

Traffic and Transport Assessment

Ibbotson Street Subdivision – Growth
Area 1

CG140338



Prepared for
TGM Group Pty Ltd

28 August 2015

Document Information

Prepared for TGM Group Pty Ltd
Project Name Ibbotson Street Subdivision – Growth Area 1
File Reference CG140338REP001F04.docx
Job Reference CG140338
Date 28 August 2015

Contact Information

Cardno Victoria Pty Ltd
Trading as Cardno
ABN 47 106 610 913

150 Oxford Street, Collingwood
Victoria 3066 Australia

Telephone: (03) 8415 7777
Facsimile: (03) 8415 7788
International: +61 3 8415 7777

victoria@cardno.com.au
www.cardno.com

Document Control

Version	Date	Author	Author Initials	Reviewer	Reviewer Initials
F04	28/08/15	Jeremy Peters	JP	Tim McKinley	

© Cardno. Copyright in the whole and every part of this document belongs to Cardno and may not be used, sold, transferred, copied or reproduced in whole or in part in any manner or form or in or on any media to any person other than by agreement with Cardno.

This document is produced by Cardno solely for the benefit and use by the client in accordance with the terms of the engagement. Cardno does not and shall not assume any responsibility or liability whatsoever to any third party arising out of any use or reliance by any third party on the content of this document.

Table of Contents

1	Introduction	1
2	Background and Existing Conditions	1
2.1	Location and Land Use	1
2.2	Planning Zones	2
2.3	St Leonards Structure Plan	3
2.4	Road Network	4
2.4.1	Ibbotson Street	4
2.4.2	Old St Leonards Road	5
2.4.3	Murradoc Road	6
2.4.4	Doongara Avenue	7
2.4.5	Emu Street	7
2.4.6	Rigby Street	8
2.5	Existing Traffic Volumes	9
2.5.1	Murradoc Road / Old St Leonards Road	9
2.5.2	Murradoc Road / Ibbotson Street	9
2.6	Sustainable Transport	10
2.6.1	Public Transport	10
3	Proposed Development	11
3.1	General	11
3.2	Vehicle and Pedestrian Access	12
3.3	Internal Road Network	12
3.4	Staging	12
3.5	Public Transport	12
4	Parking Considerations	14
4.1	Bicycle Parking Requirements – Clause 52.34	14
4.2	Car Parking Requirements - Residents	14
4.3	Car Parking Requirements - Visitors	14
5	Residential Subdivision Considerations	15
5.1	Access Street Level 2	15
5.2	Access Street Level 2 – Adjacent Open Space	15
5.3	Garbage and Emergency Vehicle Access	15
5.4	Residential Road Layout	15
6	Internal Traffic Management	17
6.1	Entry Threshold Treatments and Slow Points	17
6.2	Road Design Speeds	17
6.3	Signage and Line marking	17
6.4	End of Stage Treatments	17
7	Traffic Considerations	18
7.1	Traffic Generation	18
7.2	Traffic Distribution	18
7.3	Generated Traffic Volumes	19
7.4	Future Subdivision Growth	19
7.5	Expected Traffic Volume Growth	20
7.6	Future Expected Traffic Volumes	20
7.7	Intersection Analysis	22

7.8	Road Network Considerations	23
8	Conclusions	24

Appendices

Appendix A	Internal Road Cross Sections
Appendix B	External Road Cross Sections

Tables

Table 5-1	Standard Cross-Sections	15
Table 7-1	Rating of Degrees of Saturation	22
Table 7-2	SIDRA Intersection Analysis Summary	23

Figures

Figure 2-1	Site Location	1
Figure 2-2	Planning Scheme Zones	2
Figure 2-3	St Leonards Structure Plan Areas	3
Figure 2-4	Ibbotson Street, looking south from the subject site	4
Figure 2-5	Ibbotson Street, looking north from the subject site	4
Figure 2-6	Old St Leonards Road, looking west from the subject site	5
Figure 2-7	Old St Leonards Road, looking east from the subject site	5
Figure 2-8	Murradoc Road, looking west from Ibbotson Street	6
Figure 2-9	Aerial - Murradoc Road / Ibbotson Street Intersection (courtesy Nearmap)	6
Figure 2-10	Doongara Avenue, looking west from Lake View Crescent	7
Figure 2-11	Emu Street, looking west from Lake View Crescent	7
Figure 2-12	Rigby Street, looking west from Lake View Crescent	8
Figure 2-13	Existing Traffic Volumes – Murradoc Road / Old St Leonards Road	9
Figure 2-14	Existing Traffic Volumes – Murradoc Road / Ibbotson Street	9
Figure 2-15	Existing St Leonards Bus Route Locations	10
Figure 3-1	Proposed Residential Subdivision Layout	11
Figure 3-2	Walking, Cycling and Public Transport Plan	13
Figure 5-1	Proposed Road Hierarchy	16
Figure 6-1	Temporary End of Stage Road End Treatment	17
Figure 7-1	Development Traffic Peak Hour Volumes – Additional Volumes to the Network	19
Figure 7-2	Future Expected Traffic Volumes – AM Peak Period	20
Figure 7-3	Future Expected Traffic Volumes – PM Peak Period	21

1 Introduction

Cardno was retained by TGM Group Pty Ltd to undertake a traffic and transport assessment of the proposed rezoning and subdivision at 321-359 and 361-399 Ibbotson Street, St Leonards.

In the course of preparing this assessment, the subject site and its environs have been inspected, plans of the development (Drawing No. 5636-100-ODP – Plan 6, dated 25/07/2014) examined, and all relevant traffic and parking data collected and analysed.

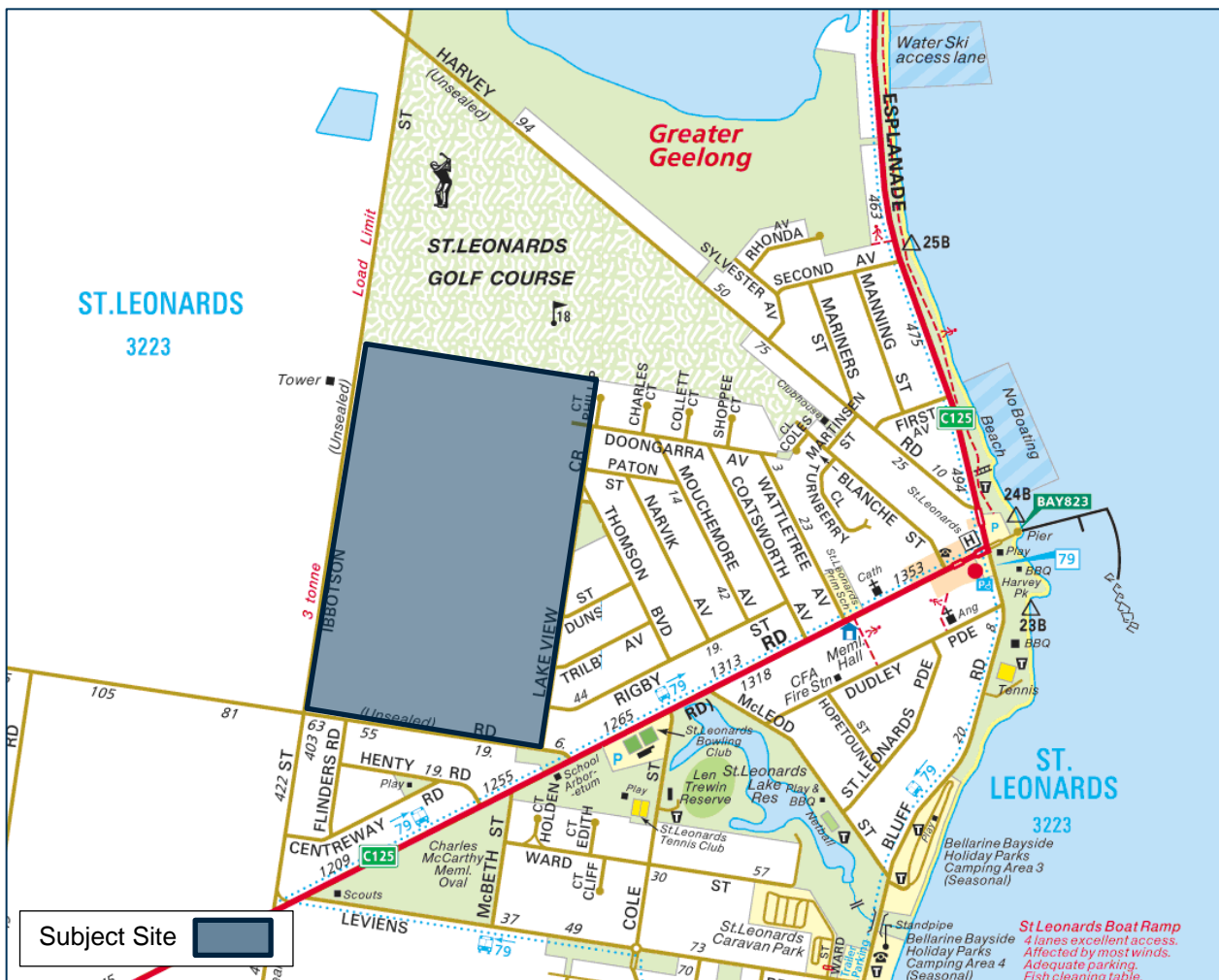
2 Background and Existing Conditions

2.1 Location and Land Use

The subject site is located to the north of St Leonards Road, taking up 38.71 hectares of land within the block bounded by Old St Leonards Road, Ibbotson Street, St Leonards Golf Course and Lake View Crescent as shown in Figure 2-1.

