LOS F[12]	0.3	0.3	0.96	0.96
P2	East Full Crossing	68	69.3	LOS F[12]	0.3	0.3	0.96	0.96
P3	North Full Crossing	68	69.3	LOS F[12]	0.3	0.3	0.96	0.96
P4	West Full Crossing	68	69.3	LOS F[12]	0.3	0.3	0.96	0.96

All Pedestrians	274	69.3	LOS F[12]	0.96	0.96

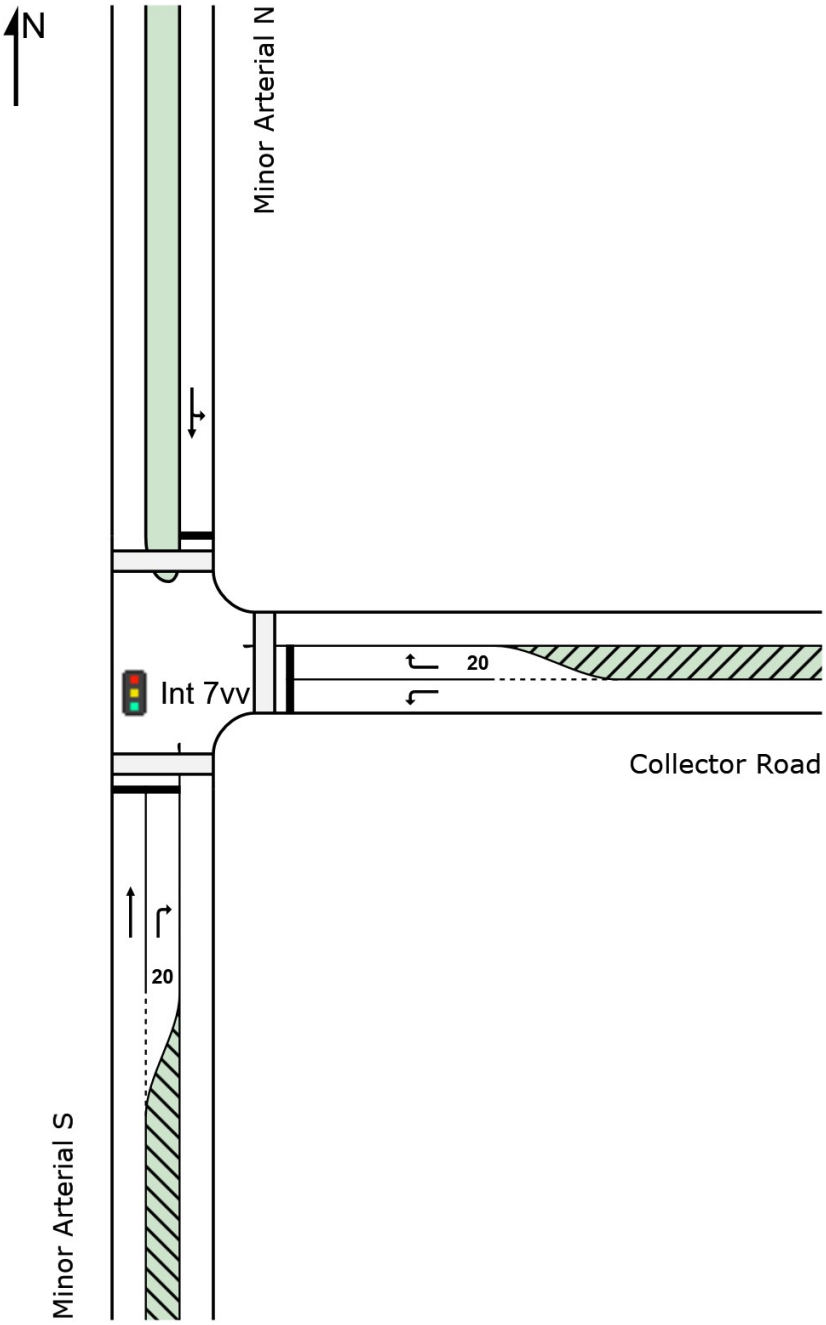
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

