Traffic and Transport Assessment

St Leonards Subdivision – Growth Area 2

CG140452

Prepared for
ABC Project Management / St Quentin Consulting

19 November 2014

Cardno
Shaping the Future

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1 Introduction

Cardno was retained by ABC Project Management / St Quentin Consulting to undertake a traffic and transport assessment of the proposed rezoning of land bound by Leviens Road, Bluff Road, Ibbotson Street and the eastern residential subdivisions currently zoned “Farming Zone” to “Residential 1 Zone” within St Leonards.

In the course of preparing this assessment, the subject site and its environs have been inspected, preliminary plans of the development examined, and all relevant traffic and parking data collected and analysed.

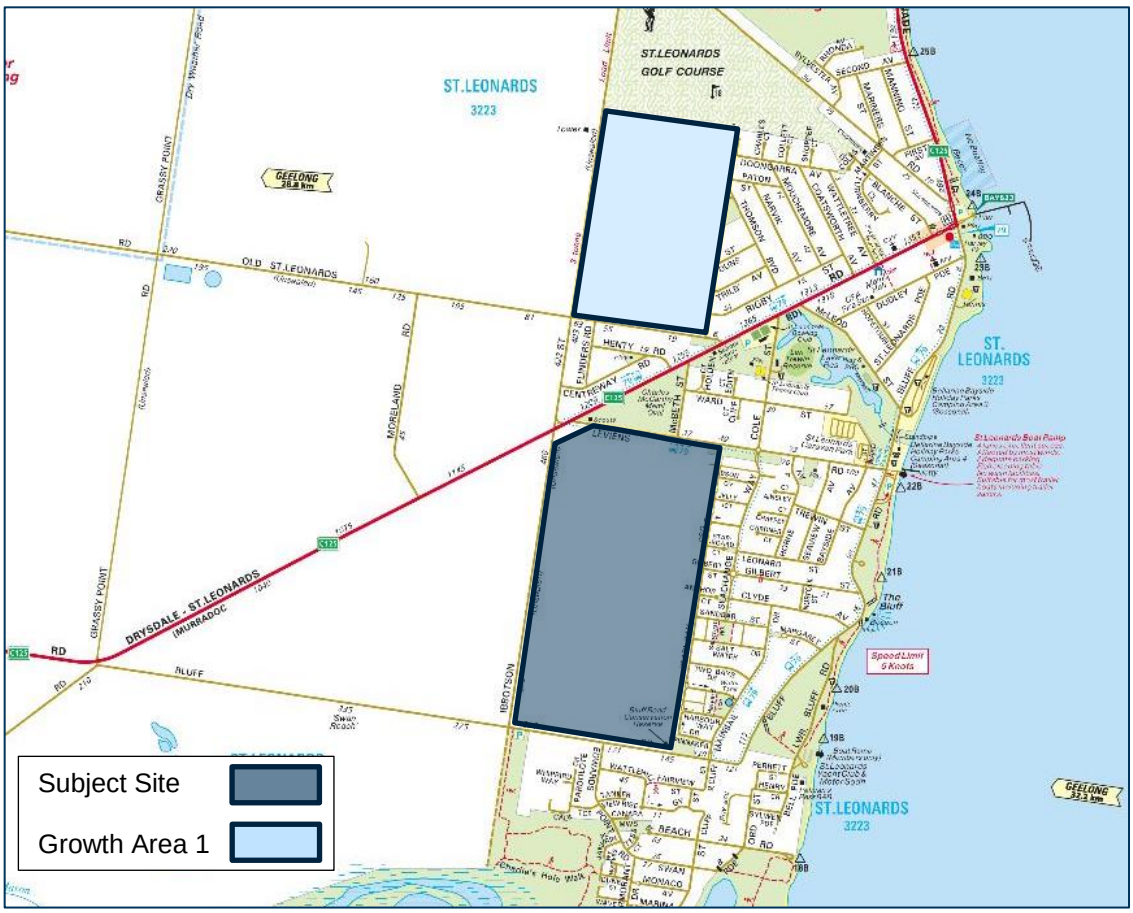
2 Background and Existing Conditions

2.1 Location and Land Use

The subject site is located south-east of Murradoc Road, St Leonards, within the block bounded by Leviens Road to the north (530m), Ibbotson Street to the west (1150m), Bluff Road to the south (610m) and existing residential lots to the east as shown in Figure 2-1. This forms Growth Area 2 as defined in the St Leonards Structure Plan and has a total land area of Growth Area 2 is 73.55 hectares. Growth Area 1 is located to the north of the site.

The site is currently flat and undeveloped, and was previously utilised for farming purposes. Land surrounding the site is generally residential to the north, south and east, with farming land to the west. The Charles McCarthy Memorial Oval abuts the site at its northern boundary.

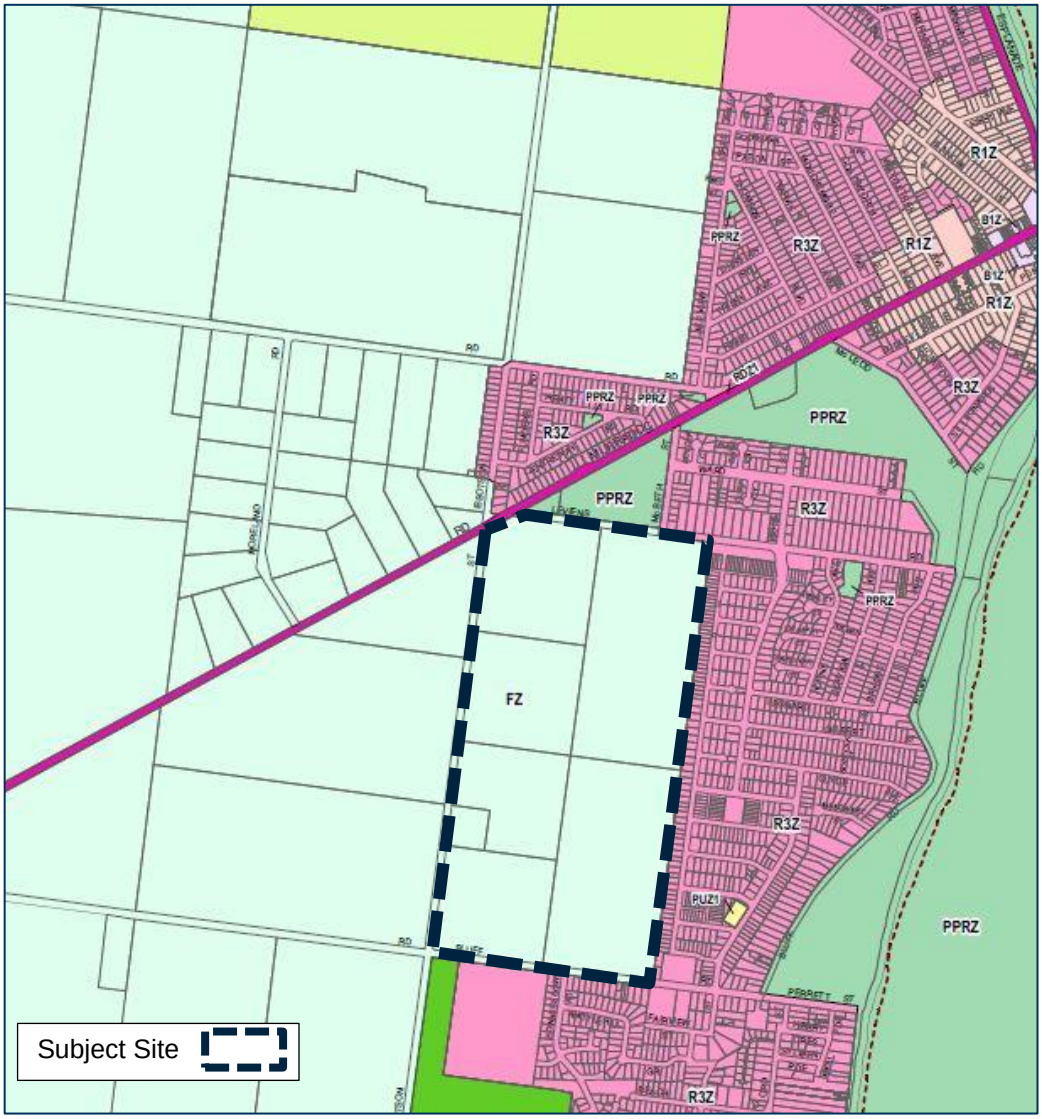
Figure 2-1 Site Location



2.2 Planning Zones

Figure 2-2 demonstrates that the subject site is located within the Farming Zone (FZ). It is proposed to rezone this area into Residential 1 Zone (R1Z).

