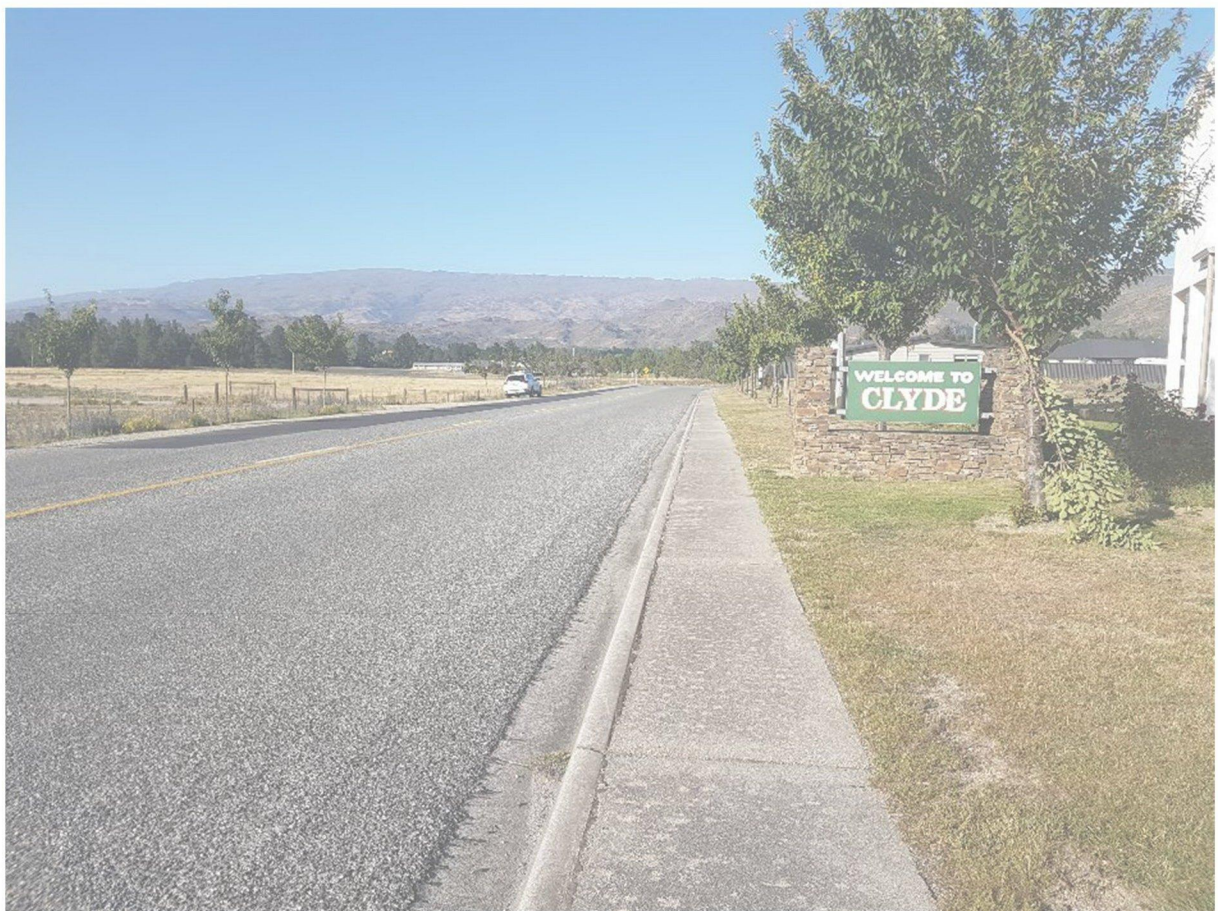


Project Number: 6-XZ581.00

Mutton Town Road

Integrated Transport Assessment

28 February 2020





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Disclaimers and Limitations

This report (**'Report'**) has been prepared by WSP exclusively for Clyde Claim Ltd and Houlahan Enterprises Ltd (**'Client'**) in relation to preparing an Integrated Transport Assessment for a proposed housing development in Clyde (**'Purpose'**) and in accordance with the ACENZ Short Form Agreement with the Client dated 29th November 2019. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

1 Introduction

This report documents an Integrated Transport Assessment undertaken for a proposed private plan change at Mutton Town Road in Clyde, Central Otago. The proposal is to rezone approximately 13ha of Rural Residential land to Residential Resource Area.

Included in the report is an assessment of existing conditions, relevant policies and plans, expected trip generation, positive and negative transport effects resulting from the development and potential mitigations against negative effects.

The process of developing the ITA is intended to align stakeholders, provide clarity on transport requirements for the developer and satisfy the Transport Agency that negative effects are suitably mitigatable, enabling them to support the developer's submission.

2 Existing Conditions

2.1 Site Location

The site is located as shown in Figure 1, adjacent to State Highway 8 connecting the nearest towns, Cromwell 25km to the north and Alexandra 7.5km to the south. The site is approximately 1.5km from the centre of Clyde, which has a small retail offering. Dunstan hospital, located just off Mutton Town Road, has a catchment that extends to Wanaka. Clyde Primary School is 1.5km from the proposed development and currently has a roll of approximately 150 students. Sports facilities in the town include lawn bowls and a golf club.