The site is currently undeveloped, and was previously utilised for farming purposes. Land surrounding the site is generally residential to the south and east, with farming land to the west. Of particular note, the St Leonards Golf Course abuts the site at its northern boundary.

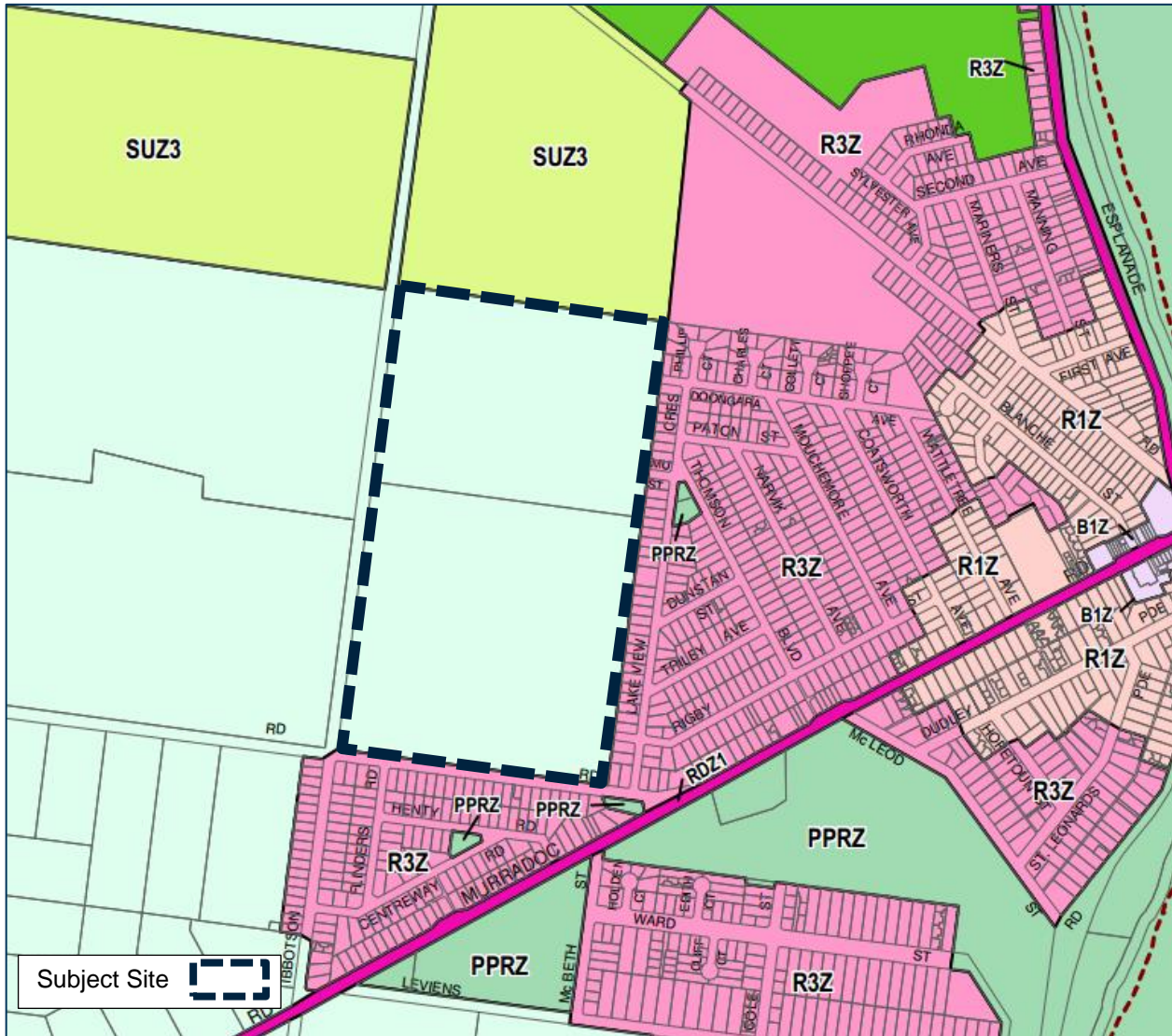
Figure 2-1 Site Location



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 a General Residential Zone (GRZ).

Figure 2-2 Planning Scheme Zones



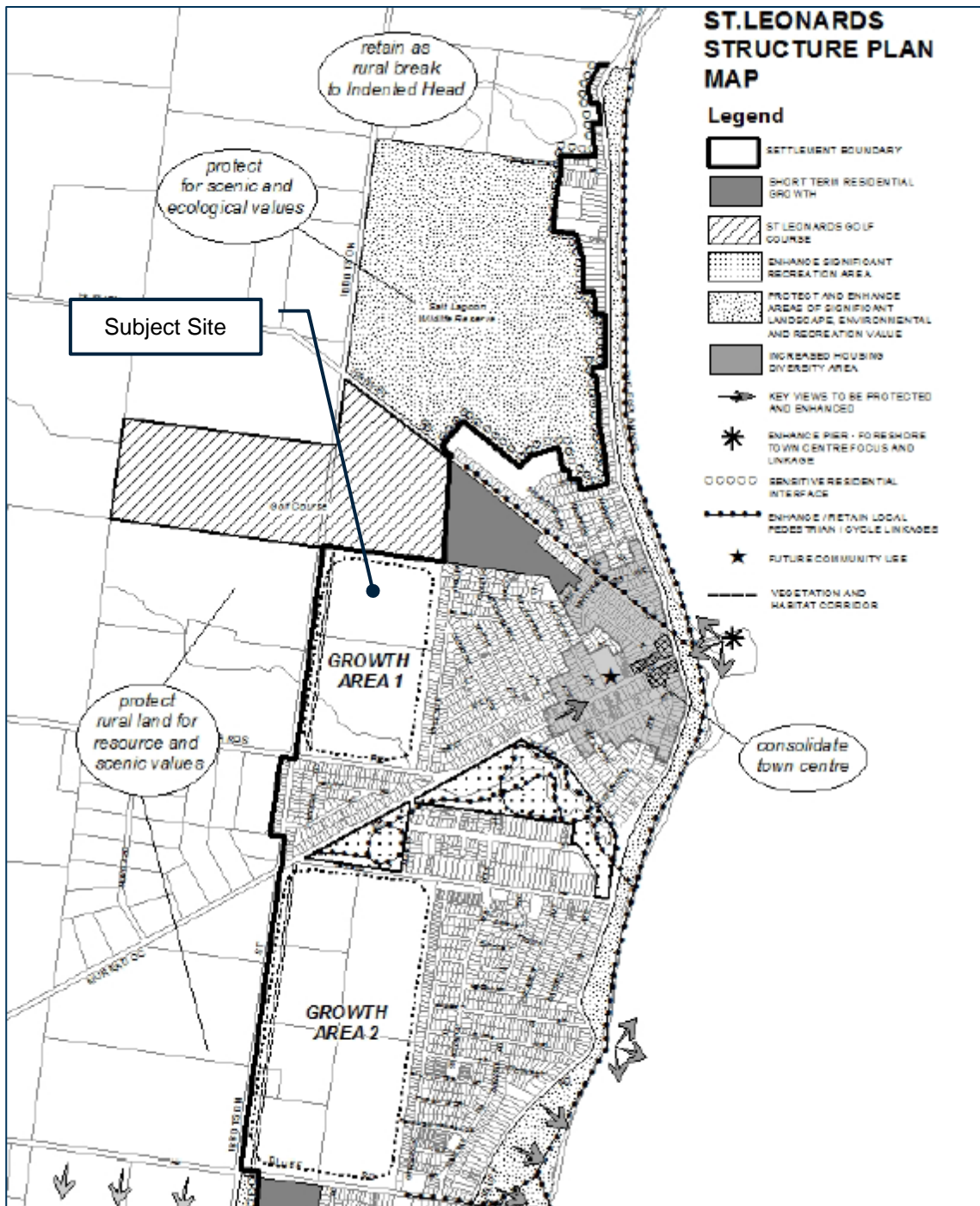
2.3 St Leonards Structure Plan

The 2014 St Leonards Structure Plan identified the subject site as Growth Area 1. Furthermore, an additional growth area, south of Murradoc Road, known as Growth Area 2, was identified within the St Leonards Structure Plan. These 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 1403 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.