Figure 2-2 Planning Scheme Zones



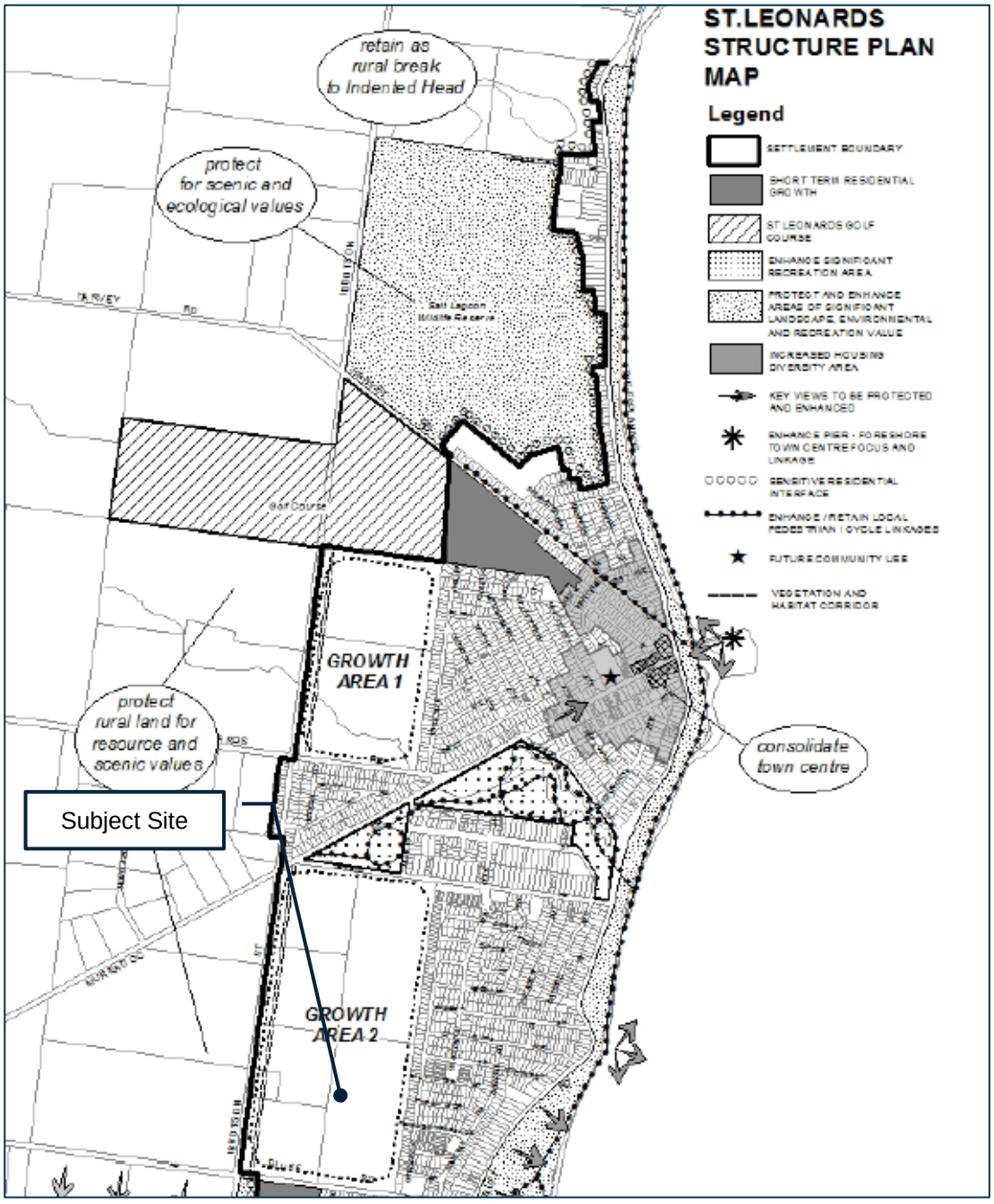
2.3 St Leonards Structure Plan

The 2014 St Leonards Structure Plan identified the subject site as Growth Area 2. Furthermore, an additional growth area, north of Murradoc Road, known as Growth Area 1, was identified within the St Leonards Structure Plan. The Structure Plan states that the two sites are estimated to provide between 25 and 33 years supply of land for the St Leonards Township.

The St Leonards Structure Plan was adopted by the City of Greater Geelong in February 2014. Within the Structure Plan, two growth areas are identified as long term residential growth areas capable of accommodating in the order of 1400 lots. Furthermore, the Structure Plan indicated that there are no planned major upgrades/improvements to the road network within the township of St Leonards.

The location of the subject site within the St Leonards Structure Plan area is shown in Figure 2-3. It is note that the land to the west is protected for “resource and scenic value”.

Figure 2-3 St Leonards Structure Plan Areas



2.4 Road Network

2.4.1 Ibbotson Street

Ibbotson Street is a local road running north-south between Batman Road in the north and Bluff Road in the south, abutting the western boundary of the site.

Within the vicinity of the site, Ibbotson Street is an unsealed gravel road, as shown in Figure 2-4 and Figure 2-5. Existing properties along the eastern side of Ibbotson Street take access via an unsealed access road, as shown in Figure 2-5. Ibbotson Street has a posted speed limit which varies between 60 and 80km/h. Observations on-site indicate that the vegetation on both sides of Ibbotson Street, in the vicinity of the subject site, are identified within a 'Biodiversity Conservation Area' and are protected from any activity or disturbance.

Figure 2-4 Ibbotson Street, looking north from the subject site

Figure 2-5 Ibbotson Street, looking south from the subject site

2.4.2 Leviens Road

Leviens Road is a local road running east-west between Bluff Road in the east and Murradoc Road in the west.

Within the vicinity of the site, Leviens Road has a sealed carriageway with unsealed shoulders, as shown in Figure 2-6 and Figure 2-7, and has a posted speed limit of 60 km/h. Existing lots on the northern side of Leviens Road take access via concrete driveways, as shown in Figure 2-7.

Figure 2-6 Leviens Road, looking west from the subject site

Figure 2-7 Leviens Road, looking east towards the subject site

2.4.3 Bluff Road

Bluff Road is a local road oriented generally east-west in the vicinity of the site, between Murradoc Road in the west and Mainsail Drive to the east, and continues further north to Murradoc Road, where it becomes The Esplanade.

In the vicinity of the site, Bluff Road operates as a two-way road and accommodates a sealed carriageway with unsealed shoulders, as shown in Figure 2-8 and Figure 2-9. A speed limit of 80km/h is applicable.

Figure 2-8 Bluff Road, looking east from the subject site

Figure 2-9 Bluff Road, looking west towards Ibbotson Street

2.4.4 Murradoc Road

Murradoc Road is a Declared Main Road and extends between Drysdale in the west and St Leonards in the east.

Within the vicinity of the site, Murradoc Road consists of a single carriageway with one traffic lane in each direction plus sealed shoulders of approximately 1.5 metres shared within cyclists. At the intersection of Bluff Road / Murradoc Road currently has a posted speed limit of 100 km/h. Futher north-east towards Leviens Road, the speed limit is 70km/h, while closer to the town centre, a 60km/h speed limit applies.

