

PROPOSED PLAN CHANGE
AUCKLAND UNITARY PLAN

WARKWORTH SOUTH
WARKWORTH

INTEGRATED TRANSPORT ASSESSMENT

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	EXISTING TRANSPORT ENVIRONMENT	3
2.1	Background	3
2.2	Road Network	4
2.2.1	State Highway 1	4
2.2.2	Valerie Close	4
2.2.3	Mason Heights	4
2.3	Existing Pedestrian and Cyclist Accessibility	4
2.4	Existing Public Transport Accessibility	7
2.5	Road Safety History	8
3.0	FUTURE TRANSPORT ENVIRONMENT	11
3.1	The Warkworth Structure Plan	11
3.2	Future Transport Context	14
3.3	Future Traffic Flows	17
3.4	Future Public Transport Accessibility	18
3.5	Future Pedestrian and Cyclist Accessibility	18
3.6	Indicative Cross Sections for Future Urban Roads	20
4.0	THE PROPOSAL	22
4.1	General Description	22
4.2	Potential Future Development	24
4.2.1	“Waimanawa Valley”	24
4.2.2	“Waimanawa Hills”	25
4.3	Future Roads – Warkworth Structure Plan	25
4.3.1	Location of WWLR Link to SH1	26
4.4	Road Hierarchy	27
4.4.1	“Waimanawa Valley”	27
4.4.2	“Waimanawa Hills”	31
4.5	Walking and Cycling Strategy	32
4.6	Accessibility Design Principles	33
5.0	PRECINCT PROVISIONS TO MANAGE TRANSPORT EFFECTS.....	35
5.1	Walking and Cycling Connections to the Developed Urban Area of Warkworth	35
5.2	Upgrading of SH1 and Intersections.....	36

5.3	Provision of Transport Infrastructure Within the Plan Change Area	36
6.0	TRANSPORT GENERATION OF THE PROPOSAL.....	37
6.1	Choice of Transport Model and Design Year	37
6.2	2028 Base Case Traffic Volumes.....	37
6.3	2028 Traffic Generation of Proposed Warkworth South Plan Change Area	39
6.4	Trip Distribution.....	40
6.5	Trip Generation of Other Transport Modes	42
7.0	ASSESSMENT OF TRANSPORT EFFECTS.....	44
7.1	Walking and Cycling Trips.....	44
7.2	Public Transport Trips.....	44
7.3	2028 Motor Vehicle Trips at the New Cross Junction Linking Wider Western Link Road 45	
7.3.1	2028 Peak Hour Performance of Roundabout Control	45
7.3.2	2028 Peak Hour Performance of Traffic Signal Control.....	47
7.4	Motor Vehicle Trips at the SH1/Valerie Close Intersection	51
7.5	Motor Vehicle Trips at the Morrisons Orchard Access on SH1	53
7.6	Ultimate Peak Hour Performance of Road Network.....	56
7.7	Road Safety.....	56
7.7.1	Safety for Pedestrians and Cyclists	56
7.7.2	Safety for Motorists	57
8.0	AUCKLAND UNITARY PLAN CONSIDERATIONS	59
8.1	B3 (Infrastructure, Transport and Energy)	59
8.2	Section E27 – Transport.....	59
8.3	Section E27 – Transport Standards	61
8.4	Section E27 – Assessment Criteria	61
8.5	Section E38 – Urban Subdivision Transport Standards	61
8.6	Section E38 – Urban Subdivision Assessment Criteria	61
9.0	INTEGRATION WITH FUTURE TRANSPORT NETWORK.....	62
9.1	Auckland Plan 2050	62
9.2	Auckland Regional Land Transport Plan 2021-2031.....	62
9.3	Auckland Regional Public Transport Plan 2018.....	62
10.0	CONCLUSIONS.....	63
APPENDIX 1 - ESTIMATION OF 2028 PEAK HOUR TRAFFIC VOLUMES		
APPENDIX 2 - PROPOSED CROSS JUNCTION 2028 PEAK HOUR PERFORMANCE		

TABLES

Table 1: Crash History	9
Table 2: Proposed Precinct Transport Infrastructure Requirements	35
Table 3: Trip Generation Rates for Approved Plan Changes/Subdivisions.....	39
Table 4: Warkworth South 2028 Peak Hour Vehicle Trip Generation	40
Table 5: Warkworth South External Vehicle Trip Distribution	41
Table 6: Warkworth Future Mode Share	42
Table 7: Warkworth Existing Journey to Work Mode Share	43
Table 8: Warkworth South Peak Hour Trips by Mode.....	43
Table 9: Forecast 2028 Peak Hour Percentages of Heavy Traffic on Existing SH1	45
Table 10: SIDRA Results –Roundabout – 2028 AM Peak Hour.....	46
Table 11: SIDRA Results –Roundabout – 2028 PM Peak Hour.....	47
Table 12: SIDRA Results – Traffic Signals – 2028 AM Peak Hour.....	49
Table 13: SIDRA Results – Traffic Signals – 2028 PM Peak Hour.....	50
Table 14: SIDRA Results – Morrisons Access – 2028 AM Peak Hour.....	55
Table 15: SIDRA Results – Morrisons Access – 2028 PM Peak Hour.....	55

FIGURES

Figure 1: General Plan Change Area Location.....	1
Figure 2: Land Subject to Plan Change.....	3
Figure 3: 500-Metre Walking Contour from the Plan Change Area.....	5
Figure 4: 1-Kilometre Walking Contour from the Plan Change Area	6
Figure 5: 3-Kilometre Cycling Contour from the Plan Change Area.....	7
Figure 6: Locations of Crashes	8
Figure 7: Warkworth Structure Plan – Proposed Zoning (June 2019).....	12
Figure 8: Emerging Preferred Transport Network	13
Figure 9: Warkworth Structure Plan – Public Transport and Rooding Plan	16
Figure 10: Warkworth Structure Plan – Active Transport Network Plan	20
Figure 11: Urban Collector – Indicative Cross Section	21
Figure 12: Urban Arterial – Indicative Cross Section.....	21
Figure 13: Proposed Zoning	22
Figure 14: Indicative Masterplan Layout – Plan Change Area	24
Figure 15: Warkworth Structure Plan – Future Road Network.....	25
Figure 16: Supporting Growth and Proposed WWLR Connections to SH1	27
Figure 17: Potential Road Hierarchy - Waimanawa Valley.....	28
Figure 18: Possible Cross Section - State Highway 1.....	28
Figure 19: Possible Cross Section – Wider Western Link Road – Morrison Orchard Section	29
Figure 20: Possible Cross Section – Wider Western Link Road – Western Section.....	29
Figure 21: Possible Cross Section – Collector Road	30
Figure 22: Possible Cross Section –Green Road.....	30
Figure 23: Potential Road Hierarchy - Waimanawa Hills	31
Figure 24: Potential Walking and Cycling Strategy – Waimanawa Valley	32
Figure 25: Potential Walking and Cycling Strategy – Waimanawa Hills	33
Figure 26: AM Peak Hour – Predicted Turning Movements	41
Figure 27: PM Peak Hour – Predicted Turning Movements	42
Figure 28: Schematic Roundabout Layout	46
Figure 29: Schematic Traffic Signal Layout	48
Figure 30: Possible Future Layout of South End of Valerie Close/SH1 Intersection	51
Figure 31: Possible Future Layout of North End of Valerie Close/SH1 Intersection	52
Figure 32: Morrisons Precinct Access Peak Hour Turning Volumes.....	53
Figure 33: Schematic Layout of Morrisons Access.....	54
Figure 34: Indicative SH1 Urban Threshold.....	58

1.0 INTRODUCTION

This report provides an Integrated Transport Assessment for a proposal to rezone approximately 165 hectares of land in Warkworth from Future Urban Zone to residential zones plus a local centre zone with the balance to be zoned open spaces and rural. The Proposed Warkworth South Plan Change seeks to introduce two new precincts – “Morrisons Heritage Orchard” and “Waimanawa”. The Morrisons Heritage Orchard precinct essentially seeks to protect the existing orchard and provides for limited development. The Waimanawa Precinct provides for urban development. This ITA therefore largely focusses on the Waimanawa Precinct.

The Plan Change Area lies on both sides of State Highway 1 at the southern end of the Future Urban Zone as shown in **Figure 1**. The area is currently rural in use and is bounded by predominantly rural land to the east, west and south as well as some residential and industrial activities towards the north. The area is also located within and at the southern end of the Warkworth Structure Plan Area.

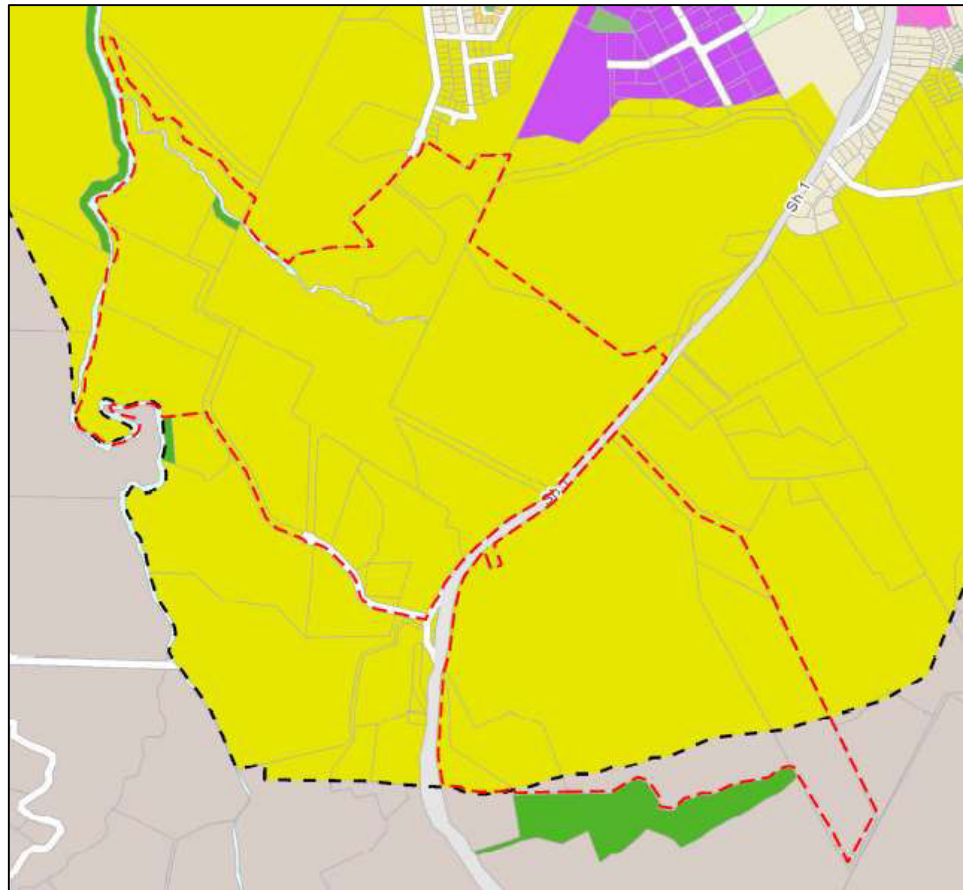


Figure 1: General Plan Change Area Location

Source: Reset Urban Design

The proposal intends to provide zoning that will enable the establishment of approximately 1,433 residential lots and 173 apartments. The proposal is generally consistent with the Warkworth Structure Plan and the Supporting Growth Strategy for the Warkworth sub region.

The assessment will consider the proposed changes to the future transport environment identified in Warkworth. It will also refer to the Warkworth Structure Plan and its accompanying Integrated Transport Assessment (ITA). The key transportation consideration for this proposal is the accessibility of the Plan Change Area by the various modes of transport, and the ability of the surrounding road network to support the proposed development safely and efficiently.

2.0 EXISTING TRANSPORT ENVIRONMENT

2.1 Background

The Plan Change Area lies on both sides of the existing State Highway 1 (SH1) on the southern side of the township of Warkworth, and it is also located towards the southern end of the Future Urban Zone. As shown in **Figure 2**:

- the part of the Plan Change Area to the west of SH1 is referred to as “Waimanawa Valley”, which comprises approximately 99.5 hectares of land stretching along the upper reaches of the Mahurangi River between State Highway 1 and Valerie Close; and
- the part of the Plan Change Area to the east of SH1 is referred to as “Waimanawa Hills”, which comprises approximately 65.5 hectares between SH1 and the Avice Miller Reserve.

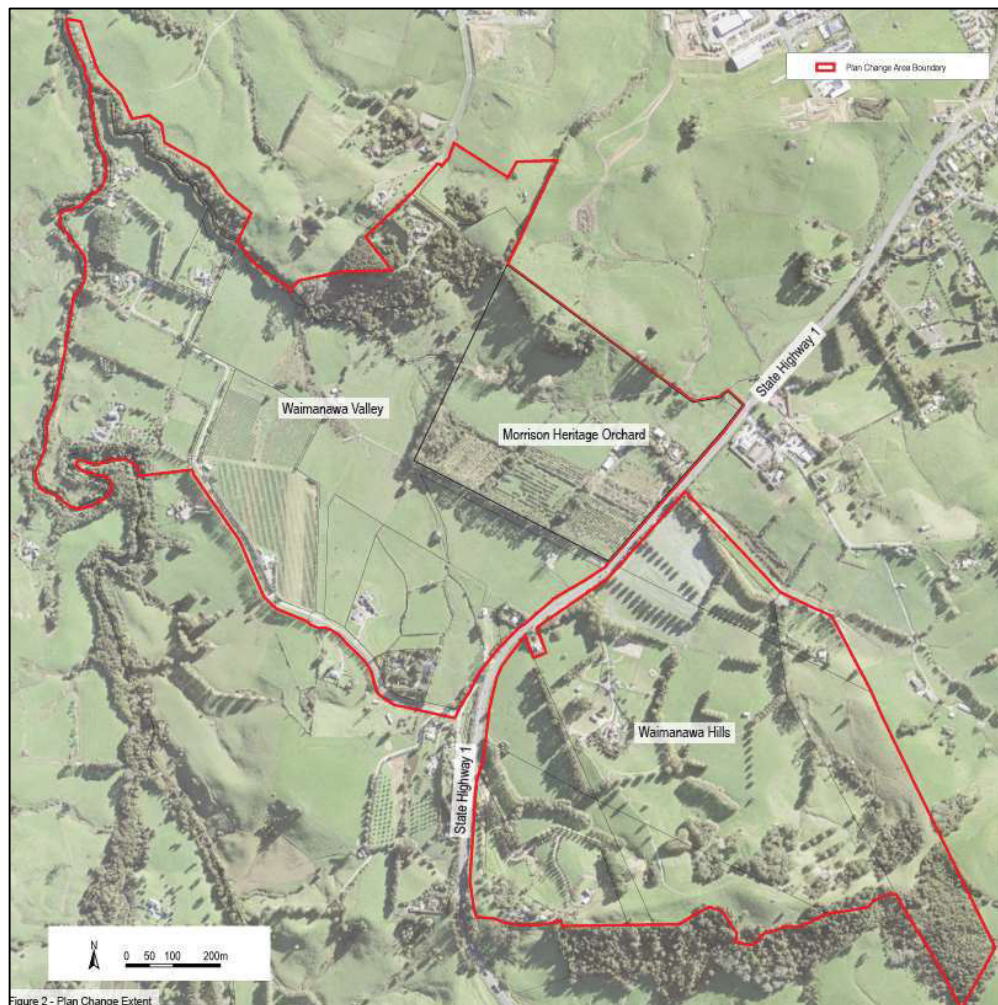


Figure 2: Land Subject to Plan Change

Source: Reset Urban Design

The area subject to this Plan Change application is currently rural in use and is bounded by predominantly rural land to the east west and south as well as some residential and industrial activities towards the north. The area is also located within and at the southern end of the Warkworth Structure Plan Area.

2.2 Road Network

The current access options for the Plan Change Area are limited to State Highway 1 north of Valerie Close, Valerie Close itself, and Mason Heights.

2.2.1 State Highway 1

State Highway 1 (SH1) currently forms the transport corridor through the Warkworth area connecting Auckland to northern New Zealand and Warkworth's arterial and collector roads, however it is to be bypassed by the Ara Tūhono - Pūhoi to Warkworth Motorway project. SH1 currently carries 19,500 vehicles per day through the Plan Change Area, however this is expected to reduce by 40% when the bypass opens in 2023. SH1 is currently classified as Strategic Arterial Road but this classification is likely to be reviewed in future. For clear referencing, SH1 mentioned in this report is referred to the existing section of SH1 unless otherwise specified.

The section of SH1 in the vicinity of the Plan Change Area currently has an 80 km/h speed limit, with one traffic lane in each direction, however a northbound passing lane ends some 230 metres south of the Valerie Close intersection and northbound traffic speeds can be expected to exceed the speed limit.

2.2.2 Valerie Close

Valerie Close is a no-exit local road connecting to SH1. A 50 km/h speed limit applies. The carriageway is some 5.5 metres wide and traffic flows are estimated to be no more than 200 vehicles per day. While few crashes have been reported at the SH1 / Valerie Close intersection (Three non-injury crashes reported since 2017 with only one associated with a vehicle turning at the intersection) the geometry and limited sight distance at the intersection are such that it is not considered suitable to allow any increase in traffic on Valerie Close without appropriate traffic management of SH1 and upgrading the intersection.

2.2.3 Mason Heights

Mason Heights is classified as a Local Road and connects with Woodcocks Road to the north of the Plan Change Area. It has the function of providing access to abutting residential properties. Mason Heights south of Jamie Lane has a two-lane carriageway 5 to 5.5 metres wide and provides one traffic lane in each direction. Traffic flows on Mason Heights are estimated to be no more than 200 vehicles per day. There is ongoing development on this road, with the side of the road alongside such development being developed to urban standard, including footpaths. South of where the upgrades have occurred, the road is of a rural standard. It is considered that Mason Heights could provide access to a limited number of residential lots in the Plan Change Area.

2.3 Existing Pedestrian and Cyclist Accessibility

There are limited existing walking and cycling opportunities near the Plan Change Area.

The land between the Plan Change Area and developed urban area of Warkworth is zoned as a Future Urban Zone, and as it is developed it is expected that integrated walking and cycling infrastructure will be developed to further facilitate active transport mode choices.

The Plan Change would include upgrading SH1 to have a footpath and cycle path connection north to Warkworth, which would provide a safer link for active mode travel between the Plan Change Area and the developed urban area of Warkworth.

Figure 3 and **Figure 4** shows the 500-metre and one-kilometre walking distances respectively from the outer boundaries of the Plan Change Area. The figures show that the Plan Change Area is generally isolated from the developed urban area of Warkworth and has a lack of walking connection to the town centre in the north.

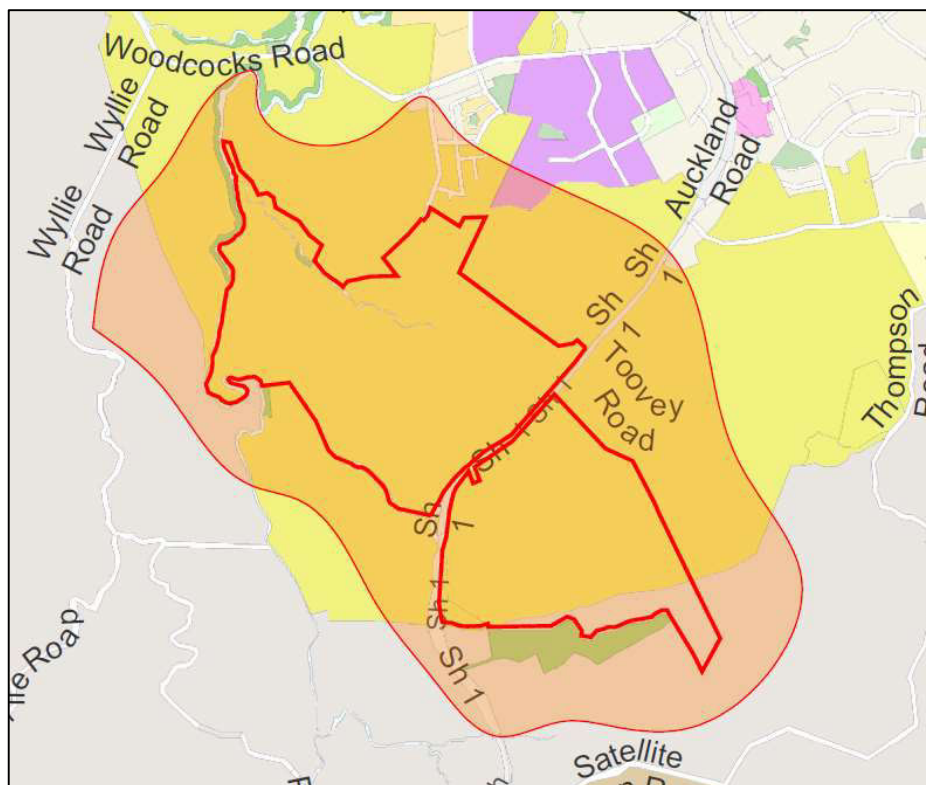


Figure 3: 500-Metre Walking Contour from the Plan Change Area

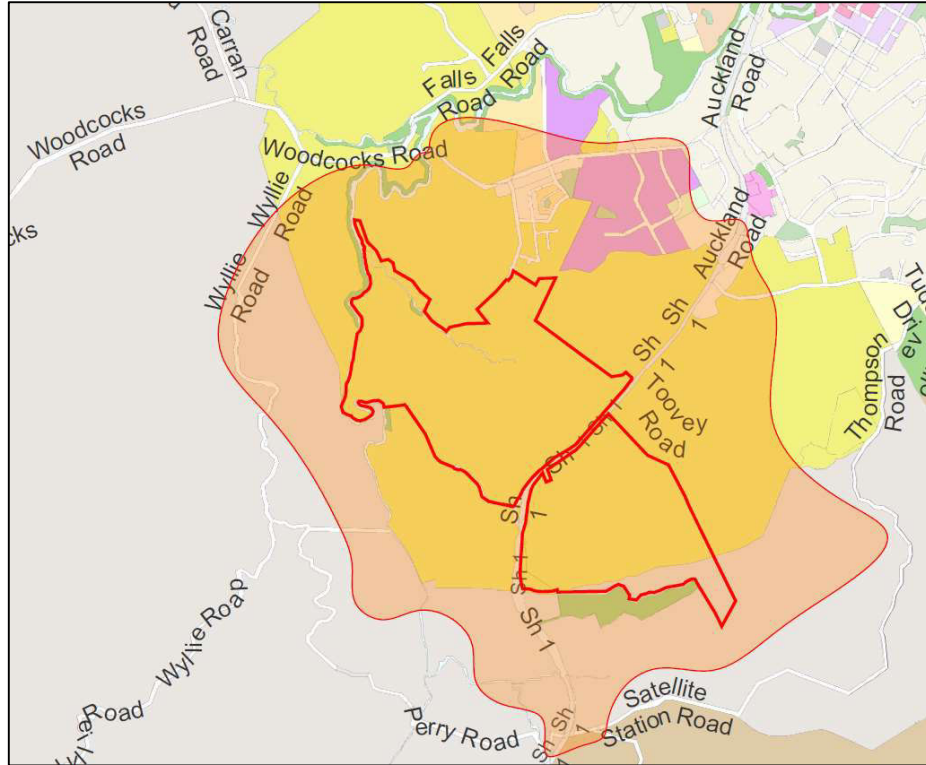


Figure 4: 1-Kilometre Walking Contour from the Plan Change Area

Figure 5 shows the three-kilometre cycling contour from the outer boundaries of the Plan Change Area, which encompasses the centre of Warkworth Town Centre and key retail, commercial and industrial areas to the north.

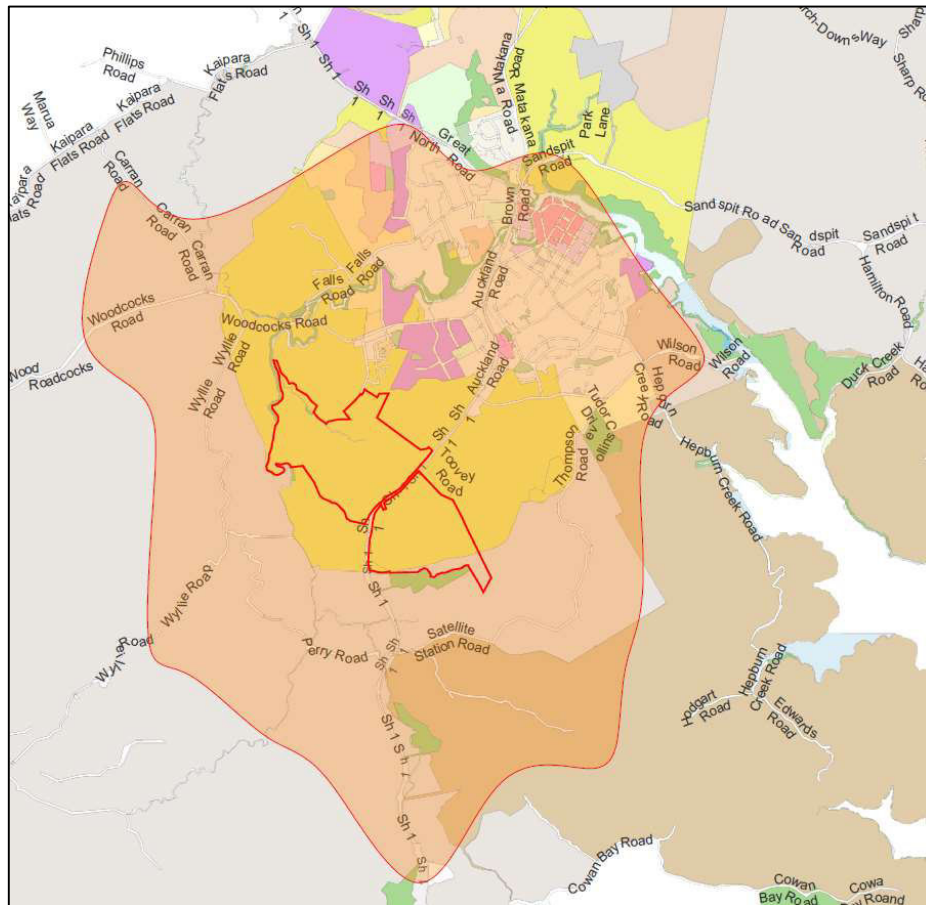


Figure 5: 3-Kilometre Cycling Contour from the Plan Change Area

2.4 Existing Public Transport Accessibility

There are currently limited public transport services within the Warkworth area:

- Warkworth to Hibiscus Coast Station, Silverdale (Route 995) with the service to Silverdale operating every 30 minutes in the weekday peak periods and the service otherwise operating hourly, 7 days per week.
- Warkworth to Wellsford (Route 998) operating hourly, 7 days per week.
- Bus routes that connect Warkworth with Algies Bay and Snells Beach (Route 996) and Omaha, Matakana and Point Wells (Route 997) that operate infrequently, 7 days per week.
- Regional bus services also operate daily between Auckland, Warkworth, Whangarei, and Kerikeri.