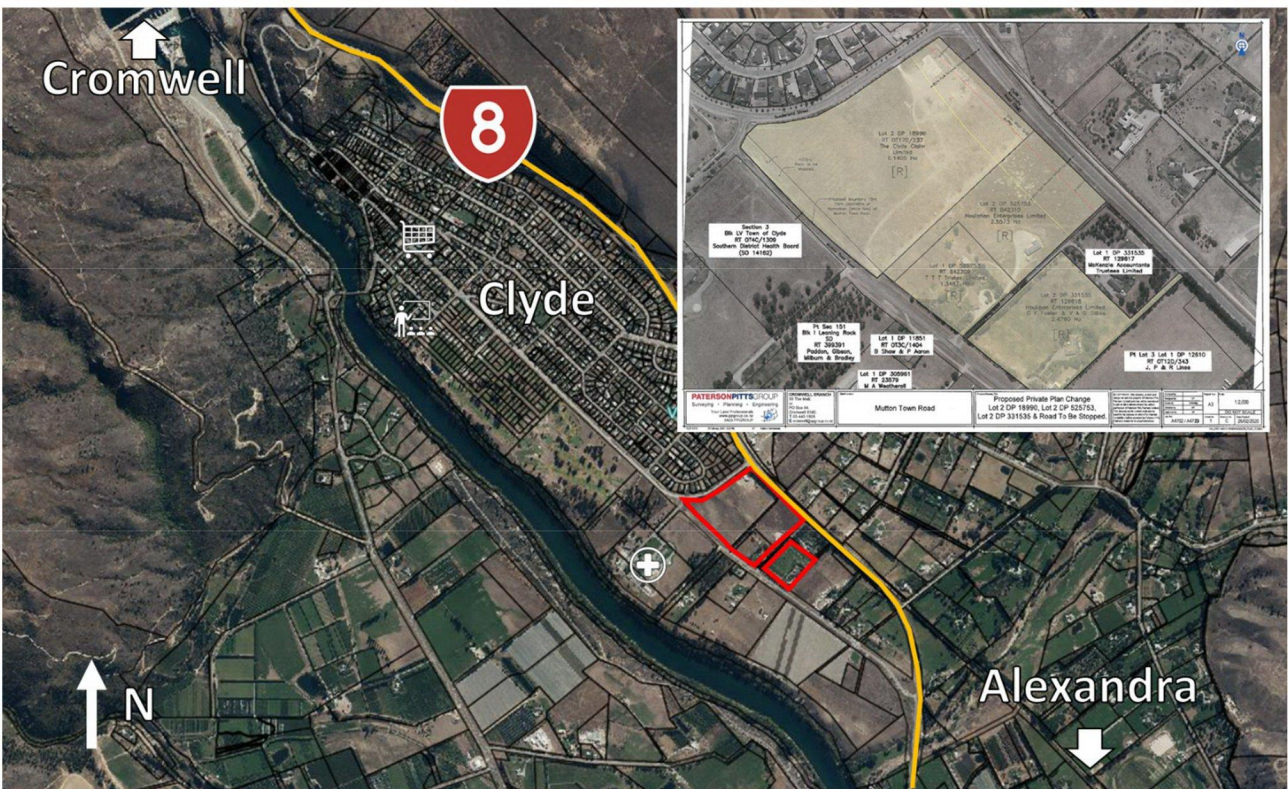


Figure 1 Proposed Development (red boundary) Site Location

2.2 Growth

The Otago region had one of the highest population growth rates in the country between the 2013 and 2018 censuses, largely driven by rapid growth in Queenstown Lakes District (Table 1). The population of Clyde itself grew by 16.2% in the same period, while Cromwell grew by 29.2% and Alexandra grew by 13.9%. By 2048, the population in Clyde and Alexandra is expected to have increased by 35% (Stats NZ).

Table 1 Population Growth in Surrounding Areas (Stats NZ Census 2018)

Otago Region	Queenstown Lakes District	Cromwell	Alexandra	Clyde
11.2%	38.7%	29.2%	13.9%	16.2%

The average age of Clyde residents has increased between the 2013 and 2018 censuses, with the number of people under 29 remaining constant at 264 and the number of people over 29 increasing by 165 to 900.

As demand for housing in Queenstown has increased, house prices there have increased by 77.9% between 2013 and 2018 (Queenstown Property Monthly Housing Statistics), and a larger proportion of the workforce now commute from further afield, including Cromwell and Wanaka. Queenstown commuters and families are increasingly likely to settle in Clyde, particularly as and when more affordable housing becomes available.

2.3 Road Network

The town of Clyde, including the proposed site, lies off State Highway 8. Access to the town is provided at Sunderland Street, Hazlett Street and the southern end of Mutton Town Road. This section describes the roads likely to be affected by development on Mutton Town Road.

2.3.1 State Highway 8

The State Highway runs along the north-eastern boundary of the site and provides the means for regional travel. The road is classified as an Arterial State Highway in the One Network Road Classification (ONRC).

The posted speed limit past the site is 100km/h, though the alignment is straight and an operating speed closer to 110km/h is assumed. A typical cross section of the road includes one 3.5m lane in each direction with 1.5m shoulders and no central median. Flush medians are provided at main intersections for right turns.

2.3.2 Sunderland Street

The road traverses the southern side of the town and connects with the western end of Mutton Town Road. It is classified as an Urban Arterial Road under the CODC District Plan and a Secondary Collector Local Road in the ONRC.

The posted speed limit is 70km/h from 210m west of SH8, where it changes to 100km/h, to 250m east of Dunstan Street, where it changes to 50km/h. The carriageway allows for wide lanes in both directions, between 4.0m and 5.5m, and a 1.5m wide footpath is provided on the northern side. There are no shoulders or central median.

2.3.3 Mutton Town Road

The road runs along the southern boundary of the development, from Hospital Street/Sunderland Street to SH8, and is proposed to provide access to the site. It currently provides access to 12 properties, mainly farms and associated buildings, and is classified as a Rural Local Road in the CODC District Plan and a Secondary Collector in the ONRC.

The posted speed limit is 100km/h, dropping to 70km/h 30m before the intersection with Hospital Street. The road has one 4.0m lane in each direction with no shoulders, central median or footpaths.

2.3.4 Mutton Town Road / Hospital Street and Mutton Town Road / Sunderland Street Intersections

The intersections are give-way controlled and less than 50m apart. The current low traffic volumes in the area are unlikely to cause queuing or stacking issues. One non-injury and two minor-injury and crashes have occurred at the intersection in the last 5 years, two caused by vehicles turning out and one caused by a vehicle turning in to Sunderland Street.

2.3.5 Sunderland Street / State Highway 8 Intersection

The give-way controlled intersection is likely to be the primary access point for traffic from the proposed development. It is one of three main access point for Clyde traffic and signposted as the turn-off for Dunstan hospital. The northern approach has a 50m right turn bay, the southern approach has a 40m channelised deceleration and left turn lane, and the Sunderland Street approach has a 30m acceleration lane northbound onto the highway. Visibility of the intersection from the highway is good, in excess of 300m in both directions.

A gap has been added to the fence directly opposite and across the road from Sunderland Street to provide access to the Otago Rail Trail. However, no formal crossing is provided and a truck was observed using their horn to alert a crossing jogger during a site visit.

2.3.6 Mutton Town Road / State Highway 8 Intersection

The intersection is located on SH8 at the southern end of a curve, where the profile of the land obscures visibility between approaching drivers and the intersection to approximately 190m. The intersection is stop-controlled and flares from 8.0m to 35.0m at the throat. There is a driveway to two properties approximately 30m north of the intersection.

No right turn bay is provided on the highway, which led to a fatal crash in 2018 whereby a vehicle queuing to turn into Mutton Town Road was rear-ended. Three similar crashes occurred at the nearby intersection with Young Lane in the last 5 years. An additional non-injury crash occurred in 2017 when a driver failed to stop at the intersection and crashed into the bank opposite.

2.4 Accessibility

According to the 2013 Census, the majority of travel in Clyde is by car, and the Mutton Town Road development is unlikely to be different. However, a proportion of trips will be made by active modes, particularly if the option exists and is designed appropriately. The local terrain and existing facilities make active modes an attractive transport option.

2.4.1 Cars

The proposed site is well connected for private vehicles, being located less than 1km from the state highway that provides quick and efficient to employment, shopping and education in Alexandra, Cromwell and Queenstown. Connectivity is also good to smaller activities in Clyde, such as the supermarket, primary school and golf club.

In the 2013 census, 88.9% of Clyde residents stated they travel to work by car, highlighting the importance of car travel to residents.