12 Level of Service is worse than the Pedestrian Level of Service Target specified in the Parameter Settings dialog.

SITE LAYOUT

Site: Int 7vv [Int 7vv PM - 30% ST]

Int 7: Minor Arterial / Chalmers Road PM
Site Category: (None)
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: Int 7vv [Int 7vv PM - 30% ST]

Int 7: Minor Arterial / Chalmers Road PM
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 50 seconds (Site Practical Cycle Time)
Flow Scale Analysis (Upper Limit): Results for Flow Scale (chosen as largest for any movement) = 130.0 %

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Minor Arterial S												
2	T1	164	10.0	0.374	17.9	LOS B	3.5	26.6	0.88	0.71	0.88	46.4
3	R2	64	10.6	0.143	21.5	LOS C	1.2	9.5	0.80	0.73	0.80	43.0
Approach		229	10.2	0.374	18.9	LOS B	3.5	26.6	0.86	0.72	0.86	45.4
East: Collector Road												
4	L2	265	9.8	0.364	16.6	LOS B	4.5	34.5	0.73	0.77	0.73	45.9
6	R2	36	11.5	0.148	27.3	LOS C	0.8	6.3	0.91	0.72	0.91	40.1
Approach		301	10.0	0.364	17.9	LOS B	4.5	34.5	0.75	0.76	0.75	45.1
North: Minor Arterial N												
7	L2	16	8.3	0.316	24.1	LOS C	2.7	20.5	0.88	0.71	0.88	44.4
8	T1	109	10.0	0.316	18.5	LOS B	2.7	20.5	0.88	0.71	0.88	45.6
Approach		126	9.8	0.316	19.2	LOS B	2.7	20.5	0.88	0.71	0.88	45.4
All Vehicles		655	10.0	0.374	18.5	LOS B	4.5	34.5	0.81	0.74	0.81	45.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