The existing bus terminus, where all services connect, is located on Baxter Street within the town centre of Warkworth, about 3.3 kilometres (40 minutes' walk) from the Plan Change Area. A new temporary bus terminus on SH1 near the Warkworth Showgrounds is to open in 2022.

2.5 Road Safety History

Information from the New Zealand Transport Agency's "Crash Analysis System" for the latest available five-year period, January 2017 to December 2021, indicates that 60 crashes have been reported along SH1, Valerie Close, Mason Heights and Woodcocks Road in the vicinity of the Plan Change Area. Of these 60 crashes, 32 resulted in no personal injuries while three fatal crashes and 25 injuries (including 2 serious injuries and 23 minor injuries) were reported.

Figure 6 illustrates the locations of these reported crashes, which also shows the hot spots for crashes. As can be seen from the figure, the sections of roads approaching the intersections have higher numbers of crashes.

Table 1 also provides detailed analysis on the reported crashes.

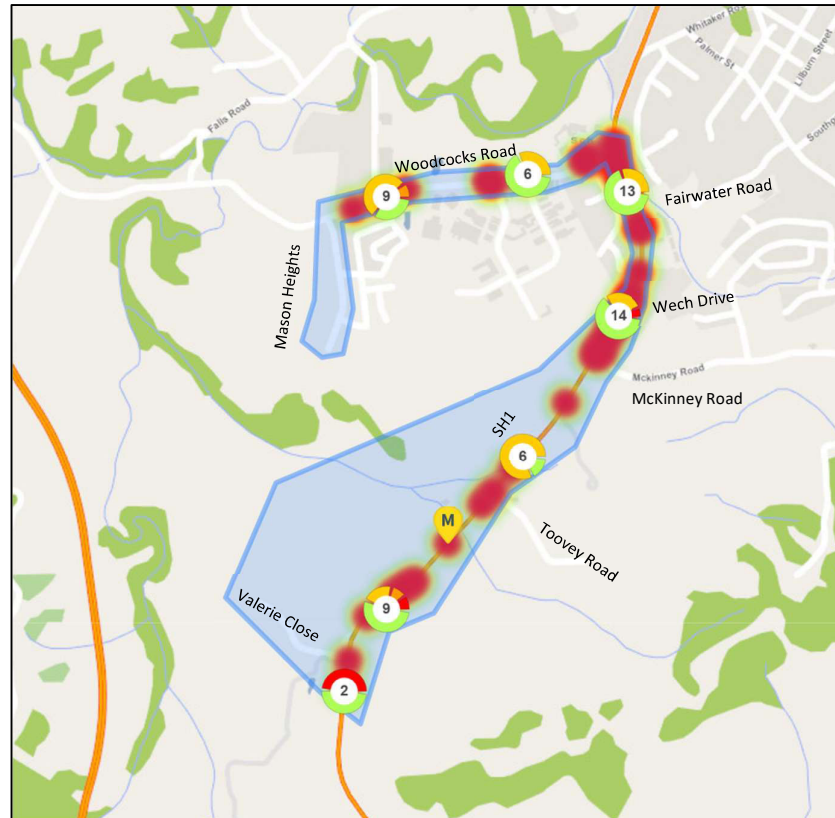


Figure 6: Locations of Crashes

Table 1: Crash History

Location	Reported Crashes			Key Factors
	Total	Injury	Non-Injury	
Intersection: SH1 / Woodcocks Road	3	0	3	2 – Rear End 1 – Overtaking and Lane Change
Intersection: SH1 / Fairwater Road	6	3 minor	3	2 – Right Turn Against (2 minor) 3 – Crossing – Vehicle Turning (1 minor) 1 – Rear End
Intersection: SH1 / Wech Drive	5	2 minor	3	3 – Rear End (2 minor) 1 – Cornering 1 – Merging
Intersection: SH1 / McKinney Road	2	1 minor	1	1 – Cornering (1 minor) 1 – Rear End
Intersection: SH1 / Toovey Road	1	1 minor	0	1 – Turning versus Same Direction (1 minor)
Intersection: SH1 / Valerie Close	2	0	2	1 – Head On 1 – Right Turn Against
Midblock: SH1 between Woodcocks Road and Valerie Close	26	3 fatal, 1 serious, 9 minor	13	4 – Head On (2 fatal) 3 – Overtaking and Lane Change (1 fatal) 10 – Rear End (4 minor) 4 – Cornering (1 serious and 2 minor) 2 – Manoeuvring (2 minor) 2 – Lost Control or Off Road (1 minor) 1 – Collision with Obstruction
Intersection: Woodcocks Road / Campbell Drive	1	1 minor	0	1 – Crossing – Vehicle Turning (1 minor)
Intersection: Woodcocks Road / Glenmore Drive	1	0	1	1 – Turning versus Same Direction
Intersection: Woodcocks Road / Morrison Drive	3	1 minor	2	2 – Crossing – Vehicle Turning (1 minor) 1 – Collision with Obstruction
Intersection: Woodcocks Road / Evelyn Street / Mansel Drive	5	1 serious, 3 minor	1	5 – Crossing – No Turns (1 serious and 3 minor)
Midblock: Woodcocks Road between SH1 and Mason Heights	5	2 minor	3	2 – Lost Control or Off Road (1 minor) 1 – Crossing – Vehicle Turning (1 minor) 1 – Right Turn Against 1 – Overtaking and Lane Change
Total	60	3 fatal, 1 serious, 23 minor	32	

19 crashes on SH1 and 10 crashes on Woodcocks Road were associated with traffic at intersections, resulting in 1 serious injury and 12 minor injuries. The crash types noted to be occurring at these locations are considered typical for the types of intersection. The crash with a serious injury was related to a car failing to give way and the driver was suspected to be driving under the influence of alcohol.

Of 26 crashes reported on the midblock of SH 1, three crashes resulted in fatal injuries. Two fatal crashes happened at corners, with one incident associated with a car swinging wide and colliding head-on with a truck, and another associated with a car cutting a corner and colliding head-on with another vehicle. The third fatal crash was related to a car losing control when overtaking another vehicle in the face of oncoming traffic under heavy rain conditions. The crash with a serious injury was related to a car losing control when turning and the driver was suspected to be driving under the influence of alcohol.

Almost 40 percent of reported incidents on the midblock of SH1 were associated with rear-end type crashes, all of which happened under slow moving conditions when queues were formed by congestion. Eight out of ten crashes were reported during the holiday time or the peak afternoon commuter periods when the traffic volume on SH1 is high, four of which were reported on a Friday afternoon in the northbound direction when people were rushing north for weekends. It is also noted that the northbound passing lane terminates 230 metres south of Valerie Close, and the sight lines along this section of the road is restrained by curving alignment and hilly topography. High approaching speed, limited sight lines, and the fact that the signalised intersections on SH1 in Warkworth are the first place north of Hamilton that northbound SH1 traffic may need to stop, are the key factors contributing to the higher rate of rear end crashes.

Five crashes on the midblock of Woodcocks Road resulted in 2 minor injuries.

The analysis of the crash records indicates that the major existing safety concern is rear-end crashes on the approach to the first intersection north of Hamilton that northbound SH1 traffic may need to stop. This will change when the longer-distance traffic on SH1 will be diverted onto the Ara Tūhono - Pūhoi to Warkworth Motorway project once it is open to traffic in 2023, which is expected to reduce the incidence of rear-end crashes.

Nevertheless, Warkworth will be the first place north of Orewa where northbound traffic on SH1 may need to stop, and careful design and planning is required for the Plan Change to make sure that the proposed Plan Change would not exacerbate the rate of rear end crashes.

3.0 FUTURE TRANSPORT ENVIRONMENT

3.1 The Warkworth Structure Plan

In June 2019, Auckland Council adopted the Structure Plan for the future urban zone surrounding Warkworth. The Structure Plan area is anticipated to provide around 7,300 new dwellings and cater for 5,400 potential additional jobs over a 20 to 30-year period (by 2046), to enable Warkworth to fulfil a strategic objective of the Auckland Unitary Plan, to function as a 'satellite town' to Auckland.

The Auckland Unitary Plan defines a 'satellite town' as a rural town which has the potential to function semi-independently from the main urban area, as well as servicing its surrounding rural community, with appropriate provisions for employment and services to support residential development. A satellite town also requires good transport connections to Auckland, in the case of Warkworth, through state highways/motorways.

The Plan Change Area aligns well with the strategic aim to enhance Warkworth' role as a satellite town, with good proximity to the current state highway and the new motorway between Puhoi and Warkworth, town centre and Business – Light Industry zoned land to the northeast of the Plan Change Area. Proposed new and improved roading connections would also serve to enhance the Plan Change Area's connectivity to the state highway network in the future.

The non-statutory Auckland Council Future Urban Land Supply Strategy (FULSS) provides the indicative sequences for the development readiness of the future urban areas across Auckland. This sequencing ensures the provision of bulk infrastructure (such as water, transport and wastewater) is in place so that homes and business can be built. The Warkworth Structure Plan adopted the sequence of the development of Warkworth by FULSS as follows:

- Stage 1 – to align with Warkworth North ('live' zoned Light Industry and General Business land) which is proposed to be development ready in 2022;
- Stage 2 – to align with Warkworth South which is proposed to be development ready from 2028 to 2032, and
- Stage 3 –to align with Warkworth North-east which is proposed to be development ready from 2033 to 2037.

In February 2019, the Supporting Growth Alliance (SGA) prepared an Integrated Transport Assessment (ITA) to support the Warkworth Structure Plan. The purpose of the ITA was to identify at a high level the proposed arterial and collector road network, the public transport network and active mode network to support the future growth of Warkworth in line with the Warkworth Structure Plan.

The ITA also identified the anticipated trip generation for the various Structure Plan zoning and land uses, provided high level traffic modelling outputs, and recommended intersection treatments and road cross sections for the key roads.

An addendum was also prepared in July 2019 to account for changes to the Warkworth Structure Plan following consultation with the public. The changes relevant to this proposal included an increased in residential density in some areas of Warkworth.

The proposed Plan Change is indicated in the FULSS for development during Stage 2 of the proposed Structure Plan, between 2028 and 2032. The Structure Plan ITA has assumed a total of 3,900 dwellings and about 3,300 jobs within Stage 2. **Figure 7** below illustrates the proposed zoning under the Warkworth Structure Plan. In terms of the Plan Change Area, it is anticipated that the Plan Change Area would be zoned mostly residential plus a local centre zone with the balance to be zoned open spaces and rural.

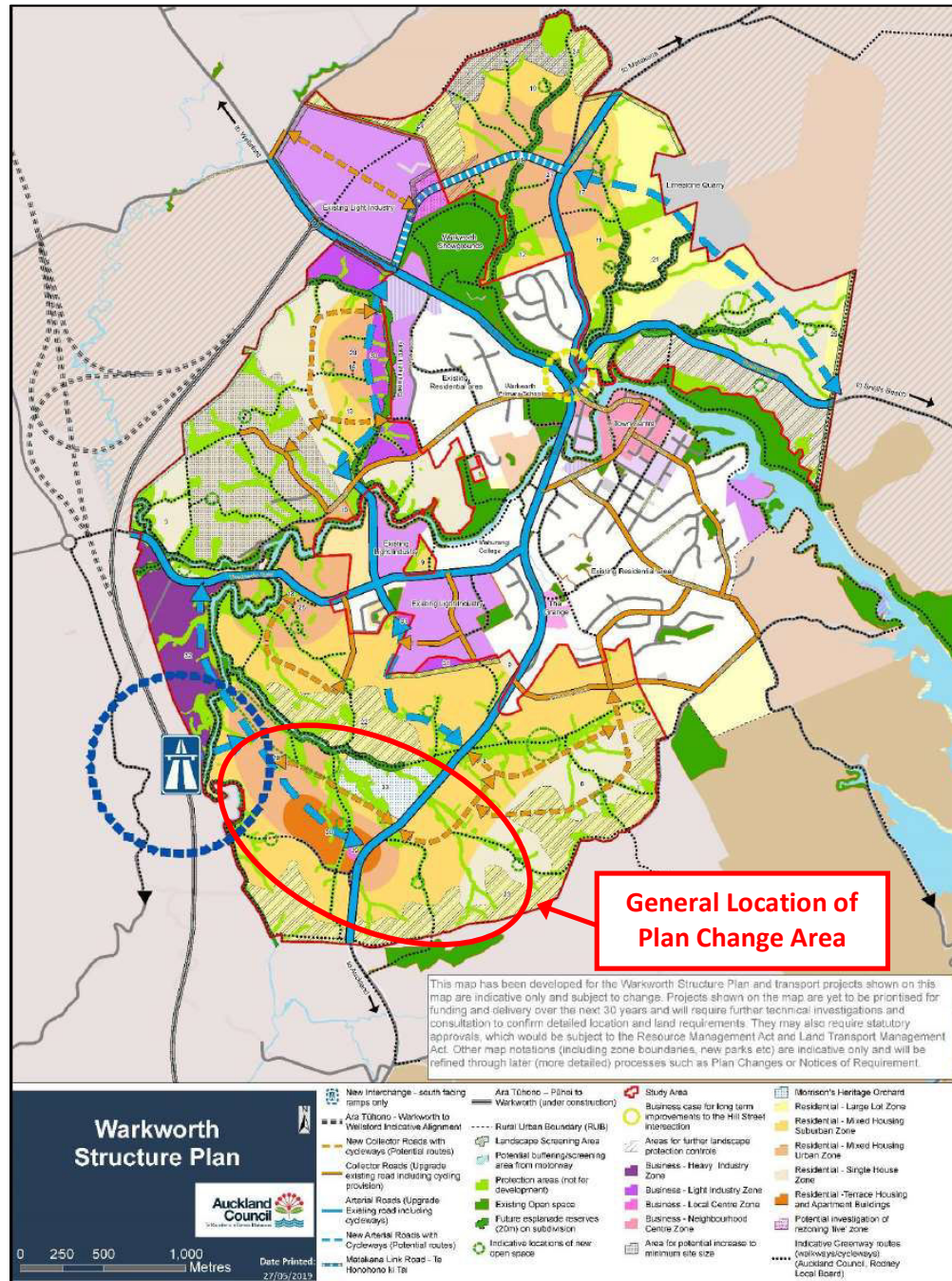


Figure 7: Warkworth Structure Plan – Proposed Zoning (June 2019)
 Source: Warkworth Structure Plan (June 2019), Auckland Council

The proposed urban development in the Plan Change Area is consistent with the land uses specified in the Structure Plan, except that the Plan Change proposes a local centre with a gross area of some 3.4ha while in the Structure Plan the gross area of the local centre is 1.0ha. Consequentially the Proposed Plan Change allows for more apartments than the Structure Plan. Overall, however, using the same assumptions for yield calculation, the Structure Plan anticipates some 1,547 households in the Plan Change area while the Proposed Plan Change anticipates some 1,606 households, an increase of 59 households (3.8%).

With regards to employment numbers, the Warkworth Structure Plan estimates the local centre in this area will have 10 employment jobs. The proposed Plan Change Area includes a Local Centre; however, the number of employment jobs is not identified but likely to be higher than 10 jobs.

The SGA has continued to revise their preferred transport network for the Warkworth region. The emerging preferred routes for the transport network as of December 2022 are shown in **Figure 8**.

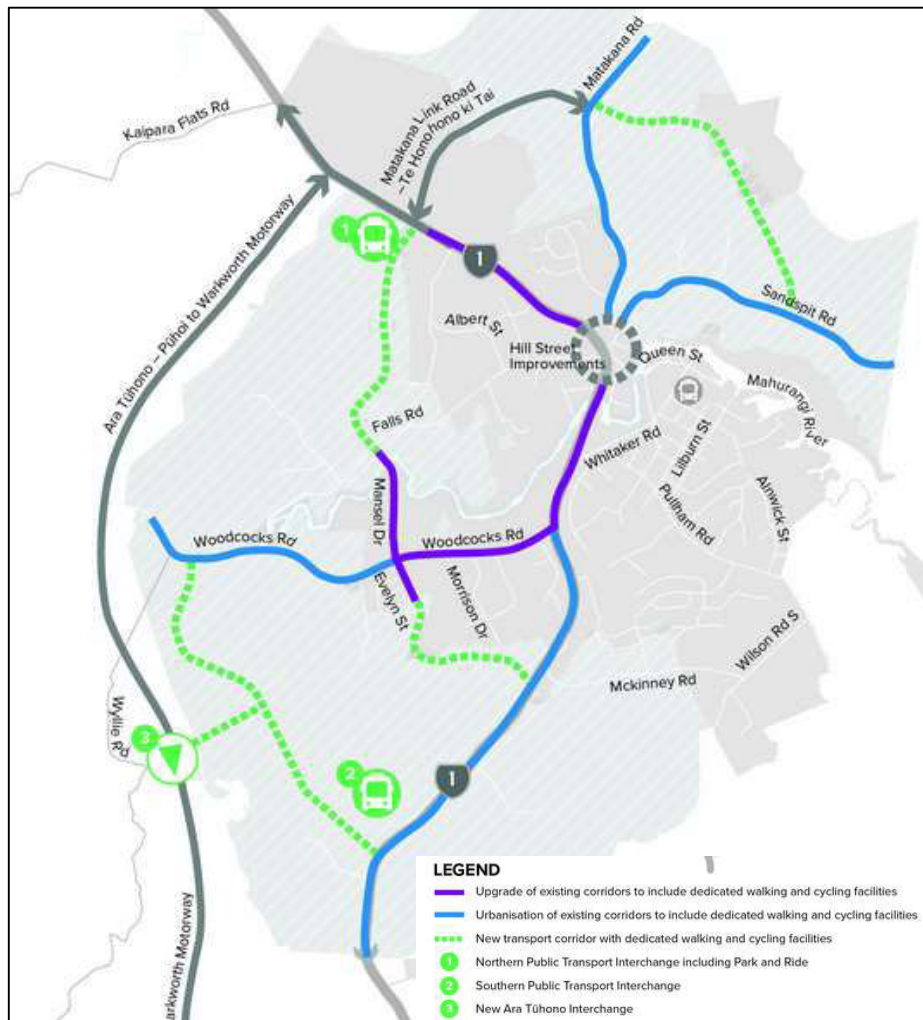


Figure 8: Emerging Preferred Transport Network

Source: Supporting Growth Alliance

The revised network generally follows what is indicated in the Warkworth Structure Plan, and the key objective is to enable future development of new and improved walking and cycling facilities, public transport interchanges and transport corridors to give the community more ways to access social and business destinations. The key differences to the Warkworth Structure Plan transport elements that enable the development in Warkworth South are listed below:

- SH1 between Woodcocks Road and the southern end of the current Future Urban Zone should be widened in some sections and separated, with safe walking and cycling paths developed on both sides of the road;
- A transport interchange to be located at the southern end of the Wider Western Link Road. A transport interchange in this area would primarily serve as a connection point for regional and local buses and will provide public transport connections to a future local centre. The public transport interchange could include bus stops, bus layovers and cycle storage parking. The investigation of the opportunity for the transport interchange is still at an early stage;
- The location of the Wider Western Link Road generally follows what has been indicated in the Structure Plan with a slightly different alignment (more curving than that indicated in the Structure Plan); and
- Compared to the Structure Plan, the southern section of Western Link Road (between Evelyn Street and SH1) will be shifted further north and its junction with SH1 will be closer to McKinney Road. The option for this section runs around the existing zoned industrial land, connecting into SH1 south of McKinney Road. This will provide a clear buffer between industrial land and future residential activities.

3.2 Future Transport Context

Through the Supporting Growth Alliance (SGA), the New Zealand Transport Agency – Waka Kotahi (NZTA-WK) and Auckland Transport have proposed several upgrades and proposals to the road environment in the Warkworth region to facilitate the expansion of Warkworth and the surrounding areas. These improvements are also recognised as key elements of the Warkworth Structure Plan.

The Warkworth Structure Plan sets out the transport infrastructure anticipated to support future development in Warkworth including the Future Urban Zones and the Plan Change Area. Several conceptual networks have been evaluated and indicative preferred roading, public transport and active mode projects have been identified. **Figure 9** illustrates the location of SGA's proposed roading and public transport network in relation to the Plan Change Area.

The Structure Plan transport network includes several roading projects, including:

- **Ara Tūhono – Pūhoi to Warkworth (P2WK)** provides a safer, more resilient and reliable route between Pūhoi and Warkworth which extends the four-lane Northern Motorway (SH1) 18.5km from the Johnstone's Hill tunnels to just north of Warkworth. The project is currently under construction and is due for completion in 2023;
- **Matakana Link Road (Te Honohono ki Tai)** improves transport connections between Matakana Road and SH1 to support the significant population growth expected in the area and to improve network resilience in Warkworth. It will have up to four lanes of traffic with provision of off-road walking and cycling facilities. The project is currently under construction with completion expected soon;

- **Western Link Road** is a proposed new north-south connection through the western growth areas of Warkworth. The Western Link Road would likely be a limited access urban arterial, which would join the northern and southern sections of SH1, through Woodcocks Road and include Mansel Drive and Evelyn Close. However, the exact form and function of much of this road is still to be determined;
- **Sandspit Link Road** is a proposed new arterial connection linking Matakana Road and Sandspit Road within future urban growth areas in the north-east of Warkworth. The road would connect the Matakana Link Road intersection at Matakana Road with Sandspit Road (the exact location on Sandspit Road is still to be determined);
- **The Warkworth Southern Interchange** is a proposed interchange on the Ara Tūhono – Pūhoi to Warkworth (P2WK) to serve traffic access between P2WK and the south of Warkworth, via the Wider Western Link Road; and
- **Wider Western Link Road** (partly through the Plan Change Area) is a proposed new north-south connection between Woodcocks Road in the north and SH1 in the south. Its role is to provide a strategic link through the south-western growth area and to provide connectivity to and from the Southern interchange if this is constructed in the future.

Whilst these projects are included in the Structure Plan, the only projects certain to be built within the time frame of the proposed Plan Change are the Matakana Link Road (MLR) and the Ara Tūhono - Pūhoi to Warkworth Motorway project. In addition, funding is allocated in the 2021 National Land Transport Programme for the upgrading of the SH1/Hill Street intersection.

Immediate to the Plan Change Area, SH1 has been identified as an arterial road with upgrades to include walking and cycling provision and new urban collector roads. Indicative collector roads are also shown but there is flexibility to potentially change these routes through further analysis. Due to topographical and watercourse constraints, there is limited opportunity to establish a grid network ideally sought for greenfields development.

A local centre and public transport interchange are shown within the Plan Change Area immediately to the west of SH1, with a network of greenways and arterial/collector road routes. In the longer term, the improved connectivity to public transport, walking, and cycling identified in the Plan Change Area by the Warkworth Structure Plan will provide choice of travel mode and a higher level of accessibility to the wider network. However, the development of the southern public transport interchange is dependant on the completion of the Wider Western Link Road and the southern P2WK motorway interchange, and thus its timing is also uncertain.

Apart from the projects mentioned above, the following other projects are anticipated to be progressed through an alliance with Auckland Transport and WK-NZTA to address the transport network issues in Warkworth:

- Short term strategies for managing network demands and improving safety, such as introducing smart technologies or improving efficiency of intersections along SH1 will continue to be implemented while new roading infrastructure is developed in the medium to long term.
- Auckland Transport and WK-NZTA has begun the investigation for upgrading the SH1/Hill Street intersection, which involves assessing possible improvements to the layout and increased capacity.

- Stage One of the Western Link Road, connecting Mansel Drive to Falls Road, was opened to the public in March 2017. The route of the Western Link Road between Falls Road and SH1 is set out in the Warkworth North Precinct provisions of the Auckland Unitary Plan, and that part of the route is required to be built as the land alongside it is developed. The exact route of the remaining stage has yet to be determined but is likely to connect to SH1 in the vicinity of Toovey Road in the south.