2.4.2 Public Transport

There is no public transport currently operating in Clyde except school buses. Given the small population, it is unlikely that any services will operate in the near future, even with the high growth rates currently occurring. Intercity bus tickets are available at around \$15 for a trip between Queenstown and Clyde.

2.4.3 Walking

Clyde town centre is approximately 2km from the proposed development, on the edge of a realistic walking catchment (approximately a 25-minute walk at an average walking speed). The 2013 census showed that 5% of Clyde residents said they walk to work.

Some walking facilities are available in the vicinity including a 1.5m wide footpath along the northern side of Sunderland Road. To access Mutton Town Road (and an existing footway on the north side of Hospital Street, pedestrians currently use a diagonal gravel track adjacent to Clyde Recreation Reserve, and cross Sunderland Street at an angle to reach the Sunderland Street footway within the 70km/h speed zone. The primary school is a 20-minute walk from the development, and there would be expected to be some generated walking trips for accompanied young children on this route.

No pedestrian footways are currently provided on Mutton Town Road.

2.4.4 Cycling

Clyde town centre is within an easy cycling distance of the proposed development. The town is increasingly becoming known as a cycling hub, with tourist numbers comparatively high for a town of its size. The development is likely to attract Airbnb-type accommodation for users of the cycle trails, people who will be unfamiliar with the local transport network looking for easy access to the Rail Trail. A crossing of SH8 is currently provided in the form of an underpass on Albert Drive, shown in Figure 2 (location is shown in Figure 1).

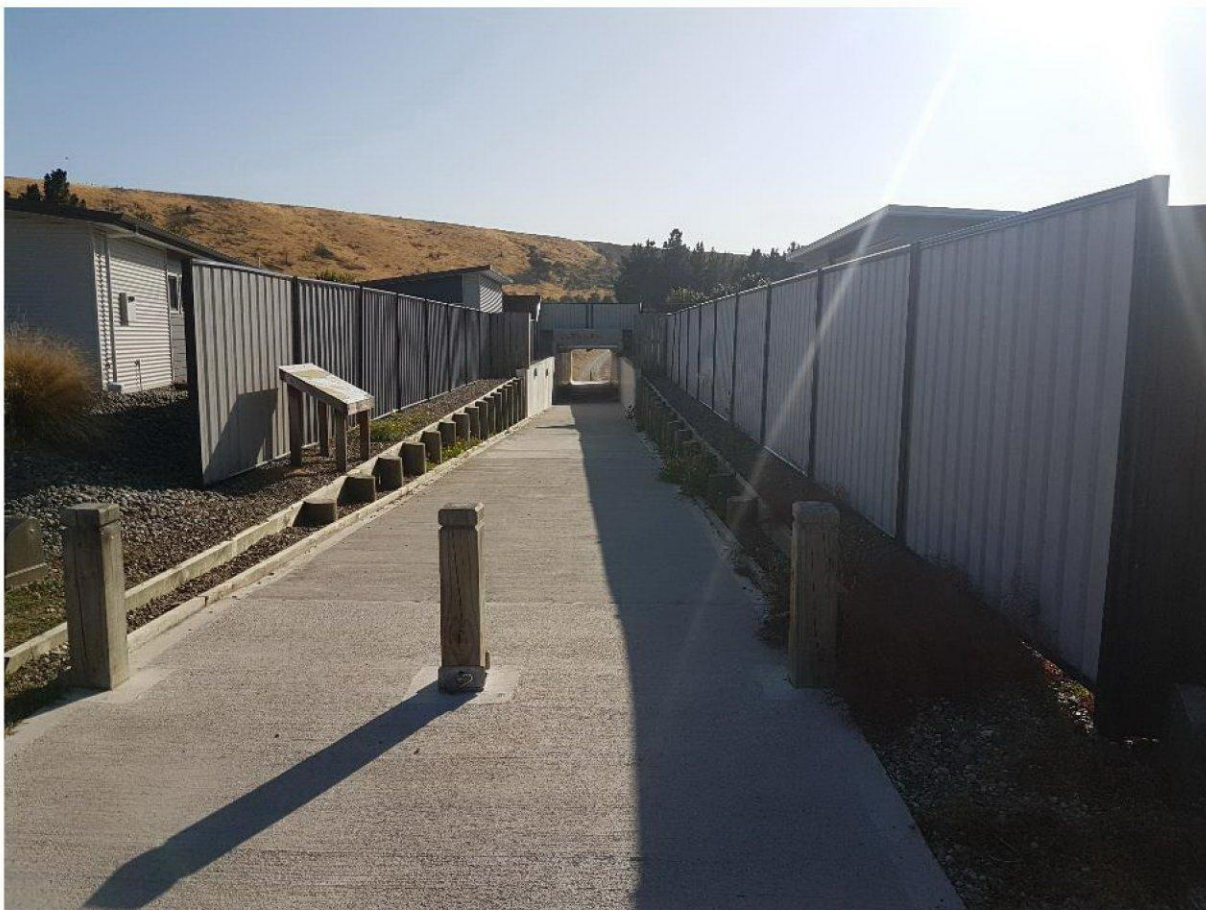


Figure 2 Albert Drive Active Mode Underpass

According to commuter census data, the majority of workers in Clyde commute to Alexandra. This is an easy 20-minute cycle on the Otago Rail Trail, an internationally-acclaimed cycling route. Dunstan High School is directly accessed by the trail, and may be attractive to students living in Clyde during warmer months, particularly those under driving age.

2.5 Traffic Volumes

A variety of data sources has been used to understand baseline traffic volumes in the vicinity of the site, including State Highway 8 and the Sunderland Street/SH8 intersection.

Waka Kotahi NZ Transport Agency's Traffic Monitoring System hosts hourly count records from stations on SH8 around Clyde, one in Cromwell Gorge to the north and one immediately before Alexandra to the south. Annual Average Daily Traffic at the sites are recorded as:

- Cromwell Gorge – 5,800
- Alexandra – 6,100

State highway traffic past the site is therefore likely to be approximately 6,000 vehicles per day.

Manual traffic counts were undertaken on 16th January 2020 at the Sunderland Street / SH8 intersection. Due to timeframe constraints, the counts occurred outside the bounds of a 'typical day'. Turning volumes have therefore been factored to represent average conditions using counts for January 2019 and the annual average from the Alexandra counting station in Waka Kotahi NZ Transport Agency's Traffic Monitoring System (TMS). Seasonality-adjusted counts are summarised in Figure 3.