A typical cross section of Murradoc Road is shown in Figure 2-10, an aerial of the intersection of Murradoc Road / Ibbotson Street is shown in Figure 2-11, an aerial of the intersection of Murradoc Road / Leviens Road in Figure 2-12 and Murradoc Road / Bluff Road in Figure 2-13.

Figure 2-10 Murradoc Road, looking west from Ibbotson Street

Figure 2-11 Aerial - Murradoc Road / Ibbotson Street Intersection

Figure 2-12 Aerial - Murradoc Road / Leviens Road Intersection

Figure 2-13 Aerial - Murradoc Road / Bluff Road Intersection

2.5 Existing Traffic Volumes

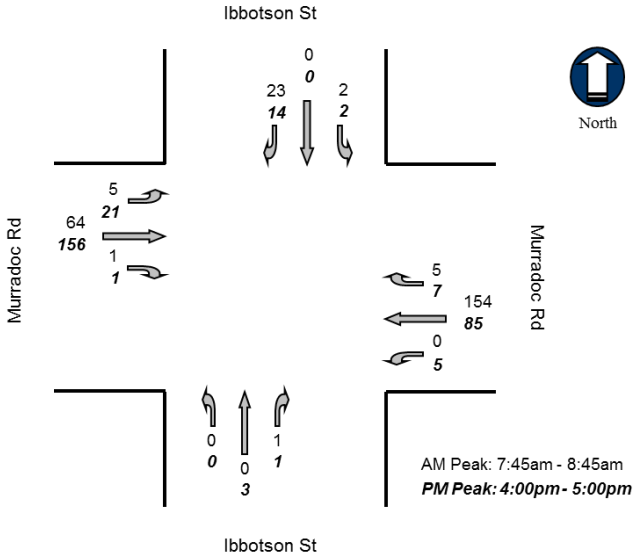
2.5.1 Murradoc Road / Ibbotson Street

Traffic Volume counts were undertaken at the intersection of Murradoc Road and Ibbotson Street, on Thursday 8th May 2014; between 6:30am and 9:30am, and between 3:30pm and 6:30pm.

The AM peak hour was found to begin at 7:45am while the PM peak hour was found to begin at 4:00pm

The peak hour results of the surveys are shown in Figure 2-14.

Figure 2-14 Existing Traffic Volumes – Murradoc Road / Ibbotson Street



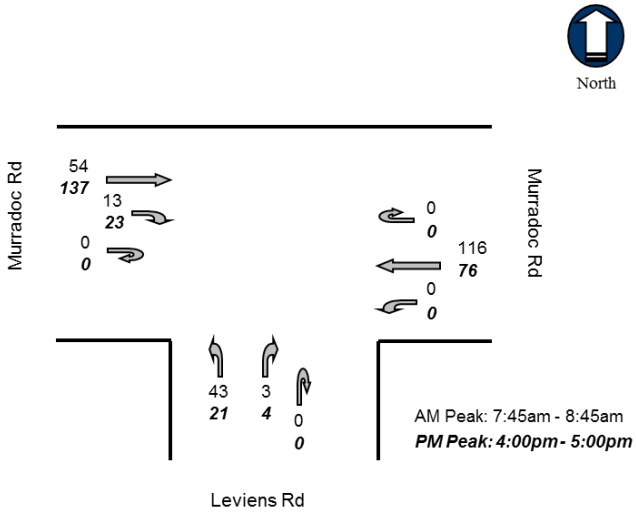
2.5.2 Murradoc Road / Leviens Road

Traffic Volume counts were also undertaken at the intersection of Murradoc Road and Ibbotson Street, on Thursday 8th May 2014; between 6:30am and 9:30am, and between 3:30pm and 6:30pm.

The AM peak hour was found to begin at 7:45am while the PM peak hour was found to begin at 4:00pm

The peak hour results of the surveys are shown in

Figure 2-15 Existing Traffic Volumes – Murradoc Road / Leviens Road



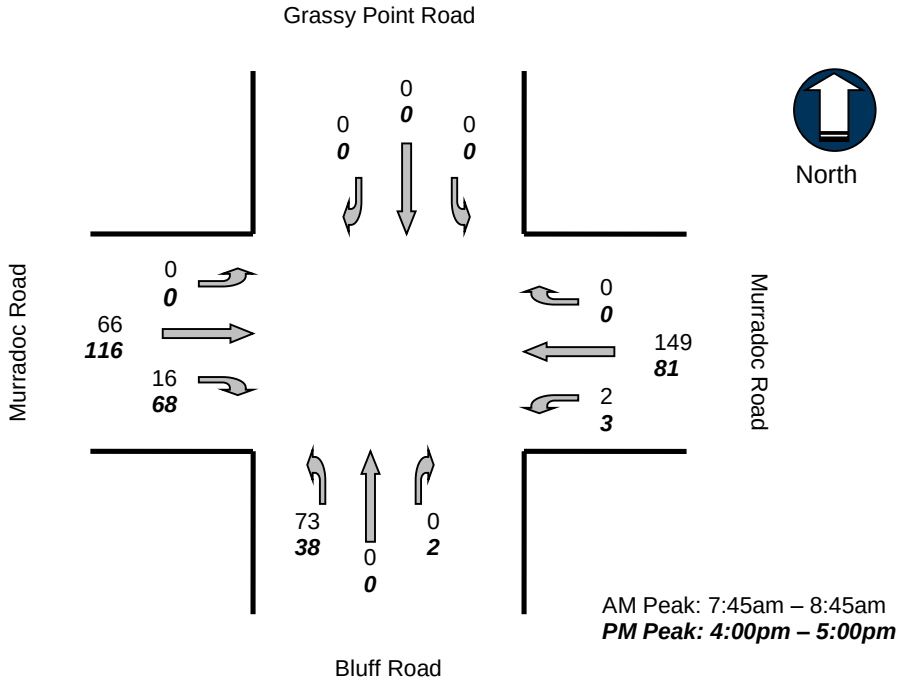
2.5.3 Murradoc Road / Bluff Road / Grassy Point Road

Traffic Volume counts were also undertaken at the intersection of Murradoc Road, Bluff Road and Grassy Point Road, on Thursday 19th June 2014; between 6:30am and 9:30am, and between 3:30pm and 6:30pm.

The AM peak hour was found to begin at 8:15am while the PM peak hour was found to begin at 4:00pm

The peak hour results of the surveys are shown in Figure 2-16. It is of note that no traffic on Grassy Point Road occurred in the peak hours, while low volumes on Manifold Street (2vph) have been added to Bluff Road

Figure 2-16 Existing Traffic Volumes – Murradoc Road / Bluff Road / Grassy Point Road



