

**“PENRITH LAKES SCHEME”**  
**PROPOSED SUBDIVISION**  
**OLD CASTLEREAGH ROAD AND LUGARD STREET,**  
**PENRITH**  
***Traffic Impact Assessment***

January 2019  
(Rev D)

Reference 18210

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FIGURE 5	STAGE 1 AND 2 PEAK TRAFFIC VOLUMES

# 1. INTRODUCTION

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This report has been prepared to accompany an Application to the Department of Planning for a proposed subdivision of land zoned for “Employment” within the Penrith Lakes Scheme at Penrith (Figure 1).

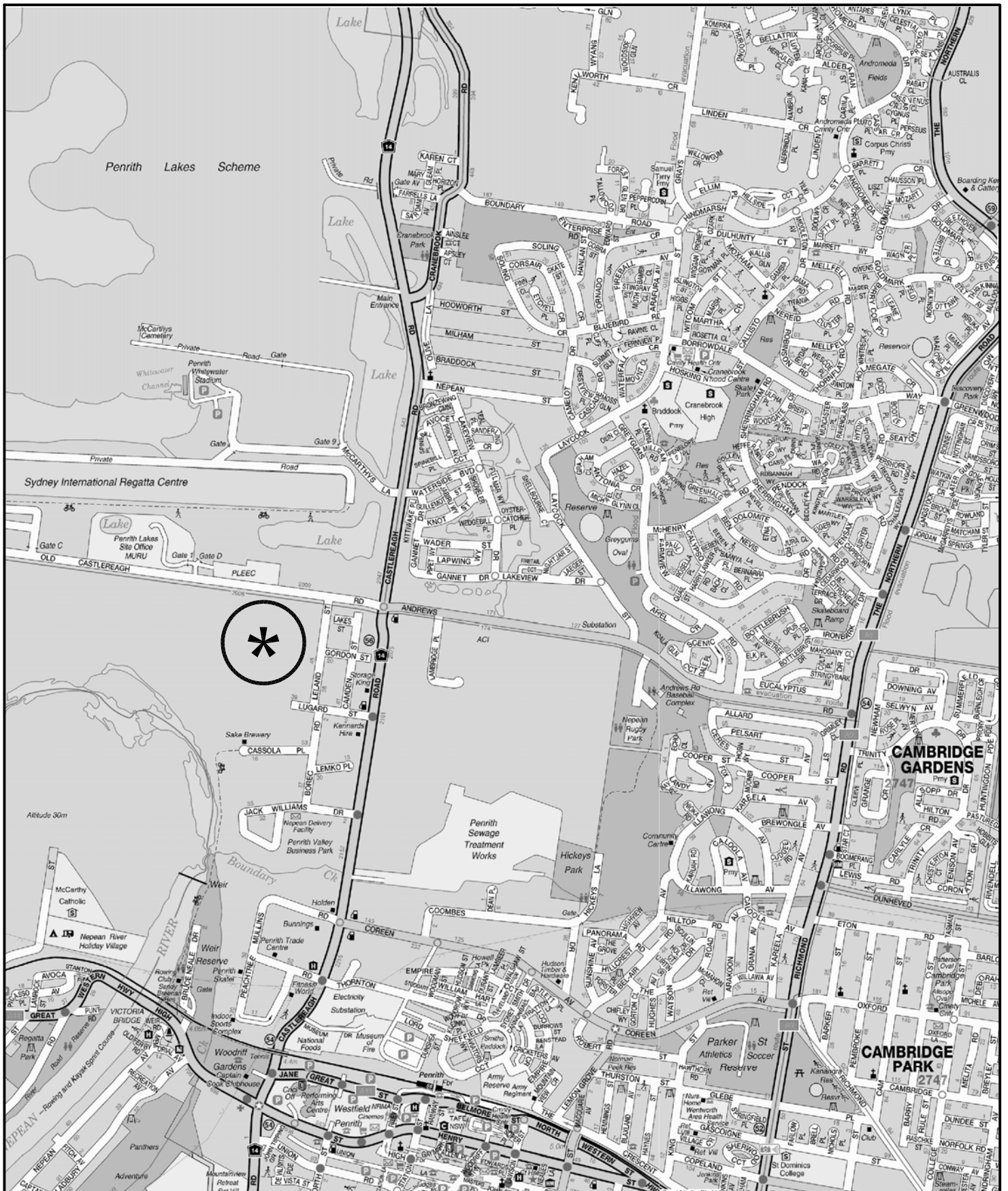
The Penrith Lakes Scheme (SEPP Penrith Lakes Scheme 1989 as amended) has the stated principal aim to “identify certain land that may be zoned for employment, environment, parkland, residential, tourism and waterway purposes”. The subject site is located in the south eastern part of the Penrith Lakes area and has convenient access to the arterial road system and public transport services.

The proposed subdivision scheme involves:

- \* a new access road system
- \* a subdivision of 100 lots

The purpose of this report is to describe the site, its context and the proposed subdivision scheme

- \* describe the existing road network serving the site and the prevailing traffic conditions
- \* describe the proposed upgrade for the arterial road system
- \* assess the suitability of the proposed access roads
- \* assess the potential traffic implications
- \* assess the adequacy of the proposed internal circulation and servicing arrangements



**LEGEND**



**LOCATION**

**FIG 1**

## 2. PROPOSED DEVELOPMENT SCHEME

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### 2.1 SITE, CONTEXT AND EXISTING CIRCUMSTANCES

The site (Figure 2) has frontage to the southern side of Old Castlereagh Road just to the west of Castlereagh Road and occupies an irregular shaped area of 46.36ha. The site, which is located approximately 2 km north of the Penrith CBD, is relatively level and is also accessed by Lugard Street which connects to Castlereagh Road and terminates at the eastern boundary.

The site is cleared and vacant with sparse grassland, scattered trees/shrubs and an unsealed “track” which runs across the southern part and connects to Lugard Street.

Land uses in the vicinity of the site include:

- \* the small light industrial buildings adjoining to the east and south
- \* the Penrith Lakes facilities extending to the north and west
- \* the Nepean River which runs immediately to the south-west
- \* the industrial area which extends to the east and south
- \* the residential precinct which extends to the north along the eastern side of Castlereagh Road.

### 2.2 PRECINCT PLANNING

State Environmental Planning Policy (Penrith Lakes Scheme 1989 as amended) is the planning policy for precinct. The aims of this policy are as follows:

- a) *to provide a development control process that ensures that environmental and technical matters are considered in the implementation of the Penrith Lakes Scheme,*
- b) *to identify and protect items of the environmental heritage,*



SITE

LEGEND



SITE

FIG 2

- c) *to identify certain land that may be rezoned for employment, environmental, parkland, residential, tourism and waterway purposes and land that will be rezoned as unzoned land,*
- d) *to permit interim development that will not detrimentally impact on the implementation of the Penrith Lakes Scheme,*
- e) *to ensure that the implementation of the Penrith Lakes Scheme does not detrimentally impact on the ongoing operation and use of Olympic legacy infrastructure, including the Sydney International Regatta Centre and the Penrith Whitewater Stadium.*

Details of the scheme are provided on the diagrams reproduced overleaf which indicate:

- the original approved Structure Plan
- the current Land Zoning Map showing the subject site zoned for “Employment” and small scattered areas along the eastern perimeter zoned for “Residential”

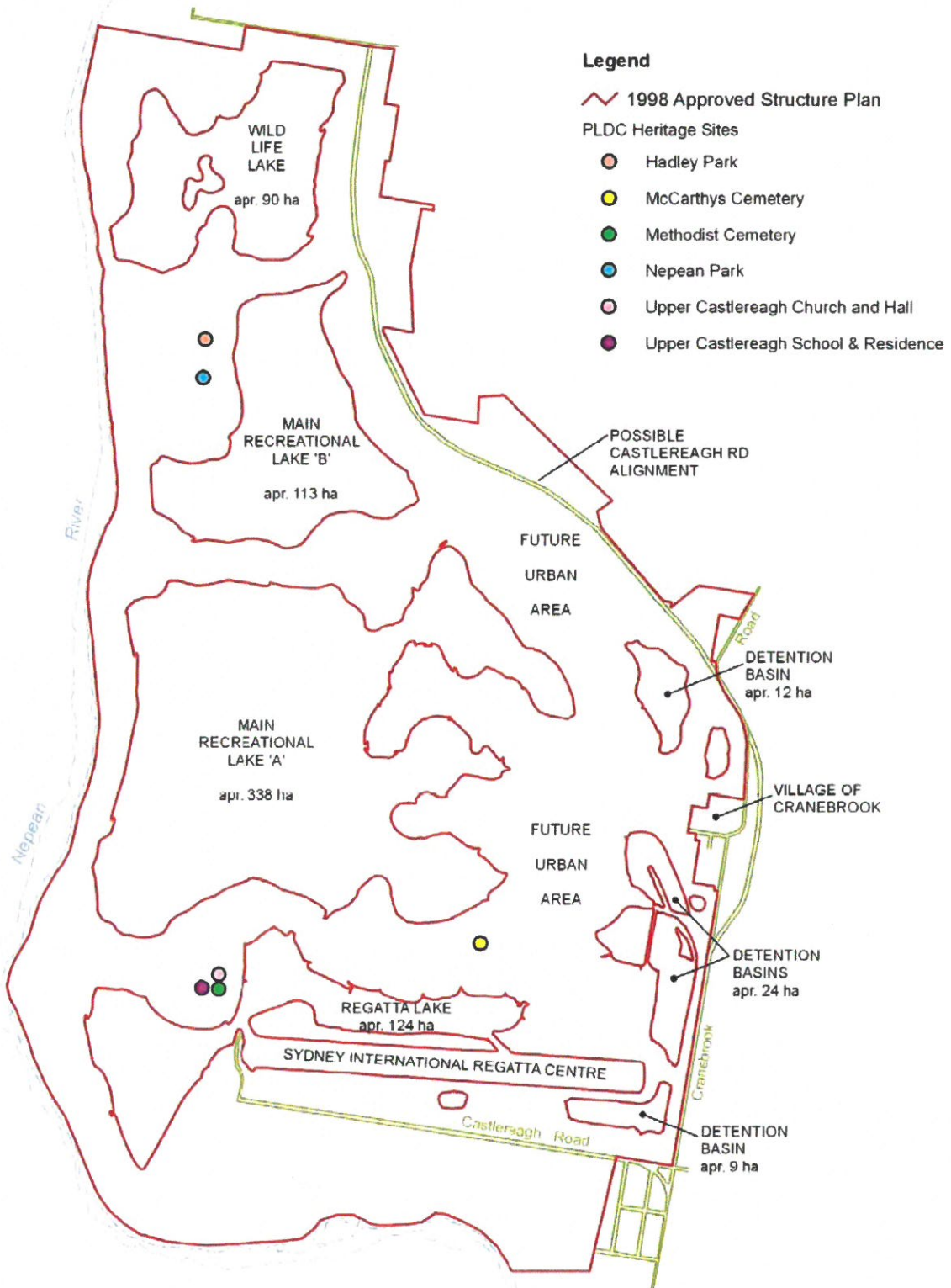
### **2.3 PROPOSED SUBDIVISION**

The proposal is to subdivide the site into 100 lots ranging between 1,500m<sup>2</sup> and 12,360m<sup>2</sup> with envisaged release stages as follows:

	<b>Lots</b>	<b>Net Area</b>	<b>Floorspace @ FSR 0.5:1</b>	<b>Envisaged Release</b>
Stage 1	19	8.90 ha	44,509m <sup>2</sup>	2021
Stage 2	13	4.61 ha	23,077m <sup>2</sup>	2022
Stage 3	11	5.52 ha	27,597m <sup>2</sup>	2024
Stage 4	28	7.10 ha	35,486m <sup>2</sup>	2025
Stage 5	15	5.95 ha	29,738m <sup>2</sup>	2026
Stage 6	14	6.03 ha	30,146m <sup>2</sup>	2027
<b>Total:</b>	<b>100</b>	<b>38.11 ha</b>	<b>190,553m<sup>2</sup></b>	

# Sydney Regional Environmental Plan No. 11 (Penrith Lakes)

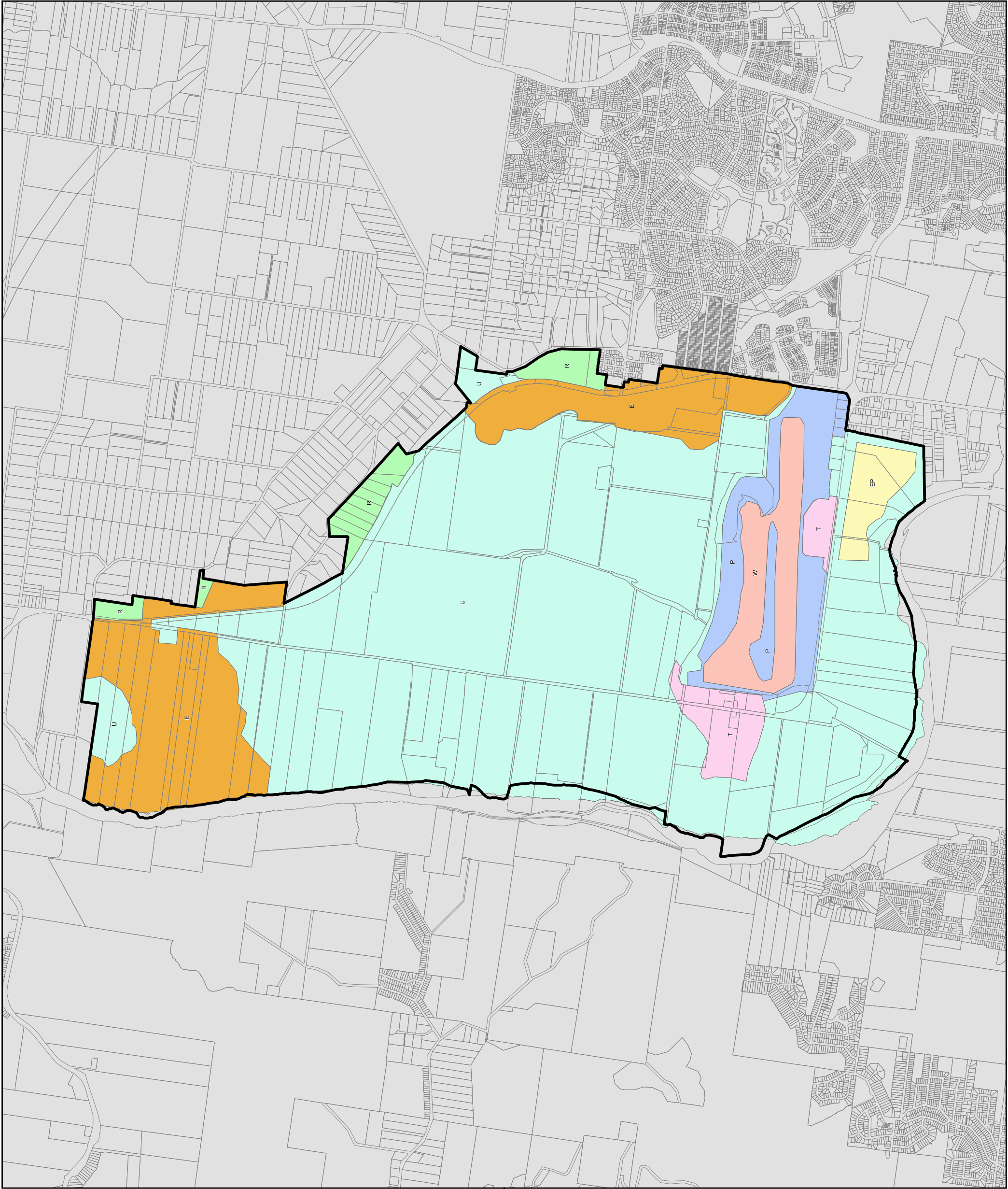
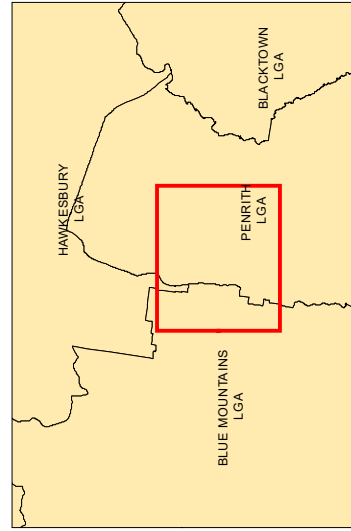
Approved Structure Plan, 1998





**Legend**

- Environment
- EP Employment
- P Parkland
- R Residential
- T Tourism
- U Unzoned
- W Waterway
- Land Application Boundary
- Cadastre 12/07/2016
- © Land & Property Information (LPI)



Lugard Street will be extended through the southern part of the site turning to the north to connect with Old Castlereagh Road as the principal internal access road. Two secondary roads will provide access to the central part of the site and there will be sections of dual carriageways separated by wetland corridors.

The development uses will comply with the "Employment" zoning provisions and it is envisaged that the majority of lots will have light industrial/warehouse uses with ancillary office elements.

Stage 1 and 2 will be accessed only via Lugard Street while Stage 3 will provide connection to Old Castlereagh Road enabling access for this and all stages to both external roadways.

Details of the proposed subdivision scheme are provided on the plans which accompany the Application and are reproduced in part in Appendix A.

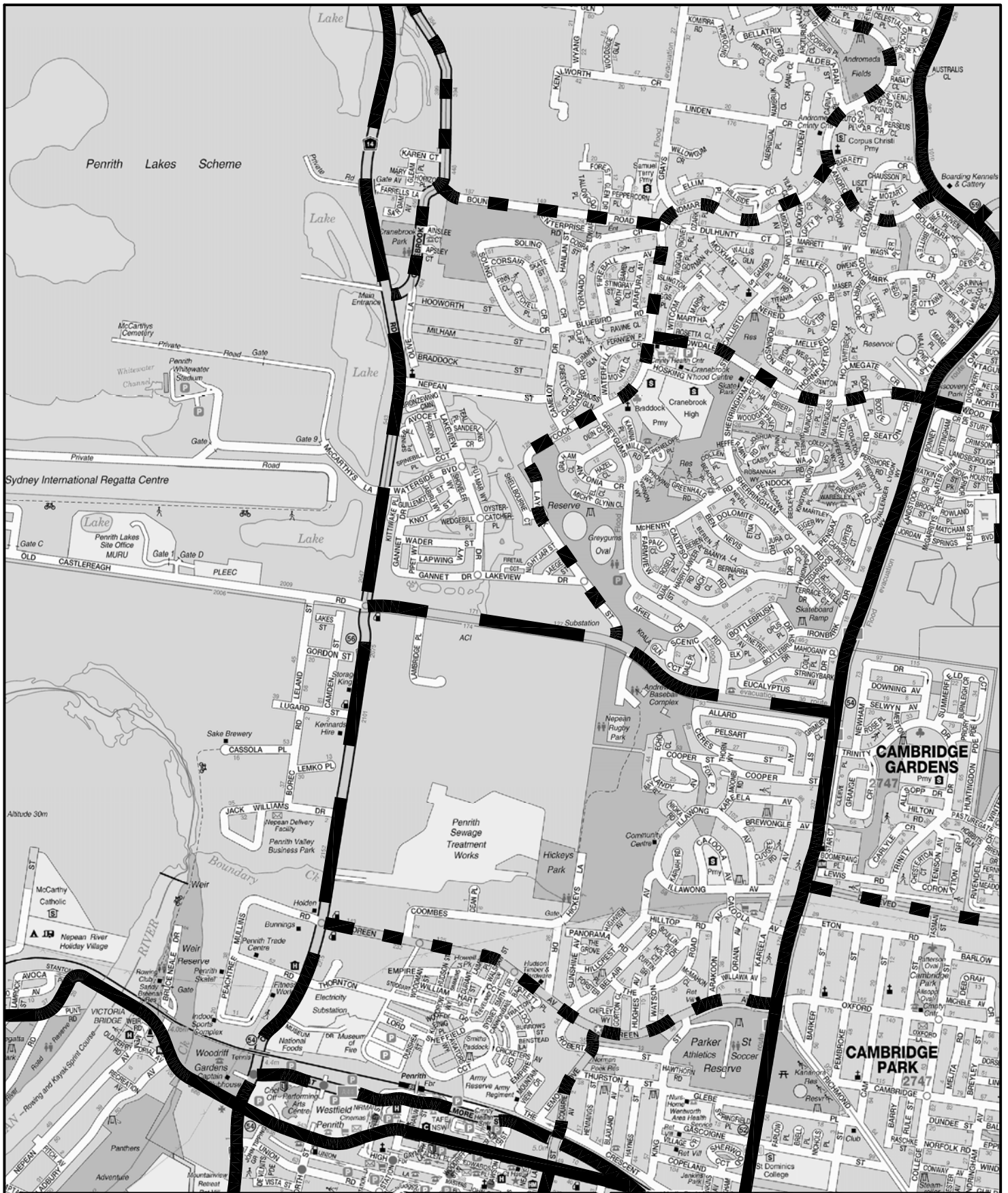
### 3. ROAD NETWORK AND TRAFFIC CONDITIONS

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#### 3.1 ROAD NETWORK

The road network serving the site (Figure 3) comprise:

- \* *Great Western Highway and M4 Western Motorway* – a State Road and east-west arterial routes which run to the South of Penrith to/from the Blue Mountains crossing.
- \* *Parker Street / Richmond Road / The Northern Road* – a State Road and arterial route which connects between Richmond and Camden
- \* *Castlereagh Road* – a State Road and arterial route which connects between Penrith and Richmond
- \* *Cranebrook Road* – a State Road and collector road route which connects between Castlereagh Road and Richmond Road providing a link to Windsor
- \* *Andrews Road* – a Regional Road and collector route linking between Castlereagh Road and The Northern Road
- \* *Old Castlereagh Road* – a local road providing access into the Penrith Lakes precinct which connects to Castlereagh Road
- \* *Lugard Street, Leland Street and Camden Street* – local access roads serving the industrial area on the western side of Castlereagh Road.