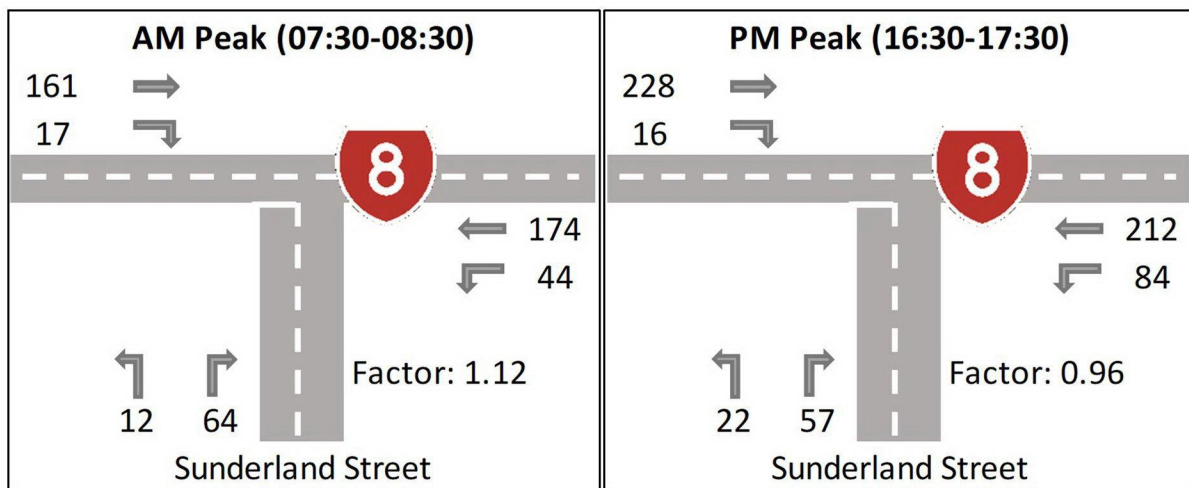


Figure 3 State Highway 8 / Sunderland Street Traffic Counts (2020, seasonality adjusted)

Based on information stored in Road Assessment and Maintenance Management (RAMM), Mutton Town Road has an Average Daily Traffic of approximately 330 vehicles and Sunderland Street approximately 1,050 vehicles.

Data from TMS shows a 10-year annual growth rate of 4.0% in Cromwell Gorge and 2.0% in Alexandra.

3 Policies and Plans

Although the Mutton Town Road development is comparatively minor, controlling authorities set out strategies to ensure development occurs in an appropriate manner that achieves long-term objectives. This section presents relevant parts of these plans and strategies.

3.1 Government Policy Statement on Land Transport

The 2018 GPS lays out strategic priorities and objectives for the Government's vision for the land transport system. The key priorities are:

- Safety – creating a safe system, free of death and serious injury. This includes an increase in funding for road safety and demand management. In practical terms this has led to NZ Transport Agency requiring a Safe Systems approach to transport design, including full protection for pedestrians at crossings and safer intersections such as roundabouts on high speed roads.
- Access – providing increased access to economic and social opportunities, enabling resilient transport choice. This builds on 'soft' transport planning themes in the strategy, including adopting mode-neutral planning in investment decisions and integrating land use with transport planning.

The NZ Transport Agency will require evidence that the increase in turning movements at intersections on SH8 caused by the proposed development will not result in an increased crash risk to satisfy the objective of creating a safe system.

3.2 Central Otago District Council 10-year Plan

Council have three Community Outcomes, a set of high level goals that frame what the Council aims to achieve:

- A Thriving Economy that is attractive to both businesses and residents alike
- A Sustainable Environment that provides a good quality of life. A community with a healthy balance between its natural and built environment
- A Safe & Healthy Community with a range of services and facilities, that values and celebrates its rich heritage

The plan acknowledges that infrastructure, particularly roading, has the potential to cause negative effects on the community and environment if not managed appropriately. Council's vision for roads and footpaths is *to ensure an efficient fully accessible, safe network*.

Also introduced in the plan is the Clyde Heritage Precinct Project, which seeks to address issues around parking demand, use of public spaces, increasing vehicle and cyclist volumes, road function and collaborative planning (Figure 4).



Figure 4 Clyde Heritage Precinct Project Plans

3.3 Central Otago District Council Activity Management Plan

A key focus of the activity management plan is the Otago Rail Trail, with planned improvements to local roads ensuring connecting infrastructure is safe and attractive to encourage maximum growth.

The plan also sets out minimum levels of service for residential streets, with a footpath required on one side of the road.

3.4 Otago Southland Regional Transport Plan

The plan sets out the vision of the 10 local authorities (plus NZTA) responsible for providing transport services and infrastructure in Otago and Southland. To achieve the intended long-term results, three factors are identified as being critical to success:

- Transport enables and supports economic activity and growth
- The transport system adequately meets social needs
- Transport helps to positively shape the future of Otago and Southland

Policies identified in the plan include:

- Minimising road trauma, which includes following the Safe System approach, focussing on vulnerable road users by allocating road space to walking and cycling, prioritising pedestrian safety and building separated cycleways/walkways in areas where active modes are at risk
- Ensuring community resilience by prompting a change in travel behaviour towards increased walking, cycling and public transport use and promoting multi-modal journeys
- Providing for mode choice including walking cycling and public transport to optimise existing systems
- Fostering integrated transport and land use planning by recognising how urban form and land use patterns influence the effectiveness and efficiency of transport and health

The plan recognises the vastly different demands for travel in the region while promoting the provision of cost-effective transport choices where possible, aligning land use planning with transport planning, all with an emphasis on safety for road users.

4 The Proposal

It is proposed to re-zone the site from Rural Resource Area to Residential Resource Area, consistent with zoning elsewhere in Clyde. There are anticipated to be 150 dwellings on the 13ha site, with lots ranging in size from 350m² to 650m².

A retirement village has also been proposed, though uncertainty remains about the form of the final proposal. No masterplan will be prepared for the proposal and there is no intention to deviate from the objectives, policies and rules of the District Plan.

The timing of development is intended to coincide with the commissioning of the Clyde reticulated wastewater scheme, currently earmarked for the 2020/2021 financial year.

Five access points are proposed, one on Sunderland Street and four on Mutton Town Road as indicated in Figure 5. It is recommended that the number of access points to the development be minimised to ensure consistency on the network and maintain the current movement function of Sunderland St and Mutton Town Road. Mitigations are provided in Section 7.