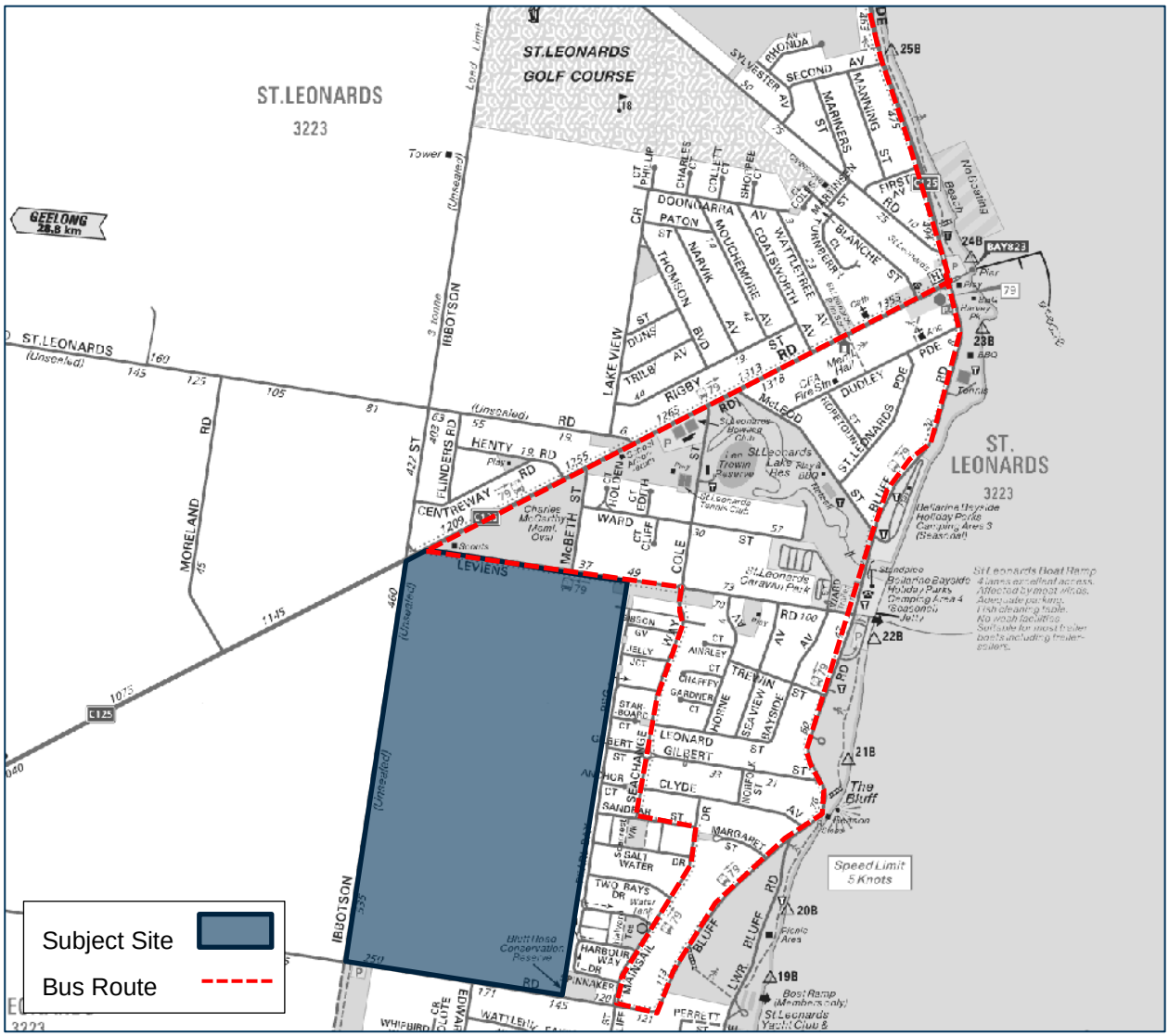
2.6 Sustainable Transport

2.6.1 Public Transport

The site has public transport accessibility, with a bus service located within 250m south-east of the site along Murradoc Road. Public transport services in St Leonards is limited to Bellarine Transit services bus routes, which operate along Murradoc Road and Geelong-Portarlington Road, with parts of the service extending into residential streets.

Bus Route 79 operates from the Geelong Railway Station to St Leonards, via Drysdale. The bus terminus is located adjacent to Harvey Park, St Leonards. Fourteen (14) services operate between 5:00am and 9:00pm weekdays, with services approximately every hour between 7:00am and 2:00pm. Furthermore, six (6) services currently operate on Saturday's and four (4) services on Sunday's and Public Holidays.

Figure 2-17 Existing St Leonards Bus Route Locations



2.7 Other Studies

Cardno has prepared a traffic and transport assessment for the Growth Area 1 site, and therefore the external traffic issues described within this report include traffic from the full development of both Area 1 and Area 2.

3 Proposed Development

3.1 General

Based on discussions with the client, it is proposed to rezone the 73.55 ha site to a Residential 1 Zone (R1Z) with a lot yield of approximately 900 lots, as well as a number of open space reserves and water basins. The development is to include the construction of Leviens Road and Bluff Road along the frontage of the site to a similar standard as to what exists within the vicinity of the site.

3.2 Vehicle and Pedestrian Access

Access to the site from the surrounding road network should be provided via a number of access points along Leviens Road to the north and Bluff Road to the south. At each of these road frontages, a single major connector road access should be installed, supplemented by smaller access streets. Access to Ibbotson Street should be minimised due to significant vegetation and the rural interface along the western boundary of the site. It is noted that there are limited opportunities to connect to the east of the subject site from the existing road network.

The development is to include road pavement sealing and installation of kerb and channel adjacent the sites boundary to Leviens Road and Bluff Road, to a similar standard to what exists surrounding the subject site.

No pedestrian paths are currently provided within the existing Leviens Road and Bluff Road reserves. As such, external pedestrian access to the subject land will be limited until such time as Leviens Road and Bluff Road are fully constructed.

3.3 Road Network

It is understood that most properties will be accessed from the internal road network proposed. All access points will form T-intersections with Leviens Road, Bluff Road (and potentially) with “Give Way” signage and line marking installed.

The road network for the subdivision will comprise of Access Streets and a Connector Road. It is recommended that the internal access street network for the residential subdivision be designed in accordance with Clause 56 of the Greater Geelong Planning Scheme. The site will provide a number of connections for pedestrians and cyclists, additional to the road connections.

The indicative road hierarchy proposed road cross sections are shown in Table 3-1.

Table 3-1 Internal Road Network Street Types

Type	Road Reserve	Indicative Capacity	Carriageway	Pedestrians
Level 1 Access Street	13.5m	1,000-2,000 vpd	5.5m	2 x 1.5m wide footpath
Level 2 Access Street (Adjacent Open Space)	13.5m	2,000-3,000 vpd	7.3m	1 x 1.5m wide footpath within road reserve 1 x 1.5m wide footpath within open space
Level 2 Access Street	16.0m	2,000-3,000 vpd	7.3m	2 x 1.5m wide footpath
Level 1 Connector Street	22.0m	3,000 vpd	7.0m plus parking	1 x 2.5m wide shared path 1 x 1.5m footpath

4 Traffic Considerations

4.1 Traffic Generation

Guidance on traffic generation characteristics of residential developments is set out within the Victorian Code for Residential Developments, April 1992, which suggests in Table E9.1 that for:

"single dwelling lots apply traffic generation rates of 10 vehicles per day per lot, equivalent to approximately 1 vehicle per hour in the peak hour, unless a lower rate can be demonstrated. Lower rates can be applied to multi-unit dwellings based on locally derived rates."

To provide a robust assessment of the traffic impacts of the proposed rezoning and subdivision, the full 10 vehicles per lot has been adopted for all dwellings for the purposes of this report.

Based on the foregoing, it is projected that the proposed development will produce 9,000 movements per day, inclusive of 900 movements in the morning and evening peak hours.

Notwithstanding, it is noted the 2014 St Leonards Structure Plan illustrated that the St Leonards township has a vacancy rate of 59.1% (based on 2011 Census data). As a result of this, the following assessment of *10 vehicles per day per lot* is considered highly conservative for the proposed residential rezoning.

4.2 Traffic Distribution

It is generally accepted that for residential developments, approximately 80% of trips are outbound and 20% inbound in the AM peak. Conversely in the PM peak, 60% are inbound and 40% are outbound.

In consideration of the existing road network and in particular the location of local schools, the St Leonards and Geelong Townships and access to arterial roads, it is expected that traffic generated by the site will mainly utilise:

> Murradoc Road (or Bluff Road) to access the St Leonards Township, Geelong and all other areas of the Bellarine Peninsula; and

> Ibbotson Street (or Bluff Road) and Murradoc Road to access parts of the Bellarine Peninsula.

The distribution of vehicle movements is based on the location of surrounding employment centres, local and major shopping destinations, recreational destinations and schools and other education centres.

Only a small percentage of the work related trips will be to destinations within the St Leonards Township, with the majority to Geelong and the remainder to the Bellarine Peninsula / Portarlington / Point Lonsdale. Likely traffic destinations within St Leonards, such as the schools and shops, typically front Murradoc Road.

The majority of local and supermarket shopping trips will be to the IGA Supermarket which fronts Murradoc Road. Other shopping trips for household goods, clothing etc. will primarily be to Geelong.