**LEGEND**

-  ARTERIAL
-  SUB-ARTERIAL
-  COLLECTOR



**ROAD NETWORK**

**FIG 3**

### 3.2 TRAFFIC CONTROLS

The traffic controls, which have been applied to the road system serving the site, (Figure 4) comprise:

- \* the traffic signals at the Castlereagh Road / Lugard Street intersection. Details of this intersection arrangement are provided on the signal design plan reproduced overleaf
- \* the roundabout at the Castlereagh Road / Old Castlereagh Road / Andrews Road intersection
- \* the traffic signals at other intersections along Castlereagh Road including Jack Williams Drive, Jane Street and High Street
- \* the 60 kmph speed limit on Castlereagh Road and 50 kmph on the local access road system
- \* the NHVR approved B Double routes along roads in the area including Castlereagh Road, Old Castlereagh Road and Lugard Street (see details overleaf)

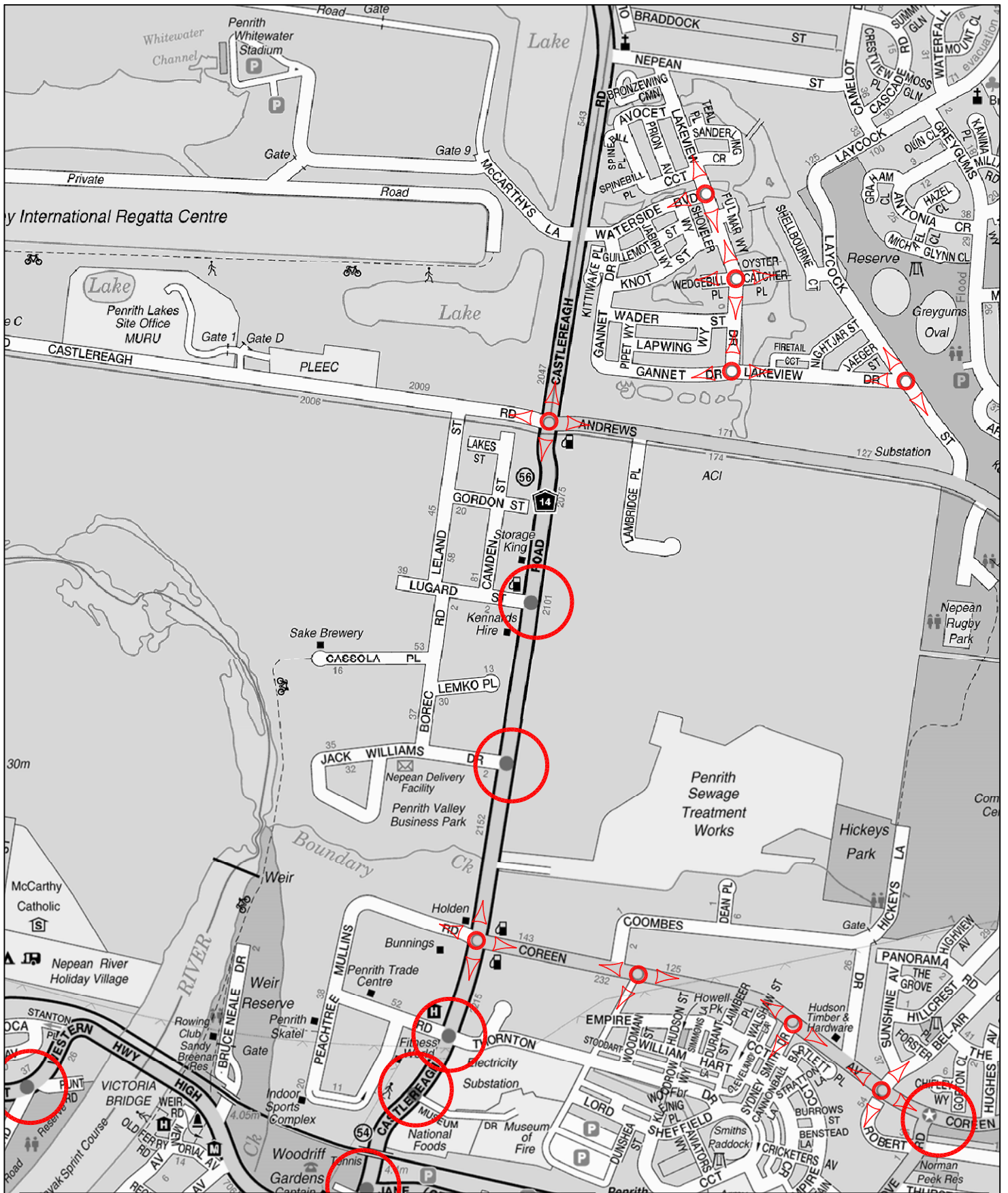
### 3.3 TRAFFIC CONDITIONS

An indication of the prevailing traffic conditions on the road system serving the development site is provided in data<sup>1</sup> published by RMS and surveys undertaken for this study. The data published by RMS is provided in the following:




<b>Location</b>	<b>AADT</b>	<b>Heavy Vehicles</b>
Castlereagh Road, north of Jack Williams Dr.	31,823	3,491 (11%)

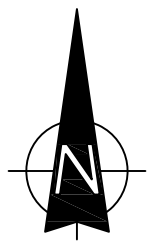
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<sup>1</sup> *Traffic Volume Data for Sydney Region  
Roads and Maritime Services*



**LEGEND**

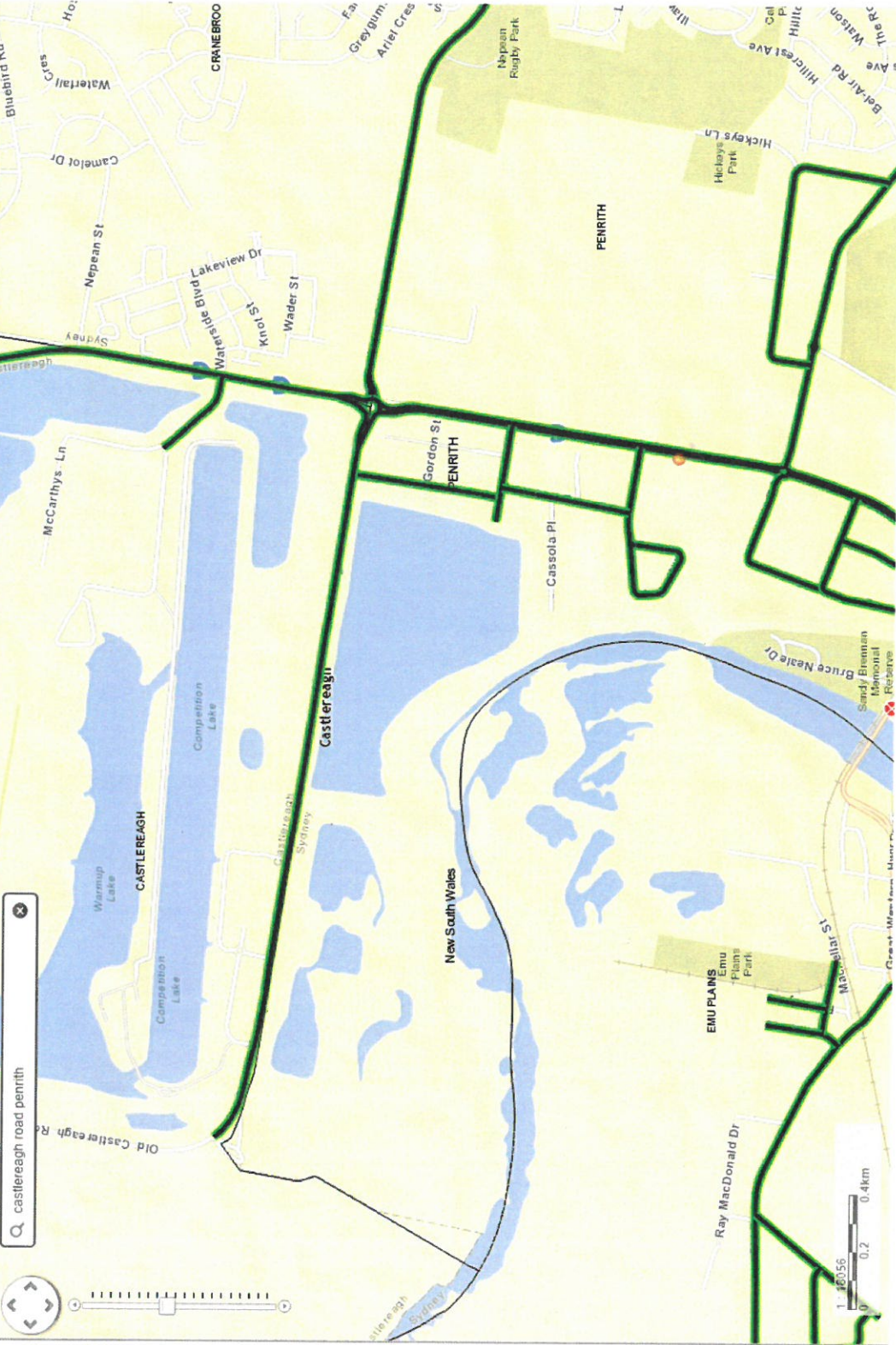
-  TRAFFIC SIGNAL CONTROL
-  ROUNDABOUT
-  RESTRICTED TURNING MOVEMENT



**TRAFFIC CONTROLS**

**FIG 4**





Map Contents

- ▶ Boundaries
- ▶ Road Ownership
- ▼ Heavy Vehicle Routes
  - Higher Mass Limit
    - ▶ Other HML Routes
    - Higher Mass Limit - NSW Only
      - ▶ HML Short Combination
      - ▶ HML B-double 25/26m
      - ▶ HML 36.5m Type 1 A-double Road Train
      - ▶ HML AB-Triple
      - ▶ HML B-Triple
      - ▶ HML Mod B-Triple
      - ▶ HML PBS Level 1
      - ▶ HML PBS Level 2A
    - Higher Mass Limit - SA Only
      - ▶ HML 19m Network
      - ▶ HML B-double 23m
      - ▶ HML B-double 26m
      - ▶ HML Road Train 32m
      - ▶ HML Road Train 36.5m
      - ▶ HML Road Train 53.5m
      - ▶ HML Vehicle Carrier 23m
      - ▶ HML Vehicle Carrier 25m
      - ▶ HML Road Train Converter Dolly
  - Higher Mass Limit - VIC Only
    - ▶ HML Routes
- Combination Vehicle Networks
  - ▶ PBS Level 1
  - ▶ PBS Level 1 - Approved with Conditions (NSW and VIC Only)
  - ▶ PBS Level 1 - Restricted (NSW and VIC Only)
  - ▶ PBS Level 2A
  - ▶ PBS Level 2A - Approved with Conditions (NSW and VIC Only)
  - ▶ PBS Level 2A - Restricted (NSW and VIC Only)
  - ▶ PBS Level 2A - Approved Areas (NSW Only)
  - ▶ PBS Level 2B
  - ▶ PBS Level 3A
- ▶ Points of Interest



The results of recent traffic surveys undertaken at the Castlereagh Road / Old Castlereagh Road / Andrews Road and Castlereagh Road / Lugard Street intersections during the morning and afternoon peak traffic period are provided in Appendix B and summarised in the following:

		<b>AM</b>	<b>PM</b>
Castlereagh Road	NB	580	893
	RT	350	479
	LT	10	1
	SB	1,261	645
	RT	16	9
	LT	111	96
Old Castlereagh Road	EB	14	47
	RT	7	14
	LT	14	42
Andrews Road	WB	54	29
	RT	91	98
	LT	589	463
<hr/>			
Castlereagh Road	NB	836	1,386
	LT	49	57
	SB	1,743	1,204
	RT	67	67
Lugard Street	LT	26	71
	RT	59	89

The operational performance of these intersections under the prevailing traffic demands has been assessed using the SIDRA model. The results of that assessment are provided in Appendix C and summarised in the following while the criteria for interpreting SIDRA output are provided overleaf.