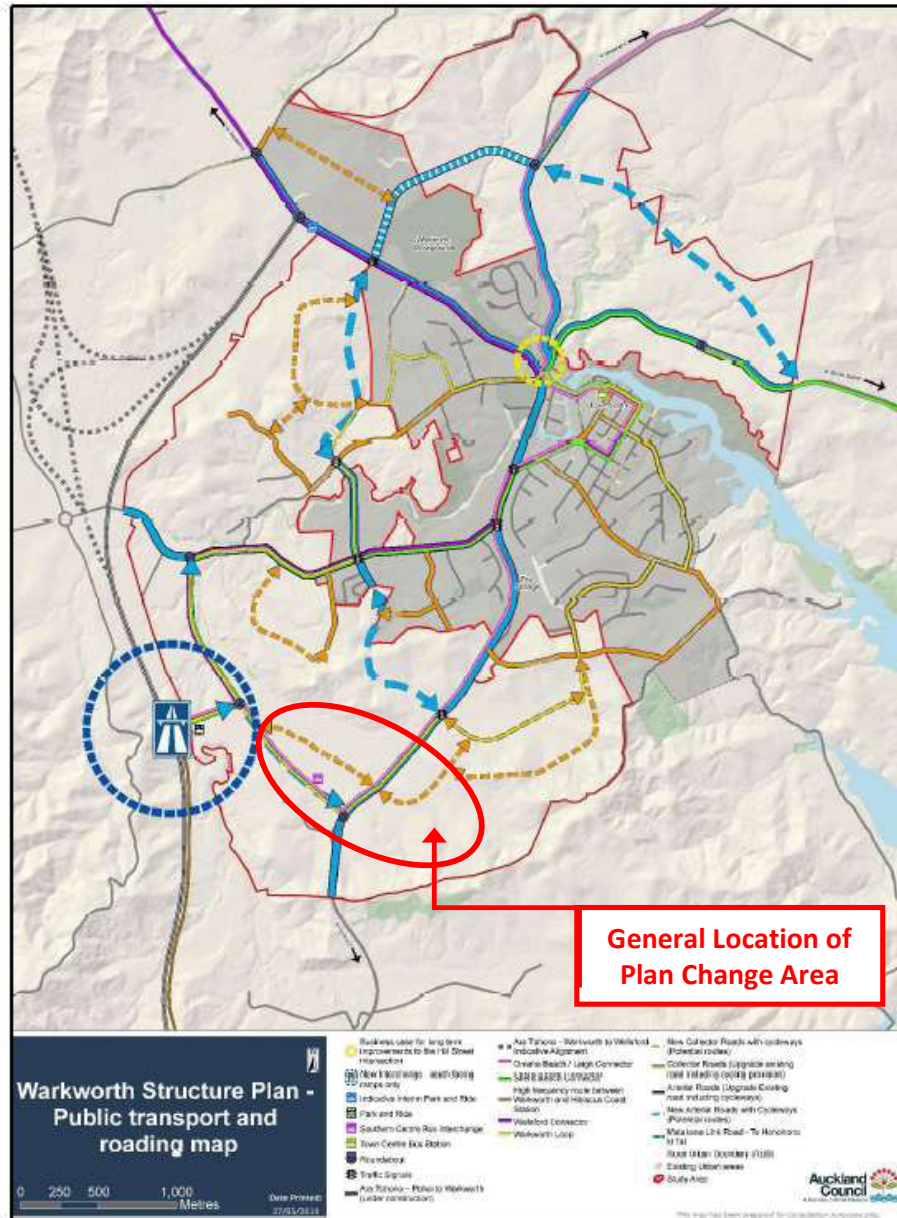


Figure 9: Warkworth Structure Plan – Public Transport and Rooding Plan
Source: Warkworth Structure Plan (June 2019), Auckland Council

This transport assessment focuses on the short to medium term transportation network, with only committed projects (Ara Tūhono – Pūhoi to Warkworth and the Matakana Link Road) in

place, but no Western Link Road, no Sandspit Link Road, no southern Warkworth motorway interchange, no southern public transport interchange, and only the portion of the Wider Western Link Road within the Plan Change Area being in place.

3.3 Future Traffic Flows

The Warkworth Structure Plan ITA also sets out predictions for future daily traffic volumes under numerous scenarios depending on which strategic infrastructure is in place. The design year they have focused on is 2046, with the assumption that all the Future Urban Zones in Warkworth will be fully developed, including the full development of Warkworth South. Under all infrastructure scenarios, the current SH1 corridor is expected to accommodate up to 27,000 vehicles movements per day in the vicinity of the Plan Change Area. The ITA utilised a Saturn traffic model which indicated that the proposed Structure Plan transport network will accommodate the 2046 peak hour traffic demands generated by the full development of Future Urban Zones in Warkworth.

Given that the traffic volumes measured by Auckland Transport in 2017 are currently sitting at about 23,800 vehicles per day on SH1 south of McKinney Road, this indicates an overall 13% increase over 29 years.

However, the forecasted 2046 traffic volumes of the Structure Plan ITA utilise the vehicle trip generation rates for 2048 from the Auckland Macro Strategic Model. These trip generation rates assume that a level of walking, cycling public transport and roading infrastructure is provided that would significantly change mode share and trip making patterns.

The Warkworth Structure Plan ITA demonstrates that the future Structure Plan transport network can accommodate the future development in Warkworth allowed for in the Structure Plan but is not relevant in the short to medium term.

As indicated above, the funding and timing of most transport projects in the proposed Warkworth transport network, including the walking, cycling and public transport network, is uncertain.

The Warkworth Structure Plan ITA did not assess the performance of the transport network in the short to medium term, when private car mode share is likely to be close to current levels, and when most of the proposed Structure Plan transport network may not be in place.

This transport assessment of the Warkworth South Plan Change therefore focuses on the short to medium term, utilising present-day trip generation rates and only the committed transport projects to determine traffic flows. This is discussed in detail in Section 6.0.

As discussed in Section 3.1, using the same assumptions for yield calculation, the Structure Plan anticipates some 1,547 households in the Plan Change Area while the Proposed Plan Change anticipates some 1,606 households, an additional 59 households (3.8%).

However, the Plan Change also anticipates an increase in the size of the local centre compared to the Structure Plan, with a corresponding increase in local travel for shopping and employment trips. The increase in traffic produced by the increase in households is offset by the increase in local traffic attracted to the local centre, such that the effect of the Proposed Plan Change on peak hour traffic volumes is neutral both in terms of total traffic entering SH1 intersections within the Plan Change area and on traffic beyond the Plan Change Area.

3.4 Future Public Transport Accessibility

The Warkworth Structure Plan includes building a public transport network upon the recently introduced “New Network for Warkworth.” **Figure 9** illustrates the location of the Structure Plan’s preferred public transport network in relation to the Plan Change Area.

Initially, a main station/bus interchange is proposed in the town centre supplemented by an interim northern station adjacent to SH1 north of Warkworth (with a Park and Ride). In the long term, the preference is to retain a Town Centre station but also have a larger bus station/interchange in Warkworth South in the southern Local Centre (within the “Waimanawa Valley” area). With a proposed southern station, it is not considered necessary to retain the interim northern station.

If implemented, these facilities are expected to function as a public transport hub for Warkworth and surrounding residential developments.

However, there is no certainty over the timing of development of this public transport infrastructure. The Plan Change makes land available within the “Waimanawa Valley” area for the future bus station/interchange in Warkworth South in the southern Local Centre. However, in the short to medium term, which is the focus of this transport assessment, this infrastructure is not assumed not to be in place. An existing bus route (995) runs along SH1 through the Plan Change Area, and the Plan Change provides for bus stops near the local centre, to provide connectivity for the area to the Warkworth town centre and beyond in the short to medium term.

3.5 Future Pedestrian and Cyclist Accessibility

The Warkworth Structure Plan prioritises active transport in Warkworth through a separated walking and cycling network that utilises the arterial road network, collector road network, riparian margins, and other off-road trails to provide connectivity throughout Warkworth. The network provides connectivity to centres, employment areas, schools, parks, and public transport stations. Through this network there is the opportunity to significantly increase walking and cycling mode share in Warkworth with the connection distances between most destinations generally less than 5 kilometres (in combination with improving e-bike and e-scooter technologies giving the opportunity to travel greater distances by personal transport modes).

The future proposals to the surrounding road environment in the area look to provide walking and cycling routes on both sides of SH1, which will provide direct links for future residents. These will be provided in the form of separated footpaths and cycle paths.

The Warkworth Structure Plan identified multiple walkway and cycleway connections within the Structure Plan area. In existing developed areas, the majority of these utilise existing roads and are largely consistent with the existing network. Both on and off-road trails identified in the vicinity of the Plan Change Area are shown in **Figure 10**.

Furthermore, the Structure Plan stated that all roads within the Warkworth Structure Plan area are proposed to have safe walking and cycling facilities. In general:

- all new and existing arterial roads are proposed to have footpaths on both sides of the road and separated cycle facilities;
- all new collector roads identified on the active mode transport network are proposed to have footpaths on both sides of the road and separated cycle facilities, whilst the existing collector roads may not have the ability to provide separated cycle facilities due to existing geometries;
- new residential and business development will be encouraged to be 'rear-loaded', where access occurs from rear lanes or consolidated accessways, on these new collector roads to enable separated facilities to be provided with minimal vehicle crossings; and
- walking and cycling facilities are proposed to be provided 'off-road' along the Mahurangi River and other riparian margins to avoid the need to encounter vehicle traffic at all. These routes will serve both a commuter and recreational function.

With an appropriate road network catering for walking and cycling modes, in conjunction with off-road facilities, there is considered to be the opportunity to significantly increase walking and cycling mode share.

The Plan Change will be consistent with these Structure Plan provisions - the proposed arterial and collector roads would have footpaths on both sides of the road and separated cycle facilities, rear lanes will be provided on arterial and other roads to enable new residential and business development to be 'rear-loaded', and there will be no vehicle crossings on SH1 or the Wider Western Link Road, thus minimising vehicle crossings across walking and cycling facilities, and 'off-road' cycle facilities will be provided along the riparian margins.

The Plan Change will also provide pedestrian and cycle connections to the urban area of Warkworth, thus maximising walking and cycle travel as far as possible in the short to medium term.

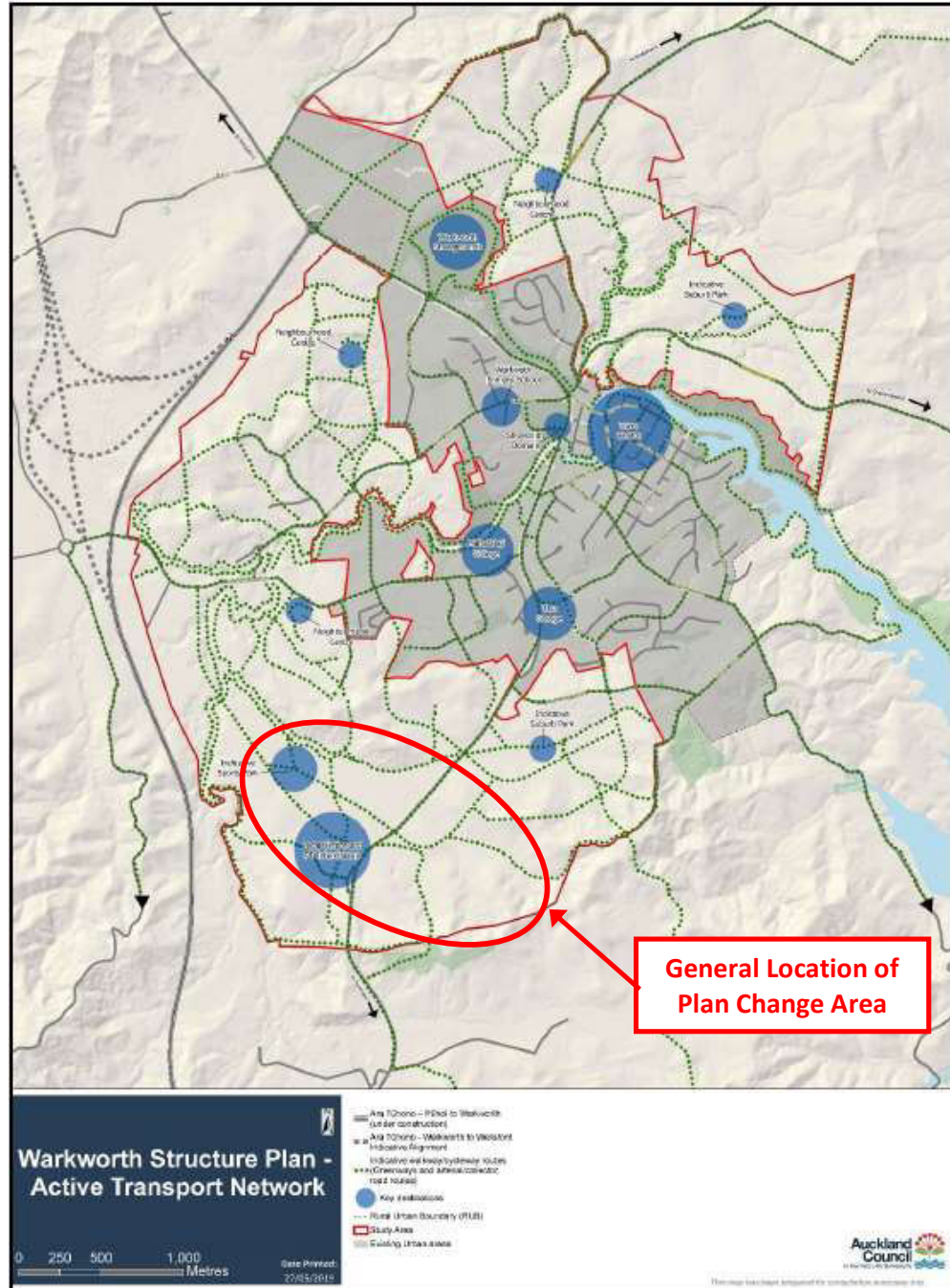


Figure 10: Warkworth Structure Plan – Active Transport Network Plan
Source: Warkworth Structure Plan (June 2019), Auckland Council

3.6 Indicative Cross Sections for Future Urban Roads

As noted earlier, SH1 has been identified as an arterial road with upgrades to include walking and cycling provision and new urban collector roads will be provided within the Plan Change Area to align with the Warkworth Structure Plan.

The urban collector roads will provide efficient access between new and existing residential frontages and the adjoining arterial road network, which will provide onward access to key locations, such as the Warkworth town centre, the future bus terminals, and employment and retail opportunities in industrial and business zones, as well as to the state highway network.

These upgraded routes will cater for walking and cycling movements on both sides of the road, as well as potential future public transport usage. It is expected that they will be subject to a 50 km/h speed limit along the Plan Change Area frontages, to support a safe speed environment.

Typical cross sections for a two-lane urban collector road and an urban arterial road are indicated in **Figure 11** and **Figure 12** respectively. Even though the indicative cross section shows a four-lane arterial road, the ITA states that some arterial roads may be two-lane roads.



Figure 11: Urban Collector – Indicative Cross Section

Source: Warkworth Structure Plan – Integrated Transport Assessment



Figure 12: Urban Arterial – Indicative Cross Section

Source: Warkworth Structure Plan – Integrated Transport Assessment

4.0 THE PROPOSAL

4.1 General Description

The Plan Change proposal seeks rezoning land from Future Urban Zone to residential zones (including Terraced Housing and Apartment Building, Mixed Housing Urban, Mixed Housing Suburban, and Large Lot zones) plus a Business – Local Centre zone with the balance to be zoned open spaces and rural. The plan change request includes the creation of a new precinct to be called “Warkworth South” (the official naming to be confirmed once the Plan Change is approved by Council).

The proposal intends to provide zones that will enable the establishment of approximately 742 residential lots and 173 apartments in “Waimanawa Valley” and 691 lots in “Waimanawa Hills”. The proposed zoning for the Plan Change Area is shown in **Figure 13**.

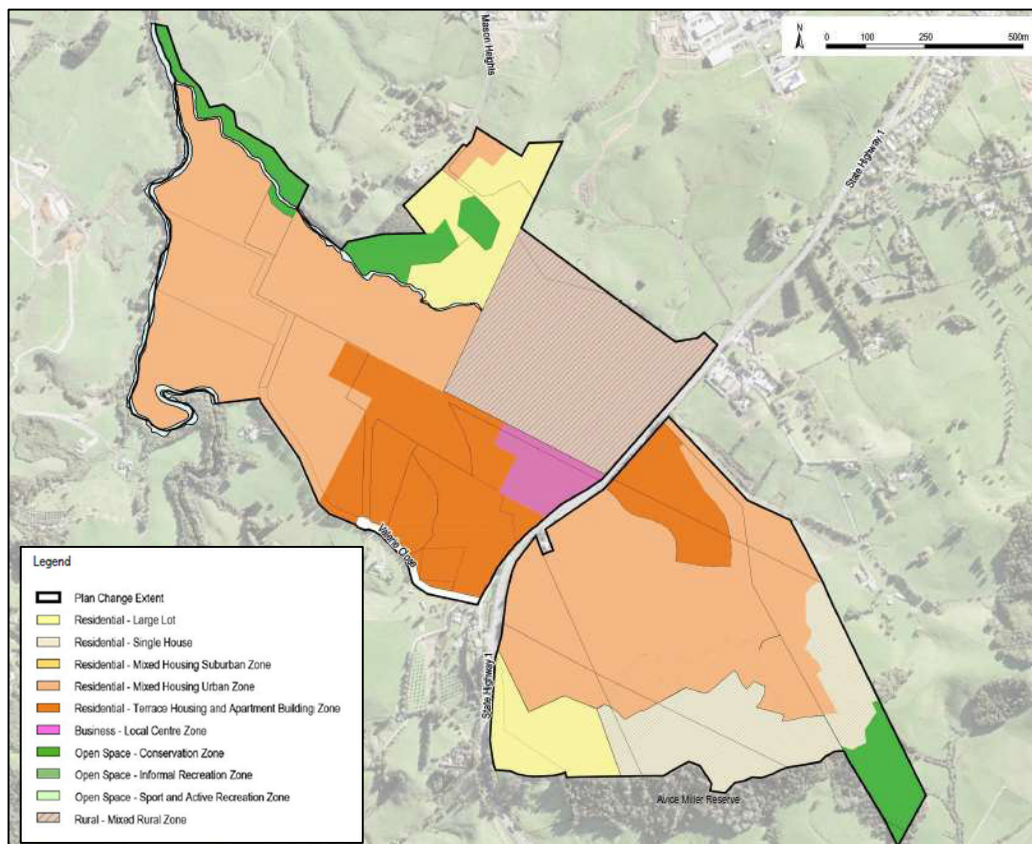


Figure 13: Proposed Zoning

Source: Reset Urban Design

As can be seen from the figure, the local centre would be located in the eastern portion of “Waimanawa Valley” next to SH1. The terraced houses and apartments would be concentrated near the local centre zone and the location of the future southern public transport interchange, with Mixed Housing Urban zones located in the centre of the “Waimanawa Valley” and the “Waimanawa Hills” and Mixed Housing Suburban and Single Lot zones on the outer perimeter of the Plan Change Area. Almost all of the Terrace Housing and Apartment zoning is located within 400 metres (a five-minute walk) of the town centre, which according to the Ministry for the Environment “People + Places + Spaces – A Design Guide for Urban New Zealand” (March 2002)

is a reasonable walking distance to convenience shops, bus stops and other daily facilities. As shown in **Figure 14**, the Plan Change proposes a new cross junction on SH1 at the north-eastern corner of the proposed local centre. This junction will include facilities for pedestrians and cyclists to cross SH1, and thus provision of Terrace Housing and Apartment zoning east of SH1 within a short walking distance of the local centre is considered appropriate. The proposed layout therefore recognises the accessibility of the Plan Change Area to the future public transport network and employment areas.

The key transport outcomes of the proposal are:

- Supporting the upgrading of the SH1 corridor to an urban arterial road along the frontage of the Plan Change Area;
- Supporting the Wider Western Link Road including its alignment, as a vital link in the transport network for Warkworth South;
- Providing quality connected residential neighbourhoods to support the growth of Warkworth;
- Locating higher-density terraced housing and apartment development within a reasonable walking distance of the local centre and bus stops to maximise walking;
- Creating a network of walkways through the Plan Change Area with a series of roads and active mode routes; and
- Identifying key intersections to provide access to adjacent land for development.

As the Plan Change Area has a state highway through it in the north-south direction, the best opportunity to provide access between the Plan Change Area and the wider road network is via SH1. It is intended to provide access to the Future Urban Zone (including the Plan Change Area), which will enable access to the wider road network. SH1 will provide certainty for developers on land accessibility.

A spine road would be available and to have one access point onto each side of SH1, being the Wider Western Link Road (as an arterial road) for “Waimanawa Valley” to the west of SH1 and Road 1 (as a collector road) for “Waimanawa Hills” to the east of SH1. The wider Western Link Road would be terminated on the western boundary of the Plan Change Area with opportunity to be extended and connected to Woodcocks Road as per the Structure Plan once the adjacent Future Urban Zone is also developed.

As discussed later in this report, it is anticipated that the SH1 / Wider Western Link Road / Road 1 (within “Waimanawa Hills”) intersection will be a crossroad intersection with either traffic signal or roundabout control to provide direct access to the Plan Change Area on both sides of SH1. A grid of local road would have accesses from the spine road.

It is noted that the northern portion of “Waimanawa Valley” abuts a local road but is isolated from the rest of the Plan Change Area and has limited access onto SH1 due to obstruction from local streams and reserves. The best opportunities to provide access between the northern portion of “Waimanawa Valley” and the wider road network is via Mason Heights.

Within the Plan Change Area, a network of local roads is anticipated that will provide access to most lots will be developed. These roads are anticipated to carry no more than 500 vehicle movements per day in line with local road functions.

4.2 Potential Future Development

The application also includes a conceptual Masterplan as shown in **Figure 14**, which is indicative only and helps to understand the potential future development within the Plan Change Area. This concept is an example of the type of development the plan change can enable. It is not necessarily the final detailed form of development, which will be determined at the time of any subdivision consent but represents the likely development for the Plan Change Area considering the natural features of the area and suitable access.



Figure 14: Indicative Masterplan Layout – Plan Change Area

Source: Reset Urban Design

4.2.1 “Waimanawa Valley”

The conceptual Masterplan indicated that the “Waimanawa Valley” to the west of SH1 would have the opportunity to enable the establishment of approximately 742 residential lots and 173 apartments in with the proposed zoning. A possible roading network is also indicative on the conceptual Masterplan. The location and alignment of all indicative roads within the “Waimanawa Valley” area have been designed to take account of topography and ecological features of the area as well as stormwater and geotechnical requirements and the alignment of Wider Western Link Road.

A small neighbourhood centre (as Business – Local Centre Zone), which would be located near SH1, is proposed to accommodate locally focused commercial and retail activities and the future public transport interchange. The conceptual Masterplan also shows the ability for an urban park to be accommodated to the centre of the “Waimanawa Valley”, with bush reserve along the outer perimeters.

4.2.2 “Waimanawa Hills”

The conceptual Masterplan indicated that “Waimanawa Hills” to the east of SH1 would have the opportunity to enable the establishment of approximately 691 residential lots with the proposed zoning. A possible roading network is also indicative on the conceptual Masterplan. The location and alignment of all indicative roads within the area have been designed to take account of topography and ecological features of the area. An open space is proposed through the centre of the area.

4.3 Future Roads – Warkworth Structure Plan

Figure 15 below illustrates the proposed roads identified near the Plan Change Area in the Warkworth Structure Plan. It includes the creation of the Wider Western Link Road (shown as a blue dashed line) on the western side of SH1 and a collector road (shown as a yellow dashed line) on the eastern side of SH1.

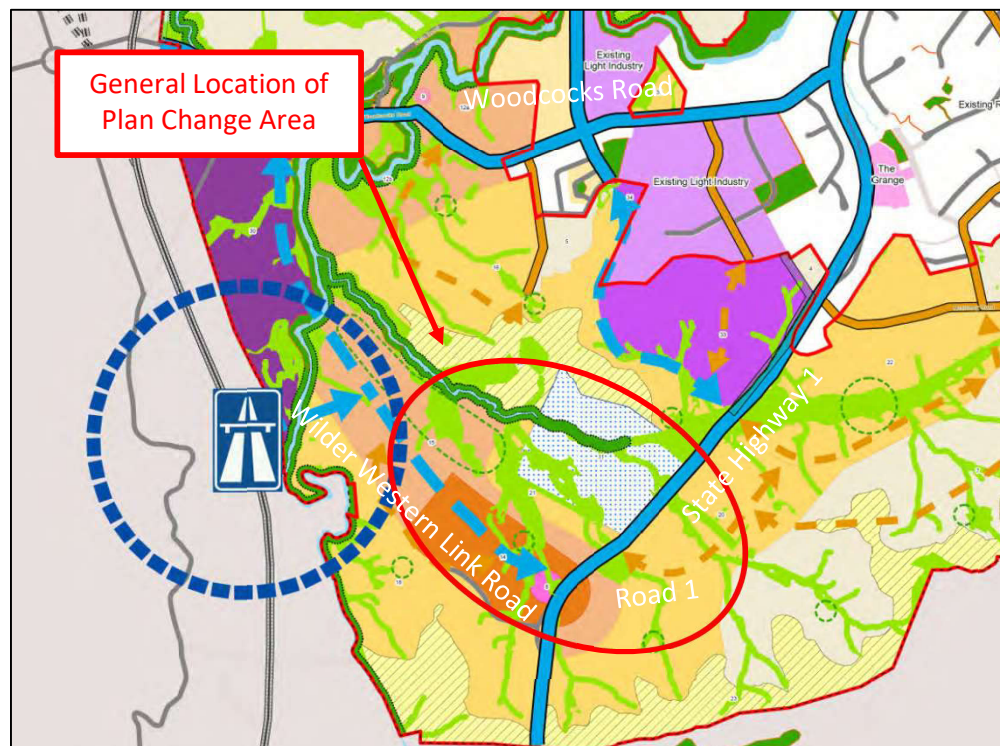


Figure 15: Warkworth Structure Plan – Future Road Network
Source: Warkworth Structure Plan (June 2019), Auckland Council

Although both road alignments are yet to be confirmed, the creation of the Wider Western Link Road has the potential to be running through the “Waimanawa Valley” in an east-west direction,

and the collector road to the east of SH1 has the potential to be located across the northern side of the “Waimanawa Hills” (as set out in the Structure Plan mapping).

In the Warkworth Structure Plan, the Wider Western Link Road is indicated to form a T-Junction with SH1 and to be located to the south of the collector road (forming another T-Junction with SH1) to the east of the SH1 in the “Waimanawa Hills” area. The Wider Western Link Road on the conceptual Masterplan is located to the north of its indicative location in the Warkworth Structure Plan. With this Plan Change, the Wider Western Link Road is proposed to form a crossroad intersection with SH1 and the collector road to the east of SH1. The feasibility of this alignment has been considered at a high level by the Applicant’s consultant team along with other options as part of the Masterplan development.