Recreational trips will likely be towards Geelong. The majority of educational trips will be generated to and from St Leonards or Geelong, with some trips also likely to Portarlington / Drysdale.

It has been assumed that 35% of traffic will travel to/from the site via Leviens Road and the remaining 65% to travel to/from the site via Bluff Road.

From the above, the following distribution of residential traffic to the surrounding area has been adopted.

> Bellarine Peninsula / Geelong (inc. Drysdale) 75%

> St Leonards 25%

4.3 Generated Traffic Volumes

Considering the traffic generation rates and distributions detailed above, the proposed development is expected to result in the following additional traffic volumes to the surrounding road network (for Growth Area 2 only).

Figure 4-1 Generated Traffic Volumes – AM Peak Period

Figure 4-2 Generated Traffic Volumes – PM Peak Period

4.4 Future Subdivision Growth

As previously mentioned within Section 2.3 of this report, the 2014 St Leonards Structure Plan incorporated an additional growth area north of Murradoc Road, known as Growth Area 1. It is understood that this area would accommodate up to 484 residential lots in the future. In order to ascertain the overall impacts to the surrounding road network, we have undertaken a traffic analysis incorporating both Growth Area 1 and Growth Area 2.

As stated within Section 4.1 a rate of 10 vehicles per day per lot has been adopted, which equates to a total of 4,880 movements per day, inclusive of 488 movements in the morning and evening peak. It is assumed that 50% of traffic will travel to/from the site via Ibbotson Street, and 50% travel to/from the site via Old St Leonards Road.

The residential traffic distribution to the surrounding area, as specified within Section 4.2 has also been adopted for Growth Area 1.

4.5 Expected Traffic Volume Growth

In order to determine an appropriate growth rate for the area, Cardno has obtained daily traffic volume data for Murradoc Road, St Leonards from the VITM model for 2011, 2021, 2031 and 2041.

A comparison of the volumes on Murradoc Road from the VITM models indicates that an average growth rate of 1.5% compounding annually is expected between 2011 and 2021.

Post 2021, limited growth in traffic volumes is expected; therefore a growth rate of 1.5% per year has been adopted for Murradoc Road over a period of 10 years.

4.6 Future Expected Traffic Volumes

Figure 4-3 and Figure 4-4 shows the future traffic volumes for the intersection of Murradoc Road / Leviens Road, Murradoc Road / Ibbotson Street, Murradoc Road / Bluff Road, and Ibbotson Street and Bluff Road (note that a growth factor of 1.5% has been assigned to Murradoc Road). It is also noted that the traffic generated by the proposed 488 lots within Growth Area 1 has been incorporated into the below analysis.

Figure 4-3 Future Expected Traffic Volumes – AM Peak Period

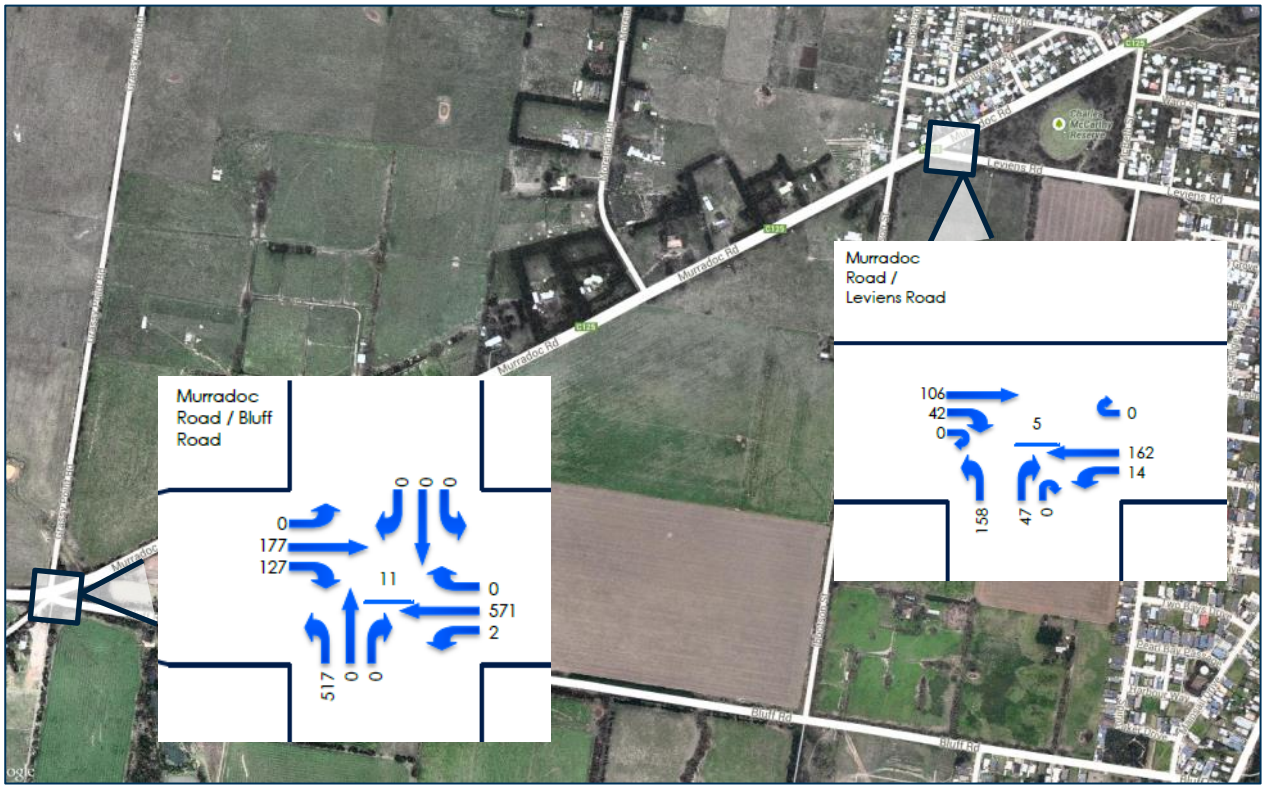
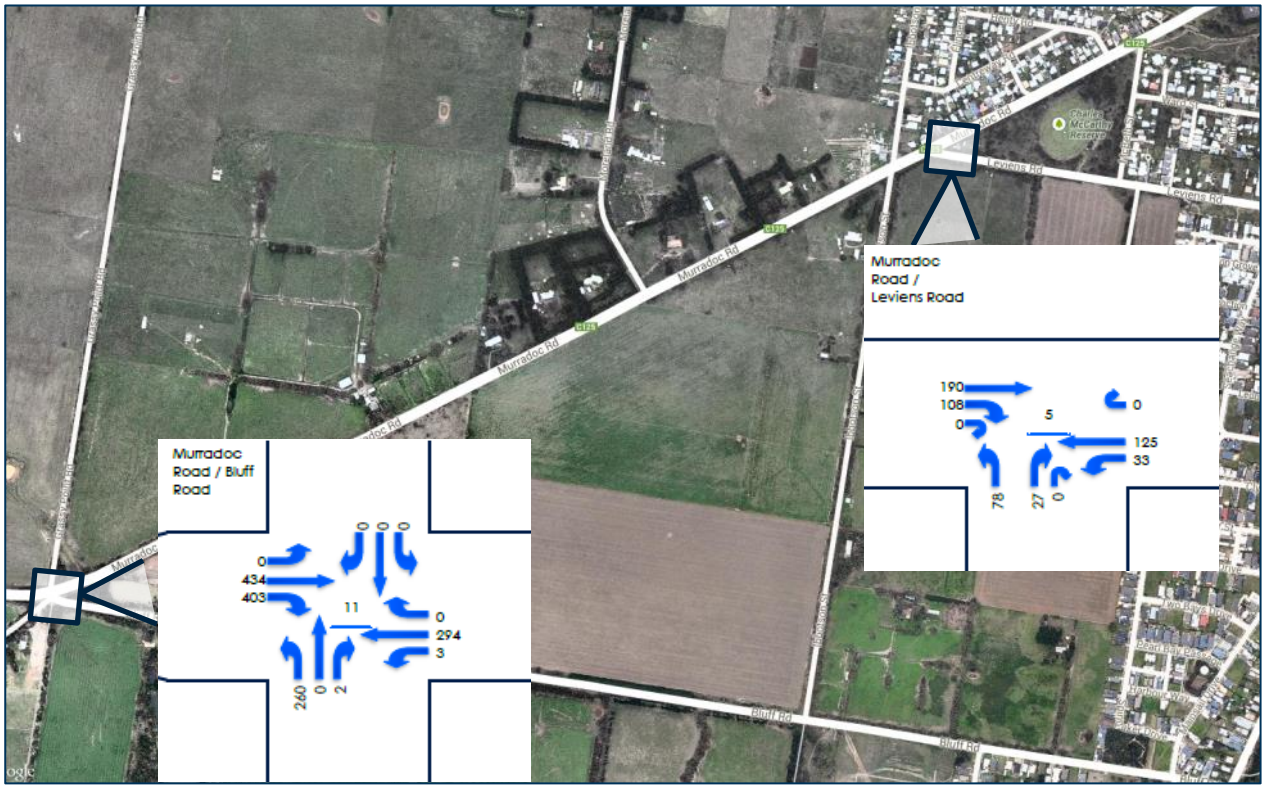