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 side of the site's boundary.

The southern section of Ibbotson Street, between the midway point of the subject site and Murradoc Road has a sealed carriageway with unsealed shoulders, as shown in Figure 2-4. North of the midway point of the subject site, Ibbotson Street has unsealed shoulders and a gravel pavement to Batman Road, as shown in Figure 2-5. Ibbotson Street has a posted speed limit which varies between 60 and 80km/h.

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



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



2.4.2 Old St Leonards Road

Old St Leonards Road is a local road connecting Portarlinton-Queenscliff Road to Murradoc Road, abutting the site's southern boundary.

Within the vicinity of the site, Old St Leonards Road is an unsealed gravel road, as shown in Figure 2-6 and Figure 2-7, and has a posted speed limit of 60km/h. Existing lots on the southern side of Old St Leonards Road take access via unsealed driveways, as shown in Figure 2-7.

Figure 2-6 Old St Leonards Road, looking west from the subject site



Figure 2-7 Old St Leonards Road, looking east from the subject site



2.4.3 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. In the vicinity of the site, Murradoc Road currently has a posted speed limit of 70 km/h.

A typical cross section of Murradoc Road is shown in Figure 2-8 and an aerial of the intersection of Murradoc Road / Ibbotson Street is shown in Figure 2-9.

Figure 2-8 Murradoc Road, looking west from Ibbotson Street



Figure 2-9 Aerial - Murradoc Road / Ibbotson Street Intersection (courtesy Nearmap)



2.4.4 Doongara Avenue

Doongara Avenue is a local road oriented east-west from the subject site's eastern boundary. The carriageway is approximately 7.3 metres wide as part of a 16 metre road reserve, as shown in Figure 2-10. It is anticipated that the general alignment of Doongara Avenue will match into the proposed Growth Area 1 road network.

Figure 2-10 Doongara Avenue, looking west from Lake View Crescent



2.4.5 Emu Street

Emu Street is a local road oriented east-west from the subject site to Lake View Crescent. Emu Street is currently unconstructed between the subject site and Lake View Crescent and provides vehicular access to two properties, as shown in Figure 2-11. Emu Street is anticipated to be constructed as an access street with a sealed carriageway and provide access to the Growth Area 1 road network.

Figure 2-11 Emu Street, looking west from Lake View Crescent



2.4.6 Rigby Street

Rigby Street is a local road generally oriented in northeast-southwest between Coatsworth Avenue and Lakeview Crescent. Rigby Street is currently unconstructed between the subject site and Lake View Crescent and provides vehicular access to two properties, as shown in Figure 2-12. It is anticipated that the section of Rigby Street between Growth Area 1 and Lake View Crescent would be constructed as an access street with a sealed carriageway and match into the existing road network.

Figure 2-12 Rigby Street, looking west from Lake View Crescent



2.5 Existing Traffic Volumes

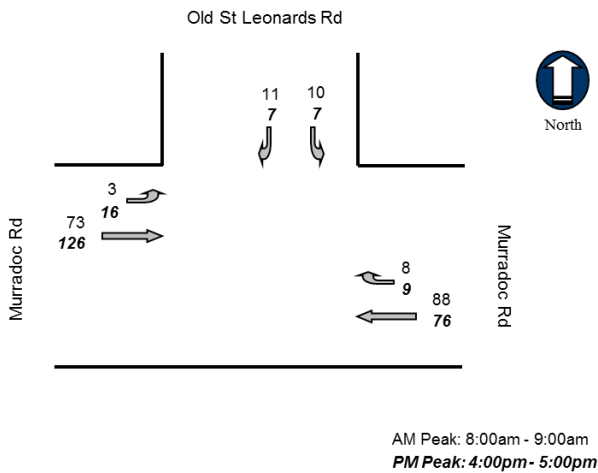
2.5.1 Murradoc Road / Old St Leonards Road

Traffic volume counts were undertaken by Trans Traffic Surveys on behalf of Cardno Pty Ltd at the intersection of Murradoc Road and Old St Leonards Road, 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 8:00am while the PM peak hour was found to begin at 4:00pm.

The peak hour results of the surveys are shown in Figure 2-13.

Figure 2-13 Existing Traffic Volumes – Murradoc Road / Old St Leonards Road



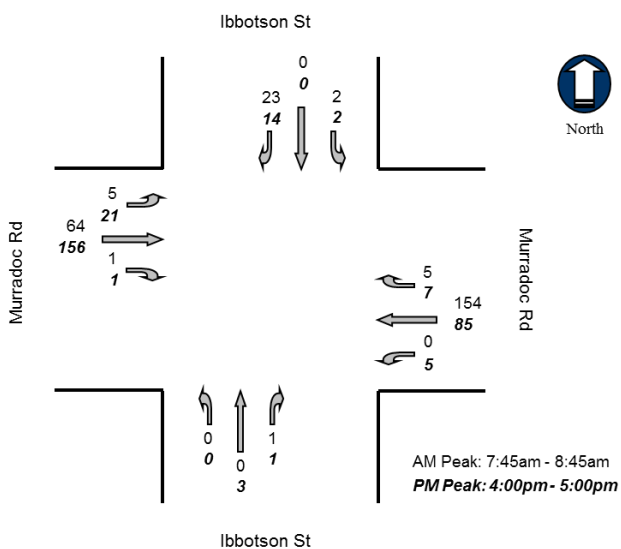
2.5.2 Murradoc Road / Ibbotson Street

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 2-14.

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



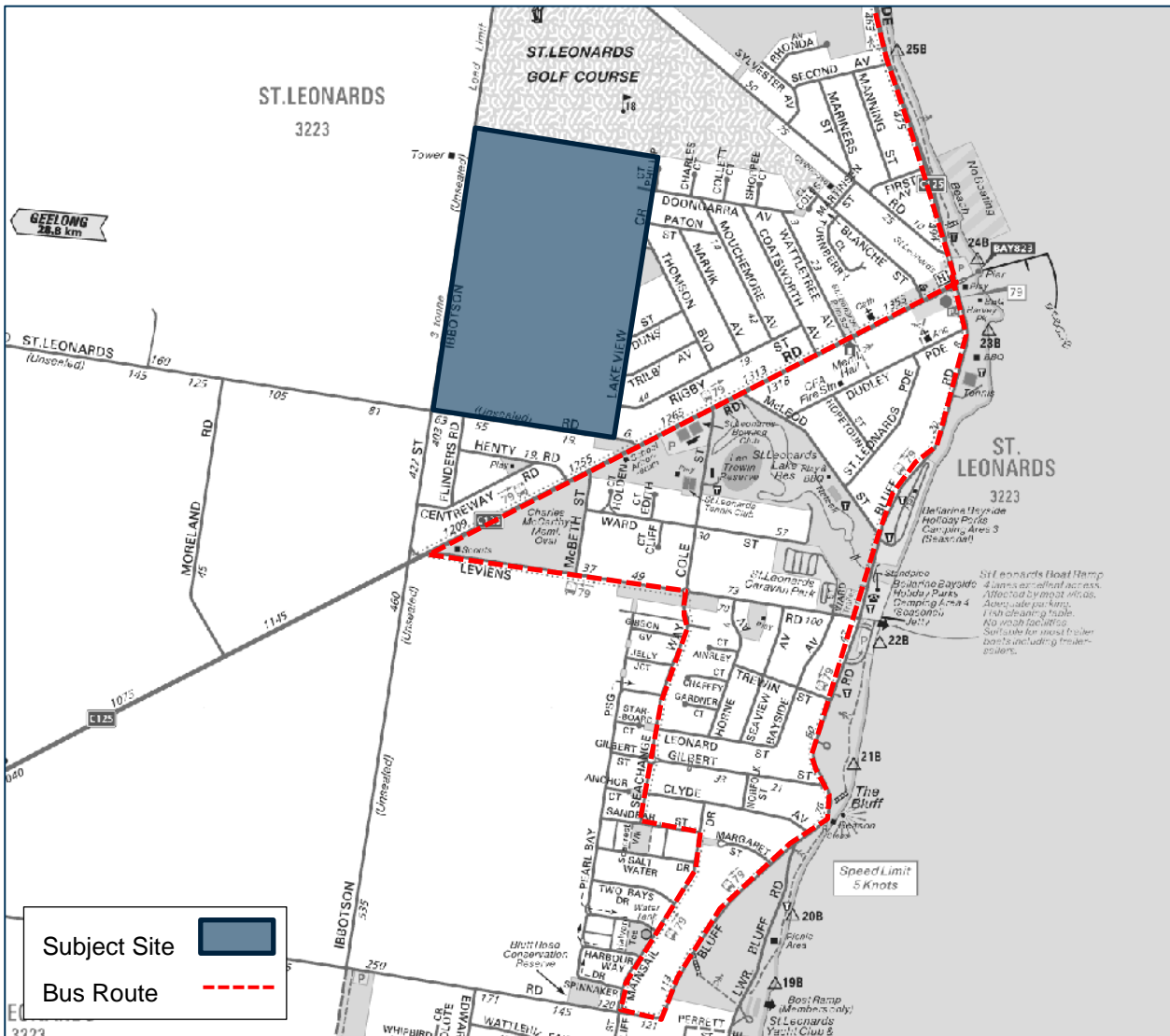
2.6 Sustainable Transport

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 2-15 Existing St Leonards Bus Route Locations