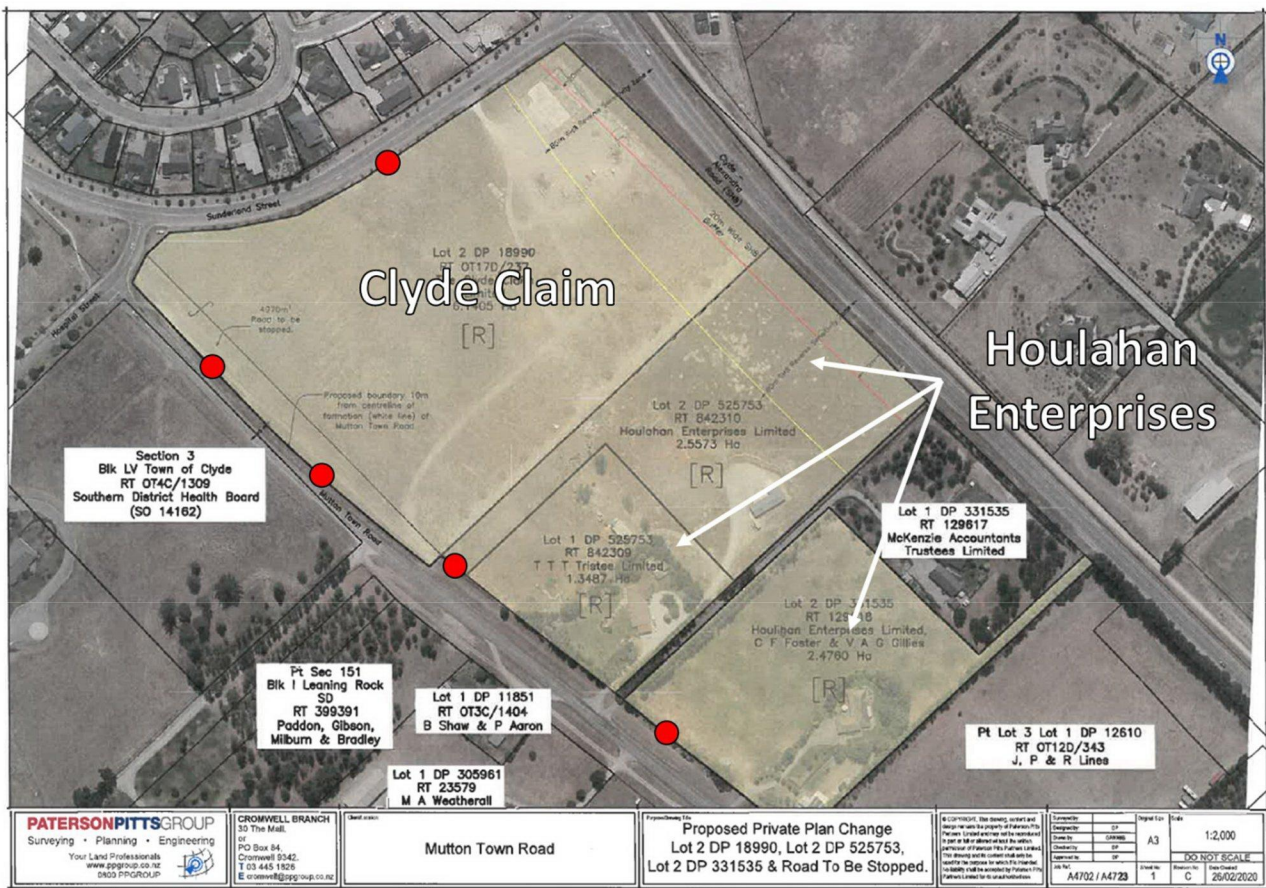


Figure 5 Proposed Mutton Town Road Plan Change Site

Plans are not currently available for the internal road network, which is therefore not assessed here. The design should complement the existing road hierarchy on the surrounding network, with collector roads providing movement through the site and local roads providing access to individual lots. This presents the opportunity to create variety and character through the development, with recognisable streetscapes reflecting the purpose of the road, in turn providing a clearly legible network with associated accessibility and safety benefits. Footpaths and cycle facilities should be included throughout the site to provide transport options to residents and ensure the safety of vulnerable road users.

5 Trip Generation

According to the 2013 census, car ownership per household is relatively high in Clyde (1.84) compared to the nationwide rate (1.63). While car ownership is not the sole factor in determining trip generation, houses with more cars available are likely to produce higher trip rates.

Waka Kotahi NZ Transport Agency research report 453 presents rates for relevant residential land use categories as shown in Table 2.

Table 2 Published Residential Trip Generation Rates

Category	15%ile Peak Hour	Average Peak Hour	85%ile Peak Hour
Dwelling (Outer Suburban)	5.4 per day	6.9 per day	0.9 per hour 8.2 per day
Dwelling (Rural)	0.9 per hour 6.9 per day	1.1 per hour 8.5 per day	1.4 per hour 10.1 per day

Surveys undertaken in 2017 at the Lake Hayes Estate and Shotover Country residential areas in Queenstown indicated trip generation rates of 0.74 trips/hh in the AM peak (74% outbound) and 0.77 trips/hh in the PM peak (61% inbound).

Given the rural nature of the site, absence of public transport and minimal employment in the immediate vicinity, an 85%ile Dwelling (Outer Suburban) rate of 0.9 trips per hour has been adopted for this assessment. For the anticipated 150 dwellings, this equates to 135 trips per peak hour and 1,230 trips per day (both directions). The inbound/outbound split is assumed to be consistent with those observed at residential areas in Queenstown.

Census data from 2013 (Table 3) shows that almost half of Clyde residents work in Alexandra, approximately a third work in Clyde itself and the remainder work in Cromwell and surrounding areas. Following the growth of the region since 2013, it is expected that a small proportion of residents now commute to Queenstown.

Table 3 Clyde Census Commuter Trip Distribution

Alexandra	Clyde	Cromwell	Dunstan
47%	31%	7%	15%

Assigning the trip generation with this distribution produces the expected traffic flows to and from the site shown in Figure 6.