Figure 4-4 Future Expected Traffic Volumes – PM Peak Period



4.7 Traffic Impact

On the basis of the future peak hour turning movements in Figure 4-3 and Figure 4-4, the design requirements and operation of the external intersections have been assessed using the SIDRA Intersection 5.1 intersection modelling software package has been used.

SIDRA Intersection is a computer package, originally developed by the Australian Road Research Board, provides information about the capacity of an intersection in terms of a range of parameters, as described below:

Degree of Saturation (D.O.S.) is the ratio of the volume of traffic observed making a particular movement compared to the maximum capacity for that movement. Various values of degree of saturation and their rating are shown in Table 4-1.

Table 4-1 Rating of Degrees of Saturation

D.O.S.	Rating
Up to 0.6	Excellent
0.6 to 0.7	Very Good
0.7 to 0.8	Good
0.8 to 0.9	Fair
0.9 to 1.0	Poor
Above 1.0	Very Poor

It is considered acceptable for some critical movements in an intersection to operate in the range of 0.9 to 1.0 during the high peak periods, reflecting actual conditions in a significant proportion of suburban signalised intersections.

The ***95th Percentile (95%ile) Queue*** represents the maximum queue length, in metres, that can be expected in 95% of observed queue lengths in the peak hour; and

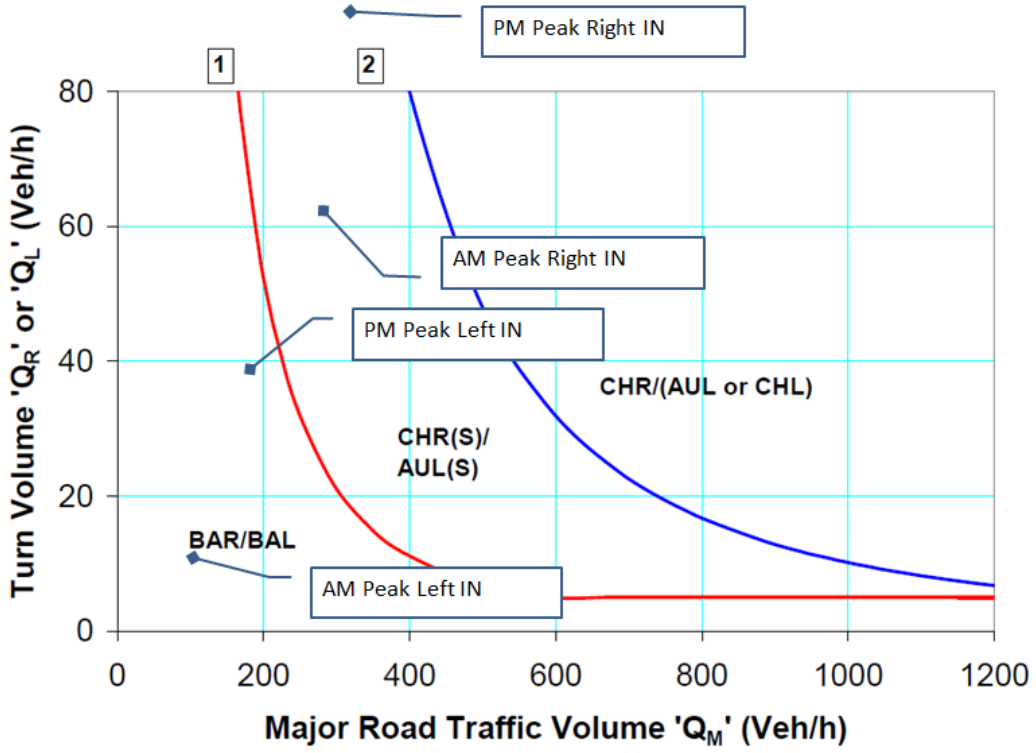
Average Delay is the delay time, in seconds, which can be expected over all vehicles making a particular movement in the peak hour.

Adopted intersection configurations based on this analysis and summarised SIDRA results are presented in the following sections.

4.1 Murradoc Road / Leviens Road

Part 4A: Unsignalised and Signalised Intersections of Austroads Guide to Road Design gives an indication of intersection types and turn treatments for roads such as Murradoc Road. A review of the warrants for Basic, Auxiliary and Channelised turn treatments has been undertaken for the Murradoc Road / Leviens Road as shown in Figure 4-5.

Figure 4-5 Austroads Part 4A – Fig 4.9 – Warrants for Turn Treatments – Future Traffic Volumes (Murradoc Road / Leviens Road)



Should this intersection be considered as a 'rural intersection' for assessment, it is warranted that a basic left turn lane and a channelised short right turn lane be provided for the turning movements into Leviens Road at the access to Murradoc Road (noting the separation between Ibbotson Street and Leviens Road is 75m).

The proposed configuration for the Murradoc Road / Leviens Road intersection is shown in Figure 4-6 with the ultimate intersection operating conditions shown in Table 4-2