3 Proposed Development

3.1 General

Based on the plans prepared by TGM Group Pty Ltd (Version 5636-100-ODP-Plan 7, Dated 11/08/2015), it is proposed to rezone the site to a General Residential Zone (GRZ) and redevelop the site for the purposes of a residential subdivision with a yield of approximately 483 lots. Figure 3-1 illustrates the proposed residential subdivision lot layout.

Figure 3-1 Proposed Residential Subdivision Layout



3.2 Vehicle and Pedestrian Access

Access to the site from the surrounding road network is proposed via seven access points. These are summarised below and shown in Figure 3-1;

- > Ibbotson Street: Three (3) access points;
- > Old St Leonards Road: One (1) access point; and
- > Lake View Crescent: Three (3) access points matching into:
 - Rigby Street
 - Emu Street
 - Doongara Avenue

The development is to include road pavement sealing and installation of kerb and channel adjacent the site's boundary to Old St Leonards Road and Ibbotson Street, to a similar standard to what exists surrounding the subject site. It is noted that where the site's open space areas abut Ibbotson Street, it is proposed to provide road pavement sealing and rural open swale channels adjacent the site boundary. External road cross-sections are attached as Appendix B.

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

A shared path is proposed within the site between Old St Leonards Road and Ibbotson Street, as illustrated in Figure 3-2, which will accommodate pedestrians and cyclists within the residential subdivision.

3.3 Internal Road Network

Preliminary drawings of the subdivision show that most properties will be accessed from the internal road network proposed. Approximately 25 lots will be accessed directly from Old St Leonards Road via the sealing of the road and construction of concrete driveways along the northern boundary of Old St Leonards Road. Furthermore, 7 lots will be accessed directly from Ibbotson Street via the sealing of road and construction of concrete driveways along the eastern boundary of Ibbotson Street.

All access points will form T-intersections with Ibbotson Street and Old St Leonards Road, with "Give Way" signage and line marking installed.

3.4 Staging

It is proposed to construct the site in twenty-one stages, with Stages 1-6 being located in the south-east section (north of the reserve) with access via Rigby Street. Stages 7-10 are proposed in the south-west section (north of the reserve). Stages 11-15 include lots generally in the mid to north section, while Stages 16-18 are located in the south/south-western section of the subdivision (south of the reserve). Lots adjacent to Ibbotson Street include Stages 9, 15, 16 and 21, while lots on the Old St Leonards Road frontage is proposed as Stage 18. Upgrades to Old St Leonards Road and Ibbotson Street would occur in the latter stages of development at the time of lot construction in the vicinity.

3.5 Public Transport

As development of the Growth Area 1 land occurs, bus routes may need to be extended within the area to meet future demands of residents. The existing Ibbotson Street and Old St Leonards Road cross-sections accommodate a minimum carriageway width of 7.0 metres respectively, which, once sealed, would be suitable to accommodate bus routes. It is noted that if bus routes are extended by Public Transport Victoria (PTV) in the future, associated bus stops would also be subject to PTV approval.

Buses would also be capable of using the Access Street Level 2 carriageway within the subdivision, as shown in Figure 3-2, noting that this road is of similar dimension to Lake View Crescent and Rigby Street which would form part of any internal bus route to the east of the subject site.

Figure 3-2 Walking, Cycling and Public Transport Plan



4 Parking Considerations

4.1 Bicycle Parking Requirements – Clause 52.34

Clause 52.34 of the Greater Geelong Planning Scheme does not specify bicycle parking provision requirements for dwellings or townhouse style developments, generally assuming that bicycles can be stored in the garage required for each dwelling.

Within high density dwellings, in developments of four or more storeys, Clause 52.34 recommends a bicycle parking provision of 1 to each 5 dwellings for residents and 1 to each 10 dwellings for visitors.

4.2 Car Parking Requirements - Residents

With regard to residential development, Clause 52.06 of the Greater Geelong Planning Scheme requires two car spaces to be provided per dwelling, with at least one space covered.

All lots with three bedrooms or more should be provided with a minimum of two off-street spaces, including a mix of single garages with a second space in tandem arrangement, or double garages, in accordance with the requirements of the Planning Scheme.

For all one and two bedroom dwellings a single off-street space should be provided. The reduced parking supply is considered appropriate, due to the reduced parking demand for these smaller homes, the on-street parking provisions, and the accessibility of public transport in the vicinity of the site.

4.3 Car Parking Requirements - Visitors

With regard to the visitors, on-street parking is able to be accommodated along the street frontages of all access streets and connector streets.

Garage and crossover locations are to be rationalised and located to enable a high yield of parking spaces for visitors to supplement on site garages for residents.

Overall, the visitor parking supply on street is a minimum of 1 on-street space per dwelling.

5 Residential Subdivision Considerations

Table C1 in Section 56.06 of the Greater Geelong Planning Scheme details carriageway requirements for the different levels of local roads.

5.1 Access Street Level 2

The Access Streets are proposed to be provided with a minimum road reserve of 16.0 metres in width, which would accommodate a proposed cross-section allowing a carriageway width of 7.3 metres, a 1.5 metre wide footpath on either side of the road, and would accommodate kerbside parking on both sides of the carriageway.

The indicative capacity specified under Clause 56.06 of the Greater Geelong Planning Scheme is for 2,000-3,000 vehicles per day.

5.2 Access Street Level 2 – Adjacent Open Space

The Access Streets, adjacent open space, are proposed to be provided with a minimum road reserve of 13.5 metres in width, which would accommodate a proposed cross-section allowing a carriageway width of 7.3 metres, a 1.5 metre wide foot path within the road reserve and a 1.5 metres wide footpath within the open space and would accommodate kerbside parking along one side of the carriageway.

The indicative capacity specified under Clause 56.06 of the Greater Geelong Planning Scheme is for 2,000-3,000 vehicles per day.

5.3 Garbage and Emergency Vehicle Access

Garbage collection is expected to be undertaken from the kerbside areas of all Access Streets. Where a shared driveway is provided, a bin pad is proposed along the abutting Access Street so that garbage trucks will not have to enter and perform turning manoeuvre. All road carriageway widths meet or exceed the minimum Planning Scheme requirements and therefore are considered appropriate.

Provision for CFA vehicles has been allowed for within the road cross-sections adopted. The minimum carriageway widths required by the CFA is exceeded with the Access Level 2 street classification.

5.4 Residential Road Layout

Based on the preceding, the proposed road network and access is as follows, with the proposed road cross-section and road hierarchy shown at Figure 5-1. Internal road cross sections are attached as Appendix A.

Table 5-1 Standard Cross-Sections

Type	Road Reserve	Indicative Capacity	Carriageway	Pedestrians
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

Figure 5-1 Proposed Road Hierarchy



6 Internal Traffic Management

6.1 Entry Threshold Treatments and Slow Points

Local street intersections with higher order streets will be constructed with entry/threshold treatments or splitter islands to define the road hierarchy.

Where street lengths of local access streets exceed 200 metres, suitable mid-block slow points will be incorporated in the form of road narrowing's. These narrowings will generally coincide with the open space connections. A minimum width of 3.5m is provided at these points to allow one vehicle to proceed at a time.

Roundabouts are proposed at the two cross intersections within the subdivision, which will provide both a slow point as well as defined vehicular priority.

6.2 Road Design Speeds

All roads within the subdivision will have a posted speed limit of 50 kilometres per hour.

6.3 Signage and Line marking

Signage and line marking throughout the subdivision should be in accordance Vic Roads Traffic Engineering Manual Volume 2, with signage to be in accordance with the Australian Standard Manual of Uniform Traffic Control Devices, AS1742.