	<b>AM</b>		<b>PM</b>	
	<b>LOS</b>	<b>AVD</b>	<b>LOS</b>	<b>AVD</b>
Castlereagh / Andrews / Old Castlereagh	A	6.2	A	5.6
Castlereagh / Lugard	B	19.7	C	22.6

The results of this SIDRA modelling indicate that these intersections currently operate quite satisfactorily with significant reserve capacity.

### **3.4 TRANSPORT SERVICES**

The existing bus network servicing the area are identified on the diagrams overleaf with 673, 783 and 784 services along Castlereagh Road connecting to Penrith CBD and Railway Station.

# Criteria for Interpreting Results of SIDRA Analysis

## 1. Level of Service (LOS)

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'	Good	Good
'B'	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
'C'	Satisfactory	Satisfactory but accident study required
'D'	Operating near capacity	Near capacity and Accident Study required
'E'	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode
'F'	Unsatisfactory and requires additional capacity	Unsatisfactory and requires other control mode

## 2. Average Vehicle Delay (AVD)

The AVD provides a measure of the operational performance of an intersection as indicated on the table below, which relates AVD to LOS. The AVD's listed in the table should be taken as a guide only as longer delays could be tolerated in some locations (ie inner city conditions) and on some roads (ie minor side street intersecting with a major arterial route).

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabouts	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode

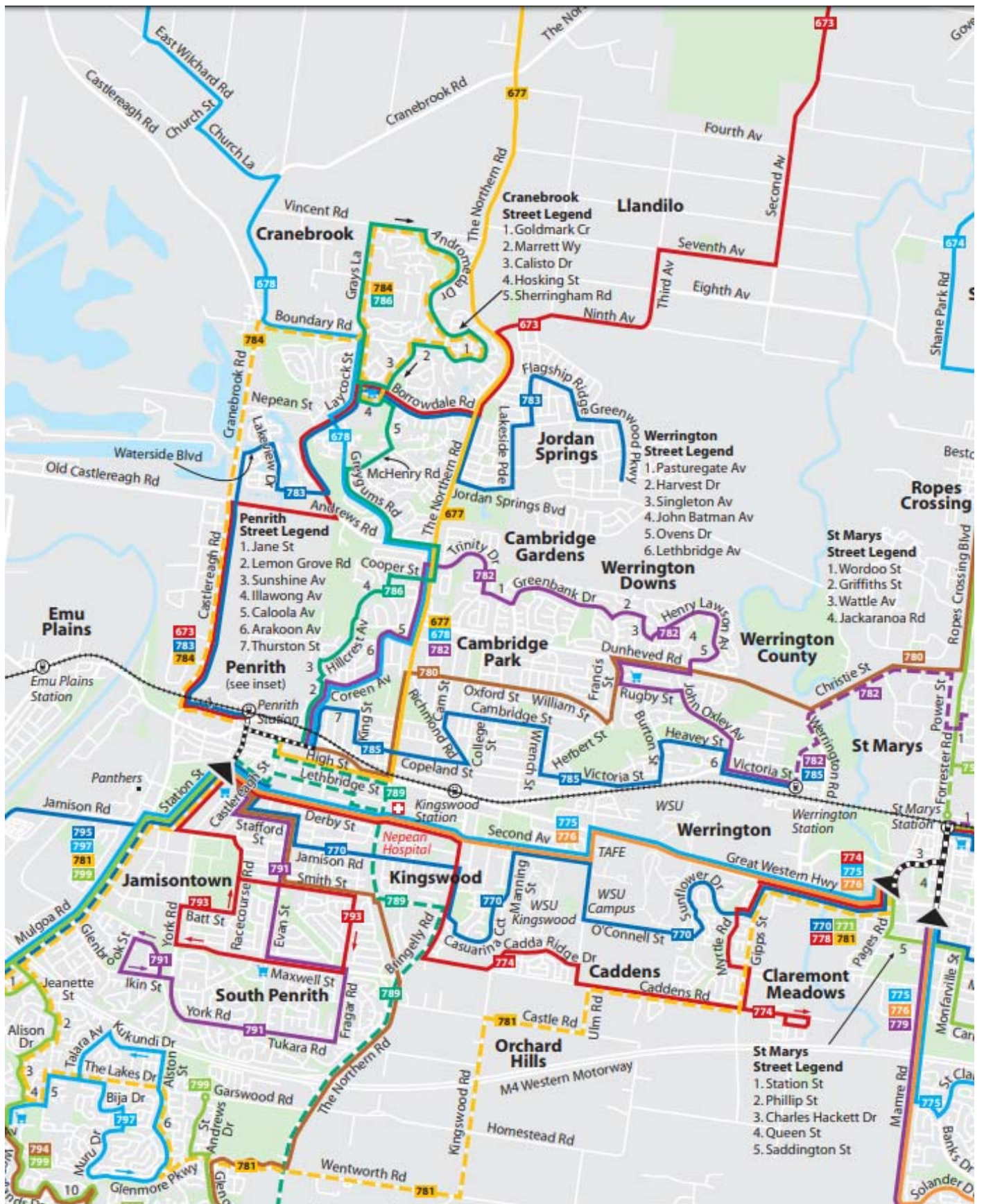
## 3. Degree of Saturation (DS)

The DS is another measure of the operational performance of individual intersections.

For intersections controlled by **traffic signals**<sup>1</sup> both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

For intersections controlled by a **roundabout or GIVE WAY or STOP signs**, satisfactory intersection operation is indicated by a DS of 0.8 or less.

<sup>1</sup> the values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs



## 4. FUTURE CIRCUMSTANCES

---

RMS, with Federal and State funding, propose to upgrade the 6.5km long Mulgoa Road/Castlereagh Road route between Glenmore Park and Andrews Road at Penrith to support the future traffic demands resultant to expected urban development in the area. The Mulgoa Road/Castlereagh Road Corridor Upgrade is part of a plan to progressively upgrade a number of major arterial roads in Western Sydney to deliver a more efficient, reliable network that meets the future needs of the community and the economy.

There are a number of key developments served by Mulgoa Road/Castlereagh Road that will contribute to increased population/employment and traffic movements in its immediate vicinity. These include:





- Penrith Panthers Entertainment precinct
- Penrith Station precinct
- Riverlink and Nepean River precincts
- Penrith Stadium
- Penrith Lakes Scheme
- Penrith Homemaker Centre
- New urban land releases at Glenmore Park and Thornton.

Related to the proposed is “Jane Street and Mulgoa Road Infrastructure Upgrade” and while it is a separate proposal, planning and staging of these two projects is being coordinated.

The diagram overleaf shows the location of both the proposal and the Jane Street and Mulgoa Road Infrastructure Upgrade.

# Mulgoa Road / Castlereagh Road corridor upgrade

## KEY

-  Funded to build
-  Short term upgrade
-  Medium term upgrade
-  Long term upgrade



### Castlereagh Road, Penrith Lakes

Lugard Street to north of Andrews Road  
(pre-design, short-term upgrade)

### Castlereagh Road, North Penrith

Coreen Avenue to Lugard Street  
(pre-design, long-term upgrade)

### Castlereagh Road, Penrith

Museum Drive to Coreen Avenue  
(pre-design, short-term upgrade)

Emu Plains



### Jane Street, Penrith

Union Road to Museum Drive  
including Railway Bridge  
(construction begins 2019)

Penrith



### Mulgoa Road, Penrith

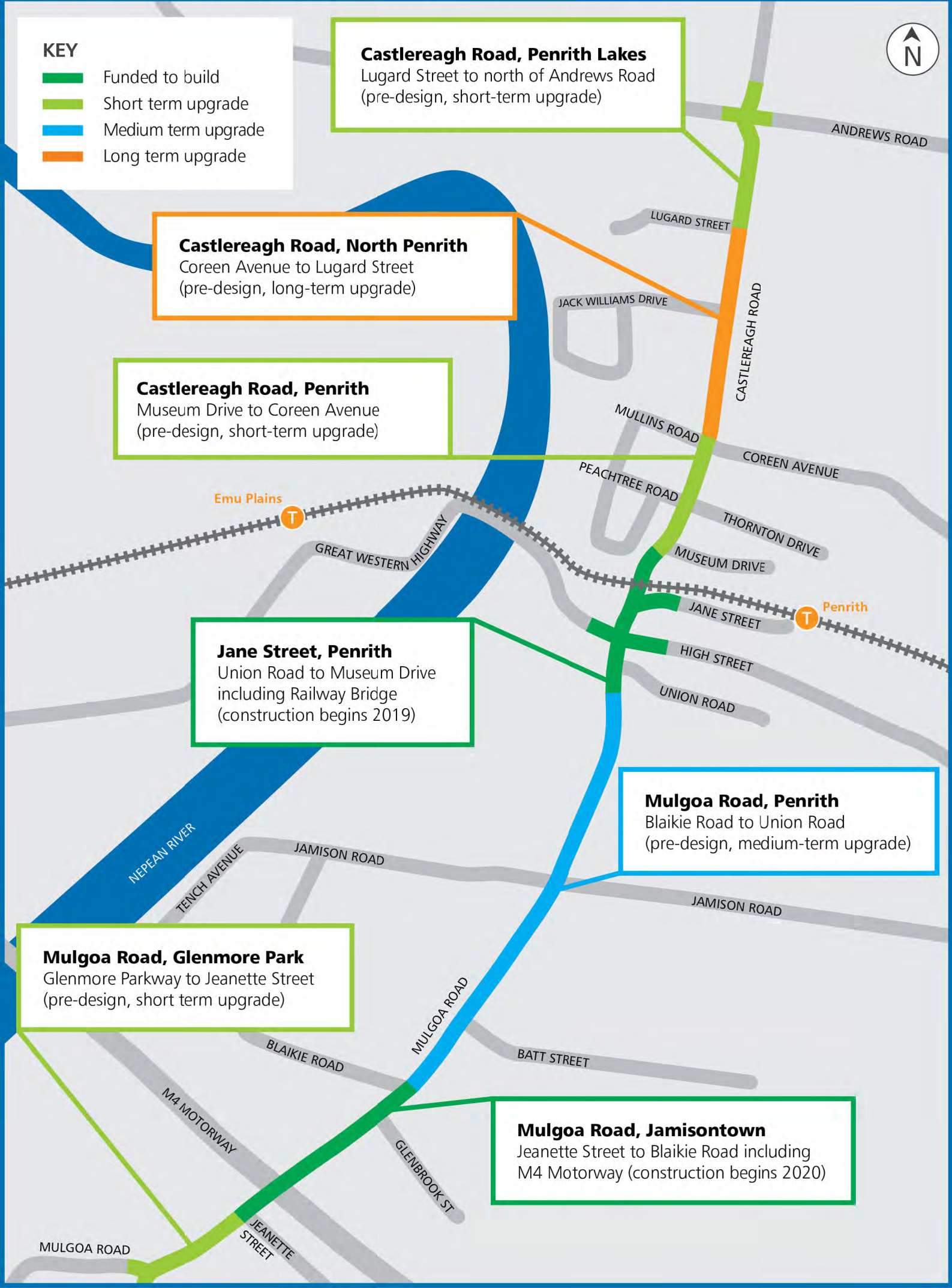
Blaikie Road to Union Road  
(pre-design, medium-term upgrade)