The collector road in the “Waimanawa Hills” area follows the location and alignment indicated in the Warkworth Structure Plan.

4.3.1 Location of WWLR Link to SH1

The locations for where the SGA Wider Western Link Road and the Proposed Wider Western Link Road would connect to SH1 are shown in **Figure 16**.

The SGA Wider Western Link Road connects to SH1 in the vicinity of the northern Valerie Close intersection, while the Proposed Wider Western Link Road would be some 300 metres further north, near Morrison’s Heritage Orchard.

It is considered advantageous to have the Wider Western Link Road intersection integrated with the Collector Road intersection, as this improves connectivity to the local centre and bus terminal for pedestrians, cyclists and vehicles coming from the eastern side of SH1. It also avoids having to provide two intersections on SH1 within 225 metres of each other.

Feedback received from Auckland Transport on 14 September 2022 indicates that “SGA is generally supportive of the proposed Wider Western Link Road alignment with an intersection on SH1 in the location indicated within the plan change documentation.”



Figure 16: Supporting Growth and Proposed WCLR Connections to SH1
Source: Maven Associates.

4.4 Road Hierarchy

4.4.1 "Waimanawa Valley"

A potential road hierarchy for the "Waimanawa Valley" area is illustrated in Figure 17.

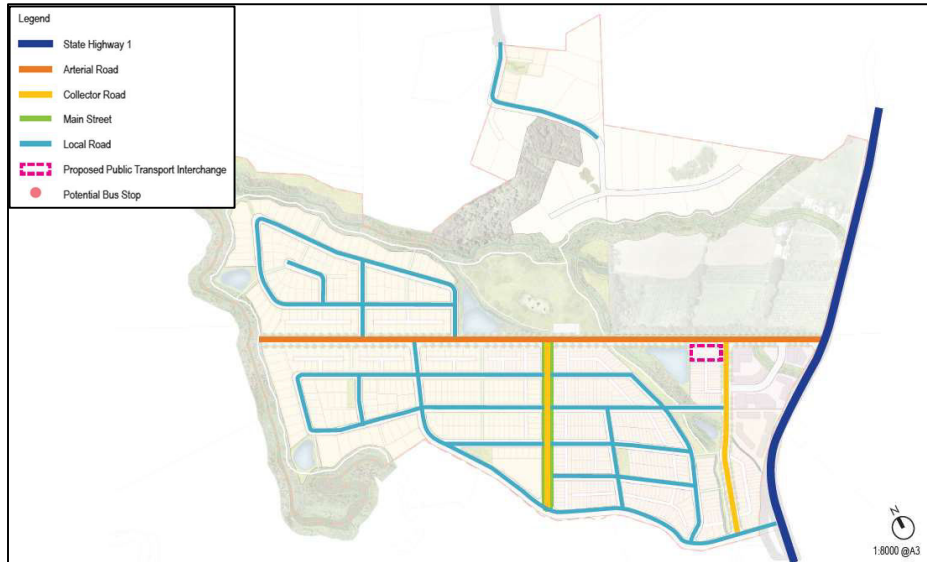


Figure 17: Potential Road Hierarchy - Waimanawa Valley

Source: Reset Urban Design

The most significant road within the “Waimanawa Valley” is SH1 which currently forms the transport corridor through the Warkworth area connecting Auckland to northern New Zealand and Warkworth’s arterial and collector roads. It will shortly be bypassed by the Ara Tūhono - Pūhoi to Warkworth Motorway project but will still retain an arterial road function.

The possible cross section for SH1 is indicated in **Figure 18**, and its design has anticipated the development of the Plan Change Area and growth within the wider Warkworth area.

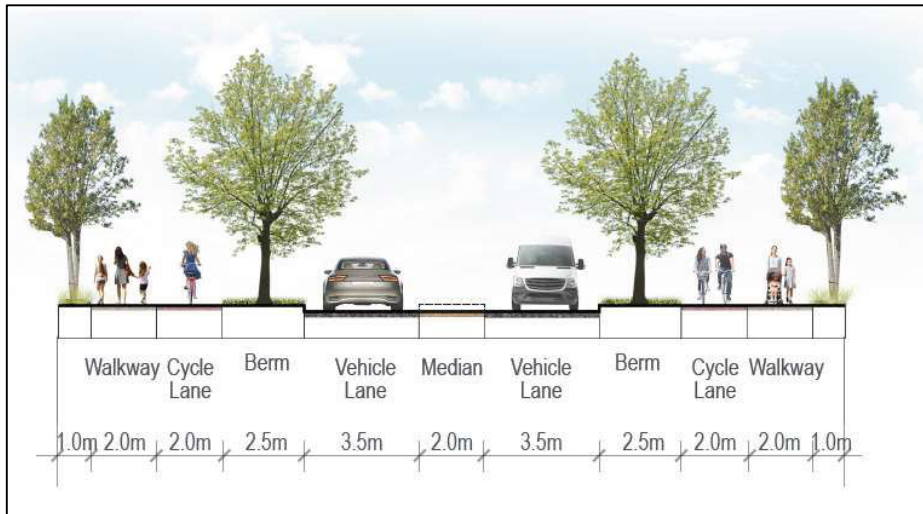


Figure 18: Possible Cross Section - State Highway 1

Source: Reset Urban Design

The Wider Western Link Road is an urban arterial road identified in the Warkworth Structure Plan, which will provide the primary function of moving traffic and providing accessibility to the future growth areas including the Plan Change Area. The possible cross sections for the Wider Western Link Road are indicated in **Figure 19** and **Figure 20**, and the design has anticipated the development of the Plan Change Area and growth within the wider Warkworth area.

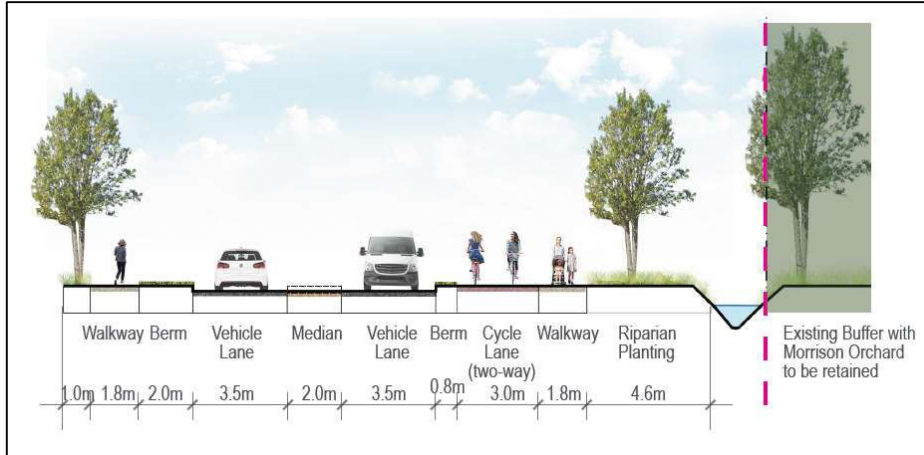


Figure 19: Possible Cross Section – Wider Western Link Road – Morrison Orchard Section
Source: Reset Urban Design

While **Figure 20** indicates that the western section of the Wider Western Link Road would have an off-road cycle path on both sides of the road, **Figure 19** indicates that on the Morrison Orchard section there would be a two-way cycle path on the northern side only, with no cycle facility on the southern side of the road. An advantage of having the cycle path on the northern side of the road is that cyclists will not need to cross any intersections or vehicle crossings. (The Matakana Link Road is a local example of an arterial road with a cycle path on one side of the road only.)

Cyclists travelling from the western section of the Wider Western Link Road to the Morrison Orchard section would need to cross the link road where the cycle lane on the southern side of the road terminates. A high-standard cycle crossing facility would need to be provided at this point.

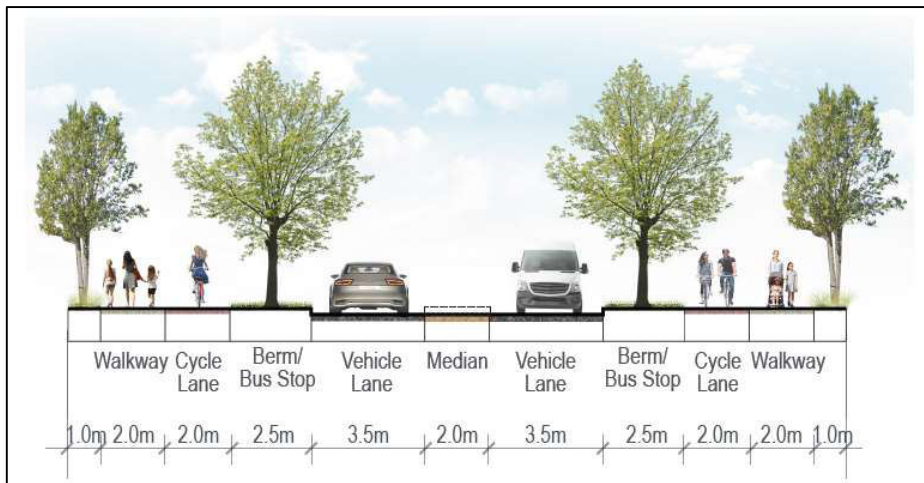


Figure 20: Possible Cross Section – Wider Western Link Road – Western Section
Source: Reset Urban Design

A “Collector” type road and a “Green Road” would run in a north-south direction, both forming a T-Junction with the Wider Western Link Road at their northern end. The traffic volume anticipated on these roads will be in the order of about 2,000 to 4,000 vehicle movements per day depending on the future extension of the roads. This level of traffic flow falls within the usual thresholds for classification as Collector Roads and would be capable of performing collector-type functions such as distributing traffic, accommodating pedestrian, and cycling facilities. It is intended that these roads will be designed for these functions as indicated in **Figure 21** and **Figure 22**.

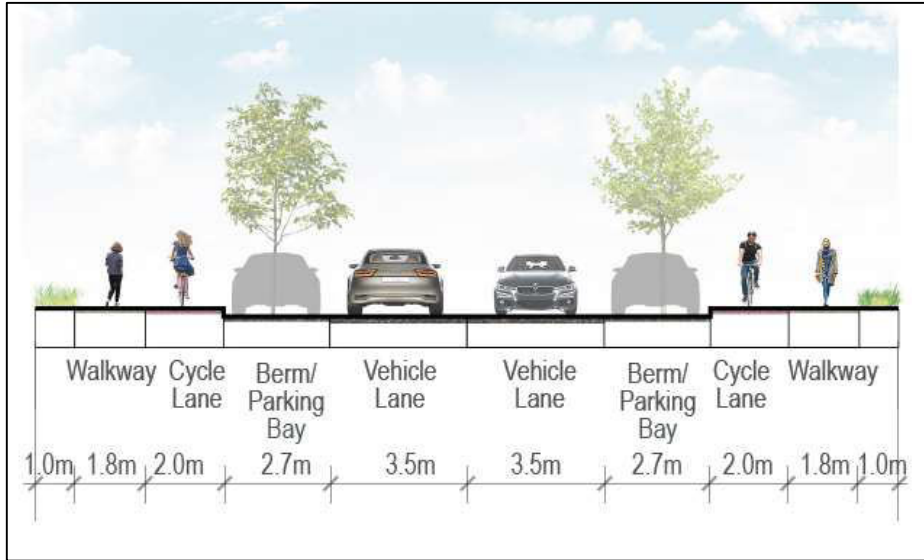


Figure 21: Possible Cross Section – Collector Road

Source: Reset Urban Design

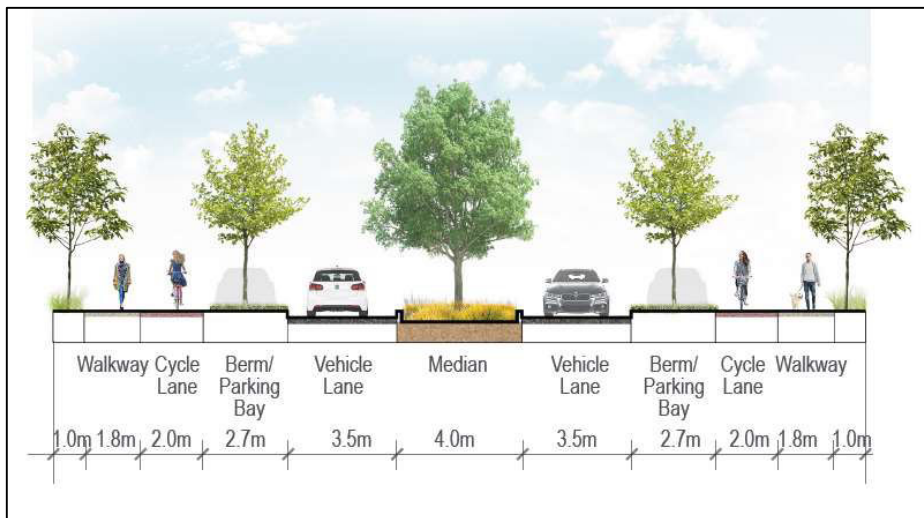


Figure 22: Possible Cross Section –Green Road

Source: Reset Urban Design

The balance of the Masterplan involved a network of local and recreational edge roads that will provide access to most lots. These roads are anticipated to carry no more than 500 vehicle movements per day in line with their local road function.

Cross-section widths would need to be confirmed with AT to ensure that there is sufficient width to provide all necessary features.

4.4.2 “Waimanawa Hills”

The potential road hierarchy for the “Waimanawa Hills” area is illustrated in **Figure 23**.

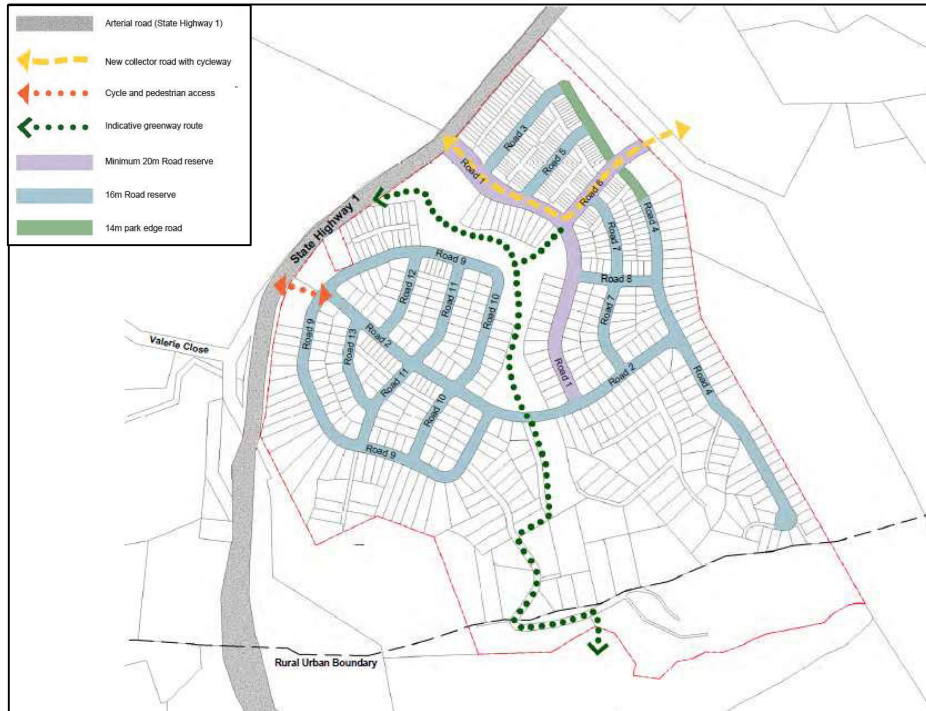


Figure 23: Potential Road Hierarchy - Waimanawa Hills

Source: A Studio Architects

The most significant road within “Waimanawa Hills” is Road 1 which is a secondary “Collector” type road with a primary function to transfer traffic from local roads onto arterial roads, in this case being SH1. There is the opportunity for it to be extended from the northern boundary of the Plan Change Area once the adjacent Future Urban Zone is developed. The traffic volume anticipated on the secondary road will be in the order of about 3,000 to 5,000 vehicle movements per day depending on the future extension of the road. This level of traffic flow falls within the usual thresholds for classification as a Collector Road and would be capable of performing collector-type functions such as distributing traffic and accommodating pedestrian and cycling facilities. It is intended that these roads will be designed for these functions.

The balance of the Masterplan involves a network of local and recreational edge roads that will provide access to most lots. These roads are anticipated to carry no more than 500 vehicle movements per day in line with their local road function.

4.5 Walking and Cycling Strategy

Figure 24 and Figure 25 illustrate the potential walking and cycling routes through the “Waimanawa Valley” and “Waimanawa Hills” areas respectively. The Plan Change will enable high quality walking and cycling infrastructure to minimise the need to use private vehicles for the trips within the Plan Change Area. For instance, all arterial and collector roads will provide protected cycleways and footpaths, and recreational routes will be provided along the green corridors.

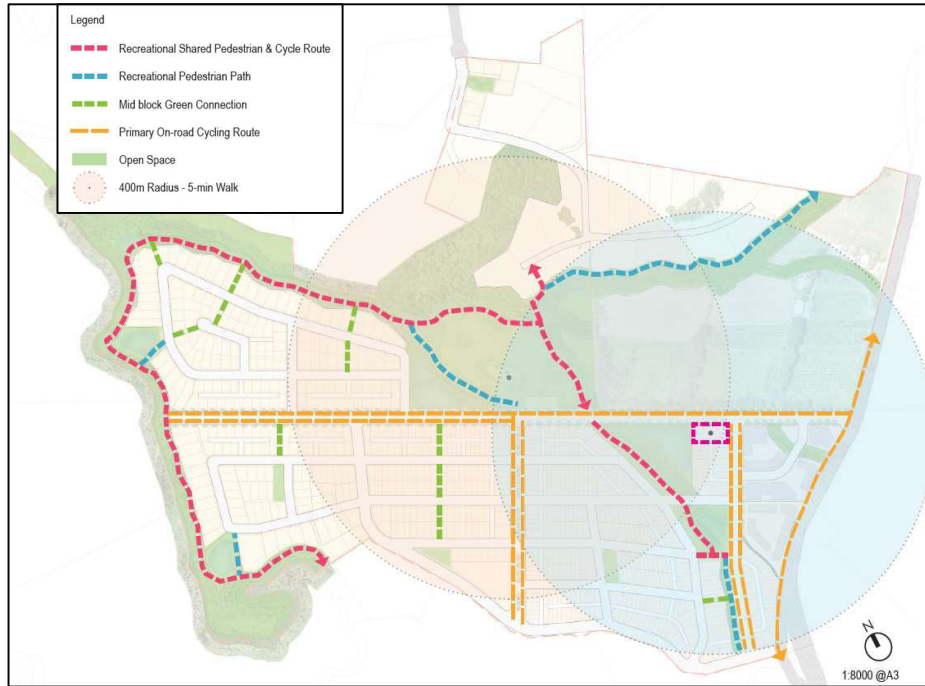


Figure 24: Potential Walking and Cycling Strategy – Waimanawa Valley

Source: Reset Urban Design

As shown in Figure 25, it is proposed to provide a cycle and pedestrian access link south of the proposed cross-junction to provide a second cycle and pedestrian connection between the Waimanawa Hills area and the pedestrian and cycle facilities on SH1 that will be provided as part of the Plan Change.

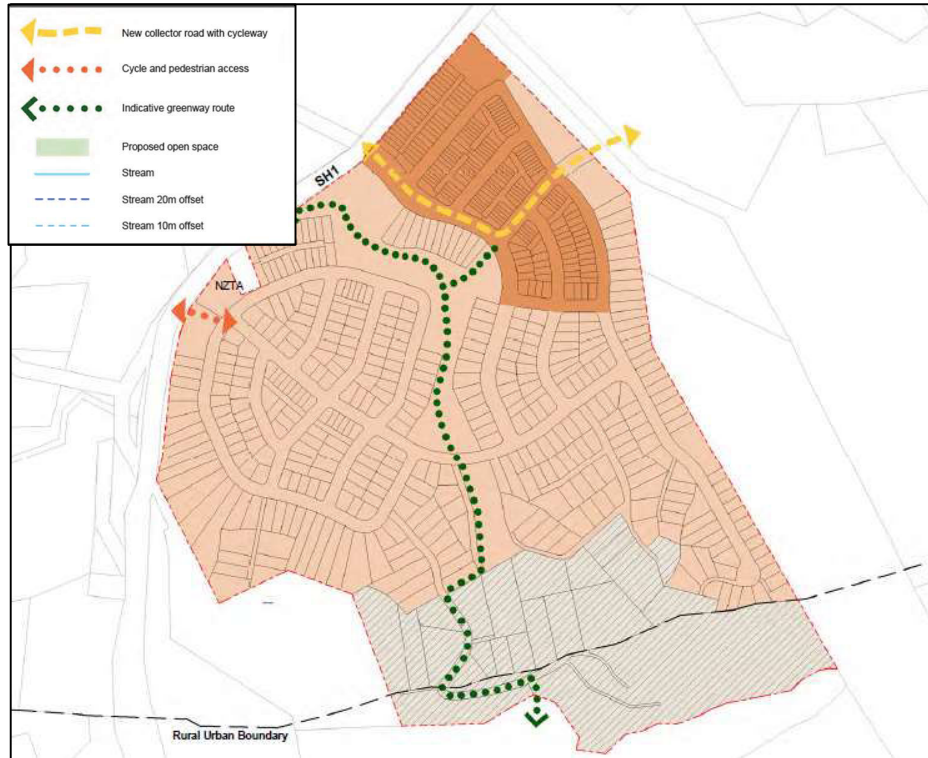


Figure 25: Potential Walking and Cycling Strategy – Waimanawa Hills

Source: A Studio Architects

By providing a high standard of pedestrian and cycle facilities, pedestrians and cyclists of all ages can move safely through the area with minimal risk. This will be an important function of any future development.

4.6 Accessibility Design Principles

Best-practice residential area design aims to produce liveable residential neighbourhoods that contribute to safety, good health, efficiency, and sustainability while having good levels of amenity.

Street patterns that allow good access through and around the area and to local services by walking and cycling are beneficial, and guidelines generally talk about connectivity and permeability as being desirable attributes. Legibility is another desirable attribute and the creation of self-explanatory roads.

It is desirable for residents to be within easy walking distance of public transport services and local service centres to assist in reducing demand for private vehicle travel. Pedestrian walkability catchments are generally based on good access being provided within 400 metres or about 5-minutes' walk, with lesser access being provided within 800 metres or a 10-minute walk. Although with the increase in micro-mobility, there will be opportunities for greater distances to be covered.

In terms of intersection design, crossroads on streets where traffic volumes are higher have been shown to have poorer crash records. In general, where traffic volumes are higher than 1,000 vehicles per day consideration should be given to controlling conflict at cross-roads. Roundabouts can be effective at controlling conflict and moderating speeds, although busy roundabouts can be difficult for pedestrians and cyclists to negotiate and therefore can become a barrier for pedestrians and cyclists in urban areas.

Any land development will need to provide high quality walking and cycling infrastructure to minimise the need to use private vehicles and for trips within the Plan Change Area. By providing a high standard of pedestrian and cycle facilities, pedestrians and cyclists of all ages can move safely within the area with minimal risk. This will be an important function of any future development of the Plan Change Area. The proposed Masterplan is designed to make the most of opportunities to promote walking and cycling. It aims to provide for the daily needs of pedestrian and cyclist movements within the area by:

- Upgrading SH1 through the Plan Change Area with new footpaths and cycle paths;
- A proposed footpath network connecting to footpaths immediately outside the Plan Change Area;
- Creating opportunities for recreational walking and cycling through the area; and
- Providing a low-speed street network that allows cyclists and vehicles to share the same carriageway on an equal basis.

New facilities outside of the Plan Change Area boundaries are also needed to provide improved safety and connectivity to key destinations. Some of this infrastructure will rely upon other landowners to develop and with the future upgrade of nearby roads, dedicated and safe facilities will be provided. As a minimum, the proposed precinct provisions will require the construction of a footpath/cycle path to the existing Warkworth urban area.

5.0 PRECINCT PROVISIONS TO MANAGE TRANSPORT EFFECTS

A variety of precinct provisions as summarised in **Table 2** are proposed to ensure that transport infrastructure is provided as it is required, and thus to manage the transport effects of development of the Plan Change Area.

Table 2: Proposed Precinct Transport Infrastructure Requirements

Transport Infrastructure Upgrade		Trigger
(T1)	Construction of the pedestrian/cycle path on the eastern side of SH1 from the WWLR/SH1 intersection to McKinney Road	As part of the first subdivision for residential development creating more than 20 residential lots.
(T2)	Upgrading of SH 1 though the WW South Precinct	As part of the first subdivision for residential development creating more than 20 residential lots.
(T3)	Construction of the WWLR/SH1 intersection	As part of the first subdivision for residential development creating more than 20 residential lots.
(T4)	Construction of the pedestrian/cycle path on the western side of SH1 from the WWLR/SH1 intersection to the Morrisons Heritage Orchard Entrance	As part of the first subdivision for residential development creating more than 20 residential lots.
(T5)	Construction of the WWLR	Any subdivision or development with frontage to that section of the WWLR.
(T6)	Collector Roads (including Green Road)	Any subdivision or development with frontage to that section of the collector road or creating a local road connection to the collector road.
(T7)	Valerie Close/SH1 intersection	In the event of any subdivision with frontage along Valerie Close occurring or a new road connection to Valerie Close, an assessment is to be undertaken to confirm if any upgrading of the intersection is required as part of that subdivision.
(T8)	Upgrading of Mason Heights	Any subdivision or development with frontage to that section of Mason Heights.

5.1 Walking and Cycling Connections to the Developed Urban Area of Warkworth

Figure 3 and **Figure 4** in Section 2.3 shows the 500-metre and one-kilometre walking distances respectively from the outer boundaries of the Plan Change Area. The figures show that the Plan Change Area is generally isolated from the developed urban area of Warkworth and has a lack of walking connection to the town centre in the north.