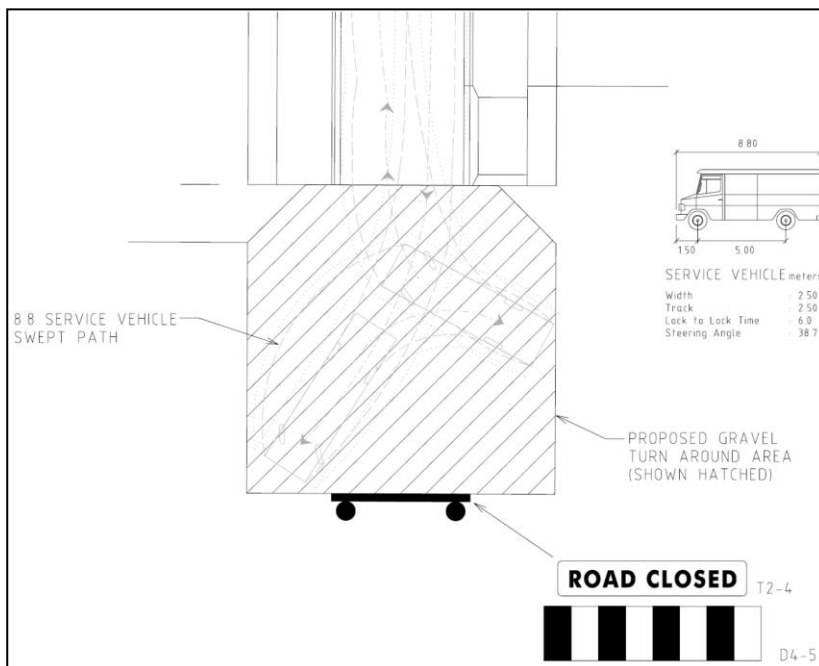
6.4 End of Stage Treatments

Where required, temporary end treatments will be installed at road discontinuations between stages. These end treatments will consist of a gravelled turn around area beyond the end of the road/street pavement with road closure signage installed at the far end of the end treatment.

End treatments will be of sufficient size to accommodate a 3 point turn manoeuvre of a medium rigid vehicle (i.e. a garbage truck / standard CFA tanker).

The proposed configuration of a typical end of stage end treatment is shown in Figure 6-1.

Figure 6-1 Temporary End of Stage Road End Treatment



7 Traffic Considerations

7.1 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 4,830 movements per day, inclusive of 483 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/development.

7.2 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 to access the St Leonards Township, Geelong and all other areas of the Bellarine Peninsula; and
- > Ibbotson Street (or Old St Leonards 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 50% of traffic will travel to/from the site via Ibbotson Street and the remaining 50% to travel to/from the site via Old St Leonards Road.

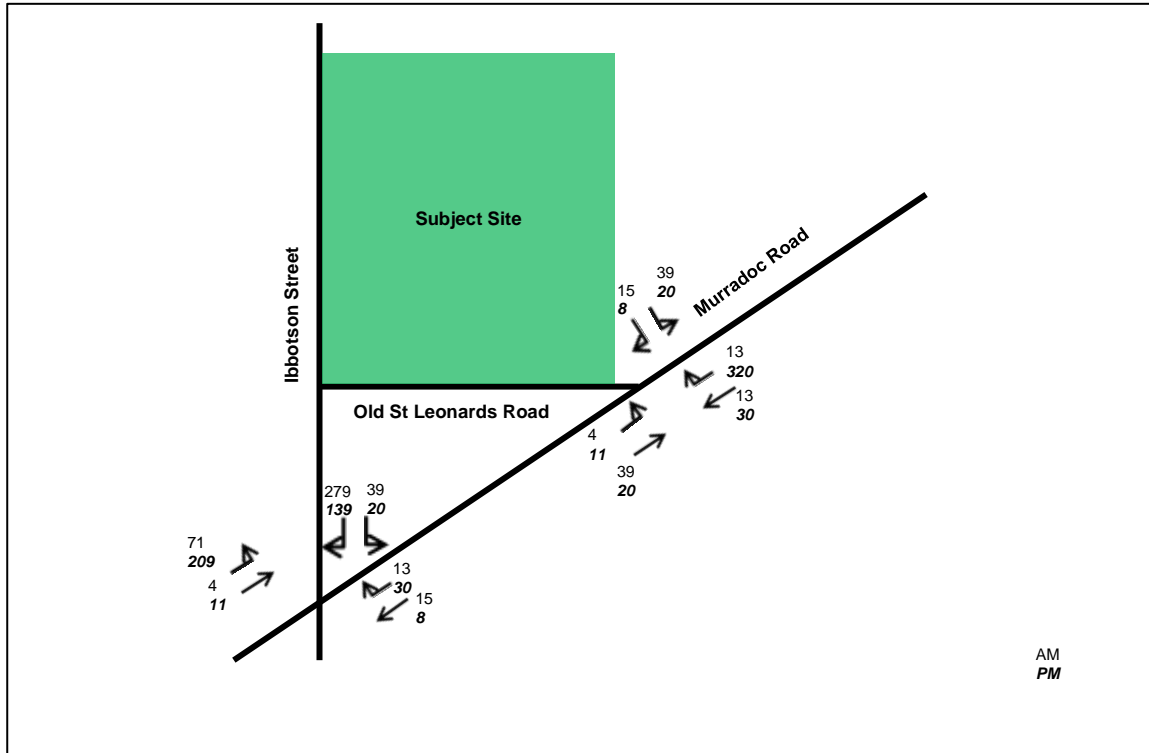
From the above, the following distribution of residential traffic to the surrounding area has been adopted.

- > Bellarine Peninsula / Geelong (inc. Drysdale) 75%
- > St Leonards 25%

7.3 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.

Figure 7-1 Development Traffic Peak Hour Volumes – Additional Volumes to the Network



7.4 Future Subdivision Growth

As previously mentioned within Section 2.3 of this report, the 2014 St Leonards Structure Plan incorporated an additional growth area south of Murradoc Road, known as Growth Area 2. It is understood that this area would accommodate up to 900 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 7.1, a rate of 10 vehicles per day per lot has been adopted, which equates to a total of 9,000 movements per day, inclusive of 900 movements in the morning and evening peak. It is noted that there is no proposed connection to the east of Growth Area 2; it is therefore assumed that 40% of traffic will travel to/from the site via Leviens Road, 50% of traffic will travel to/from the site via Bluff Road and 10% of traffic will travel to/from the site via Ibbotson Street.

The residential traffic distribution to the surrounding area, as specified within Section 7.2, has also been adopted for Growth Area 2.

7.5 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.

7.6 Future Expected Traffic Volumes

Figure 7-2 and Figure 7-3 shows the future traffic volumes for the Murradoc Road / Old St Leonards Road intersection and the Murradoc Road / Ibbotson Street intersection (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 900 lots within Growth Area 2 has been incorporated into the below analysis.