### Mulgoa Road, Glenmore Park

Glenmore Parkway to Jeanette Street  
(pre-design, short term upgrade)

### Mulgoa Road, Jamisontown

Jeanette Street to Blaikie Road including  
M4 Motorway (construction begins 2020)



Details of the assessments undertaken for the upgrade and the identified Preferred Option are provided in a Preferred Option Report<sup>2</sup> which includes a Traffic and Transport Assessment Study<sup>3</sup>. The preferred upgrade option is to widen the roadway to provide 3 lanes in each direction plus turning lanes at intersections. Details of the proposal for the Jack Williams Drive to Andrews Road section are provided in Appendix D and include:

- Replacement of the roundabout at the Andrews Road/Old Castlereagh Road intersection with a traffic signal controlled arrangement
- Provision for bus bays and bus “start up” arrangements
- Widening along the eastern side of Old Castlereagh Road.

The traffic modelling undertaken took into account the projected future traffic growth, including development in the Penrith Lakes Scheme, both for a normal growth scenario (i.e. 1.3% p.a.) and an accelerated growth scenario (i.e. 2.0% p.a.) as follows:

**Daily Volumes Andrews Road – Museum Drive Section**

	<b>2015</b>	<b>2026</b>	<b>2036</b>
Normal Growth	36,700	53,000	60,000
Accelerated Growth	36,700	55,000	65,000

The assessed operational performance outcome with the upgrade works completed were as follows:

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<sup>2</sup> *Mulgoa Road/Castlereagh Road Corridor Upgrade Preferred Option Report Hills Environmental April 2017*

<sup>3</sup> *Mulgoa Road/Castlereagh Road Corridor Upgrade Transport & Traffic Assessment Study Arcadis January 2017*

	2020				2026				2036			
	AM		PM		AM		PM		AM		PM	
	LOS	AVD	LOS	AVD	LOS	AVD	LOS	AVD	LOS	AVD	LOS	AVD
Andrews Road / Old Castlereagh Road	C	33	C	34	C	37	C	39	C	38	C	41
Jack Williams Drive	A	13	B	16	B	26	B	19	B	20	B	17

Details of modelling for the Lugard Street intersection are not provided. The proposed staging plan reproduced overleaf indicates that the Andrews Road/Old Castlereagh Road intersection works and the widening between Andrews Road and Lugard Street will be undertaken as the first “short term” stage.

In relation to bus services, pedestrians and cyclists, the upgrade scheme will:

- provide bus priority measures as “start up lanes” at intersections and bus bays and this will ensure optimised bus travel lines for the expected increased bus services required to meet the urban development needs
- provide a Shared Path along the eastern side of Castlereagh Road as well as a normal pathway on the western side and signalised pedestrian crossings at intersections



# Proposed staging plan map

## KEY

- █ Short term upgrade
- █ Medium term upgrade
- █ Long term upgrade
- █ Jane Street and Mulgoa Road Infrastructure Upgrade
- - - Indicates separation of Stages 1 and 2

## Staging plan

### Short term upgrade

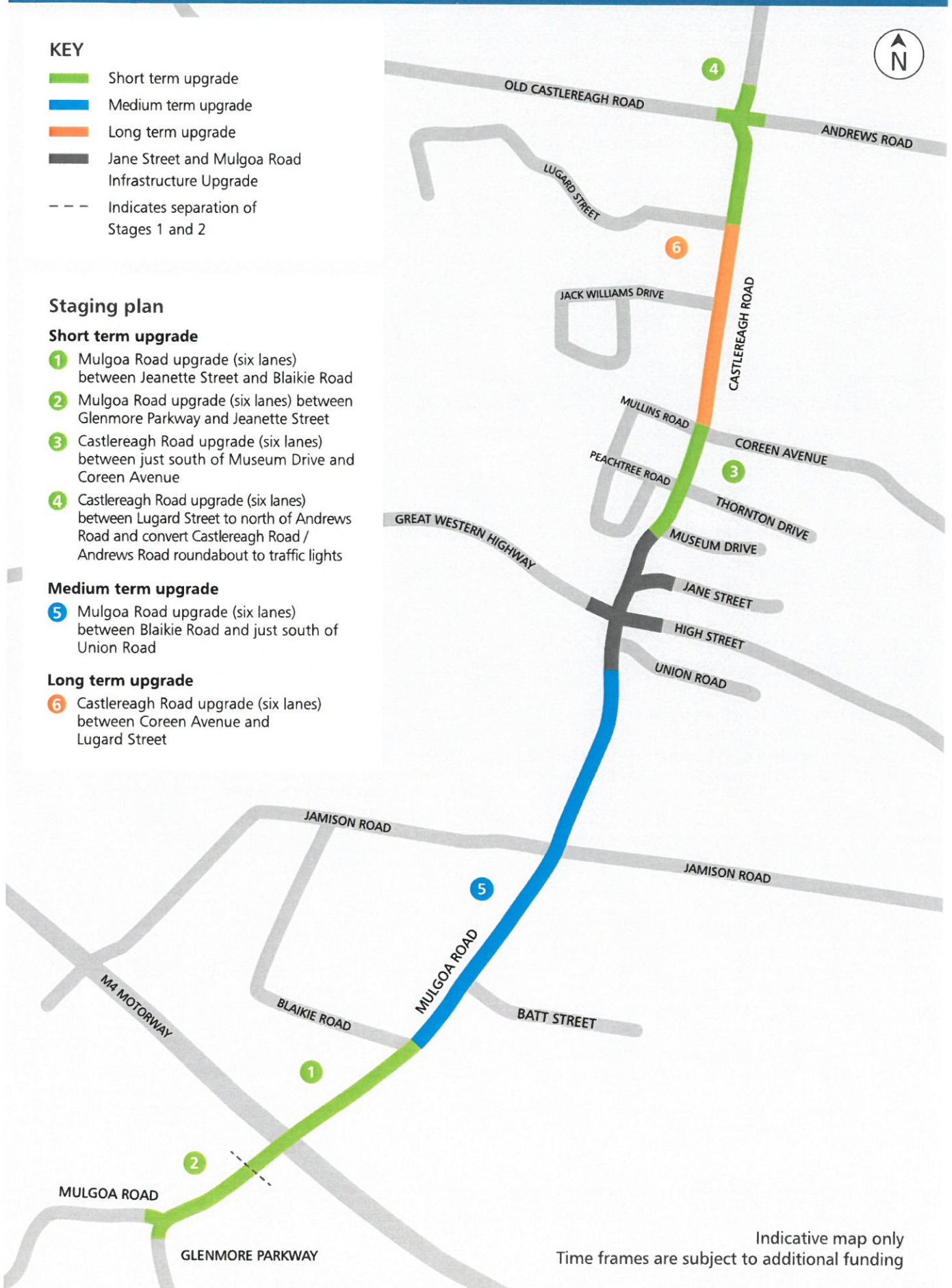
- 1 Mulgoa Road upgrade (six lanes) between Jeanette Street and Blaikie Road
- 2 Mulgoa Road upgrade (six lanes) between Glenmore Parkway and Jeanette Street
- 3 Castlereagh Road upgrade (six lanes) between just south of Museum Drive and Coreen Avenue
- 4 Castlereagh Road upgrade (six lanes) between Lugard Street to north of Andrews Road and convert Castlereagh Road / Andrews Road roundabout to traffic lights

### Medium term upgrade

- 5 Mulgoa Road upgrade (six lanes) between Blaikie Road and just south of Union Road

### Long term upgrade

- 6 Castlereagh Road upgrade (six lanes) between Coreen Avenue and Lugard Street



Indicative map only  
Time frames are subject to additional funding

## 5. PROPOSED ACCESS ROADS

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Much of the principal access road (Roads 1 and 2) and all of the secondary central access road (Roads 4 and 5) will have separate carriageways separated by wetland corridors. These carriageways will have 3.5m wide travel lanes and 3.0m wide parking lanes.

The eastern part of the principal access road and the outer secondary road will have 13m wide roadways (3.5m wide travel lanes and 3.0m wide parking lanes). The proposed road arrangements comply with normal industrial road requirements.

The proposed access road system will accommodate B Double trucks (subject to NHVR approval) and details of turning path assessments for these vehicles are provided in Appendix F indicating satisfactory road and intersection geometry.

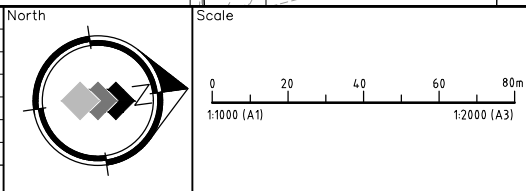
Extracts from the Civil Design plans are reproduced overleaf indicating 3.5m wide footways along each side of the single carriageways and 4.5m wide verges on the outside of the dual carriageways.