The precinct provisions would require upgrading of SH1 to have a footpath and cycle path connection north to Warkworth, and staged upgrading of Mason Heights to urban standards (including footpaths), which would provide a safer link for active mode travel between the Plan Change Area and the developed urban area of Warkworth.

On SH1, as soon as any subdivision for residential development occurs creating more than 20 residential lots, the precinct provisions would require construction of the pedestrian/cycle path

on the eastern side of SH1 from the Wider Western Link Road/SH1 intersection to McKinney Road, construction of the pedestrian/cycle path on the western side of SH1 from the Wider Western Link Road /SH1 intersection to the Morrisons Heritage Orchard Entrance, and upgrading of SH1 (including provision of pedestrian and cycle paths on both sides of the road) though the Plan Change Area. At the same time, construction of the Wider Western Link Road/SH1 intersection would be required, which would provide facilities for pedestrians and cyclists to cross SH1 and the Wider Western Link Road.

Upgrading of Mason Heights to urban standards would be required when any subdivision or development occurs with frontage to that section of Mason Heights. By requiring pedestrian and cycle infrastructure connecting the Plan Change Area to the developed urban area of Warkworth at the outset, walking and cycling would be established as viable transport modes from the outset, to minimise auto dependency.

5.2 Upgrading of SH1 and Intersections

The main road access to the Plan Change Area in the short to medium term will be the new cross junction on SH1 incorporating the Wider Western Link Road and a collector road to the east as described in Section 4.3.1. As soon as any subdivision for residential development occurs creating more than 20 residential lots, the precinct provisions would require the upgrading of SH1 though the Plan Change Area and construction of the Wider Western Link Road/SH1 Intersection. The layout of this intersection is assessed in Section 7.3 of this report.

As mentioned in Section 2.2.2, it is not considered suitable to allow any additional traffic on Valerie Close without appropriate upgrading of the Valerie Close/SH1 intersection. Therefore, the proposed precinct provisions would require an assessment to be undertaken to confirm if any upgrading of the intersection is required as soon as any development occurs that might increase traffic on Valerie Close, viz. any subdivision with frontage along Valerie Close or any new road connection to Valerie Close. A potential layout of the Valerie Close/SH1 intersection is illustrated in Section 7.4 of this report.

5.3 Provision of Transport Infrastructure Within the Plan Change Area

The proposed precinct provisions would require transport infrastructure to be developed in conjunction with development in the Plan Change Area. Thus, any subdivision or development with frontage to the Wider Western Link Road or a collector road would require construction of the section of Wider Western Link Road or collector road for the extent of that frontage, and any subdivision or development with frontage to Mason Heights would require upgrading of the section of Mason Heights for the extent of that frontage. In addition, construction of collector roads would be required in conjunction with any subdivision or development creating a local road connection to the collector roads.

The Wider Western Link Road and collector roads would include off-road pedestrians and cycle paths, while the upgrade of Mason Heights and new local roads would be constructed to urban standards, including footpaths. As noted in Section 3.4, an existing bus route (995) runs along SH1 through the Plan Change Area, and the Plan Change provides for bus stops near the local centre, to provide connectivity for the area to the Warkworth town centre and beyond in the short to medium term. Thus, transport infrastructure for all transport modes within the Plan Change Area will be provided as development occurs.

6.0 TRANSPORT GENERATION OF THE PROPOSAL

6.1 Choice of Transport Model and Design Year

As mentioned in Section 3.3, the Warkworth Structure Plan ITA used a Saturn model to confirm that in the long term, the future transport network proposed to serve Warkworth will have adequate capacity to accommodate the traffic expected to be generated by the full development of Warkworth as per the Structure Plan, including full development of Warkworth South.

However, the Structure Plan ITA did not assess the performance of the roading network in the short to medium term. The ITA utilised the vehicle trip generation rates for 2048 from the Macro Strategic Model, which assume a level of walking, cycling and public transport infrastructure is provided that would significantly change mode share and trip making patterns, which would not be the case in the short to medium term. Also, the future land uses now provided for in the Warkworth Structure Plan have changed from those used in the 2046 Saturn model. Finally, a few recent plan changes have been approved that alter the level of development from that anticipated in the Structure Plan.

The focus of this current traffic assessment is therefore on the short to medium term, when there will be only parts of the proposed roading network for Warkworth in place, and when existing vehicle trip generation rates will still apply.

For its 2020 assessment of tolling scenarios for the Ara Tūhono – Pūhoi to Warkworth motorway extension, BECA refined the Warkworth Structure Plan ITA Saturn model. Amongst other changes, the model was re-based to 2018 conditions, and a 2028 design year model was developed, utilising land use forecasts based on Macro Strategic Model Scenario I-11.4, as used in the Warkworth Structure Plan.

As mentioned in Section 3.2, the only projects in the proposed Warkworth transport network certain to be built within the time frame of the proposed Plan Change are the Matakana Link Road (MLR) and the Ara Tūhono - Pūhoi to Warkworth Motorway project. In addition, funding is allocated in the 2021 National Land Transport Programme for the upgrading of the Hill Street intersection. The 2028 SGA Saturn model includes these three transport projects, and no others, and is therefore an appropriate transport network for the short to medium term traffic assessment of Warkworth South.

The 2028 SGA Saturn model has therefore been chosen as the most appropriate model to use to assess the traffic impacts of the proposed Plan Change in Warkworth South.

6.2 2028 Base Case Traffic Volumes

Future traffic flows in Warkworth will be determined from the future land use development. As discussed in Section 3.1, the Warkworth Structure Plan anticipates Warkworth North being released in Future Urban Land Supply Strategy (FULSS) Decade 1 (development ready 2022), land in Warkworth South being released in FULSS Decade 2 (development ready 2028-32), and land in Warkworth North-East being released in FULSS Decade 3 (development ready 2033-37).

These three areas were initially all zoned as Future Urban zones and require private plan changes and/or subdivision consents to bring them into development. To date, the approved plan changes/subdivision consents are all in the Warkworth North FULSS area as follows:

- Goatley Holdings – a light industrial area at the north end of the Warkworth North FULSS area, east of SH1, south of Goatley Road and north of the Matakana Link Road.
- The Clayden Road Precinct – a predominantly residential development with a new neighbourhood centre, all with road access off the Matakana Link Road, and adjacent to Goatley Holdings (Plan Change 40, AUP precinct I552).
- The Warkworth North Precinct – A mixture of residential, business and light industry development plus a neighbourhood centre with road access off the future Western Link Road (Plan Change 25, AUP precinct I553).
- The Pak'n Save development, comprising a supermarket plus large format retail development at the intersection of SH1 and Hudson Road, adjacent to the Warkworth North Precinct.

The 2028 SGA Saturn Model includes the full development of Warkworth North and Warkworth South, albeit using trip generation rates that assume a level of walking, cycling and public transport infrastructure, mode share and trip making patterns which would not be the case in the short to medium term.

The traffic assessment of the Warkworth South Plan Change has focussed on the section of SH1 through the Plan Change Area.

The 2028 peak hour traffic levels on this section of SH1 as forecasted in the 2028 SGA Saturn Model have been used to develop a more realistic level of peak hour base traffic by:

1. Identifying the 2028 AM and PM peak hour traffic volumes currently forecast by the 2028 SGA Saturn model on SH1 through the Plan Change Area, from link volume plots supplied by the Auckland Forecasting Centre,
2. Using Saturn model select link analyses supplied by the Auckland Forecasting Centre to determine the total traffic generated by the Warkworth North and Warkworth South FULSS areas in the 2028 SGA model that travel on SH1,
3. Using the same select link analyses to quantify the proportion of total traffic generated by the Warkworth North and Warkworth South FULSS areas in the 2028 SGA model that travel on SH1,
4. Using traffic generation rates more realistic for the short to medium term, and applying them to the scale of development enabled by the approved plan changes/subdivisions listed previously to calculate a more realistic level of traffic generated in these areas in the short to medium term,
5. Applying the proportions calculated in step 3 to the total traffic generation calculated in step 4 to determine the realistic short to medium term levels of additional traffic on SH1 associated with the approved plan changes/subdivisions, and
6. Subtracting the traffic volumes calculated in step 2 from the travel volumes identified in step 1 and then adding the volumes calculated in step 5 to determine more realistic AM and PM peak hour base traffic volumes on SH1 past the Plan Change Area, accounting for the traffic generated by the approved plan changes/subdivisions.

These calculations were made in a spreadsheet, a print-out of which is included as **Appendix 1** to this report.

The realistic traffic generation rates in step 4 are based on the traffic generation rates used in the Integrated Transport Assessment (ITA) reports that supported the various approved plan changes/ subdivisions and are consistent with the rates published in the New South Wales Road and Maritime Service Guide to Traffic Generating Developments.

These trip generation rates are tabulated below. Where the directionality of trips was not stated in the ITA reports, standard directionality assumptions have been used, as included in the **Table 3** below.

Table 3: Trip Generation Rates for Approved Plan Changes/Subdivisions

Land Use Category	Peak Hour Trip Rates (vph per household or per 100m2)	Percent Vehicle Movements Outbound	
		AM Peak	PM Peak
Goatley Light Industrial	0.728/100m2	25%	75%
Low Density Residential (PC 40)	0.85/HH	80%	20%
Medium Density Residential (PC 40)	0.65/HH	80%	20%
Residential Single House (PC25)	0.85/HH	80%	20%
Residential Urban/Suburban (PC25)	0.65/HH	80%	20%
Local Centre	3.7/100m2	37%	63%
Business – Mixed Use	1.6/100m2	20%	80%
General Business	2.0/100m2	20%	80%
Light Industry	1.16/100m2	25%	75%
Pak’n Save Supermarket – AM Peak	0.5/100m2	50%	50%
Pak’n Save Supermarket – PM Peak	12.0/100m2 ¹	50%	50%
Pak’n Save Large Format Retail- AM Peak	0.5/100m2	50%	50%
Pak’n Save Large Format Retail- PM Peak	4.0/100m2 ¹	50%	50%

To be consistent with the Integrated Transport Assessment of the Clayden Road Precinct (PC40), it has been assumed that all peak hour traffic associated with the new neighbourhood centre is internal to the neighbourhood and would not travel beyond the Plan Change Area.

6.3 2028 Traffic Generation of Proposed Warkworth South Plan Change Area

The Warkworth Structure Plan anticipates that land in the Warkworth South FULSS area would be development ready in 2028-32. The proposed Warkworth South Plan Change would bring forward the release of some land in this area to be development-ready by late 2024, with subsequent development occurring over 7 to 10 years.

The proposed Masterplan for this Plan Change shows some 742 residential lots, 173 apartments and a local centre of some 9,900 - 10,000m2 GFA located west of SH1, and 691 dwellings of various types located east of SH1.

¹ Accounting for 20% pass-by trips

With the agreement of the SGA, the peak hour trip generation and directionality of trips from the Warkworth South Plan Change has been estimated using the trip generation rates and directionalities used in previous ITA reports for the approved plan changes/subdivisions as shown in **Table 3** above. The peak hour traffic generation calculated on this basis are tabulated below (as **Table 4**), and their calculation is detailed in **Appendix 1**. The spreadsheet is available on request.

Table 4: Warkworth South 2028 Peak Hour Vehicle Trip Generation

EAST OF EXISTING SH1	Dwellings	Peak hour trip rate	Peak Hour Trips	Out - AM	Out - PM	AM Peak Hour		PM Peak Hour	
						Productions	Attractions	Productions	Attractions
Terrace Housing and Apartments	183	0.50	92	80%	20%	73	18	18	73
Mixed housing urban	455	0.65	296	80%	20%	237	59	59	237
Residential single house	41	0.65	27	80%	20%	21	5	5	21
Large lot	12	0.85	10	80%	20%	8	2	2	8
Rural	0	0.85	0	80%	20%	0	0	0	0
			424			339	85	85	339
WEST OF EXISTING SH1	Dwellings/ area	Peak hour trip rate	Peak Hour Trips	Out - AM	Out - PM	Productions	Attractions	Productions	Attractions
Terrace Housing and Apartments & local centre	540	0.50	270	80%	20%	216	54	54	216
Mixed housing urban	352	0.65	229	80%	20%	183	46	46	183
Large lot	11	0.85	9	80%	20%	7	2	2	7
Mixed housing rural	12	0.85	10	80%	20%	8	2	2	8
Local centre commercial	9950	3.70	368	37%	63%	136	232	232	136
			887			551	336	336	551
TOTAL			1311			890	420	420	890

The 2028 SGA Saturn model includes a park and ride public transport terminal in the Warkworth South area. While the proposed Plan Change provides room for a bus terminal to be developed, we understand it is no longer proposed to provide a park and ride station serving Warkworth South. For the purposes of this traffic assessment, it is assumed that neither the bus terminal nor a park and ride station will be in place in Warkworth South and will therefore not generate any vehicle trips.

6.4 Trip Distribution

As stated previously, except for the Ara Tūhono – Pūhoi to Warkworth motorway extension, with an interchange to the northwest of Warkworth, and the Matakana Link Road, the funding and timing of strategic roads serving Warkworth is uncertain and have not been included in this assessment. For the purposes of this traffic assessment, it is assumed that all Warkworth South Plan Change traffic (excluding Morrisons Orchard) will access the wider road network by way of a new cross-junction on SH1. As such, the distribution of external trips to and from Warkworth South in the vicinity of the Plan Change Area will be confined to trips on SH1 travelling to/from either the north or the south of the area.

The Auckland Forecasting Centre supplied the 2028 AM and PM peak hour vehicle demand matrices for the 2028 SGA Saturn Model. These matrices, in spreadsheet form, tabulated the forecast vehicle trip productions from each Saturn model zone to each Saturn model zone. These matrices were aggregated to count vehicle trips to/from the Warkworth South zones (excluding the park and ride zone), and vehicle trips to/from zones south of Warkworth (including Pūhoi, Orewa, Silverdale, and areas south of Silverdale).

The 2028 Saturn Model percentages of Warkworth South traffic travelling to or from area south of Warkworth in each peak period is tabulated below.

Table 5: Warkworth South External Vehicle Trip Distribution

Peak Period	Warkworth South Vehicle Trip Productions		Warkworth South Vehicle Trip Attractions	
	To the North	To the South	From the North	From the South
AM Peak	78%	22%	83%	17%
PM Peak	86%	14%	76%	24%

It has been assumed that the traffic generated by the local centre will be internal to the Warkworth South area, and that the proportion of traffic to/from the areas of Warkworth South, east and west of SH1, will be in proportion to the number of residential trips generated to the east and west of SH1.

It is assumed that all Warkworth South vehicle trips, apart from the internal trips associated with the local centre, will be external to the Warkworth South area and will be in addition to the Base Case traffic volumes estimated in Section 6.2. The trip productions and attraction have been allocated onto SH1 to/from the north or the south in accordance with the proportions set out in **Table 5** above.

The resulting forecast turning movements at the new Warkworth South cross junction on SH1 for the AM peak hour are shown in **Figure 26** and for the PM peak hour are shown in **Figure 27**.

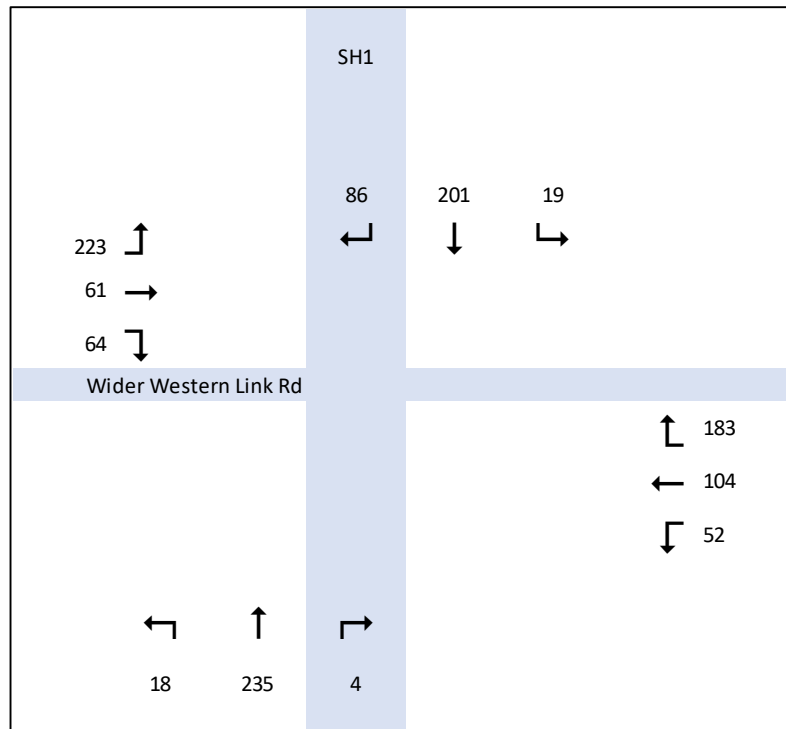


Figure 26: AM Peak Hour – Predicted Turning Movements

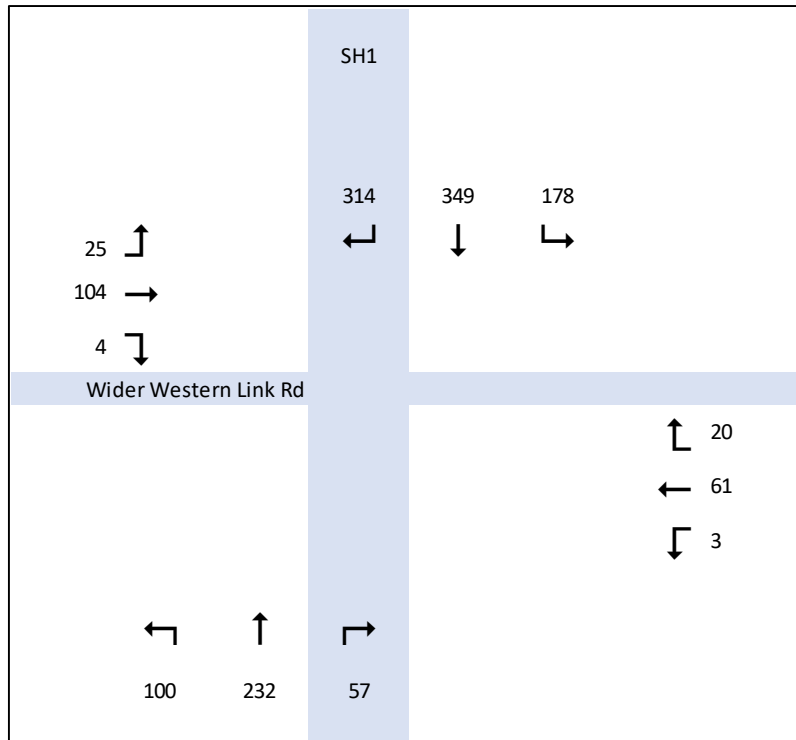


Figure 27: PM Peak Hour – Predicted Turning Movements

It should be noted that travel between the local centre and residential development on the western side of SH1 will not travel through the SH1 intersection, and so the traffic turning movement volumes on the Wider Western Link Road leg of the intersection will be less than the total peak hour trip generation calculated in **Table 5**.

6.5 Trip Generation of Other Transport Modes

Table 8 of the Warkworth Structure Plan ITA indicates realistic future peak period mode shares, which are tabulated below (as **Table 6**).

Table 6: Warkworth Future Mode Share

Main Means of Travel to Work	Percentage
Private vehicle	75%
Public Transport	10%
Active Modes	15%
TOTAL	100%

However, these mode shares would be contingent on a level of walking, cycling and public transport infrastructure which would not be the case in the short to medium term.

In the short to medium term mode share in Warkworth will be more likely to follow existing mode shares. The Warkworth Structure Plan ITA sets out the existing mode share for travel to work in the Warkworth area, based on Census data. The mode share percentages are reproduced in **Table 7** below.

Table 7: Warkworth Existing Journey to Work Mode Share

Main Means of Travel to Work	Percentage
Drove a car or motorcycle	82.7%
Car passenger	6.4%
Bus	0.2%
Bicycle	0.5%
Walked or jogged	9.2%
Other	0.9%
TOTAL	100%

The short to medium term peak hour traffic generation of the plan change has been calculated in Section 6.3 as 1,311 vehicle trips in peak hours. Maintaining the mode share percentages shown in **Table 7** yields the estimated peak hour trips by mode in **Table 8**.

Table 8: Warkworth South Peak Hour Trips by Mode

Mode	Number of Peak Hour Trips
Car or motorcycle driver	1,311
Car passenger	101
Bus	3
Bicycle	8
Walk or Jog	146
Other	14
TOTAL	1,585

7.0 ASSESSMENT OF TRANSPORT EFFECTS

7.1 Walking and Cycling Trips

Although the predicted walking and cycling numbers are expected to be relatively low, any development in the Plan Change Area will need to manage pedestrian and cycling amenity and safety. As the surrounding area develops with other activities such as employment, schools, and public transport hub, it is anticipated that the volume of pedestrians and cyclists will increase.

To cater for these new trips and to ensure a safe environment for active modes, any development of the Plan Change Area will need to include the following:

- Creation of footpaths along both sides of the new street alignments that meet Auckland Transports standards;
- Connection of new footpaths with the existing public footpath network outside the Plan Change Area, with new and upgraded pedestrian infrastructure along the frontages on SH1 and Valerie Close;
- Consistency with the Warkworth Structure Plan – Active Transport Network;
- Pedestrian and cyclist facilities incorporated into the intersection layouts on the Wider Western Link Road and SH1;
- Regular and safe crossing opportunities on the arterial roads where pedestrian desire lines are evident;
- Separated, protected, or off-street cycle facilities on arterial and collector roads; and
- Provision of a low-speed local street network that allows cyclists and vehicles to share the same carriageway on an equal basis.

As discussed in Section 5.0, such facilities will be promoted by the proposed precinct provisions. The implementation of such measures will ensure that pedestrian and cycling activity in the area will not be adversely affected and will promote an increase in active travel.

7.2 Public Transport Trips

As proposed by Warkworth Structure Plan, in the longer-term public transport provision in Warkworth will be significantly enhanced to help accommodate the anticipated demands associated with growth in Warkworth and other key areas. As set out above, the Warkworth Structure Plan shows a bus station/interchange in Warkworth South in the southern Local Centre (within the “Waimanawa Valley” area). Together with the opening of the Ara Tūhono – Pūhoi to Warkworth Motorway, it will reduce bus travel times and is expected to increase the number of people using bus services and contribute to a reduction in private car travel. The proposed bus terminal within the Plan Change Area will enable all households within the Plan Change Area to be within suitable walking distance of a bus stop and services.

The proposed plan change will therefore provide for a bus terminal adjacent to the local centre in Warkworth South, locate higher-density residential development within convenient walking distance and ensure that high quality walking connections are provided to the future bus terminal.

The exact nature, timing, and routes of future bus services through the Warkworth area will be finalised and decided upon by Auckland Transport. When this occurs, accessibility will be significantly improved and in return will reduce private car travel.

In the short to medium term, the Plan Change will allow for the location of bus stops alongside the local centre.

7.3 2028 Motor Vehicle Trips at the New Cross Junction Linking Wider Western Link Road

The key intersection for Warkworth South is the proposed new cross junction with SH1.

A SIDRA-9 traffic model has been run for this intersection, for both signalised and roundabout control, using the 2028 peak hour turning movements set out in **Figure 26** and **Figure 27**.

The percentage of heavy traffic on SH1 through Warkworth South is based on the percentages forecast in the 2028 SGA Saturn model, as shown in **Table 9** below.

Table 9: Forecast 2028 Peak Hour Percentages of Heavy Traffic on Existing SH1

Peak Hour	Northbound	Southbound
AM Peak	8.8%	7.2%
PM Peak	5.2%	10.1%

Level of service (LOS) and average delays provide a robust measure of an intersection's performance and resilience to accommodate added traffic demand and when it may need upgrading. Once intersections reach a LOS D, it is considered close to reaching its capacity.

The SIDRA outputs for the modelled intersection layouts are included in **Appendix 2**.

7.3.1 2028 Peak Hour Performance of Roundabout Control

A schematic roundabout layout for the new cross-junction on SH1 to serve the Warkworth South Plan Change Area is shown in **Figure 28**.

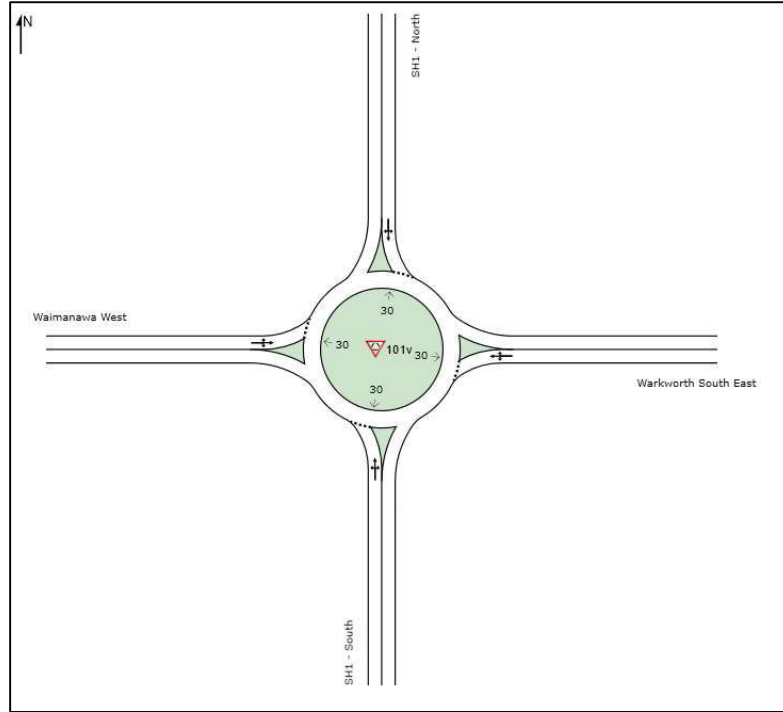


Figure 28: Schematic Roundabout Layout

The SIDRA modelled performance of this roundabout layout in the 2028 AM and PM peak hours are summarised in **Table 10** and **Table 11** respectively.