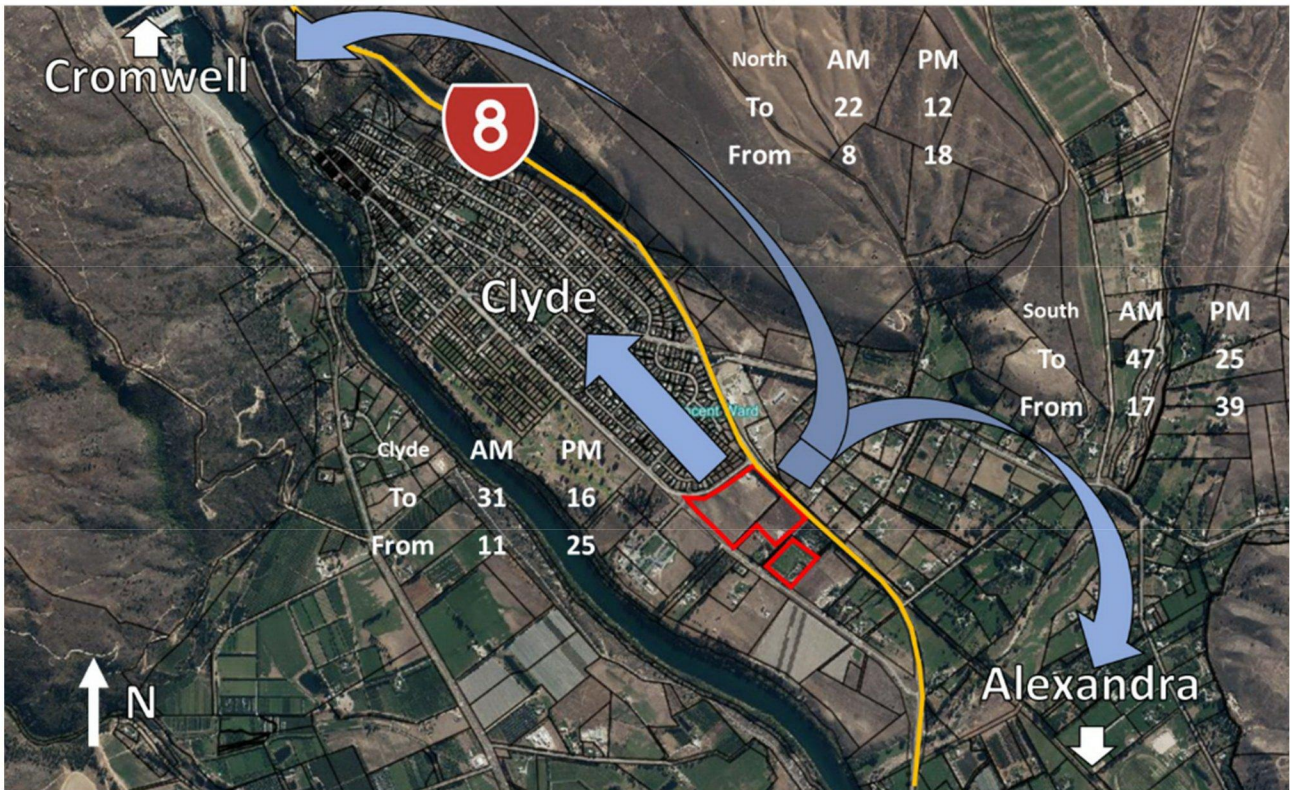


Figure 6 Calculated Trip Generation and Distribution

As expected, the census data also shows that the car is overwhelmingly the most used mode of transport for traveling to work for Clyde residents. The share for walking and cycling is marginally higher than the national average of 7.05% (combined) as shown in Table 4.

Table 4 Clyde Mode Share

Car	Walking	Cycling	Public Transport
89.5%	4.9%	5.6%	0.0%

6 Assessment of Transport Effects

This section provides evaluation of potential effects resulting from development of the site. To assess the likely impacts on the local road network, counted traffic volumes have been overlaid with expected trip generation rates and assignment from Section 5. Additional commentary is provided on opportunities relating to development of the site, including promotion of active modes through the Otago Rail Trail. Adopting a conservative approach, all calculations assume all development traffic uses the intersection being assessed.

6.1 Road Network Impacts

Although the increase in traffic on Sunderland Street represents an increase in peak hour volumes of 50%-70%, this is unlikely to have a significant effect on the road network, primarily due to low baseline volumes.

Combining the traffic counts in Figure 3 with the trip generation and assignment figures in Figure 6 produces the post-development traffic turning volumes at the SH8/Sunderland Street intersection shown in Figure 7. All southbound and northbound (i.e. everything but Clyde traffic) traffic generated by the site is assumed to use this intersection in this scenario.

Given the minimal remaining developable land accessed by Sunderland Street following the Mutton Town Road development, and assuming local housing density is unlikely to increase through infill, the values shown in Figure 7 represent expected long-term Sunderland Street volumes.

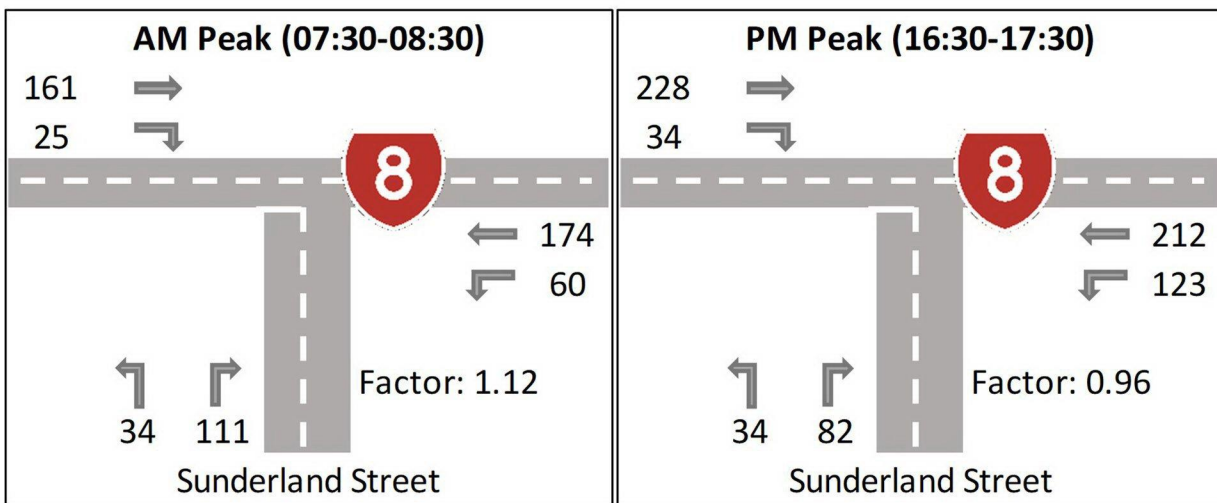


Figure 7 Post-development State Highway 8 / Sunderland Street Traffic Counts (2020)

To confirm the effect of traffic volume increases on the Sunderland Street intersection with State Highway 8, it was tested in SIDRA Intersection 8 traffic modelling software. Results shown in Table 5 indicate that there would be no discernible change to Level of Service (LOS), average delays or queueing as a result of traffic generated by the site. Sensitivity testing showed that there would be no discernible change in performance when accounting for traffic growth on SH8.

A roundabout option was tested and found to produce marginally higher total intersection delays than the existing layout. For the assessment, all development traffic was assumed to use the intersection tested. The colour of the arrows specifies Level of Service as per Figure 8.

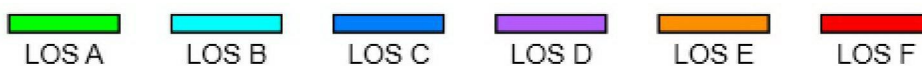


Figure 8 SIDRA Level of Service Legend

Table 5 SIDRA Modelling Results for SH8/Sunderland Street (seconds average delay and LOS)

	Existing	Post Development
AM Peak	<p>SH8 North: 8.1, LOS B SH8 South: 0.0, LOS A Sunderland Street (Left): 7.9, LOS B Sunderland Street (Right): 9.5, LOS C</p>	<p>SH8 North: 8.1, LOS B SH8 South: 0.0, LOS A Sunderland Street (Left): 8.0, LOS B Sunderland Street (Right): 9.9, LOS C</p>
PM Peak	<p>SH8 North: 8.2, LOS B SH8 South: 0.0, LOS A Sunderland Street (Left): 8.1, LOS B Sunderland Street (Right): 10.8, LOS D</p>	<p>SH8 North: 8.3, LOS B SH8 South: 0.0, LOS A Sunderland Street (Left): 8.1, LOS B Sunderland Street (Right): 11.4, LOS D</p>

6.2 Road Safety

A preliminary crash analysis was undertaken for the wider Clyde area using Waka Kotahi's Crash Analysis System. The resulting Collision Diagram is shown in Figure 9, which includes 18 crashes over the past 5 years. Locations of interest are the State Highway intersections with Sunderland Street (centred) and Mutton Town Road (bottom right).