Figure 4-6 Murradoc Road / Leviens Road – Proposed

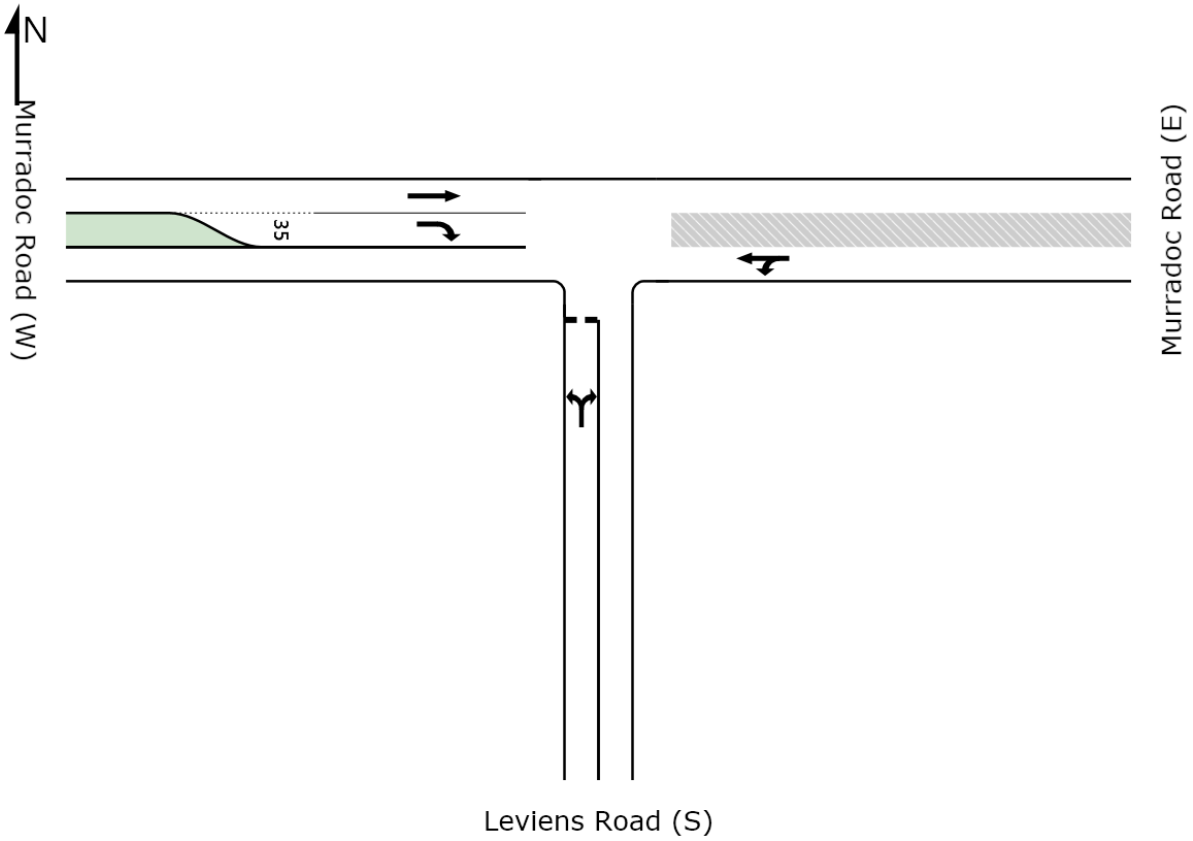


Table 4-2 Murradoc Road / Leviens Road – SIDRA Intersection Analysis Summary

Approach	AM Peak			AM Peak		
	Degree of Saturation	95th%ile Queue	Average Delay	Degree of Saturation	95th%ile Queue	Average Delay
Murradoc Road (W)	0.06	1.0 m	2.6 sec	0.11	2.7 m	3.3 sec
Leviens Road (S)	0.26	7.8 m	10.2 sec	0.14	3.9 m	10.5 sec
Murradoc Road (E)	0.10	0.0 m	0.7 sec	0.09	0.0 m	1.7 sec
Intersection	**0.26**	**7.8 m**	**5.9 sec**	**0.14**	**3.9 m**	**4.2 sec**

A review of Table 4-2 indicates that the subject intersection is expected to operate under “excellent” conditions. The analysis indicates that there is a significant amount of spare capacity at the intersection during both peak periods, and therefore the proposed intersection treatments are considered acceptable.

A sensitivity analysis has been performed for this intersection with existing conditions (i.e. no turning lane). The results are virtually identical, with minor queuing and delay increases on the western leg and the intersection still operating under excellent conditions. Given the SIDRA results presented above, should this intersection be considered as an ‘urban intersection’ for assessment due to the surrounding Growth Areas and future road upgrades, then no additional treatments would be required.

4.2 Murradoc Road / Bluff Road

Considering the expected traffic generation and distribution by the proposed rezoning, the future operation of the existing intersection of Murradoc Road and Bluff Road, as illustrated in Figure 2-13, was analysed using SIDRA intersection.

The results of the SIDRA Intersection analysis are summarised in Table 4-3.

Table 4-3 Murradoc Road / Bluff Road – SIDRA Intersection Analysis Summary

Approach	AM Peak			PM Peak		
	Degree of Saturation	95th%ile Queue	Average Delay	Degree of Saturation	95th%ile Queue	Average Delay
Grassy Point Road (N)	0.024	0.5 m	32.3 sec	0.027	0.6 m	36.5 sec
Murradoc Road (W)	0.142	4.2 m	8.3 sec	0.316	11.9 m	7.9 sec
Bluff Road (S)	0.728	68.6 m	22.0 sec	0.252	10.6 m	10.7 sec
Murradoc Road (E)	0.318	18.9 m	7.2 sec	0.166	11.0 m	8.9 sec
Intersection	**0.728**	**68.6 m**	**13.0 sec**	**0.316**	**11.9 m**	**8.7 sec**

The results of the SIDRA Intersection analysis for the future volumes indicate that the intersection will continue to operate under ‘very good’ conditions during the AM peak hour and ‘excellent’ in the PM peak hours.

It is noted that the traffic volumes generated to the intersection are still well within the intersection capacity, and as such it is considered that the additional traffic generated by the proposed residential rezoning can be accommodated within the existing channelised right turn intersection treatment, without any need for modifications.

5 Road Network Considerations

Having regard to the expected traffic volumes and road functions, the following road works are recommended.

5.1 External

As outlined in the previous section, the only external works potentially considered necessary is the provision of a right turn treatment at Murradoc Road / Leviens Road. For a 70km/h speed environment, the length of the turn lane would require a minimum length of 55m for deceleration.

5.2 Leviens Road Frontage and Access

Based on the anticipated traffic volumes illustrated in Figure 4-1 and Figure 4-2, it is recommended that at least two access points be provided to Leviens Road. The primary access point should be designed to the standard of a Level 1 Connector Street with a carriageway width of 7.0 metres plus additional parking. The secondary access points should be designed to the standard of a Level 2 Access Street with a carriageway width of 7.3 metres, inclusive of parking.

It is noted that the drainage, parking and footpath works would be undertaken by the developer for the southern side of the road only, with the carriageway width being 7.0m wide, exclusive of parking.

No turning treatment is likely to be required at the intersection of Leviens Road and the access points. The traffic volumes would be significantly less than the Leviens Street / Murradoc Road intersection analysed in Table 4-2.

Anticipated cross sections for the frontage are shown in Appendix A.

5.3 Ibbotson Street

Ibbotson Street, in the vicinity of the subject site is identified as a Biodiversity Conservation Area. It is therefore recommended that no road works or supplementary verge and drainage works occur along this portion of Ibbotson Street to preserve the existing environment.

Further to this, any access to Ibbotson Street would provide traffic access to the southern leg of the Ibbotson Street / Murradoc Road intersection. Given the traffic volumes generated by GA1 on the northern leg of this intersection, traffic volumes on the southern leg are likely to create potential safety and operational issues at this intersection. No access from the GA2 area to Ibbotson Street is recommended.

5.4 Bluff Road Frontage and Access

Based on the anticipated traffic volumes shown in Figure 4-1 and Figure 4-2, it is recommended that at least two access points be provided to Bluff Road. The primary access point should be designed to the standard of a Level 1 Connector Street with a carriageway width of 7.0 metres. The secondary access points should be designed to the standard of a Level 2 Access Street with a carriageway width of 7.3 metres.

It is noted that the drainage, parking and footpath works would be undertaken by the developer for the northern side of the road only, ensuring a 3.5m wide eastbound lane, supplemented by on-street parking.

Similarly to Leviens Road, no turning treatment is required at the intersection of Bluff Road and the access points.

Anticipated cross sections for the frontage are shown in Appendix A.

5.5 Bicycle and Pedestrian Connectivity

The 2014 St Leonards Structure Plan identifies that the majority of residential streets in St Leonards have no formal pedestrian paths, wide grassy verges and a lack of kerb and channel. Notwithstanding this, it is recommended that the sites frontage to Leviens Road and Bluff Road match provide footpaths at the site frontage to match into any existing or future footpaths to the east of the subject site.

The 2014 St Leonards Structue Plan Cycling Strategy identifies Leviens Road as a key bicycle route, which provides a connection to Murradoc Road, which connects Geelong and the Bellarine Peninsula. It is recommended that the north-south Connector Road provide a shared path to connect the subject site to Leviens Road and the surrounding bicycle network.

5.6 Internal

It is recommended that the internal road network is designed in accordance with Clause 56.06 of the City of Greater Geelong Planning Scheme – Access and Mobility Management, with cross sections generally designed as Level 2 Access Streets, other than the central north-south connection between Leviens Road and Bluff Road, which will be designated as a Level 1 Connector Road.