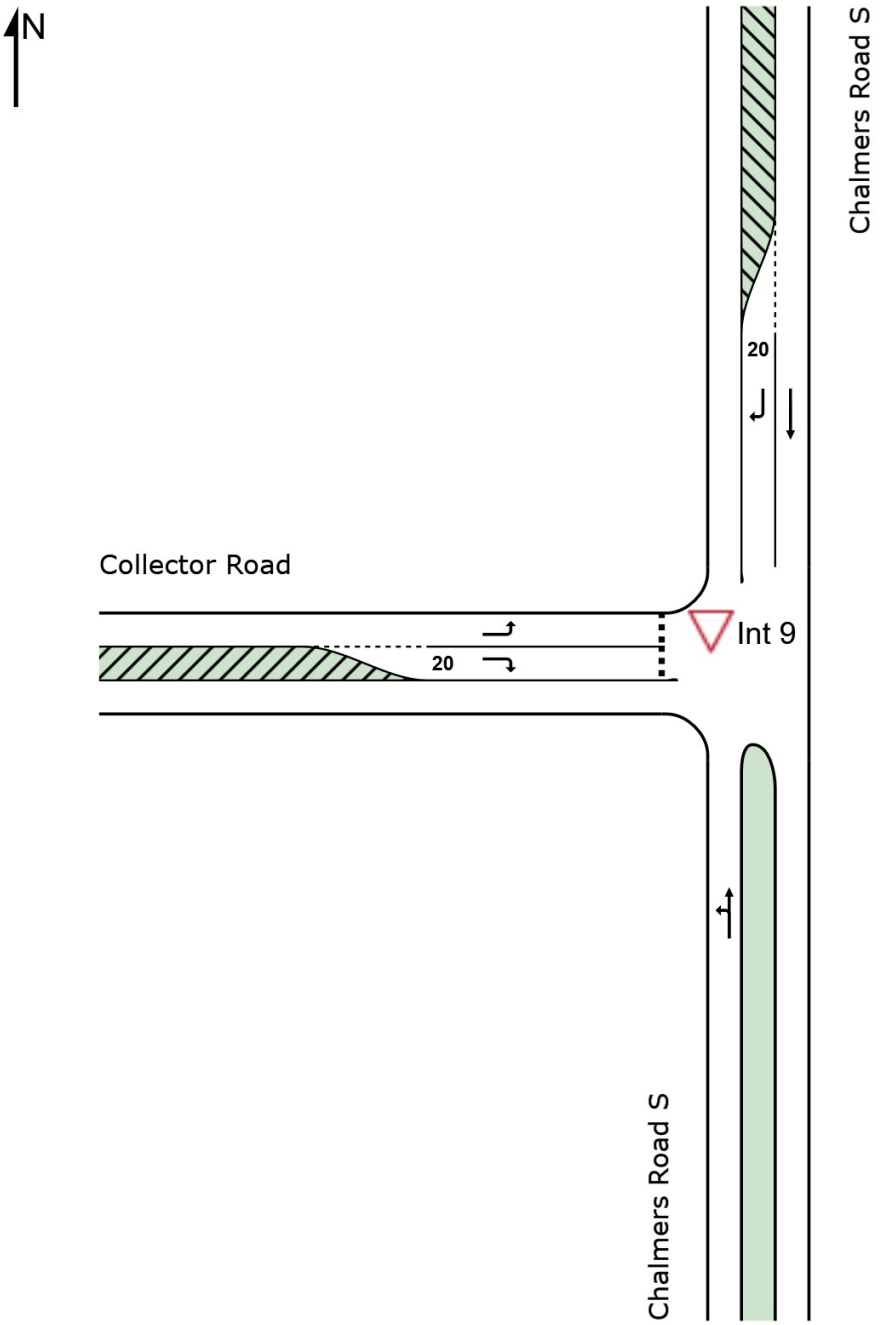
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	68	19.4	LOS B	0.1	0.1	0.88	0.88
P2	East Full Crossing	68	19.4	LOS B	0.1	0.1	0.88	0.88
P3	North Full Crossing	68	19.4	LOS B	0.1	0.1	0.88	0.88
All Pedestrians		205	19.4	LOS B			0.88	0.88

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: Int 9 [Int 9 PM - 30% ST]

Int 9: Chalmers Road / New Road PM
Site Category: (None)
Giveway / Yield (Two-Way)



MOVEMENT SUMMARY

Site: Int 9 [Int 9 PM - 30% ST]

Int 9: Chalmers Road / New Road PM
Site Category: (None)
Giveway / Yield (Two-Way)
Flow Scale Analysis (Upper Limit): Results for Flow Scale (chosen as largest for any movement) = 130.0 %

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Chalmers Road S												
1	L2	30	9.1	0.040	5.7	LOS A	0.0	0.0	0.00	0.24	0.00	55.9
2	T1	42	9.7	0.040	0.0	LOS A	0.0	0.0	0.00	0.24	0.00	57.8
Approach		73	9.4	0.040	2.3	NA	0.0	0.0	0.00	0.24	0.00	57.0
North: Chalmers Road S												
8	T1	101	9.5	0.055	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	271	10.1	0.169	5.9	LOS A	0.9	6.6	0.20	0.55	0.20	52.4
Approach		372	9.9	0.169	4.3	NA	0.9	6.6	0.14	0.40	0.14	54.3
West: Collector Road												
10	L2	71	9.6	0.047	5.8	LOS A	0.2	1.5	0.12	0.54	0.12	52.8
12	R2	10	14.3	0.015	8.9	LOS A	0.1	0.4	0.50	0.66	0.50	50.1
Approach		81	10.2	0.047	6.2	LOS A	0.2	1.5	0.17	0.55	0.17	52.5
All Vehicles		525	9.9	0.169	4.3	NA	0.9	6.6	0.13	0.40	0.13	54.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.