Table 10: SIDRA Results –Roundabout – 2028 AM Peak Hour

Vehicle Movement Performance											
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] m	
South: SH1 - South											
1	L2	18	0.0	19	0.0	0.271	4.6	LOS A	1.9	14.1	
2	T1	235	8.8	247	8.8	0.271	4.6	LOS A	1.9	14.1	
3	R2	4	0.0	4	0.0	0.271	9.8	LOS A	1.9	14.1	
Approach		257	8.0	271	8.0	0.271	4.7	LOS A	1.9	14.1	
East: Warkworth South East											
4	L2	52	0.0	55	0.0	0.331	4.7	LOS A	2.4	16.5	
5	T1	104	0.0	109	0.0	0.331	4.5	LOS A	2.4	16.5	
6	R2	183	0.0	193	0.0	0.331	9.9	LOS A	2.4	16.5	
Approach		339	0.0	357	0.0	0.331	7.4	LOS A	2.4	16.5	
North: SH1 - North											
7	L2	19	0.0	20	0.0	0.246	3.0	LOS A	1.8	13.2	
8	T1	201	7.2	212	7.2	0.246	2.9	LOS A	1.8	13.2	
9	R2	86	0.0	91	0.0	0.246	8.2	LOS A	1.8	13.2	
Approach		306	4.7	322	4.7	0.246	4.4	LOS A	1.8	13.2	
West: Waimanawa West											
10	L2	223	0.0	235	0.0	0.363	5.3	LOS A	2.7	18.7	
11	T1	61	0.0	64	0.0	0.363	5.1	LOS A	2.7	18.7	
12	R2	64	0.0	67	0.0	0.363	10.5	LOS B	2.7	18.7	
Approach		348	0.0	366	0.0	0.363	6.2	LOS A	2.7	18.7	
All Vehicles		1250	2.8	1316	2.8	0.363	5.8	LOS A	2.7	18.7	

In the 2028 weekday AM peak hour, the roundabout will operate well within its capacity, with a maximum degree of saturation of 0.363 and average delay of 5.8 seconds. The overall level of service (LOS) for the intersection will be A, with the worst movement being the right turn onto SH1 from Waimanawa Valley (west of SH1) with an average delay of 10.5 seconds and LOS B.

Table 11: SIDRA Results –Roundabout – 2028 PM Peak Hour

Vehicle Movement Performance										
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE	
		[Total veh/h]	[HV %]	[Total veh/h]	[HV %]				[Veh. veh]	[Dist m]
South: SH1 - South										
1	L2	100	0.0	105	0.0	0.411	5.1	LOS A	3.2	22.9
2	T1	232	5.2	244	5.2	0.411	5.1	LOS A	3.2	22.9
3	R2	57	0.0	60	0.0	0.411	10.3	LOS B	3.2	22.9
Approach		389	3.1	409	3.1	0.411	5.8	LOS A	3.2	22.9
East: Warkworth South East										
4	L2	3	0.0	3	0.0	0.121	6.7	LOS A	0.9	6.1
5	T1	61	0.0	64	0.0	0.121	6.5	LOS A	0.9	6.1
6	R2	20	0.0	21	0.0	0.121	11.9	LOS B	0.9	6.1
Approach		84	0.0	88	0.0	0.121	7.8	LOS A	0.9	6.1
North: SH1 - North										
7	L2	178	0.0	187	0.0	0.670	4.0	LOS A	7.5	54.4
8	T1	349	10.1	367	10.1	0.670	3.9	LOS A	7.5	54.4
9	R2	314	0.0	331	0.0	0.670	9.2	LOS A	7.5	54.4
Approach		841	4.2	885	4.2	0.670	5.9	LOS A	7.5	54.4
West: Waimanawa West										
10	L2	25	0.0	26	0.0	0.129	4.0	LOS A	0.9	6.0
11	T1	104	0.0	109	0.0	0.129	3.8	LOS A	0.9	6.0
12	R2	4	0.0	4	0.0	0.129	9.2	LOS A	0.9	6.0
Approach		133	0.0	140	0.0	0.129	4.0	LOS A	0.9	6.0
All Vehicles		1447	3.3	1523	3.3	0.670	5.8	LOS A	7.5	54.4

In the weekday PM peak hour, the roundabout will also operate well within its capacity, with a maximum degree of saturation of 0.670 and average delay of 5.8 seconds. The overall level of service (LOS) for the intersection will be A, with the worst movements being the right turns from SH1 into Waimanawa Hills (east of SH1) and from Waimanawa Hills (east of SH1) onto SH1 with average delays of 10.3 seconds and 11.9 seconds respectively and LOS B.

As the modelled overall LOS is A during the busiest times of the day, the roundabout layout for this intersection would provide an acceptable level of vehicle access for the Proposed Plan Change.

7.3.2 2028 Peak Hour Performance of Traffic Signal Control

A schematic traffic signal layout for the new cross-junction on SH1 to serve the Warkworth South Plan Change Area is shown in **Figure 29**.

The SIDRA modelled performance of this traffic signal layout in the 2028 AM and PM peak hours are summarised in **Table 12** and **Table 13**.

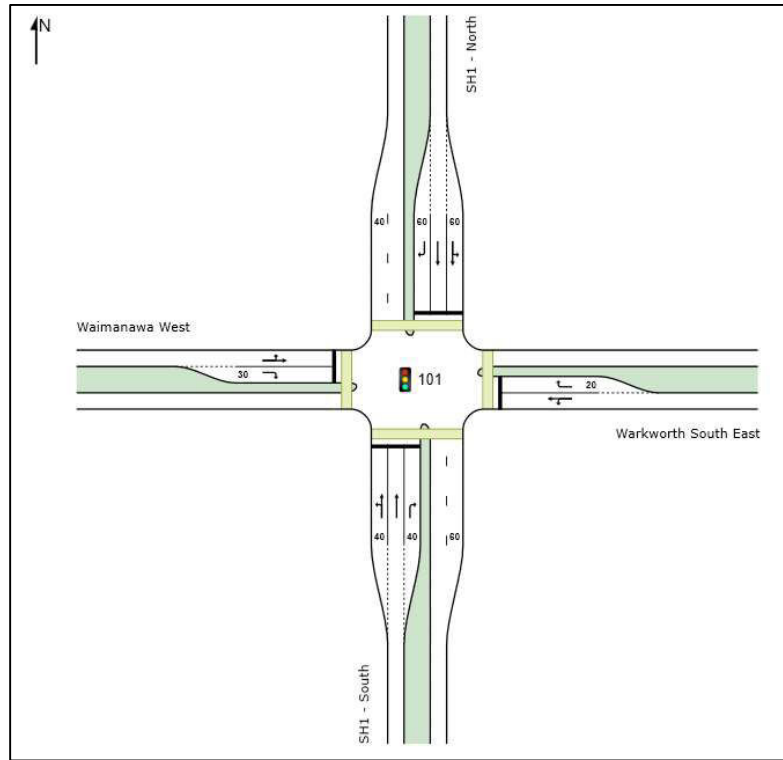


Figure 29: Schematic Traffic Signal Layout

Table 12: SIDRA Results – Traffic Signals – 2028 AM Peak Hour

Vehicle Movement Performance										
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE	
		[Total veh/h]	[HV %]	[Total veh/h]	[HV %]				[Veh. veh]	[Dist m]
South: SH1 - South										
1	L2	18	0.0	19	0.0	0.207	29.9	LOS C	1.5	11.4
2	T1	235	8.8	247	8.8	*0.756	29.6	LOS C	6.6	49.8
3	R2	4	0.0	4	0.0	0.023	31.9	LOS C	0.1	0.8
Approach		257	8.0	271	8.0	0.756	29.7	LOS C	6.6	49.8
East: Warkworth South East										
4	L2	52	0.0	55	0.0	0.428	28.2	LOS C	4.4	30.7
5	T1	104	0.0	109	0.0	0.428	23.6	LOS C	4.4	30.7
6	R2	183	0.0	193	0.0	*0.737	34.3	LOS C	6.0	41.9
Approach		339	0.0	357	0.0	0.737	30.1	LOS C	6.0	41.9
North: SH1 - North										
7	L2	19	0.0	20	0.0	0.217	29.9	LOS C	1.6	11.9
8	T1	201	7.2	212	7.2	0.612	27.3	LOS C	5.0	37.5
9	R2	86	0.0	91	0.0	*0.487	34.4	LOS C	2.7	19.0
Approach		306	4.7	322	4.7	0.612	29.4	LOS C	5.0	37.5
West: Waimanawa West										
10	L2	223	0.0	235	0.0	0.820	35.2	LOS D	9.8	68.3
11	T1	61	0.0	64	0.0	*0.820	30.5	LOS C	9.8	68.3
12	R2	64	0.0	67	0.0	0.242	30.1	LOS C	1.8	12.8
Approach		348	0.0	366	0.0	0.820	33.4	LOS C	9.8	68.3
All Vehicles		1250	2.8	1316	2.8	0.820	30.8	LOS C	9.8	68.3

In the 2028 weekday AM peak hour, the traffic signals will operate within its capacity, with a maximum degree of saturation of 0.820 and average delay of 30.8 seconds. The overall level of service (LOS) for the intersection will be C, with the worst movement being the left turn from Waimanawa Valley (west of SH1) to SH1 with an average delay of 35.2 seconds and LOS D.

Table 13: SIDRA Results – Traffic Signals – 2028 PM Peak Hour

Vehicle Movement Performance										
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE	
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist m
South: SH1 - South										
1	L2	100	0.0	105	0.0	0.227	30.6	LOS C	3.3	23.2
2	T1	232	5.2	244	5.2	0.518	28.5	LOS C	8.4	61.4
3	R2	57	0.0	60	0.0	0.144	31.7	LOS C	1.9	13.3
Approach		389	3.1	409	3.1	0.518	29.5	LOS C	8.4	61.4
East: Warkworth South East										
4	L2	3	0.0	3	0.0	0.231	37.9	LOS D	2.4	16.7
5	T1	61	0.0	64	0.0	0.231	33.3	LOS C	2.4	16.7
6	R2	20	0.0	21	0.0	*0.151	44.2	LOS D	0.8	5.7
Approach		84	0.0	88	0.0	0.231	36.1	LOS D	2.4	16.7
North: SH1 - North										
7	L2	178	0.0	187	0.0	0.404	32.1	LOS C	6.2	43.6
8	T1	349	10.1	367	10.1	*0.803	35.3	LOS D	15.0	114.3
9	R2	314	0.0	331	0.0	*0.791	40.5	LOS D	13.5	94.3
Approach		841	4.2	885	4.2	0.803	36.5	LOS D	15.0	114.3
West: Waimanawa West										
10	L2	25	0.0	26	0.0	0.469	39.5	LOS D	5.0	35.3
11	T1	104	0.0	109	0.0	*0.469	34.8	LOS C	5.0	35.3
12	R2	4	0.0	4	0.0	0.030	43.1	LOS D	0.2	1.1
Approach		133	0.0	140	0.0	0.469	36.0	LOS D	5.0	35.3
All Vehicles		1447	3.3	1523	3.3	0.803	34.6	LOS C	15.0	114.3

In the 2028 weekday PM peak hour, the traffic signals will also operate within capacity, with a maximum degree of saturation of 0.803 and average delay of 34.6 seconds. The overall level of service (LOS) for the intersection will be C, with the worst movements being the right turns from Waimanawa Hills (east of SH1) and from Waimanawa Valley (west of SH1) onto SH1 with average delays of 44.2 seconds and 43.1 seconds respectively and LOS D.

As the overall LOS is measured as C during the busiest time of the day, the traffic signal layout for this intersection would provide an acceptable level of vehicle access for the Proposed Plan Change.

Overall, it is therefore anticipated that the 2028 peak hour traffic flows including the forecasted vehicle trip generation from development of the Plan Change Area can be accommodated on SH1 in the vicinity of the plan change by a crossroad intersection with either roundabout or traffic signal control.

The appropriate selection of intersection control will require a careful trade-off between any positive and adverse effects and be integrated with the traffic management on SH1. It is therefore recommended that provision for a cross junction on SH1 with either roundabout or traffic signal control to serve the Plan Change Area be included for the Waimanawa Precinct, with the appropriate control being confirmed at the resource consent stage.

7.4 Motor Vehicle Trips at the SH1/Valerie Close Intersection

As mentioned in Section 2.2.2, it is not considered suitable to allow any additional traffic on Valerie Close without appropriate upgrading of the Valerie Close/SH1 intersection. The assessment of the new crossroad intersection to the north with either roundabout or traffic signal control described above has been undertaken on the basis of the cross junction accommodating all of the traffic generated by development in the Plan Change Area, and thus the proposed Plan Change does not rely on the Valerie Close/SH1 intersection.

When a road link is built to connect Valerie Close to the Wider Western Link Road, one potential scenario to upgrade the Valerie Close/SH1 intersection would be to limit turning movements to left turns only, as shown in **Figure 30** and **Figure 31** below. Any right turn movements would be diverted to the Wider Western Link Road/SH1 cross junction.

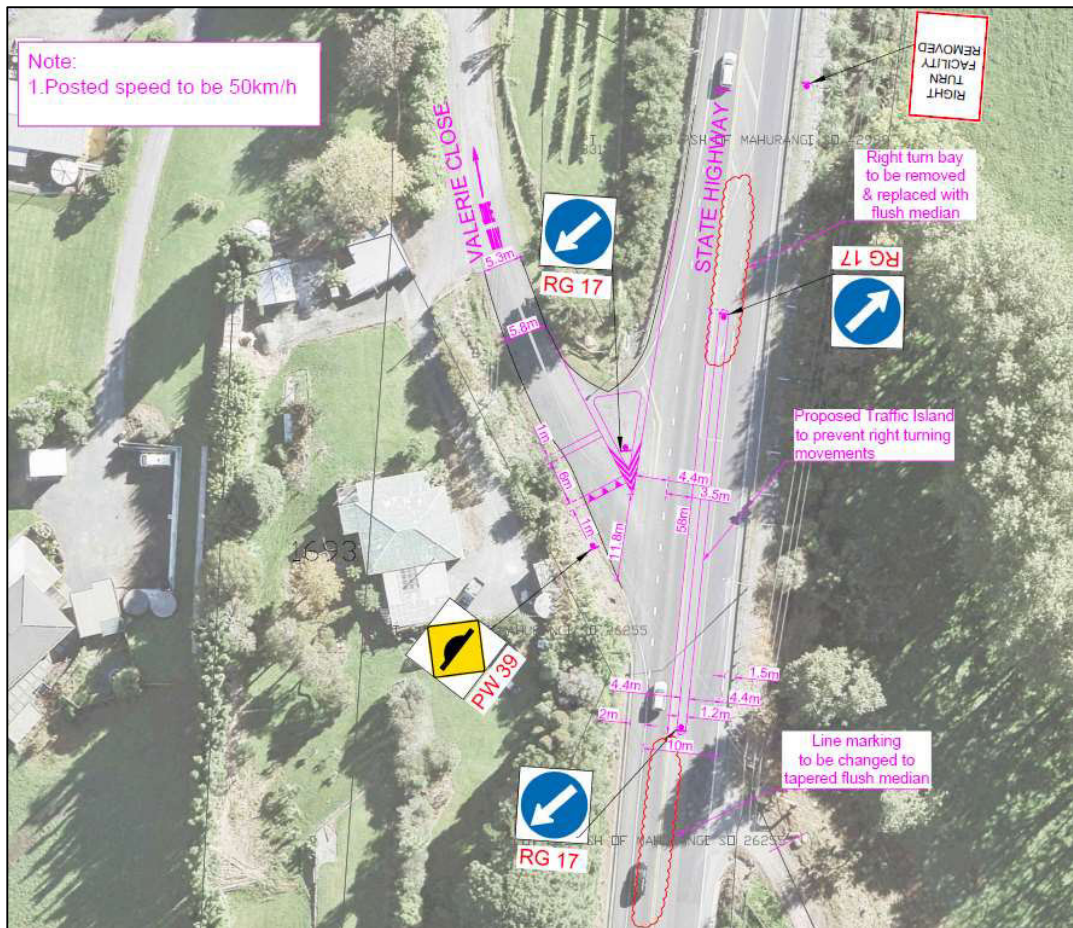


Figure 30: Possible Future Layout of South End of Valerie Close/SH1 Intersection

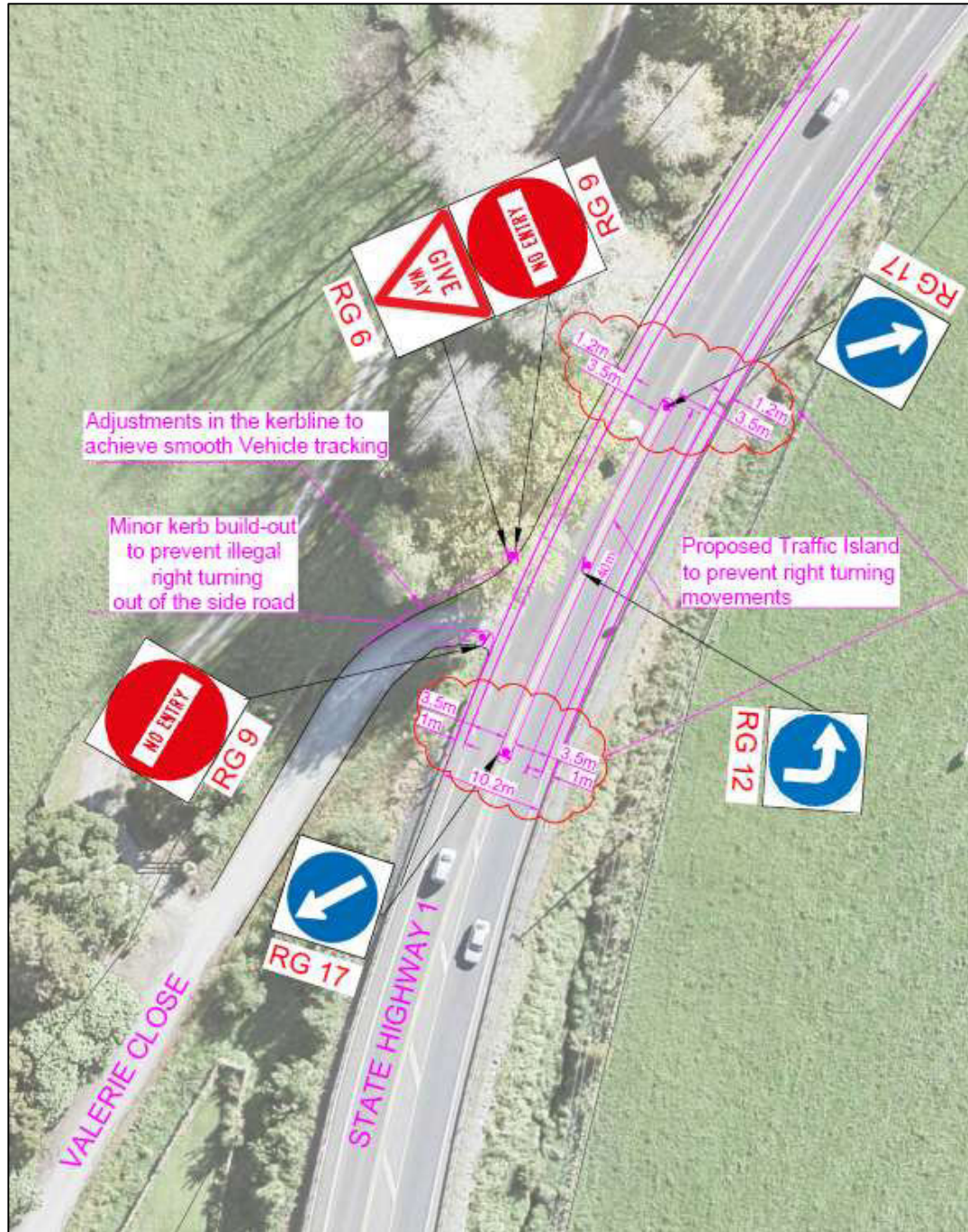


Figure 31: Possible Future Layout of North End of Valerie Close/SH1 Intersection

As discussed in Section 5.2, the proposed precinct provisions would require an assessment to be undertaken to confirm if any upgrading of the intersection is required as soon as any development occurs that might increase traffic on Valerie Close, viz. any subdivision with frontage along Valerie Close or any new road connection to Valerie Close.

7.5 Motor Vehicle Trips at the Morrisons Orchard Access on SH1

The proposed provisions for the Morrison Orchard Precinct only allow activities in the precinct that “do not either singularly or cumulatively exceed a trip generation threshold of 100 vehicles per hour in any hour”.

The directionalities used in previous ITA reports for the approved plan changes/subdivisions in Warkworth suggest that for residential development 80% of vehicle trips would depart in the morning peak and 20% would arrive, with the percentages reversed for the PM peak. Similar directionality would be expected for any camping ground, visitor accommodation or workers accommodation activity. Previous ITA reports used 63% of commercial activity trips arriving and 37% departing in the AM peak, with the percentages reversed for the PM peak. Similar directionality would apply to non-residential activities within the Morrison Orchard Precinct.

It cannot be known at this stage what the relative proportions of accommodation and commercial activity would be developed in this precinct, and so the overall directionality would be a weighted average of the directionalities of the two categories of activity. For the purposes of this assessment, it is assumed that a higher proportion of peak hour traffic related to the Morrison Precinct would be non-residential traffic, and a directionality of 50% in and 50% out has been used for both peak periods.

It can be assumed that the distribution of precinct vehicle trips in each peak period would be similar to the 2028 SGA Saturn Model percentages of Warkworth South traffic travelling to or from areas north and south of the Plan Change Area, as tabulated in

Table 5. The through movement volumes on SH1 for the AM peak are taken from **Figure 26** and for the PM peak from **Figure 27**. The 2028 peak hour turning movement volumes at the Morrison Precinct access calculated on this basis are shown in **Figure 32**.

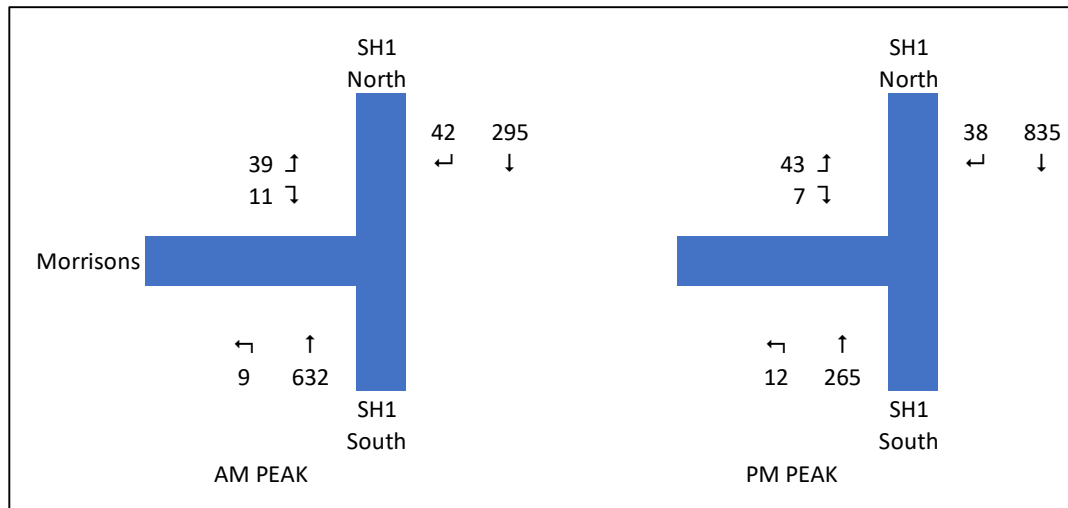


Figure 32: Morrisons Precinct Access Peak Hour Turning Volumes

The percentage of heavy traffic on the exiting SH1 are based on the percentages forecast in the 2028 SGA Saturn model, as shown in **Table 9**.

A schematic layout for the Morrisons access on SH1 is shown in **Figure 33**.

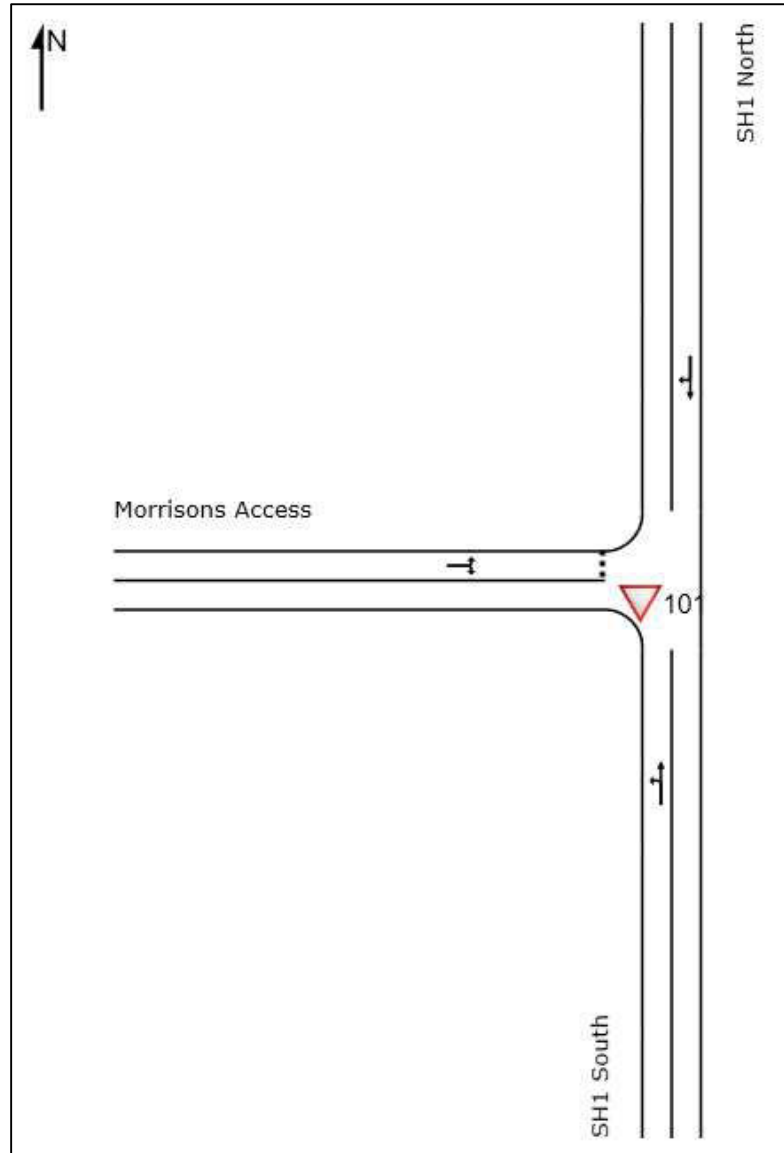


Figure 33: Schematic Layout of Morrisons Access

The SIDRA modelled performance of this traffic signal layout in the 2028 AM and PM peak hours are summarised in **Table 14** and **Table 15**.