**LEGEND**

	STORMWATER PIPE
	EKI PIT
	SAG PIT
	HEADWALL
	INTERLOT DRAINAGE PIPE
	INTERLOT DRAINAGE PIT
	CONCEPT SEWER POSITION
	CONCEPT REGRADING DIRECTION OF FALL
	CONCEPT FINISHED LEVEL CONTOUR (MAJOR)
	CONCEPT FINISHED LEVEL CONTOUR (MINOR)
	CONCEPT FINISHED LEVEL LABEL

1	ORIGINAL ISSUE	DB	AS	19.11.18
Amendment	Description	Drawn	App'd	Date



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Designed  
KS

Cad Reference  
18255 C02 r1

Scale  
1:1000

Project Approval  
IAN HILL (B.E)  
Consulting Civil Engineer

**A1 SHEET**

Client

**GCA**  
ENGINEERING SOLUTIONS

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
**PROPOSED SUBDIVISION  
PENRITH LAKES INDUSTRIAL  
PENRITH  
PLAN SHEET (1 OF 2)**

Project No  
**18255C**

Drawing No  
**C02**

Revision  
**1**

**LEGEND**

-  STORMWATER PIPE
-  EKI PIT
-  SAG PIT
-  HEADWALL
-  INTERLOTMENT DRAINAGE PIPE
-  INTERLOTMENT DRAINAGE PIT
-  CONCEPT SEWER POSITION
-  0.5% MIN FALL CONCEPT REGRADING DIRECTION OF FALL
-  CONCEPT FINISHED LEVEL CONTOUR (MAJOR)
-  CONCEPT FINISHED LEVEL CONTOUR (MINOR)
-  29.00 CONCEPT FINISHED LEVEL LABEL

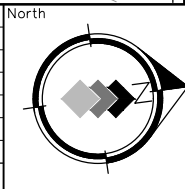


DWG C03

DWG C02

PRELIMINARY ISSUE  
NOT FOR CONSTRUCTION

Amendment	Description	Drawn	App'd	Date
1	ORIGINAL ISSUE	DB	AS	19.11.18



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IAN HILL (B.E)  
Consulting Civil Engineer

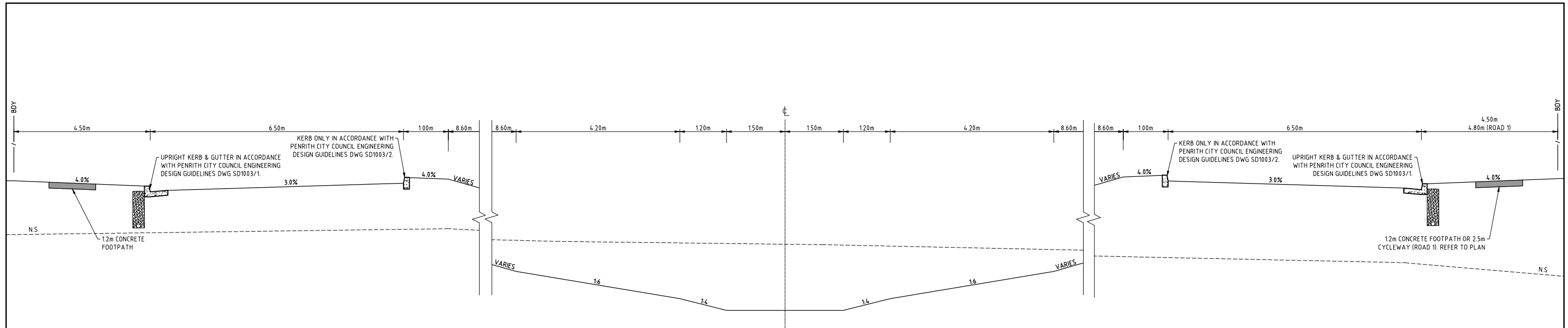
Cad Reference  
18255 C03 r1  
**A1 SHEET**

Client

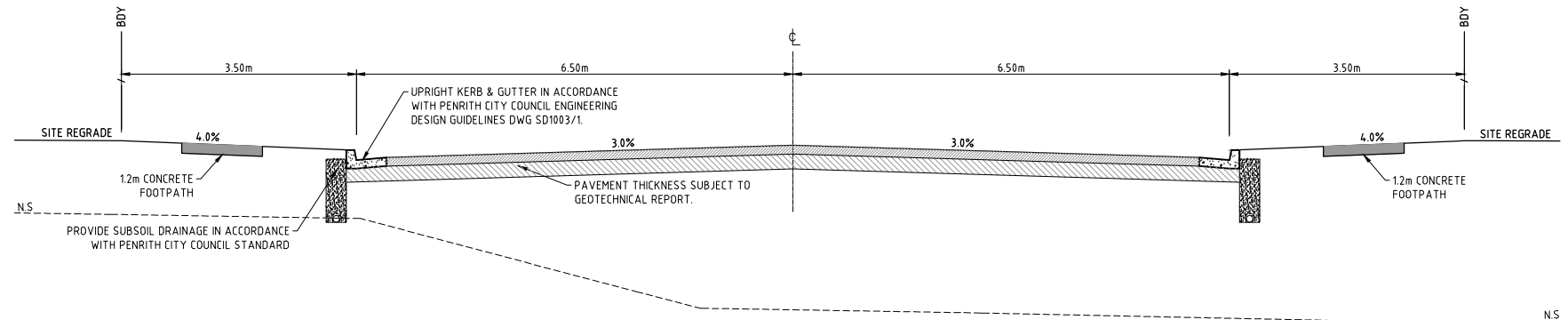
**GCA**  
ENGINEERING SOLUTIONS  
A.B.N. 92 086 017 745  
1 HARTLEY DRIVE, THORNTON NSW 2322  
PO BOX 3337, THORNTON NSW 2322  
PHONE: (02) 4964 1811 ♦ FAX: (02) 4964 1822

**PROPOSED SUBDIVISION  
PENRITH LAKES INDUSTRIAL  
PENRITH  
PLAN SHEET (2 OF 2)**

Project No  
**18255C**  
Drawing No  
**C03**  
Revision  
**1**



TYPICAL WETLAND ROAD SECTION - ROAD 1,2,4, AND 5  
SCALE 1:50

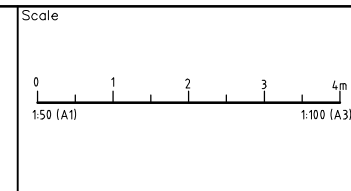


TYPICAL ROAD SECTION - ROAD 1 AND 3  
SCALE 1:50

PRELIMINARY ISSUE  
NOT FOR CONSTRUCTION

Amendment	Description	Drawn	App'd	Date
1	ORIGINAL ISSUE	DB	AS	19.11.18

North



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Designed  
KS  
Scale  
1:50  
Project Approval  
IAN HILL (B.E)  
Consulting Civil Engineer

Cad Reference  
18255 C07 r1  
Client

**GCA**  
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PROPOSED SUBDIVISION  
PENRITH LAKES INDUSTRIAL  
PENRITH  
TYPICAL SECTIONS

Project No 18255C	
Drawing No C07	Revision 1

## 6. TRAFFIC IMPLICATIONS

---

An indication of the traffic generation potential of development on the proposed lots is provided by the recent RMS study of “Business Parks and Industrial Estates”. There were 4 sites in the Sydney Metropolitan Area surveyed for this study, namely:

Site 1	Erskine Park
Site 2	Helensburgh
Site 3	Eastern Creek
Site 4	Riverwood

Site 2 had 13 lots comprising 9 with “office” use and is therefore not relevant to the Penrith Lakes outcome. The Erskine Park site had a mixture of factories, warehouse and workshop uses while Sites 1 and 3 had larger lots and Site 4 had smaller lots. (see Appendix E details)

If the traffic generation of Sites 1, 3 and 4 is averaged for the AM and PM “on street peak periods”, the following outcomes result:

	Vtph per 100m <sup>2</sup>	
	AM	PM
Site 1	0.13	0.14
Site 3	0.17	0.17
Site 4	0.43	0.23
<b>Average</b>	<b>0.243</b>	<b>0.18</b>

It is noted that the Institute of Transportation Engineers document “trip generation” in respect of “Mini Warehouse” use derived a peak trip generation during the AM and PM peak on-street peak traffic periods in the following ranges:

<b>AM</b>	0.04 – 0.27 vtp
<b>PM</b>	0.13 – 0.48 vtp

In order to provide a “sensitivity factor”, the adopted traffic generation rates are 0.3vtp/100m<sup>2</sup> for the AM and 0.20 vtp/100m<sup>2</sup> for the PM and the assessed traffic generation for each stage on this basis are as follows:

		<b>AM</b>	<b>PM</b>
Stage 1	44,509m <sup>2</sup>	134 vtp	89 vtp
Stage 2	23,077m <sup>2</sup>	69 vtp	46 vtp
Stage 3	27,597m <sup>2</sup>	83 vtp	55 vtp
Stage 4	35,486m <sup>2</sup>	106 vtp	71 vtp
Stage 5	29,738m <sup>2</sup>	89 vtp	60 vtp
Stage 6	30,146m <sup>2</sup>	90 vtp	60 vtp
	<b>Total</b>	<b>571 vtp</b>	<b>381 vtp</b>
	<b>IN</b>	400 vtp	114 vtp
	<b>OUT</b>	171 vtp	267 vtp

The Stage 1 and 2 traffic movements (203 vtp AM and 135 vtp PM) will ingress and egress through the Castlereagh Road/Lugard Street intersection and it is assessed that the projected traffic generation will be distributed in the same manner of that of the existing recorded intersection movements as follows:

	<b>AM</b>	<b>PM</b>
RT IN	58%	54%
LT IN	42%	46%
RT OUT	69%	56%
LT OUT	31%	44%

The assessed peak traffic movements at the Castlereagh Road/Lugard Street intersection for Stages 1 and 2 (2021) with 3 years background growth along Castlereagh Road as shown on Figure 5. SIDRA modelling of the operation of the existing intersection for the 2022 Stages 1 and 2 development circumstance has been undertaken and the results are provided in Appendix C and summarised in the following:

	<b>AM</b>		<b>PM</b>	
<b>LOS</b>	<b>AVD</b>	<b>LOS</b>	<b>AVD</b>	
C	22.0	C	24.2	

The results indicate that the existing intersection will accommodate the Stages 1 and 2 traffic generation quite satisfactorily.

LUGARD STREET

45  
99

AM

147  
1813  
117  
869

CASTLEREAGH ROAD

LUGARD STREET

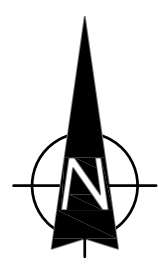
111  
149

PM

89  
1257  
75  
1441

CASTLEREAGH ROAD

LEGEND



STAGES 1 & 2  
2022 PEAK  
TRAFFIC VOLUMES

FIG 5



The completion of Stage 3, envisaged in 2024, will complete the road connection to Old Castlereagh Road which will enable traffic to/from the north (Castlereagh Road) and east (Andrews Road) to travel along Old Castlereagh Road. There will be additional traffic movements generated through the Castlereagh Road/Andrews Road intersection, however the proposed upgrade of this intersection will be well and truly completed by this time. In fact, due to the high priority that RMS has placed on this intersection upgrade, it is quite likely that it will be completed to accommodate the traffic from Stages 1 and 2 of the development.