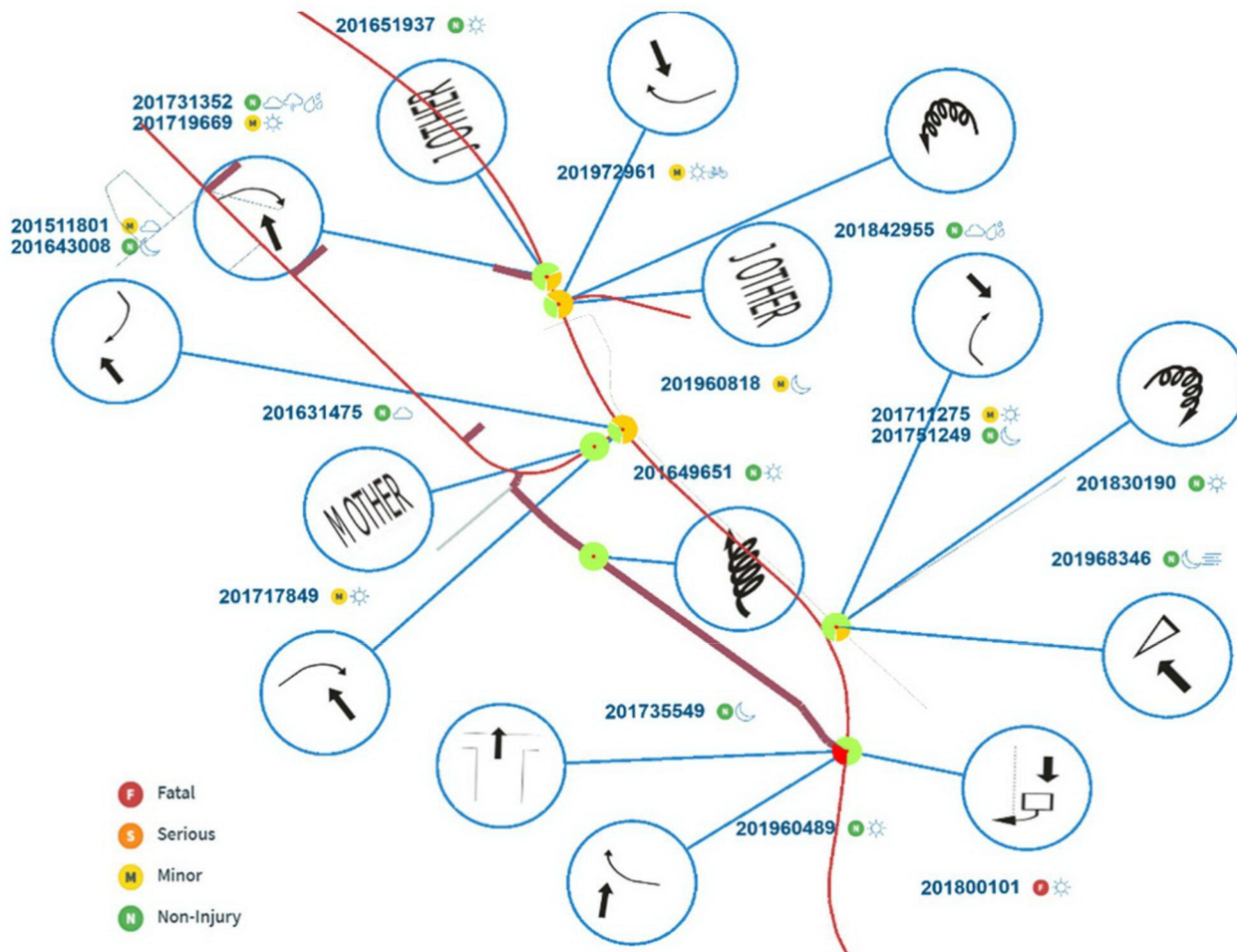


Figure 9 Collision Diagram for Crash History in Clyde 2015-2019

6.2.1 State Highway 8 / Sunderland Street

The analysis shows one non-injury and two minor injury crashes at the SH8/Sunderland Street intersection. However, inspection of the crash reports shows that both injury crashes have been geolocated incorrectly, and actually refer to the other SH8/Sunderland Street intersection at the northern end of the town. Therefore, there has been one non-injury crash at the intersection in the last 5 years, caused by a southbound vehicle failing to give way when turning into Sunderland Street.

The intersection has turning bays on all approaches and good visibility in all directions. However, the speed limit through the intersection is 100km/h, which is likely to lead to have high severity in the event of a crash. In this case, the high proportion of right turning vehicles, primarily commuters travelling from Clyde to Alexandra, and to a lesser extent, evening commuters returning from Cromwell, means that the *crossing - vehicle turning* crash type is at risk of increasing.

A crash model for the intersection was developed using the methods in Waka Kotahi's Crash Estimation Compendium, part of the Economic Evaluation Manual. Model 2 for the *crossing - vehicle turning* crash type at a high-speed rural T-junction was used to assess increased crash risk associated with traffic generated from the site, as per the equation below:

$$A_T = 4.39 \times 10^{-6} \times q_1^{1.33} \times q_5^{0.15} \times V_D^{0.33}$$

Where:

Parameter		Before Development	After Development
q5	Through vehicle flow along major road to right of minor road in veh/day	3,100	4,500 (accounting for SH growth)
q1	Right-turning flow from minor road in veh/day	410	700*
V _D	Sum of visibility deficiency	1	1
A _T	Modelled annual injury crash rate	0.04	0.09

*410 + 1,230 development trips/day x 50% outbound x 47% trips to Alexandra

Right turn flows (q1) were calculated using surveyed turning splits, census commute data and existing and future AADT on Sunderland Street. Due to the ample sight distance (Figure 10), and therefore zero visibility deficiency, the before and after annual injury crash rates for this crash type were calculated to be **0.04** and **0.09** respectively.



Figure 10 Visibility at Sunderland Street/SH8 Intersection (left - looking north; right - looking south)

Upgrading the intersection to a roundabout is unlikely to prove cost efficient given the low traffic volumes, adequate visibility and high improvement cost. A more cost-effective treatment to address the increased crash risk would be to separate the northbound left turn lane with a median to reduce the obscuring effect of turning vehicles on vehicles waiting on Sunderland Street.

6.2.2 State Highway 8 / Mutton Town Road

The SH8/Mutton Town Road intersection has seen one fatal and two non-injury crashes over the past 5 years. The fatal crash involved a car waiting to turn right into Mutton Town Road being hit from behind. It is unlikely that demand for this movement will increase given the time-saving and more direct route provided by Sunderland Street to the north.

The intersection has a posted speed limit of 100km/h and no turning bays. There is sufficient sight distance to the south, but insufficient sight distance to the north (measured to be 170m during a site visit (Figure 11)). The Safe Intersection Sight Distance (SISD), as defined in Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections, is 300m, assuming an operating speed of 110km/h and reaction time of 2.5 seconds.