Table 14: SIDRA Results – Morrisons Access – 2028 AM Peak Hour

Vehicle Movement Performance										
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE	
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m
South: SH1 South										
1	L2	9	8.8	9	8.8	0.366	4.8	LOS A	0.0	0.0
2	T1	632	8.8	665	8.8	0.366	0.1	LOS A	0.0	0.0
Approach		641	8.8	675	8.8	0.366	0.2	NA	0.0	0.0
North: SH1 North										
8	T1	295	7.2	311	7.2	0.226	1.2	LOS A	0.7	5.6
9	R2	42	7.2	44	7.2	0.226	9.3	LOS A	0.7	5.6
Approach		337	7.2	355	7.2	0.226	2.2	NA	0.7	5.6
West: Morrisons Access										
10	L2	39	8.8	41	8.8	0.092	8.3	LOS A	0.3	2.3
12	R2	11	7.2	12	7.2	0.092	13.5	LOS B	0.3	2.3
Approach		50	8.4	53	8.4	0.092	9.5	LOS A	0.3	2.3
All Vehicles		1028	8.3	1082	8.3	0.366	1.3	NA	0.7	5.6

In the 2028 weekday AM peak hour, the Morrisons access will operate well within its capacity with a maximum degree of saturation of 0.366. The average delay to traffic southbound on SH1 will be 2.2 seconds and 0.2 seconds northbound on SH1. The level of service (LOS) for the right turn out of the Morrisons Access will be B (average delay 13.5 seconds) and there will be a LOS A for all other movements.

Table 15: SIDRA Results – Morrisons Access – 2028 PM Peak Hour

Vehicle Movement Performance										
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE	
		[Total veh/h	HV] %	[Total veh/h	HV] %				[Veh. veh	Dist] m
South: SH1 South										
1	L2	12	5.2	13	5.2	0.155	4.6	LOS A	0.0	0.0
2	T1	265	5.2	279	5.2	0.155	0.0	LOS A	0.0	0.0
Approach		277	5.2	292	5.2	0.155	0.2	NA	0.0	0.0
North: SH1 North										
8	T1	835	10.1	879	10.1	0.513	0.2	LOS A	0.8	6.0
9	R2	38	10.1	40	10.1	0.513	7.0	LOS A	0.8	6.0
Approach		873	10.1	919	10.1	0.513	0.5	NA	0.8	6.0
West: Morrisons Access										
10	L2	43	5.2	45	5.2	0.071	5.6	LOS A	0.2	1.8
12	R2	7	10.1	7	10.1	0.071	20.0	LOS C	0.2	1.8
Approach		50	5.9	53	5.9	0.071	7.6	LOS A	0.2	1.8
All Vehicles		1200	8.8	1263	8.8	0.513	0.7	NA	0.8	6.0

In the 2028 weekday PM peak hour, the Morrisons access will also operate well within its capacity, with a maximum degree of saturation of 0.513. The average delay to traffic southbound on SH1 will be 0.5 seconds and 0.2 seconds northbound on SH1. The right turn out of the Morrisons Access will have LOS C (average delay 20.0 seconds) and there will be a LOS A for all other movements.

The Morrisons access would therefore provide an acceptable level of vehicle access for the Proposed Plan Change.

7.6 Ultimate Peak Hour Performance of Road Network

The Warkworth Structure Plan Integrated Transport Assessment has demonstrated that in 2048, the transport infrastructure anticipated in the Structure Plan will accommodate the traffic that would be generated by the ultimate buildout of land development.

As discussed in Section 3.3, the increase in traffic produced by the increase in households in the Plan Change area anticipated by the Plan Change compared to the Structure Plan is offset by the increase in local traffic attracted to the larger local centre anticipated by the Plan Change, such that the effect of the Proposed Plan Change on peak hour traffic volumes is neutral both in terms of total traffic entering SH1 intersections within the Plan Change area and on traffic beyond the Plan Change area.

This being the case, and all being equal, the Proposed Plan change will have no effect on the ability of the transport infrastructure anticipated in the Structure Plan to accommodate the traffic that would be generated by the ultimate buildout of land development in Warkworth in 2048.

7.7 Road Safety

7.7.1 Safety for Pedestrians and Cyclists

The most critical road safety concern for any development is the safety of vulnerable road users (pedestrians and cyclists) when they come into conflict with motor vehicle traffic.

The proposed Plan Change adopts the principles of safe walking and cycling facilities set out in the Warkworth Structure Plan. In general:

- all new and existing arterial roads are proposed to have footpaths on both sides of the road and separated cycle facilities;
- all new collector roads are proposed to have footpaths on both sides of the road and separated cycle facilities;
- new residential and business development will be encouraged to be 'rear-loaded', where access occurs from rear lanes or consolidated accessways, to enable separated facilities to be provided with minimal vehicle crossings;
- the design of any intersection with the Wider Western Link Road or SH1 will be assessed by the extent to which it is supported by a transport assessment and safety audit, demonstrating the intersection will provide a safe, efficient and effective connection to

service the expected subdivision and development, including safe and convenient provision for pedestrians and cyclists; and

- walking and cycling facilities are proposed to be provided 'off-road' along the riparian margins to avoid the need to encounter vehicle traffic at all. These routes will serve both a commuter and recreational function.

The Warkworth South development would include bus stops (and ultimately a bus terminal) and a local centre on the western side of SH1, which would serve the approximately 691 households on the eastern side of SH1 as well as 742 residential lots and 173 apartments on the western side.

A significant volume of pedestrians and cyclists can therefore be expected to wish to cross SH1 at the proposed Wider Western Link Road/SH1 intersection, and it is critical that the intersection include safe crossing provisions for pedestrians and cyclists. Such crossing facilities can readily be provided at a signalised intersection by inclusion of pedestrian and cyclist crossing phases. At roundabouts, crossing facilities should be provided on raised tables. To maximise the safety of pedestrian and cyclist crossings, they must be sufficiently in advance of the roundabout so that as motorists approach, they first look for and give way to pedestrians and cyclists, and then shift their attention to any traffic circulating on the roundabout that they need to give way to. Similarly, crossings must be sufficiently set back from the roundabout departures so that motorists have sufficient time to shift their attention from negotiating the roundabout to look ahead and stop for any pedestrians and cyclists crossing on the roundabout departure.

Roundabouts can be difficult and potentially hazardous for cyclists to negotiate, and it is thus also important to provide off-road cycle paths to enable less confident cyclists to drive around, and not through, the roundabout.

Provided such appropriate design considerations are satisfied, the cross junction at the Wider Western Link Road/SH1 intersection could safely accommodate pedestrians and cyclists with either roundabout or traffic signal control.

7.7.2 Safety for Motorists

It is expected that in general motorist safety will be addressed by the road changes that can be expected under the Auckland Transport Roads and Streets Framework, the Council's underlying development controls for access and parking provisions, and by the AUP controls relating to development on arterial roads, that will apply regardless of the proposed Plan Change.

Nevertheless, as discussed in Section 2.5, high approaching speeds and the absence of any preceding intersections requiring northbound vehicles to stop, are the key factors contributing to the higher rate of rear end crashes on SH1 within the vicinity of the Plan Change Area. Recommended mitigation measures include:

- The introduction of a lower speed limit on SH1, recognising the shift of transport environment from the current rural state highway to the future urban arterial road; and
- Goods sight lines to intersections from each approaching direction that meet relevant design standards.

It is proposed that a key to changing the expectations of drivers northbound on SH1 will be the provision of an appropriate rural/urban threshold. An indicative threshold layout is shown in **Figure 34**.

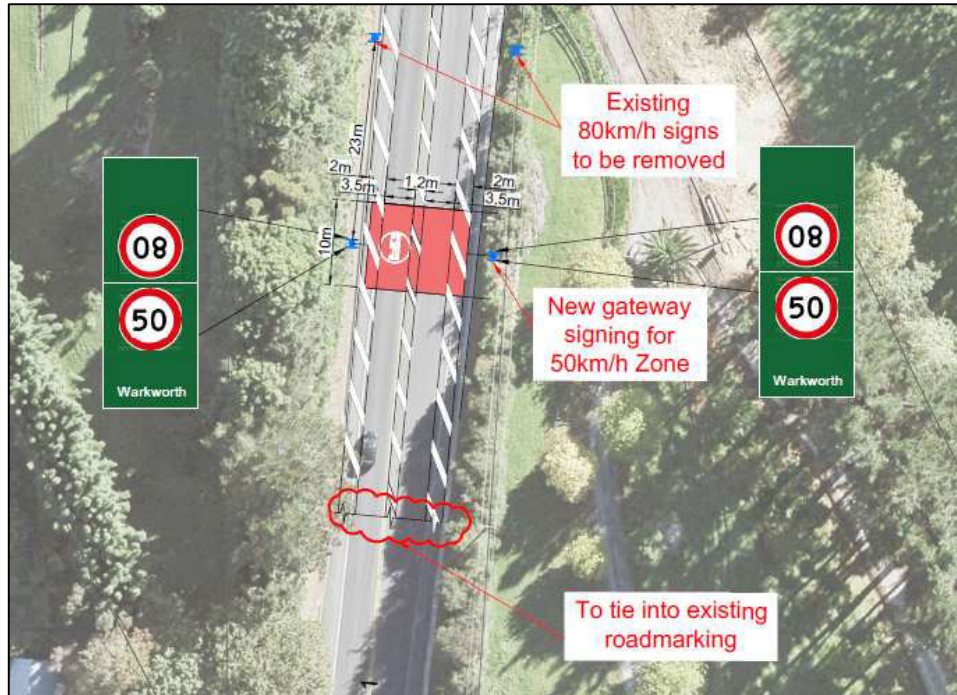


Figure 34: Indicative SH1 Urban Threshold

It is recommended that such a threshold be included in the Warkworth South precinct provisions, so that any road safety effects of the proposal can be adequately mitigated.

At the Wider Western Link Road, a roundabout of suitable size would provide more effective speed management and could be expected to have fewer serious injury crashes for motorists compared to traffic signals. However, the safety of a signalised intersection could be improved by the crossing facilities provided on raised tables on the approaches, as described previously.

As discussed in Section 5.2, the proposed precinct provisions would require an assessment to be undertaken to confirm if any upgrading of the Valerie Close/SH1 intersection is required as soon as any development occurs that might increase traffic on Valerie Close. That assessment would be required to assess the safety of the intersection.

Overall, it is considered that the proposed Masterplan and precinct provisions, in conjunction with the Auckland Transport Roads and Streets Framework, the Council's underlying development controls for access and parking provisions, and by the AUP controls relating to development on arterial roads, will adequately address the motor vehicle safety effects of the Plan Change.

8.0 AUCKLAND UNITARY PLAN CONSIDERATIONS

While the documentation within the application considers the proposed Plan Change against all relevant policies and objectives of the AUP, we have focused our assessment on the objectives and policies most relevant to transport, especially those in Sections B3 (Infrastructure, transport and energy) and E27 (Transport).

8.1 B3 (Infrastructure, Transport and Energy)

The relevant Auckland-wide transport objectives and policies in the AUP are set out below and comments are provided as to how the proposal aligns with each:

The key issue for this plan change is B3.1(2) integrating the provision of infrastructure with urban growth. As explained in more detail below in Section 8.2, the Plan Change Area will be well served with transport infrastructure and integrates well with local road, pedestrian and cycle connections and the more intensive development will be within a walkable catchment of the bus stops and future bus interchange.

The transport aspects of the plan change are consistent with the objectives and policies of Section B3.3 Transport, in that:

- There is good supporting infrastructure for people and the goods they need;
- A suitably high density of zoning has been chosen which is appropriate for the convenient links to public transport;
- The proposed transport linkages do not create amenity or any safety issues of concern that cannot be mitigated, and a range of transport choices are enabled; and
- No major transport upgrades are required beyond the Plan Change Area as part of this plan change, though small localised upgrades may be appropriate as part of the design and assessment at a resource consent stage.

8.2 Section E27 – Transport

The relevant Auckland-wide transport objectives and policies in the AUP are set out below and comments are provided as to how the proposal aligns with each:

E27.2 Objectives

- (1) *Land use and all modes of transport are integrated in a manner that enables:*
- (a) *the benefits of an integrated transport network to be realised; and*
 - (b) *the adverse effects of traffic generation on the transport network to be managed.*

As demonstrated in this report, the Plan Change Area will be well served by roading, bus, and cycling infrastructure in the future, and thus the proposal is integrated with all modes of transport and enables the benefits of the integrated transport network at this location to be further utilised.

With appropriate traffic management on SH1, the motor vehicle traffic effects of the proposal are expected to be negligible. The impacts of the proposal on the public transport, walking and cycling network are expected to be positive.

- (2) *An integrated transport network including public transport, walking, cycling, private vehicles and freight, is provided for.*

As demonstrated in this report, the Plan Change Area is well served by an integrated transport network of roading, bus, walking and cycling infrastructure.

E27.3 Policies

- (1) *Require subdivision, use and development which:*
- (a) *generate trips resulting in potentially more than minor adverse effects on the safe, efficient and effective operation of the transport network;*
to manage adverse effects on and integrate with the transport network by measures such as travel planning, providing alternatives to private vehicle trips, staging development or undertaking improvements to the local transport network.

The proposed Plan Change could be expected to generate some 1,311 vehicle movements in peak hours. This transport assessment has demonstrated that this increase in vehicle movements would be served by a new cross junction on SH1, with either roundabout or traffic signal control providing an acceptable level of service.

Standard E27.6.1 of the AUP requires resource consent for any land use or subdivision that generates more than 100 vehicles per hour in any hour, or accommodates more than 100 lots. Assessment of any effects on the road network, including the effects of the location and design of any intersections on the safe and efficient operation of the adjacent transport network, is required. However Standard E27.6.1 excludes from this requirement any development in a Terrace Housing and Apartment Building zone, or development being undertaken in accordance with 'provisions approved on the basis of an Integrated Transport Assessment where the land use and the associated trip generation and transport effects are the same or similar in character, intensity and scale to those identified in the previous assessment.'

There are no changes proposed to the current AUP controls and standards that relate to the effects of development on the safe, efficient, and effective operation of the transport network, and these standards would apply as development occurs.

Thus, the effects of motor vehicle traffic generated by any future development in the Plan Change Area not in accordance with the proposed precinct provisions as assessed in this transport assessment report will need to be assessed and addressed at the resource consent stage. Under the proposed precinct provisions, this would include any development in the Morrison's Heritage Orchard that 'either singularly or collectively exceed a trip generation threshold of 100 vph (any hour', or any development that increases traffic on Valerie Close.

As stated above, this requirement excludes any development in a Terrace Housing and Apartment Building zone, however any risk of the Terrace Housing and Apartment Building zone yield exceeds what has been assessed in this transport assessment the same risk that was accepted by the SGA in developing and assessing the SGA structure plan, and so is considered to be acceptable.

On this basis, with appropriate traffic management on SH1, the effects of the proposal on the efficient and effective operation of the road transport network are expected to be negligible. As discussed above, the impacts of the proposal on the efficient and effective operation of the public transport, walking and cycling network are expected to be positive.

8.3 Section E27 – Transport Standards

Section E27.6 sets out the transport related standards for development. These standards are considered suitable to be applied to activities and any future development of the Plan Change Area.

Compliance with these standards would be assessed as part of any future resource consent application.

8.4 Section E27 – Assessment Criteria

These assessment criteria will need to be considered at the time of a future resource consent application. Notwithstanding that, this report demonstrates that, with appropriate traffic management on SH1, access to the Plan Change Area can be provided safely and efficiently from the wider road network.

8.5 Section E38 – Urban Subdivision Transport Standards

Section E38 Standards sets out the subdivision related standards for development. These standards are considered suitable to be applied to activities and any future development of the Plan Change Area.

Compliance with these standards would be assessed as part of any future resource consent application.

8.6 Section E38 – Urban Subdivision Assessment Criteria

These assessment criteria will need to be considered at the time of a future resource consent application and are also considered appropriate for future development of the Plan Change Area.

9.0 INTEGRATION WITH FUTURE TRANSPORT NETWORK

The following section considers the various regional plans and considers that the proposal is consistent with them. The following is noted in this regard:

9.1 Auckland Plan 2050

The Auckland Plan 2050 is the Council's long-term spatial plan to ensure Auckland grows in a way that will meet the opportunities and challenges of the future. It was originally released in 2012 and has subsequently updated in 2018. The Auckland Plan 2050 describes Auckland in general terms, outlines the major challenges that we face, and sets the direction for tackling these challenges.

Warkworth South is identified as a location where new dwellings can be provided in a future urban zone.

- The Plan Change Area's improved connectivity to other modes such as public transport, walking, and cycling are identified and will provide choice of travel mode and a higher level of accessibility for the Plan Change Area;
- Short term strategies for managing network demands and improving safety, such as introducing smart technologies or improving efficiency of intersections, will continue to be implemented while new roading infrastructure is developed in the medium to long term; and
- A new road network will also be investigated in the wider Warkworth area when the area begins to develop, providing more local road options for travel.

9.2 Auckland Regional Land Transport Plan 2021-2031

The Auckland Regional Land Transport Plan 2021-2031 sets out the land transport objectives, policies, and measures for the Auckland region over the next 10 years. It includes the land transport activities of Auckland Transport, Auckland Council, Waka Kotahi NZ Transport Agency, KiwiRail, and other agencies.

The Plan sets out the direction for the region's transport systems. It identifies what is needed to achieve an affordable, integrated, safe, responsive, and sustainable land transport system that can cope with population growth and the changing economic environment. The provision of intensified residential housing in Warkworth will promote walking and cycling to nearby activities, thus removing some vehicles making short trips from the network.

9.3 Auckland Regional Public Transport Plan 2018

The Auckland Regional Public Transport Plan 2018 seeks to deliver an improved public transport network in Auckland by increasing public transport frequency along key transport corridors. Future public transport services are anticipated, and the Plan Change Area is considered well located to support further growth in public transport use.

10.0 CONCLUSIONS

The following conclusions can be made in respect of the proposal to rezone the Plan Change Area to residential zones plus a local centre with the balance to be zoned open spaces and rural:

- The potential residential development and local centre for the Plan Change Area is feasible from a transportation perspective and has been anticipated in the future planning for Warkworth in the Warkworth Structure Plan and other strategic plans;
- Based on current mode shares, the 2028 peak hour trip generation of the proposal is estimated to be 1,311 motor vehicle movements, 146 walking movements, 8 cycle movements and 3 public transport movements;
- With appropriate traffic management on SH1, the estimated trips generated by the proposal can be accommodated on the adjacent transport network while maintaining acceptable levels of safety and performance;
- The Plan Change Area will have a high level of accessibility to public transportation, walking, and cycling and the effects of private car travel from the development area will likely be reduced; and
- Any development enabled by the proposed plan change is consistent with and encourages key regional and district transport policies.

The provision of the following transport elements are included within the precinct provisions to enable any future development to be designed to adequately cater for all travel modes and to mitigate the traffic impact on the wider transport network:

- a) Creation of footpaths along both sides of the new street alignments that meet Auckland Transport standards;
- b) Connection of new footpaths with the existing public footpath network outside the Plan Change Area, with new and upgraded pedestrian infrastructure along the frontages on SH1 and Valerie Close;
- c) The design of any intersection with the Wider Western Link Road or SH1 will be assessed by the extent to which it is supported by a transport assessment and safety audit, demonstrating the intersection will provide a safe, efficient and effective connection to service the expected subdivision and development, including safe and convenient provision for pedestrians and cyclists;
- d) Regular and safe crossing opportunities on the arterial roads where pedestrian desire lines are evident;
- e) Separated, protected, or off-street cycle facilities on arterial and collector roads;
- f) A public transport interchange to be accommodated adjacent to the proposed Local Centre zone to enhance the accessibility to the public transport to help accommodate the anticipated demands associated with growth in Warkworth South and other areas;
- g) Measures such as a lower speed limit, a speed threshold and advanced road markings and signage on SH1 to slow northbound traffic; and

- h) Allowance for a crossroad intersection on State Highway 1 at the Wider Western Link Road and Collector Road in the “Waimanawa Hills” area with either traffic signal or roundabout control.

Prepared by



Anatole Sergejew



Elemit Fu

APPENDIX 1 - ESTIMATION OF 2028 PEAK HOUR TRAFFIC VOLUMES

CURRENTLY IN 2028 SATURN MODEL - PC 40

CURRENTLY IN SATURN MODEL

Saturn Zone	Future Location	AM Peak Hour		PM Peak Hour	
		Productions	Attractions	Productions	Attractions
53	Matakana Link Road	49	78	95	61
66	West of Matakana Link Road - Industrial Zone	27	53	60	30
67	Matakana Link Road	16	9	13	23
68	Clayton Road	85	213	281	108
TOTAL Existing 2028 Saturn Model - PC 40 zones		177	352	448	222

(cars + trucks)

VOLUME IN SATURN MODEL THRU SH1 SOUTH (LINK 103-104)

AM Peak Hour		PM Peak Hour	
Productions	Attractions	Productions	Attractions
3	2	3	2
1	2	2	1
1	0	1	1
4	6	9	4
9	10	15	8

PC 40

Saturn Zone	Future Location
53	Matakana Link Road
66	West of Matakana Link Road - Industrial Zone
67	Matakana Link Road
68	Clayton Road
TOTAL for PC 40 zones	

GFA (m2)	Peak hour trip rate /100m2	Peak Hour Trips	Out -	
			AM	PM
206908	0.728	1506	25%	75%

Goatley

PC40

AM Peak Hour		PM Peak Hour	
Productions	Attractions	Productions	Attractions
390	151	173	338
377	1130	1130	377
165	90	96	146
0	0	0	0
932	1371	1399	861

PERCENTAGES IN SATURN MODEL THRU SH1 SOUTH (LINK 103-104)

5.1% 2.8% 3.3% 3.6%

VOL PC40 THRU SH1 SOUTH (LINK 103-104)

47.4 38.9 46.8 31.0

VOL CHANGE

38.4 28.9 31.8 23.0

CURRENTLY IN 2028 SATURN MODEL - PC 25 ZONES

TOTAL CURRENTLY IN SATURN MODEL

Saturn Zone	Future Location	AM Peak Hour		PM Peak Hour	
		Productions	Attractions	Productions	Attractions
14	Sanderson Road	4	2	3	5
47	Western Collector North (was Lyttle Lane in base)	56	26	40	63
52	Falls Road North end South side	13	10	13	14
1505	South of SH1- Pak'nSave Hypermarket	2	3	4	2
1519	Western Collector Road- Industry Zone	4	10	11	5
1527	Western Collector Road- Residential Zone	8	5	7	12

VOLUME IN SATURN MODEL THRU SH1 SOUTH (LINK 103-104)

AM Peak Hour		PM Peak Hour	
Productions	Attractions	Productions	Attractions
0	0	0	0
2	2	2	2
0	0	1	1
0	0	0	0
0	0	0	0
0	0	0	0

TOTAL Existing 2028 Saturn Model - PC 25 zones **87** **51** **78** **102**
 (cars + trucks)

2 **2** **3** **3**

PC 25

Type	Dwellings/area	Peak hour trip rate	Peak Hour Trips	Out - AM	Out - PM
Residential single house	137	0.85	116	80%	20%
Residential suburban	653	0.65	424	80%	20%
Residential urban	560	0.65	364	80%	20%
Local centre	?	3.70	453	37%	63%
Business - mixed use	?	1.60	1,093	20%	80%
General Business	?	2.00	149	20%	80%
Light industry	?	1.16	162	25%	75%
Pak'nSave Hypermarket AM	4800	0.50	24	50%	50%
Pak'nSave Hypermarket PM	4800	12.00	576	50%	50%
Pak'nSave Large Format Retail AM	4800	0.50	24	50%	50%
Pak'nSave Large Format Retail PM	5000	4.00	200	50%	50%

PC25

AM Peak Hour		PM Peak Hour	
Productions	Attractions	Productions	Attractions
93	23	23	93
340	85	85	340
291	73	73	291
168	285	285	168
219	874	874	219
30	119	119	30
41	122	122	41
12	12		
12	12	288	288
		100	100

TOTAL for PC 25 zones **adjusted for 20% pass by trips** **1204** **1605** **1969** **1568**

PERCENTAGES IN SATURN MODEL THRU SH1 SOUTH (LINK 103-104) 2.3% 4.0% 3.8% 2.9%

VOL PC40 THRU SH1 SOUTH (LINK 103-104) 27.7 63.5 75.5 46.2

VOL CHANGE 25.7 61.5 72.5 43.2

2028 SATURN MODEL -

SOUTH OF LINK 103-104?