Figure 7-2 Future Expected Traffic Volumes – AM Peak Period

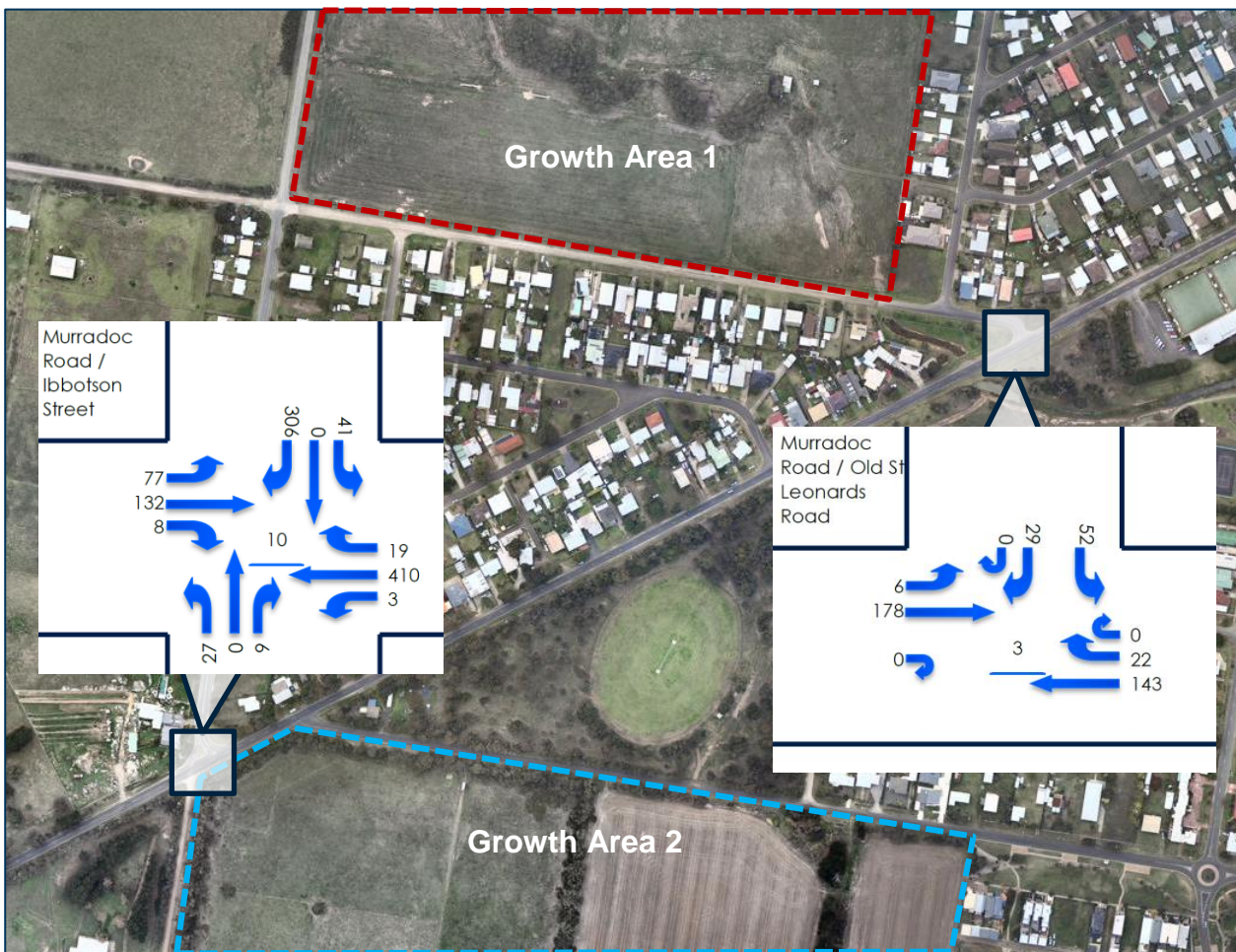
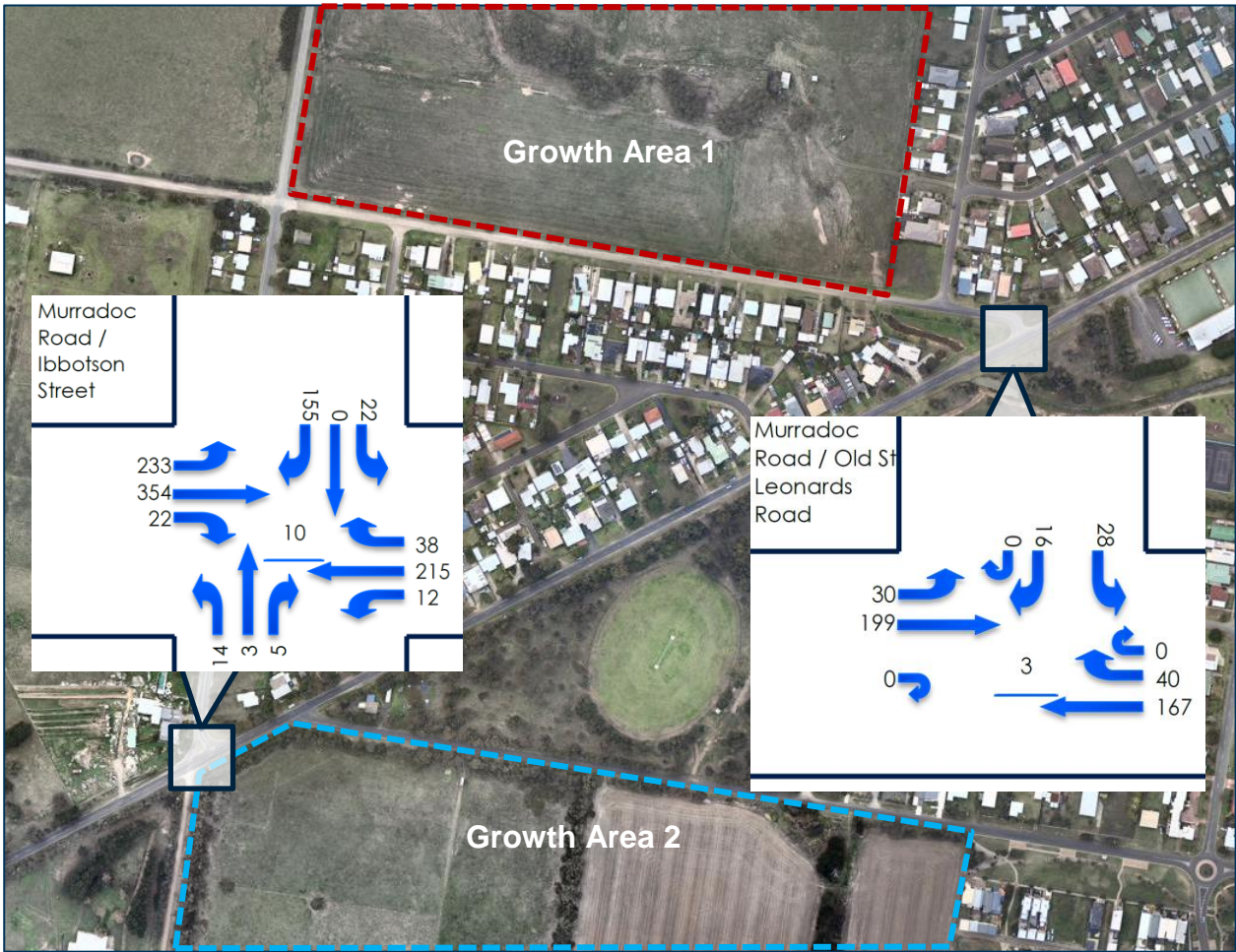


Figure 7-3 Future Expected Traffic Volumes – PM Peak Period



7.7 Intersection Analysis

On the basis of the future peak hour turning movements in Figure 7-2 and Figure 7-3, 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 7-1.

Table 7-1 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.

The results of the SIDRA Intersection analysis are summarised in Table 7-2.

Table 7-2 SIDRA Intersection Analysis Summary

Intersection	Approach	AM Peak			PM Peak		
		Degree of Saturation	95 th %ile Queue	Average Delay	Degree of Saturation	95 th %ile Queue	Average Delay
Murradoc Road / Old St Leonards Road	Old St Leonards (N)	0.093	2.4 m	9.7 sec	0.054	1.4 m	10.0 sec
	Murradoc Road (W)	0.102	0.0 m	0.3 sec	0.127	0.0 m	1.1 sec
	Murradoc Road (E)	0.095	3.9 m	1.8 sec	0.122	5.2 m	2.5 sec
	Intersection	0.102	3.9 m	2.6 sec	0.127	5.2 m	2.5 sec
Murradoc Road / Ibbotson Street	Ibbotson Street (N)	0.607	30.8 m	16.9 sec	0.374	12.2 m	16.0 sec
	Murradoc Road (W)	0.140	5.4 m	3.5 sec	0.393	20.9 m	3.7 sec
	Ibbotson Street (S)	0.058	1.4 m	11.4 sec	0.034	0.9 m	11.0 sec
	Murradoc Road (E)	0.241	11.4 m	1.0 sec	0.158	7.7 m	3.2 sec
	Intersection	0.607	30.8 m	7.2 sec	0.393	20.9 m	5.8 sec

A review of Table 7-2 indicates that all approaches to intersections are expected to operate under “excellent” or “very good” conditions during the AM and PM peak periods.

The analysis indicates that the residential rezoning and subsequent development are expected to cause no significant operational impact on the cross intersection of Murradoc Road and Ibbotson Street, nor the T-intersection at Old St Leonards Road / Murradoc Road.

7.8 Road Network Considerations

It is considered that the rural warrants for right turn treatments should not apply to this site, given that the subject intersections are within the settlement boundary as defined within the St Leonards Structure Plan, the residential land uses along the western approach and the 70km/h speed limit along Murradoc Road. The warrants for a rural right turn lane are met, however given the context of the approach to the intersections and the minimal queuing and delays, it is not considered appropriate.

The right turn from east to north at the Old St Leonards Road and Murradoc Road intersection is currently provided for by a sealed shoulder which allows through vehicles to pass turning vehicles. This is consistent with all intersections and property access points within the vicinity of this intersection. Subsequent to this, it is recommended that the shoulder on the east approach of the Murradoc Road and Ibbotson Street intersection be sealed to allow through vehicles to pass turning vehicles.