The north-south connector should be designed to the standard of a Level 1 Connector Road and provide for a future bus route and an off road share path. Treatments such as midblock slow points should be incorporated into the road design where applicable to ensure that vehicle speeds are maintained at appropriate levels on these roads.

Anticipated internal cross sections are shown in Appendix B.

6 Conclusions

Based on the foregoing analysis it is concluded that;

> The proposed development is expected to generate up to 900 vehicles trips during the AM and PM peak periods if fully occupied;

> The site will contain various access points to Bluff Road and Leviens Road (inclusive of primary and secondary access points), with simple 'give-way' intersection control;

> The internal site layout is recommended to be designed in accordance with Clause 52.06 of the Greater Geelong Planning Scheme to provide adequately for vehicles, pedestrians and cyclist connectivity;

> To facilitate access to the subject land, it is proposed to upgrade the site frontage to Leviens Road and Bluff Road to urban standards; and

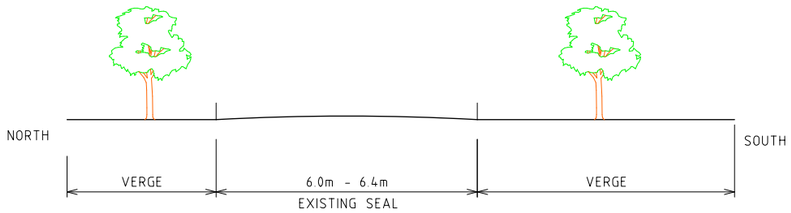
> The roads surrounding the subject site are able to absorb the traffic generated by the proposed rezoning if assessed as an "urban area", however, if the site is considered as a "rural area", a channelised right turn treatment would be warranted at Murradoc Road / Leviens Road intersection.

St Leonards Subdivision – Growth Area 2

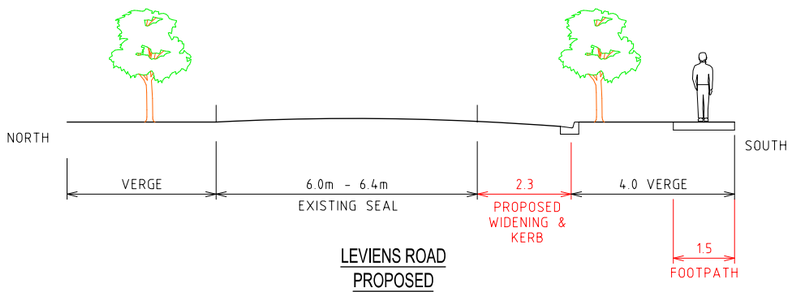
APPENDIX A

EXTERNAL ROAD CROSS SECTIONS

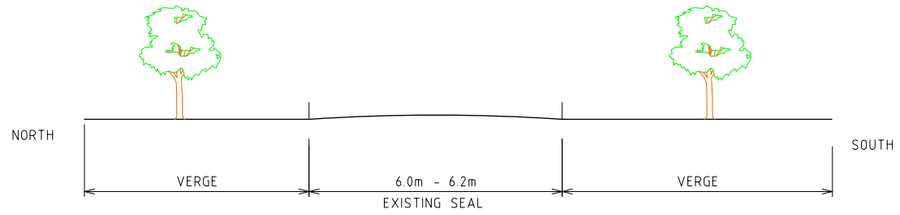
Cardno
Shaping the Future



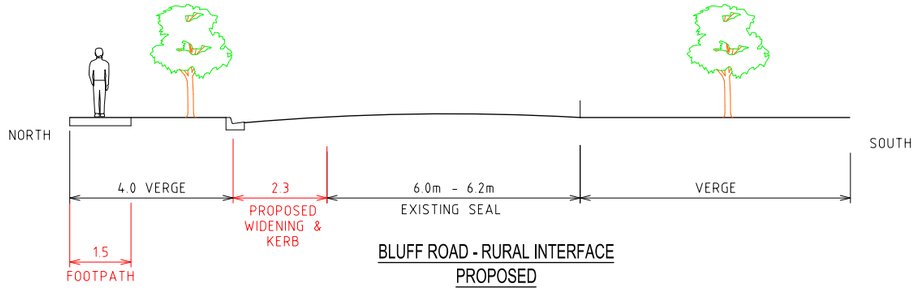
LEVIENS ROAD
EXISTING



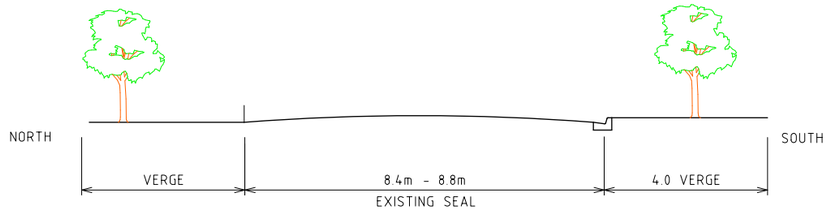
LEVIENS ROAD
PROPOSED



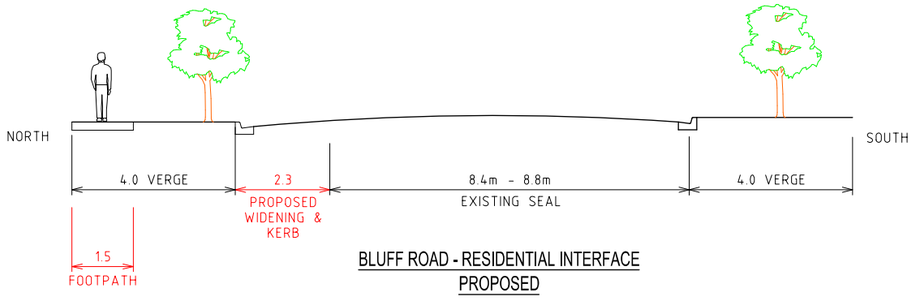
BLUFF ROAD - RURAL INTERFACE
EXISTING



BLUFF ROAD - RURAL INTERFACE
PROPOSED



BLUFF ROAD - RESIDENTIAL INTERFACE
EXISTING



BLUFF ROAD - RESIDENTIAL INTERFACE
PROPOSED

SKETCH CG140452SK01P01
ROAD CROSS SECTIONS

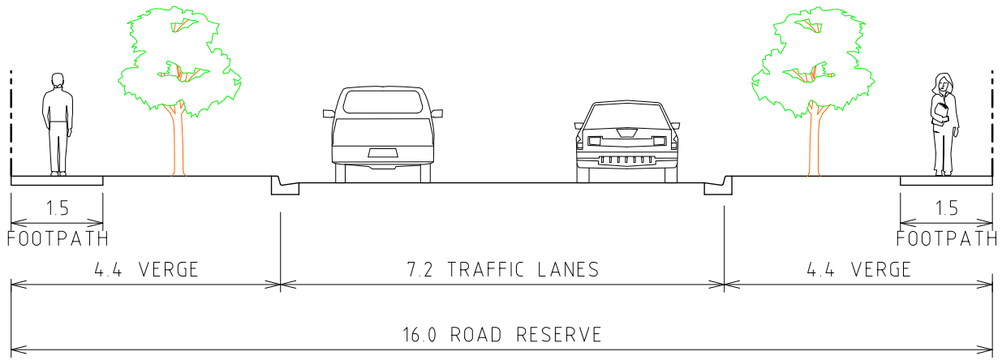
SCALE - 1:100 @ A3 DATE - 25-09-2014

St Leonards Subdivision – Growth Area 2

APPENDIX B

INTERNAL ROAD CROSS SECTIONS

Cardno
Shaping the Future



ACCESS STREET
16m ROAD RESERVE

CONNECTOR STREET WITH INDENTED PARKING
22m ROAD RESERVE

* FLARED TO 8.0m
AT ROUNDABOUT
AND PARKING
REMOVED

SKETCH CG140452SK01P01
ROAD CROSS SECTIONS
SCALE - 1:100 @ A3 DATE - 25-09-2014