It is apparent that:

- the RMS assessments undertaken for the design of the Castlereagh Road upgrade took account of the proposed development of the Penrith Lakes Precinct
- the RMS assessments with projected 2020 traffic demands identified a LOS C operational performance for the Castlereagh Road/Andrews Road intersection
- this assessment has identified a satisfactory operational performance for the existing Castlereagh Road/Lugard Street intersection for the Stages 1 and 2 of development (i.e. prior to the proposed RMS upgrading)
- when the development of the estate is completed (i.e. Stage 6), there will be quite adequate spare capacity on the section of upgraded Castlereagh Road
- there is no apparent need for any interim or temporary road/intersection upgrade works to accommodate the development of the estate.

## **7. PEDESTRIANS AND CYCLISTS**

---

The proposed provisions for pedestrians and cyclists comprise:

- a 2.5m wide shared path along the southern side of Road No. 1
- 1.2m wide footways along all other verges
- appropriate street lighting

This proposed provision will enable connection to the external pedestrian and cycle network as well as flexible and appropriate internal circulation and site access.

## 8. INTERNAL CIRCULATION, SERVICING AND PARKING

---

The design of the proposed vehicle access, internal circulation and servicing arrangements for development of the lots will be subject to subsequent individual applications. However, the design of these aspects will accord with the relevant AS2890.1, 2 and 6 standards and there are no apparent reasons why these design standards cannot be achieved.

The car parking provision for each developed lot will comply with the parking rates set out in the RMS *Guide to Traffic Generating Developments* and the design of the car park areas will comply with AS2890.1 & 6.

## **9. CONCLUSION**

---

The traffic assessment undertaken for the proposed subdivision in the Penrith Lakes Scheme has concluded that:

- \* there will not be any unsatisfactory traffic implications and in particular:
  - there will be adequate spare capacity on Castlereagh Road when the development is completed
  - there will be no need for any interim or temporary road upgrades to accommodate the staged completion of development
  
- \* the proposed access road system will be suitable and appropriate
  
- \* appropriate provisions will be made for pedestrians, cyclists and bus services

**APPENDIX A**

**SUBDIVISION PLANS**

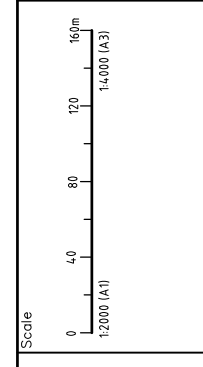
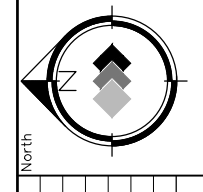
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(B) - PROPOSED EASEMENT TO DRAIN WATER 10 WIDE (WIDE D.P.)  
 (C) - PROPOSED EASEMENT TO DRAIN WATER 10 WIDE

OVERALL SITE PLAN  
 SCALE 1:2000



Amendment	Description	Drawn	App'd	Date
16	PEDESTRIAN CROSSINGS ADDED	KS	AS	05.12.18
15	ROAD NAMES ADDED	DB	AS	28.11.18
14	FOOTPA THS ADDED	DB	AS	28.11.18
13	WETLAND, ROADS & LOT NUMBERING AMENDED	DB	AS	27.11.18
12	STAGING AMENDED	DB	AS	26.11.18
11	ROAD, MEDIAN AND LOTS AMENDED	DB	AS	19.11.18

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**Designed**  
 AM

**Scale**  
 1:2000

**Project Approval**  
 IAN HILL (B.E)  
 Consulting Civil Engineer

**Client**

**Cod Reference**  
 18255LD LD03 r16

**A1 SHEET**



**PENRITH LAKES**

INDICATIVE CONCEPT ONLY

PRELIMINARY ISSUE  
 NOT FOR CONSTRUCTION

**Project No**  
 18255LD

**Drawing No**  
 LD03

**Revision**  
 16

**APPENDIX B**

**TRAFFIC SURVEY RESULTS**

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Location Castlereagh Road  
Andrews Road  
Castlereagh Road  
Old Castlereagh Road

Suburb PENRITH

Duration 0700 - 0900  
1500 - 1800

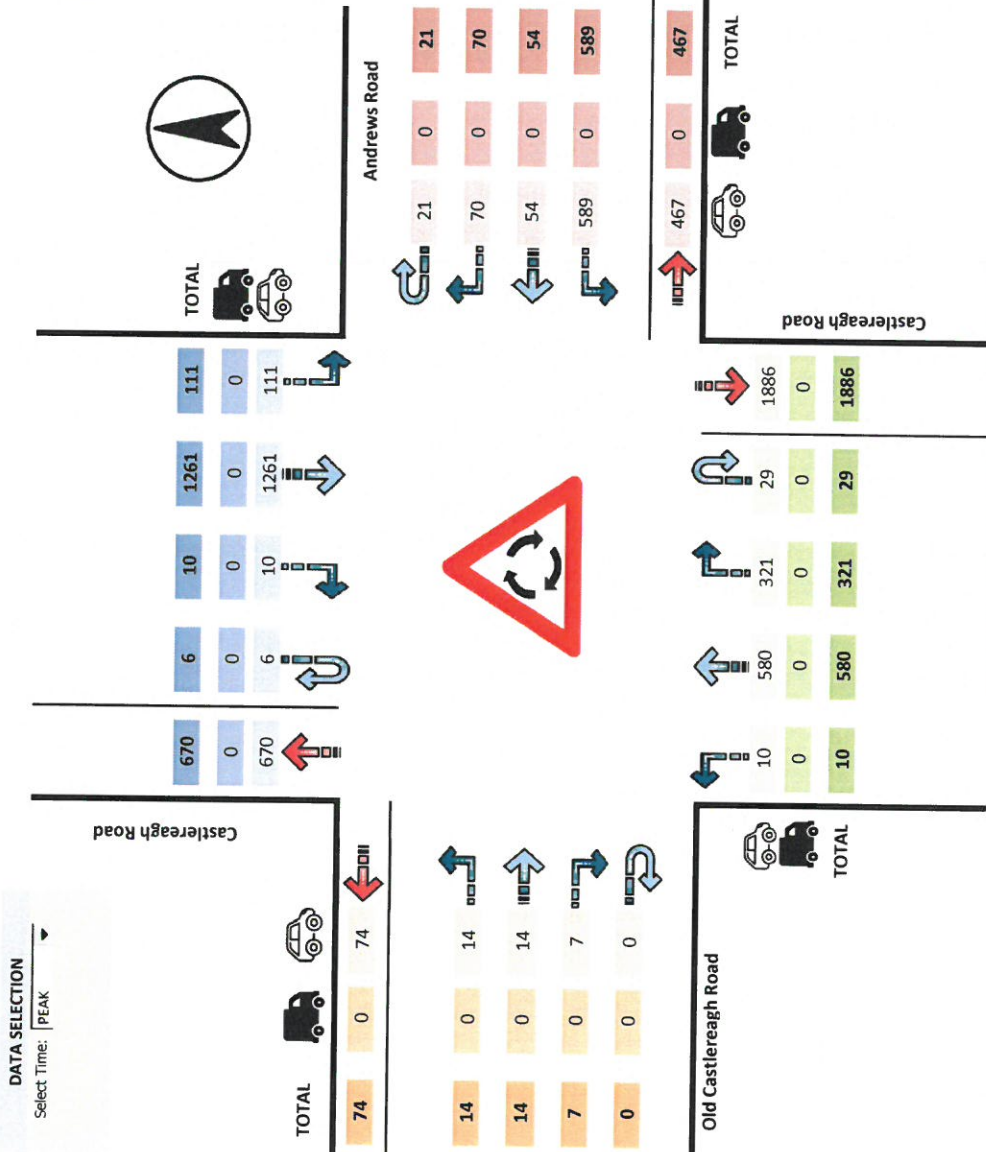
Day/Date Tuesday, October 16, 2018  
 Weather -

All Vehicles Time Per Hour	NORTH Castlereagh Road				EAST Andrews Road				SOUTH Castlereagh Road				WEST Old Castlereagh Road								
	L	I	R	U	TOTAL	L	I	R	U	TOTAL	L	I	R	U	TOTAL	L	I	R	U	TOTAL	
	7:00 - 8:00	104	1044	10	5	1163	541	46	48	8	643	11	556	262	9	838	10	13	8	0	31
7:15 - 8:15	115	1114	11	6	1246	567	49	52	12	680	14	587	274	13	888	9	10	8	0	27	2841
7:30 - 8:30	102	1209	12	7	1330	600	49	60	15	724	11	602	290	16	919	11	15	7	0	33	3006
7:45 - 8:45	111	1261	10	6	1388	589	54	70	21	734	10	580	321	29	940	14	14	7	0	35	3097
8:00 - 9:00	113	1191	8	6	1318	572	58	75	25	730	12	536	339	31	918	11	21	10	0	42	3008
Period End	545	5819	51	30	6445	2869	256	305	81	3511	58	2861	1486	98	4503	55	73	40	0	168	14627
15:00 - 16:00	108	677	11	1	797	402	27	75	12	516	2	815	327	16	1160	41	26	17	0	84	2557
15:15 - 16:15	101	711	14	1	827	414	19	72	12	517	1	914	368	16	1299	39	37	12	0	88	2731
15:30 - 16:30	83	671	11	1	766	447	21	79	12	559	1	918	421	11	1311	41	45	12	0	98	2734
15:45 - 16:45	96	645	9	0	750	463	29	86	12	590	1	893	470	9	1333	42	47	14	0	103	2776
16:00 - 17:00	105	618	15	0	738	455	30	96	15	596	1	838	480	9	1288	39	54	14	0	107	2729
16:15 - 17:15	102	608	12	0	722	454	33	99	13	599	4	871	478	4	1317	38	53	13	0	104	2742
16:30 - 17:30	97	610	11	1	719	421	31	95	13	560	5	871	440	7	1323	42	56	15	0	113	2715
16:45 - 17:45	83	574	17	2	676	417	25	91	13	546	4	908	402	5	1319	41	53	13	0	107	2648
17:00 - 18:00	75	571	13	2	661	429	28	77	9	543	5	977	393	4	1379	37	42	13	0	92	2675
Period End	850	5685	113	8	6656	3902	243	770	111	5026	24	8005	3779	81	11729	360	413	123	0	896	24307



Location: Castlereagh Road, Andrews Road, Castlereagh Road, Old Castlereagh Road  
 Suburb: PENRITH  
 Duration: 0700 - 0900, 1500 - 1800  
 Day/Date: Tuesday, October 16, 2018  
 Weather: -