Given the increase in traffic volumes as a result of the proposed residential rezoning and subsequent development, a separate short turn lane is recommended within the southbound leg of the Ibbotson Street north approach of the Murradoc Road / Ibbotson Street intersection. This additional turn lane would provide additional storage capacity for left and right turners and reduce the expected delay within the north approach.

A review of the traffic distributions specified within Section 7.2, reveals that no traffic will be generated to or from Levens Road or Bluff Road as part of the Growth Area 1 rezoning, and the subsequent development of the land. As such, no road works or intersection upgrades are considered required as a consequence of this development.

8 Conclusions

Based on the foregoing analysis it is concluded that;

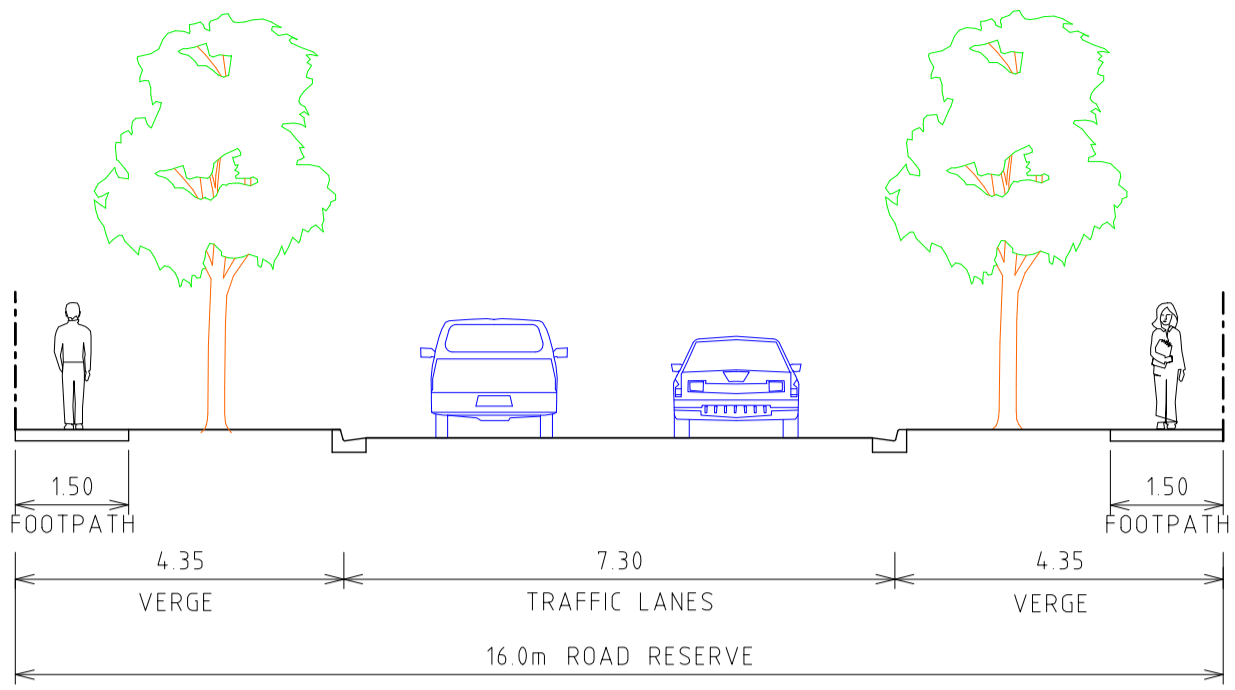
- > The proposed development is expected to generate up to 483 vehicles trips during the AM and PM peak periods;
- > The expected daily traffic volumes on the internal road network fall within the range specified in the road hierarchy, and therefore the cross-sections proposed are appropriate;
- > The site will contain various access points to Ibbotson Street, Old St Leonards Road and Lakeview Crescent, with simple 'give-way' intersection control;
- > To facilitate access to the subject land, it is proposed to seal and install kerb and channel along the site's lot frontage to Old St Leonards Road and Ibbotson Street and seal and install rural open swale channels along the open space frontage to Ibbotson Street; and
- > The roads surrounding the subject site are able to absorb the traffic generated by the proposed rezoning.