CURRENTLY IN SATURN MODEL

VOLUME IN SATURN MODEL FOR ZONES SOUTH OF LINK 103-104 THRU SH1 SOUTH (LINK 103-104)

VOLUME IN SATURN MODEL FOR ZONES NORTH OF LINK 103-104 THRU SH1 SOUTH (LINK 103-104)

Saturn Zone	Future Location		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
			Productions	Attractions	Productions	Attractions	Pro duc	Attractions	Productions	Attractions	Productions	Attractions	Productions	Attractions
4	Valerie Close	Y	2	2	2	3	0	0	0	0	0	0	0	
5	Campbell Drive	N	34	77	68	54					0	0	0	0
15	Toovey Road	Y	9	14	14	13	21	18	23	26				
16	Thompson Road	N	8	9	10	11					1	1	1	2
62	South west Future Urban	Y	0	0	0	0	0	0	0	0				
63	South east Future Urban	Y	0	0	0	0	0	0	0	0				
64	Spare	Y	0	0	0	0	0	0	0	0				
69	Warkworth Park and Ride	Y	0	212	116	0	6	214	121	7				
76	Spare	Y	0	0	0	0	0	0	0	0				
1507	Woodcocks Road Commercial	N	1	3	3	2					0	7	0	5
1508	Local Road Connecting Wood	N	1	1	1	1					1	0	2	1
1510	Local Road Connecting Wood	N	0	0	0	0					0	0	0	0
1511	Local Road Connecting Wood	N	5	2	3	6					0	0	0	0
1514	Wider Western Collector Road	Y	1	0	0	1	0	0	0	0				
1515	Wider Western Collector Road	Y	0	0	0	0	0	0	0	0				
1517	East of SH1 Local Road- Resid	Y	2	1	1	2	2	1	1	2				
1518	Southwest of Valeri Cl Road -	Y	5	2	3	6	0	0	0	0				
1520	Wider Western Collector Road	Y	3	1	2	3	0	0	0	0				
1521	Wider Western Collector Road	Y	3	1	2	3	0	0	0	0				
1523	South East Collector Road - R	Y	12	6	9	14	0	0	0	0	0	0	0	0
1524	Southwest of Woodcocks Road	N	2	1	1	2					1	0	0	1
1526	Woodcocks Road-Industrial Z	N	9	5	7	12					1	2	1	2
TOTAL	Existing 2028 Saturn Model - Warkworth Sc		96	334	244	134	29	233	145	35	4	8	4	11

(cars + trucks)

WARKWORTH SOUTH PPC

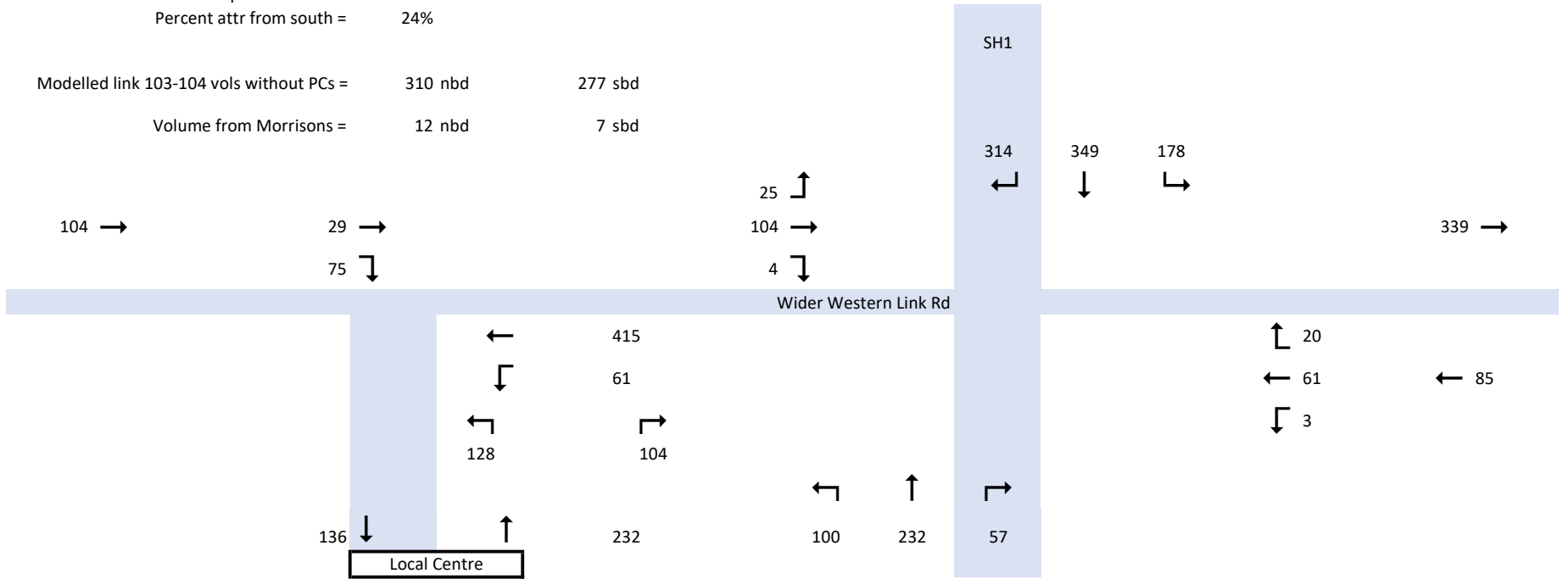
						AM Peak Hour		PM Peak Hour	
	Dwellings	Peak hour trip rate	Peak Hour Trips	Out - AM	Out - PM	Productions	Attractions	Productions	Attractions
EAST OF EXISTING SH1									
Terrace Housing and Apartments	183	0.50	92	80%	20%	73	18	18	73
Mixed housing urban	455	0.65	296	80%	20%	237	59	59	237
Residential single house	41	0.65	27	80%	20%	21	5	5	21
Large lot	12	0.85	10	80%	20%	8	2	2	8
Rural	0	0.85	0	80%	20%	0	0	0	0
			424			339	85	85	339
WEST OF EXISTING SH1									
Terrace Housing and Apartments & local centre	540	0.50	270	80%	20%	216	54	54	216
Mixed housing urban	352	0.65	229	80%	20%	183	46	46	183
Large lot	11	0.85	9	80%	20%	7	2	2	7
Mixed housing rural	12	0.85	10	80%	20%	8	2	2	8
Local centre commercial	9950	3.70	368	37%	63%	136	232	232	136
			887			551	336	336	551
TOTAL			1311			890	420	420	890

Main Means of Travel to Work	Percentage	
Drove a car or motorcycle	82.70%	1,311
Car passenger	6.40%	101
Bus	0.20%	3
Bicycle	0.50%	8
Walked or Jogged	9.20%	146
Other	0.90%	14
TOTAL	100%	1,585

2028 PM TURN VOLS AT SH1 INTERSECTION WITH WS PPC

Percent prod to south = 14%
 Percent attr from south = 24%

Modelled link 103-104 vols without PCs = 310 nbd 277 sbd
 Volume from Morrisons = 12 nbd 7 sbd

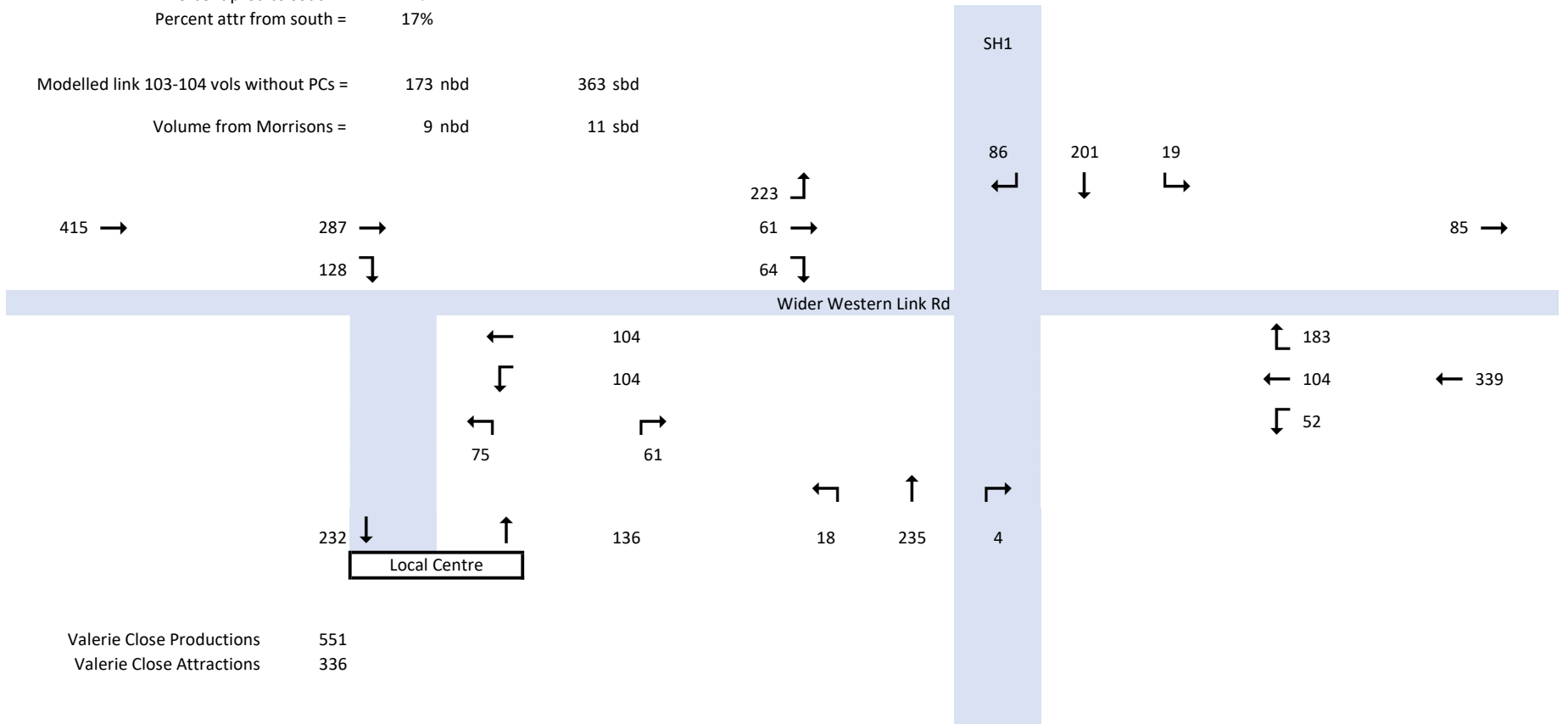


Valerie Close Productions 336
 Valerie Close Attractions 551

2028 AM TURN VOLS AT SH1 INTERSECTION WITH WS PPC

Percent prod to south = 22%
 Percent attr from south = 17%

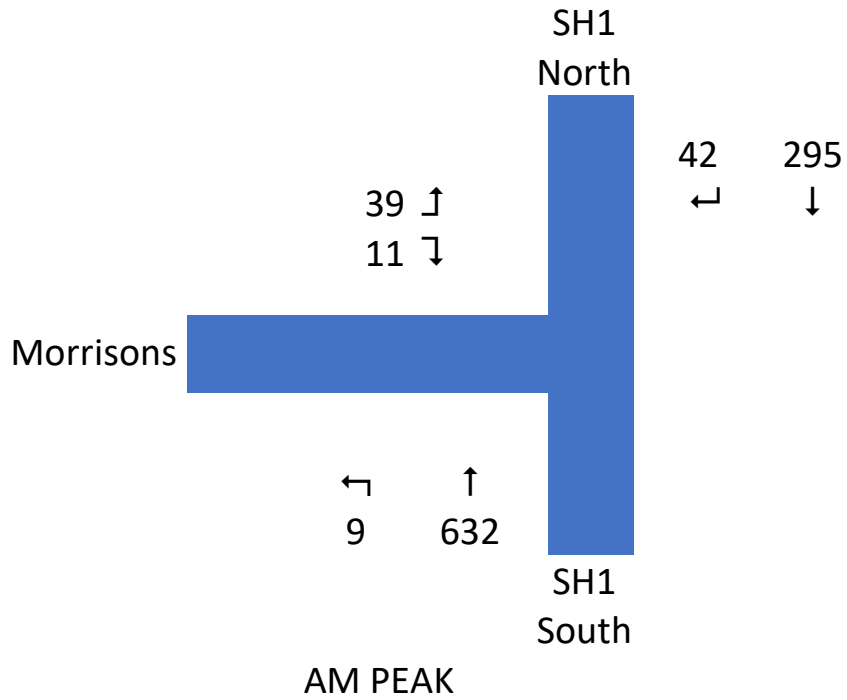
Modelled link 103-104 vols without PCs = 173 nbd 363 sbd
 Volume from Morrisons = 9 nbd 11 sbd



Valerie Close Productions 551
 Valerie Close Attractions 336

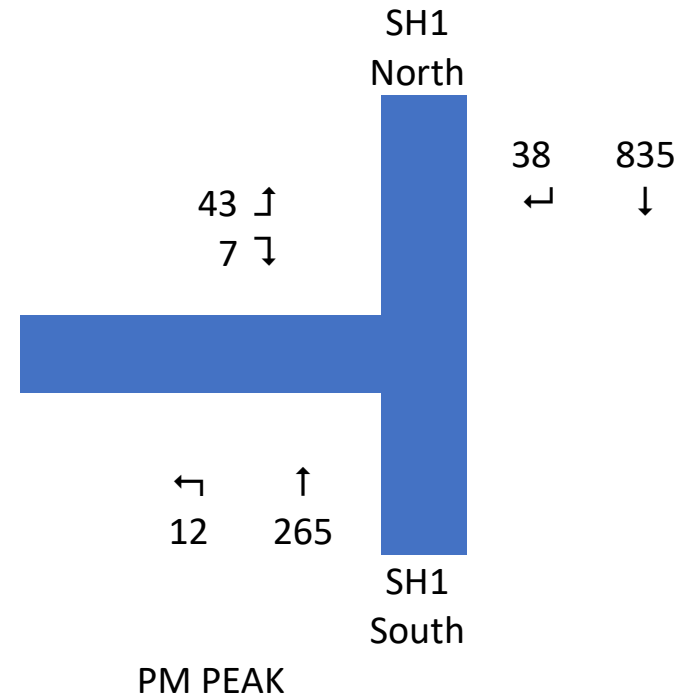
AM Peak SH1/Morrisons Peak Hour Volumes

	NBD	SBD
SH1 thru vols	632	295
Total Peak Hour Trip Generation of Morrisons	100 vph	
% in	50%	
%out	50%	
% productions to/from north	78%	
% productions to/from south	22%	
% attractions to/from north	83%	
% attractions to/from south	17%	



PM Peak SH1/Morrisons Peak Hour Volumes

	NBD	SBD
SH1 north of X junction	265	835
Total Peak Hour Trip Generation of Morrisons	100 vph	
% in	50%	
%out	50%	
% productions to/from north	86%	
% productions to/from south	14%	
% attractions to/from north	76%	
% attractions to/from south	24%	



APPENDIX 2 - PROPOSED CROSS JUNCTION 2028 PEAK HOUR PERFORMANCE

MOVEMENT SUMMARY

Site: 101v [2028 AM Peak with PC (1-lane) (Site Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] m				
South: SH1 - South														
1	L2	18	0.0	19	0.0	0.271	4.6	LOS A	1.9	14.1	0.65	0.54	0.65	46.6
2	T1	235	8.8	247	8.8	0.271	4.6	LOS A	1.9	14.1	0.65	0.54	0.65	48.0
3	R2	4	0.0	4	0.0	0.271	9.8	LOS A	1.9	14.1	0.65	0.54	0.65	48.6
Approach		257	8.0	271	8.0	0.271	4.7	LOS A	1.9	14.1	0.65	0.54	0.65	47.9
East: Warkworth South East														
4	L2	52	0.0	55	0.0	0.331	4.7	LOS A	2.4	16.5	0.64	0.65	0.64	45.6
5	T1	104	0.0	109	0.0	0.331	4.5	LOS A	2.4	16.5	0.64	0.65	0.64	46.9
6	R2	183	0.0	193	0.0	0.331	9.9	LOS A	2.4	16.5	0.64	0.65	0.64	47.5
Approach		339	0.0	357	0.0	0.331	7.4	LOS A	2.4	16.5	0.64	0.65	0.64	47.0
North: SH1 - North														
7	L2	19	0.0	20	0.0	0.246	3.0	LOS A	1.8	13.2	0.41	0.42	0.41	46.9
8	T1	201	7.2	212	7.2	0.246	2.9	LOS A	1.8	13.2	0.41	0.42	0.41	48.2
9	R2	86	0.0	91	0.0	0.246	8.2	LOS A	1.8	13.2	0.41	0.42	0.41	48.9
Approach		306	4.7	322	4.7	0.246	4.4	LOS A	1.8	13.2	0.41	0.42	0.41	48.3
West: Waimanawa West														
10	L2	223	0.0	235	0.0	0.363	5.3	LOS A	2.7	18.7	0.71	0.67	0.71	46.4
11	T1	61	0.0	64	0.0	0.363	5.1	LOS A	2.7	18.7	0.71	0.67	0.71	47.7
12	R2	64	0.0	67	0.0	0.363	10.5	LOS B	2.7	18.7	0.71	0.67	0.71	48.3
Approach		348	0.0	366	0.0	0.363	6.2	LOS A	2.7	18.7	0.71	0.67	0.71	46.9
All Vehicles		1250	2.8	1316	2.8	0.363	5.8	LOS A	2.7	18.7	0.61	0.58	0.61	47.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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\SIDRA Modelling\RC application\Warkworth South PPC v7.sip9

MOVEMENT SUMMARY

Site: 101v [2028 PM Peak with PC (1-lane) (Site Folder: General)]

New Site
 Site Category: (None)
 Roundabout

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn	Aver. Delay	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] m				
South: SH1 - South														
1	L2	100	0.0	105	0.0	0.411	5.1	LOS A	3.2	22.9	0.73	0.63	0.73	46.2
2	T1	232	5.2	244	5.2	0.411	5.1	LOS A	3.2	22.9	0.73	0.63	0.73	47.5
3	R2	57	0.0	60	0.0	0.411	10.3	LOS B	3.2	22.9	0.73	0.63	0.73	48.1
Approach		389	3.1	409	3.1	0.411	5.8	LOS A	3.2	22.9	0.73	0.63	0.73	47.2
East: Warkworth South East														
4	L2	3	0.0	3	0.0	0.121	6.7	LOS A	0.9	6.1	0.81	0.72	0.81	45.4
5	T1	61	0.0	64	0.0	0.121	6.5	LOS A	0.9	6.1	0.81	0.72	0.81	46.7
6	R2	20	0.0	21	0.0	0.121	11.9	LOS B	0.9	6.1	0.81	0.72	0.81	47.3
Approach		84	0.0	88	0.0	0.121	7.8	LOS A	0.9	6.1	0.81	0.72	0.81	46.8
North: SH1 - North														
7	L2	178	0.0	187	0.0	0.670	4.0	LOS A	7.5	54.4	0.68	0.54	0.68	45.9
8	T1	349	10.1	367	10.1	0.670	3.9	LOS A	7.5	54.4	0.68	0.54	0.68	47.2
9	R2	314	0.0	331	0.0	0.670	9.2	LOS A	7.5	54.4	0.68	0.54	0.68	47.9
Approach		841	4.2	885	4.2	0.670	5.9	LOS A	7.5	54.4	0.68	0.54	0.68	47.2
West: Waimanawa West														
10	L2	25	0.0	26	0.0	0.129	4.0	LOS A	0.9	6.0	0.56	0.46	0.56	46.9
11	T1	104	0.0	109	0.0	0.129	3.8	LOS A	0.9	6.0	0.56	0.46	0.56	48.3
12	R2	4	0.0	4	0.0	0.129	9.2	LOS A	0.9	6.0	0.56	0.46	0.56	49.0
Approach		133	0.0	140	0.0	0.129	4.0	LOS A	0.9	6.0	0.56	0.46	0.56	48.1
All Vehicles		1447	3.3	1523	3.3	0.670	5.8	LOS A	7.5	54.4	0.69	0.57	0.69	47.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

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.

Roundabout Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: 101 [2028 AM Peak with PC (RT-phases) (Site Folder: General)]

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h	HV %	[Total veh/h	HV %				[Veh. veh	Dist] m				
South: SH1 - South														
1	L2	18	0.0	19	0.0	0.207	29.9	LOS C	1.5	11.4	0.91	0.70	0.91	36.3
2	T1	235	8.8	247	8.8	* 0.756	29.6	LOS C	6.6	49.8	0.99	0.90	1.18	35.5
3	R2	4	0.0	4	0.0	0.023	31.9	LOS C	0.1	0.8	0.92	0.63	0.92	34.6
Approach		257	8.0	271	8.0	0.756	29.7	LOS C	6.6	49.8	0.98	0.88	1.16	35.5
East: Warkworth South East														
4	L2	52	0.0	55	0.0	0.428	28.2	LOS C	4.4	30.7	0.92	0.76	0.92	37.0
5	T1	104	0.0	109	0.0	0.428	23.6	LOS C	4.4	30.7	0.92	0.76	0.92	37.2
6	R2	183	0.0	193	0.0	* 0.737	34.3	LOS C	6.0	41.9	1.00	0.91	1.21	33.9
Approach		339	0.0	357	0.0	0.737	30.1	LOS C	6.0	41.9	0.96	0.84	1.08	35.3
North: SH1 - North														
7	L2	19	0.0	20	0.0	0.217	29.9	LOS C	1.6	11.9	0.91	0.71	0.91	36.3
8	T1	201	7.2	212	7.2	0.612	27.3	LOS C	5.0	37.5	0.97	0.80	1.02	36.3
9	R2	86	0.0	91	0.0	* 0.487	34.4	LOS C	2.7	19.0	0.99	0.76	0.99	33.8
Approach		306	4.7	322	4.7	0.612	29.4	LOS C	5.0	37.5	0.97	0.78	1.00	35.5
West: Waimanawa West														
10	L2	223	0.0	235	0.0	0.820	35.2	LOS D	9.8	68.3	1.00	1.00	1.31	33.9
11	T1	61	0.0	64	0.0	* 0.820	30.5	LOS C	9.8	68.3	1.00	1.00	1.31	34.1
12	R2	64	0.0	67	0.0	0.242	30.1	LOS C	1.8	12.8	0.92	0.74	0.92	35.2
Approach		348	0.0	366	0.0	0.820	33.4	LOS C	9.8	68.3	0.99	0.96	1.24	34.2
All Vehicles		1250	2.8	1316	2.8	0.820	30.8	LOS C	9.8	68.3	0.97	0.87	1.12	35.1

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.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
		ped/h	ped/h	sec	[Ped ped	Dist] m						
South: SH1 - South												
P1	Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	194.0	220.5	1.14
East: Warkworth South East												
P2	Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	188.9	213.9	1.13

North: SH1 - North												
P3 Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	194.0	220.5	1.14	
West: Waimanawa West												
P4 Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	188.9	213.9	1.13	
All Pedestrians	200	211	24.4	LOS C	0.1	0.1	0.90	0.90	191.4	217.2	1.13	

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.

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MOVEMENT SUMMARY

Site: 101 [2028 PM Peak with PC (RT-phases) (Site Folder: General)]

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES		DEMAND FLOWS		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE		Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
		[Total veh/h]	HV %	[Total veh/h]	HV %				[Veh. veh]	[Dist m]				
South: SH1 - South														
1	L2	100	0.0	105	0.0	0.227	30.6	LOS C	3.3	23.2	0.83	0.75	0.83	35.0
2	T1	232	5.2	244	5.2	0.518	28.5	LOS C	8.4	61.4	0.91	0.76	0.91	36.0
3	R2	57	0.0	60	0.0	0.144	31.7	LOS C	1.9	13.3	0.84	0.73	0.84	34.6
Approach		389	3.1	409	3.1	0.518	29.5	LOS C	8.4	61.4	0.88	0.75	0.88	35.5
East: Warkworth South East														
4	L2	3	0.0	3	0.0	0.231	37.9	LOS D	2.4	16.7	0.92	0.70	0.92	34.1
5	T1	61	0.0	64	0.0	0.231	33.3	LOS C	2.4	16.7	0.92	0.70	0.92	34.3
6	R2	20	0.0	21	0.0	* 0.151	44.2	LOS D	0.8	5.7	0.97	0.70	0.97	31.0
Approach		84	0.0	88	0.0	0.231	36.1	LOS D	2.4	16.7	0.93	0.70	0.93	33.5
North: SH1 - North														
7	L2	178	0.0	187	0.0	0.404	32.1	LOS C	6.2	43.6	0.88	0.79	0.88	34.5
8	T1	349	10.1	367	10.1	* 0.803	35.3	LOS D	15.0	114.3	1.00	0.98	1.17	33.7
9	R2	314	0.0	331	0.0	* 0.791	40.5	LOS D	13.5	94.3	1.00	0.93	1.17	32.0
Approach		841	4.2	885	4.2	0.803	36.5	LOS D	15.0	114.3	0.97	0.92	1.11	33.2
West: Waimanawa West														
10	L2	25	0.0	26	0.0	0.469	39.5	LOS D	5.0	35.3	0.96	0.77	0.96	33.4
11	T1	104	0.0	109	0.0	* 0.469	34.8	LOS C	5.0	35.3	0.96	0.77	0.96	33.6
12	R2	4	0.0	4	0.0	0.030	43.1	LOS D	0.2	1.1	0.95	0.63	0.95	31.3
Approach		133	0.0	140	0.0	0.469	36.0	LOS D	5.0	35.3	0.96	0.76	0.96	33.5
All Vehicles		1447	3.3	1523	3.3	0.803	34.6	LOS C	15.0	114.3	0.95	0.85	1.02	33.8

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.

Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Model: SIDRA Standard.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
						[Ped ped]	[Dist m]					
South: SH1 - South												
P1	Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	203.9	220.5	1.08
East: Warkworth South East												
P2	Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	198.8	213.9	1.08

North: SH1 - North												
P3 Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	203.9	220.5	1.08	
West: Waimanawa West												
P4 Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	198.8	213.9	1.08	
All Pedestrians	200	211	34.3	LOS D	0.1	0.1	0.93	0.93	201.4	217.2	1.08	

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.

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