Figure 11 Visibility at Mutton Town Road/SH8 Intersection Looking North

Using the same crash model and equation defined in Section 6.2.1, and assuming all southbound traffic from the development uses the intersection, the annual crossing vehicle turning injury crash rate at the Mutton Town Road intersection is calculated to increase from **0.01** to **0.36**. Crash rates for other movements are unlikely to increase as a result of the development. It is important to investigate safety improvements to treat the visibility deficiency at this intersection prior to completion of the development. Potential mitigations are discussed in Section 7.

6.3 Active Modes

The Otago Rail Trail presents a good opportunity to promote active modes as a means of transport to future residents of the development, contributing to Waka Kotahi's strategic mode shift objectives. It is also expected that short-term visitor accommodation will be utilised at the site to cater to demand for the Rail Trail.

An underpass connecting the development directly to the trail would be optimal from a network connectivity perspective but may be excessive given the proximity to the existing underpass on Albert Drive, approximately 500m away (roughly a 4-minute ride from the site). Although the route is less convenient and may put people off using it, a new connection is unlikely to be economically viable. Mitigations for active mode components are presented in Section 7.

6.4 Parking

Planning in urban areas is beginning to focus on restricting the amount of parking provided in an effort to reduce car dependency and encourage mode shift. However, given the current lack of transport options available in Clyde, it is considered counterproductive to adopt this approach, to the point that a shortfall in car parking could lead to negative effects such as excessive roadside parking or parking on berms. When detailed design is undertaken, detailed consideration should be given to the likely number of vehicles per household to mitigate this risk.

7 Mitigations

Developing 150 houses on Mutton Town Road is likely to increase the crash risk at the SH8 / Mutton Town Road intersection, as explained in Section 6.2.2. A range of potential mitigations and associated benefits and constraints is presented in Table 6. Providing access to the Clyde Claim lot (Figure 5) via Sunderland Street only is considered to be the most cost-effective mitigation.

Table 6 Proposed Mitigations for Mutton Town Road/SH8 Intersection

Mitigation	Benefits	Constraints
Access to Clyde Claim lot (DP 18990) from Sunderland Street only	<ul style="list-style-type: none"> Southbound traffic highly likely to use the safer Sunderland Street intersection to access SH8 due to lower travel time, reducing crash risk at Mutton Town Road intersection by 60%* Cost-effective and avoids disproportionate capital works 	<ul style="list-style-type: none"> Houlahan Enterprises lots (DP525753 and DP331535) and the T T T Trustee lot (DP525753) do not share a boundary with Sunderland Street and must therefore retain access onto Mutton Town Road. Signage directing traffic to the highway via Sunderland Street should reduce the number of vehicles using the Mutton Town Road intersection
Close Intersection	<ul style="list-style-type: none"> Removes crash risk at the intersection 	<ul style="list-style-type: none"> Reduces accessibility for current users Some capital works and therefore cost
Upgrade to roundabout	<ul style="list-style-type: none"> Reduces overall crash risk at the intersection 	<ul style="list-style-type: none"> Likely to require a large diameter roundabout, requiring property purchase and excessive costs for low traffic volumes Adequate sight distance to the north difficult to achieve
Provide right turn bay on SH8	<ul style="list-style-type: none"> Reduces crash risk for right turn movement from the highway Treats the cause for the site's recent fatal crash 	<ul style="list-style-type: none"> Very low turning movement volume that typically would not require a turning bay Does not treat visibility issue Some capital works on the highway and therefore cost and disruption
Reduce speed limit to 70km/h through the intersection	<ul style="list-style-type: none"> Results in adequate sight distance to the north, thus reducing overall crash risk at the intersection 	<ul style="list-style-type: none"> Does not align with the speed environment and compliance likely to be low
Cut out bund on north-west corner of intersection	<ul style="list-style-type: none"> Results in adequate sight distance to the north, thus reducing overall crash risk at the intersection 	<ul style="list-style-type: none"> Earthworks on 3rd party land would be required
Increase conspicuousness of intersection	<ul style="list-style-type: none"> Signs, lighting, advanced warning and rumble strips may improve compliance with Stop sign 	<ul style="list-style-type: none"> Does not treat visibility deficiency

*forecast annual injury crash rate down from 0.38 to 0.15 if southbound traffic from Clyde Claim lot uses Sunderland Street intersection rather than Mutton Town Road intersection

In addition to the traffic mitigations above, active mode improvements are recommended as part of the development. As a minimum, it is recommended that the route between the site and the existing underpass on Albert Drive be clearly signposted. Additionally, it is recommended that adequate walking and cycling facilities be provided on the northern side of Mutton Town Road, if access is not provided on Sunderland Street, for users to safely connect with the existing path on Sunderland Street. It is also recommended that the gap in the Rail Trail fence opposite Sunderland Street be closed to prevent unsafe crossing, with current users advised to instead use the formal crossing point at the underpass on Albert Drive. Figure 12 provides context.



Figure 12 Existing and Recommended Active Mode Connectivity

Additional improvements to safety could be made at the Sunderland Street/SH8 intersection by utilising available road reserve on the western edge to provide painted separation between the northbound through lane and the left turn lane. This provides better visibility to vehicles waiting on Sunderland Street of oncoming traffic that may be obscured by a left-turning vehicle. However, this is not considered critical to continued safe operation of the intersection.

8 Conclusions

The following conclusions can be drawn from this assessment:

- The amount of traffic generated by the site is unlikely to have a material effect on network performance due to the low baseline and forecast volumes. State Highway intersections with both Sunderland Street and Mutton Town Road have sufficient spare capacity to support background traffic growth and traffic expected from the development.
- At the time of writing, full plans for the development were not available, but the concept generally aligns with relevant transport policies and strategies. Opportunity exists to promote active modes through use of the nearby Otago Rail Trail, which would help contribute to local and national mode shift objectives.
- The site's proximity to the Otago Rail Trail will make cycling an attractive mode for travelling to Alexandra. It is recommended that this be taken advantage of by clearly signposting the route to the existing underpass on Albert Drive and providing adequate facilities to get to the route.
- The Sunderland Street / State Highway 8 intersection is in a 100km/h environment and thus has an inherent risk for high severity crashes. However, the intersection has turning bays on all approaches and ample sight distance in both directions. Limited crash history exists at the site and the calculated crash rate before and after development indicates that the existing layout is appropriate. Upgrading the intersection to a roundabout would be costly and provide limited benefits given the low existing crash risk and relatively low current and forecast traffic volumes.
- The crash risk at the Mutton Town Road / State Highway 8 intersection has been calculated to increase significantly, primarily due to poor visibility to the north, if used by all southbound traffic from the development. Several possible mitigations are presented in Section 7. The most cost-effective option is considered to be providing access to the Clyde Claim lot (DPI8990) via Sunderland Street only. Additional signage should be provided at the Houlahan Enterprises and T T T Trustee lots, directing traffic to the highway via Sunderland Street.



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