Ibbotson Street Subdivision – Growth
Area 1

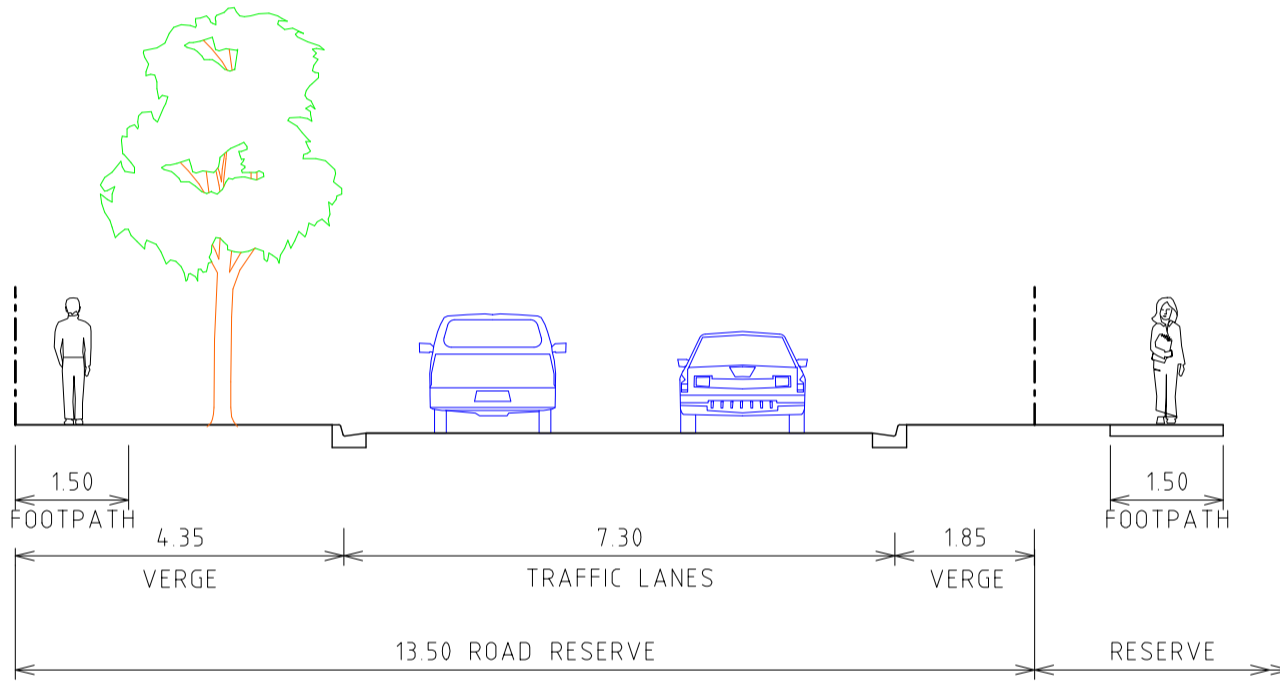
APPENDIX

A

INTERNAL ROAD CROSS SECTIONS



TYPICAL LOCAL ACCESS STREET
(LEVEL 2)
16.0m RESERVE



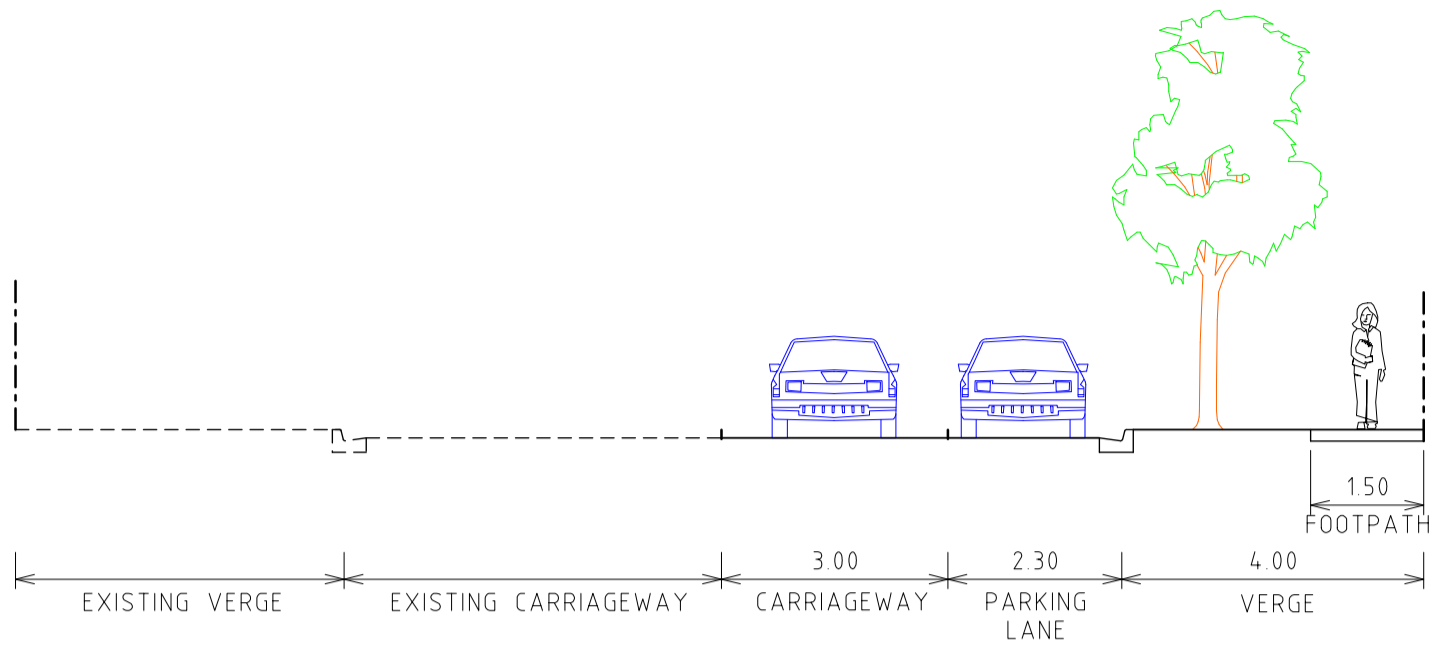
TYPICAL LOCAL ACCESS STREET
(LEVEL 2 - ADJACENT RESERVE)
13.5m RESERVE

Ibbotson Street Subdivision – Growth
Area 1

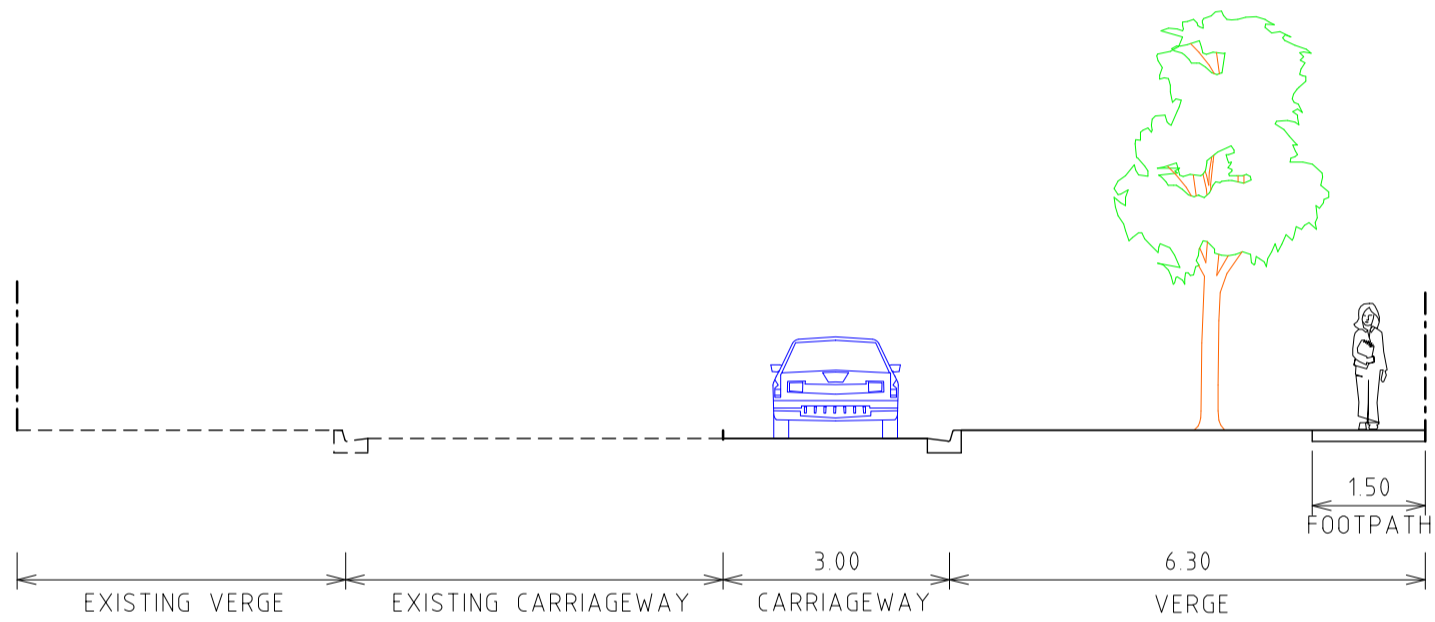
APPENDIX

B

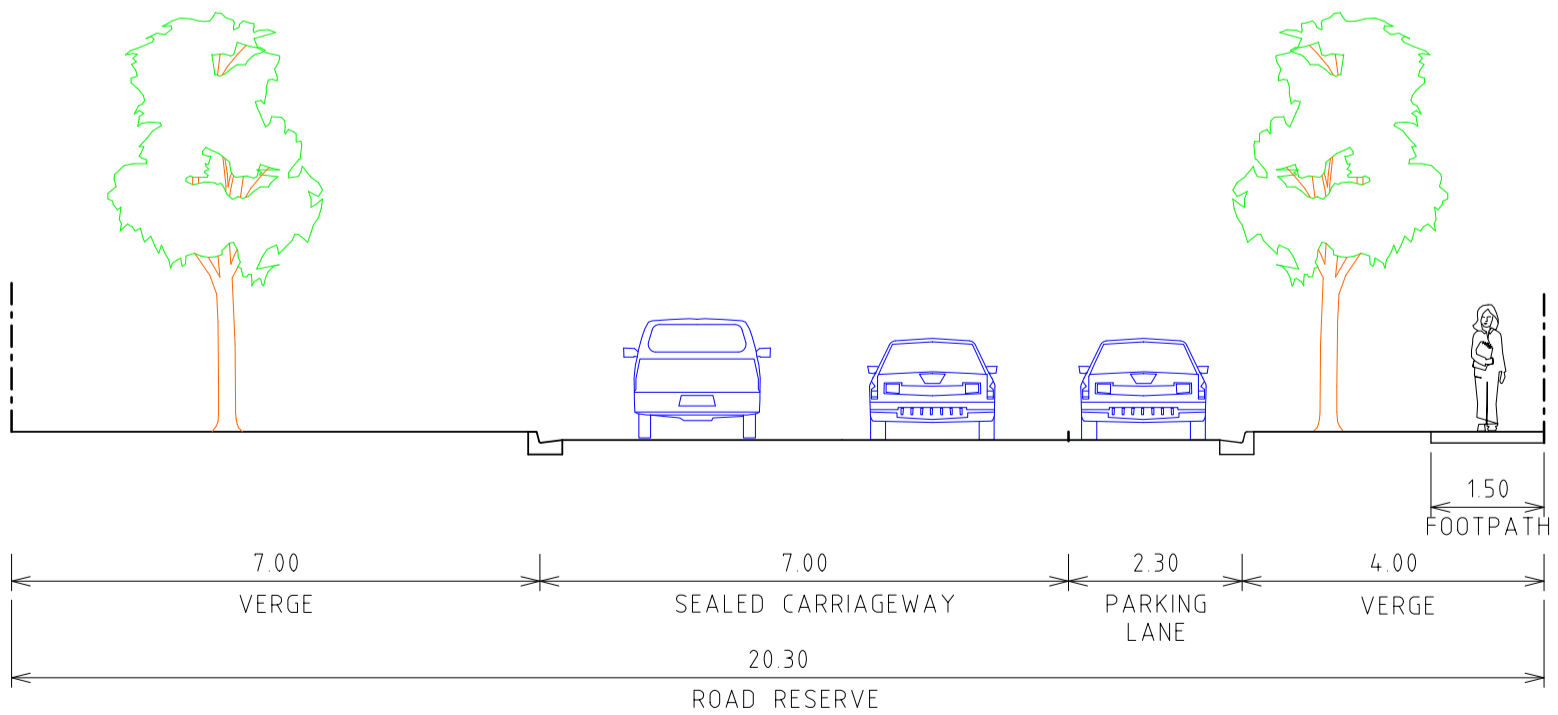
EXTERNAL ROAD CROSS SECTIONS



IBBOTSON STREET - ADJACENT LOT FRONTAGE
(PROPOSED CROSS-SECTION - EASTERN SIDE OF ROAD)



IBBOTSON STREET - ADJACENT OPEN SPACE AREAS
(PROPOSED CROSS-SECTION - EASTERN SIDE OF ROAD)



OLD ST LEONARDS ROAD
PROPOSED CROSS-SECTION