TIME RANGE	PEAK	AM
	7:45	8:45

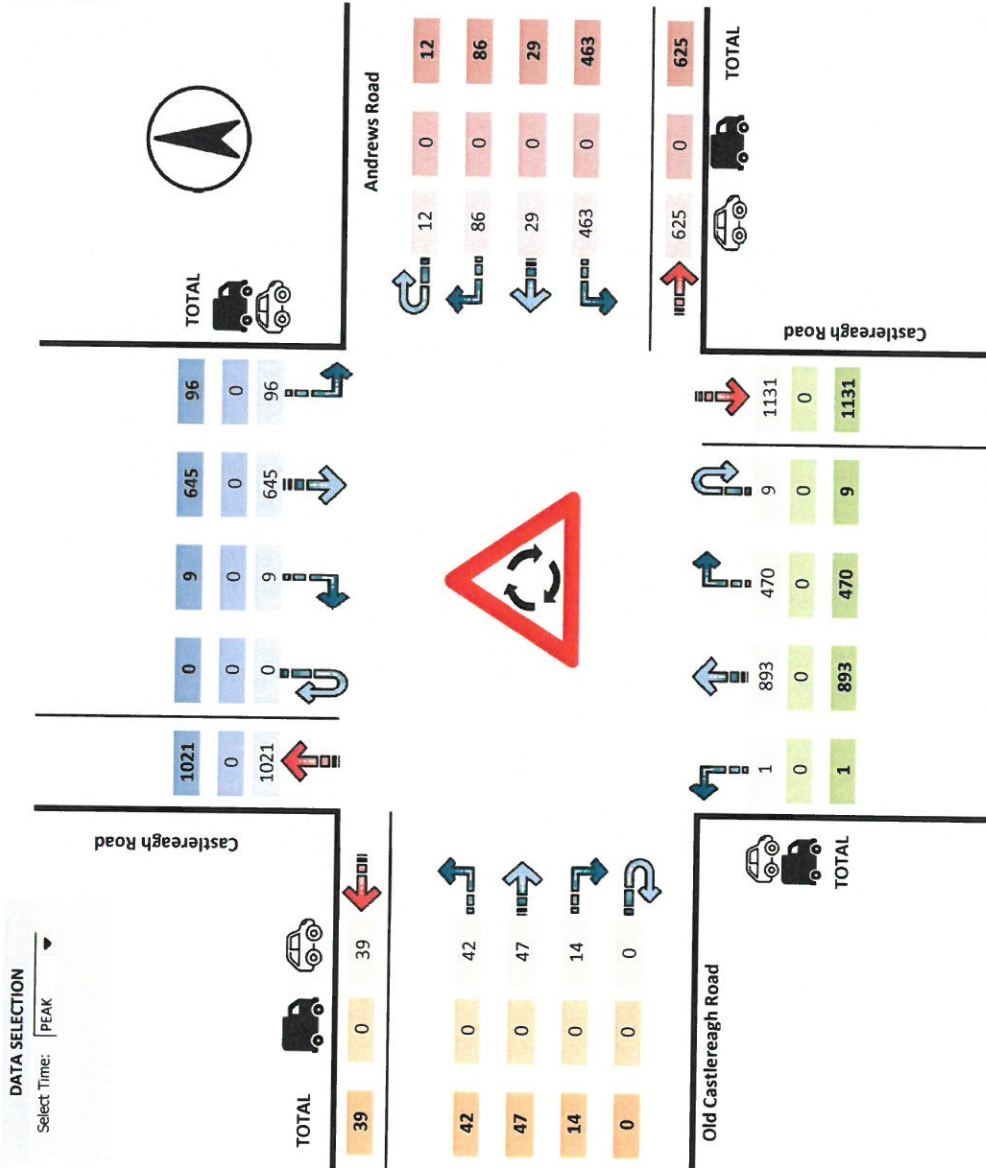


Location: Castlereagh Road  
Andrews Road  
Castlereagh Road  
Old Castlereagh Road  
 Suburb: PENRITH

Duration: 0700 - 0900  
1500 - 1800

Day/Date: Tuesday, October 16, 2018  
 Weather: \_\_\_\_\_

TIME RANGE	PEAK	PEAK
	15:45	16:45

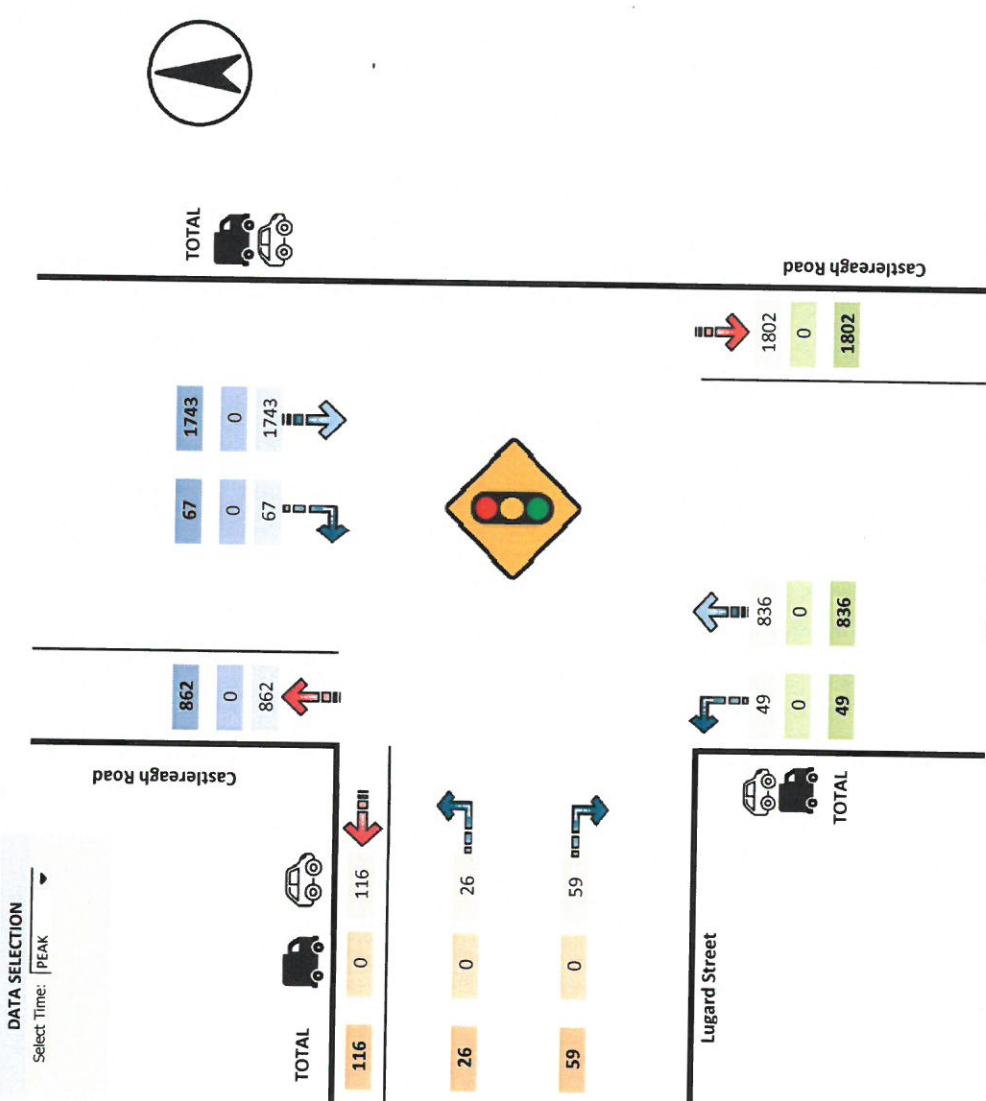


Location Castlereagh Road Duration 0700 - 0900  
Castlereagh Road 1500 - 1800  
Castlereagh Road  
 Day/Date Tuesday, October 16, 2018  
 Suburb PENRITH Weather -

All Vehicles Time Per Hour	NORTH Castlereagh Road			EAST -			SOUTH Castlereagh Road			WEST Lugard Street			TOTAL	
	L	I	R	L	I	R	L	I	R	L	I	R		TOTAL
7:00 - 8:00	0	1500	67	0	0	0	42	778	0	23	0	29	52	2439
7:15 - 8:15	0	1574	59	0	0	0	49	820	0	24	0	43	67	2569
7:30 - 8:30	0	1695	58	0	0	0	48	822	0	21	0	56	77	2700
7:45 - 8:45	0	1743	67	0	0	0	49	836	0	26	0	59	85	2780
8:00 - 9:00	0	1696	80	0	0	0	45	783	0	31	0	57	88	2692
Period End	0	8208	331	0	0	0	233	4039	0	125	0	244	369	13180
15:00 - 16:00	0	1136	52	0	0	0	52	1225	0	39	0	93	132	2597
15:15 - 16:15	0	1168	59	0	0	0	55	1344	0	55	0	89	144	2770
15:30 - 16:30	0	1204	67	0	0	0	57	1386	0	71	0	89	160	2874
15:45 - 16:45	0	1217	63	0	0	0	53	1365	0	75	0	82	157	2855
16:00 - 17:00	0	1140	57	0	0	0	53	1389	0	84	0	75	159	2798
16:15 - 17:15	0	1127	47	0	0	0	49	1446	0	78	0	65	143	2812
16:30 - 17:30	0	1000	26	0	0	0	43	1481	0	69	0	54	123	2673
16:45 - 17:45	0	977	30	0	0	0	33	1574	0	73	0	52	125	2739
17:00 - 18:00	0	972	36	0	0	0	25	1568	0	66	0	45	111	2712
Period End	0	9941	437	0	0	0	420	12778	0	610	0	644	1254	24830

Location: Castlereagh Road  
 Duration: 0700 - 0900  
Castlereagh Road  
 Duration: 1500 - 1800  
Lugard Street  
 Day/Date: Tuesday, October 16, 2018  
 Suburb: PENRITH  
 Weather: -

TIME RANGE	
PEAK	AM
7:45	8:45



Location: Castlereagh Road

Duration: 0700 - 0900

Castlereagh Road

1500 - 1800

Suburb: PENRITH

Lugard Street

Day/Date: Tuesday, October 16, 2018

Weather:

DATA SELECTION  
Select Time: PEAK

TIME RANGE  
PEAK - PM  
15:30 - 16:30

Castlereagh Road

1457 0 1457

67 0 67

1204 0 1204

TOTAL 124 0 124

71 0 71

89 0 89

Castlereagh Road

1293 0 1293

1386 0 1386

57 0 57

TOTAL



**APPENDIX C**

**SIDRA RESULTS**

---

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# MOVEMENT SUMMARY

 Site: 101 [EX AM OLD CASTLEREAGH - CASTLEREAGH - ANDREWS]

 Network: N101 [EX AM PEAK]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	Aver. Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: CASTLEREAGH ROAD														
1	L2	11	2.0	11	2.0	0.357	3.4	LOS A	0.8	5.9	0.33	0.29	0.33	56.4
2	T1	611	2.0	611	2.0	0.357	2.8	LOS A	0.8	5.9	0.33	0.33	0.33	58.4
3	R2	368	2.0	368	2.0	0.357	10.3	LOS B	0.8	5.7	0.35	0.59	0.35	55.9
Approach		989	2.0	989	2.0	0.357	5.6	LOS A	0.8	5.9	0.34	0.43	0.34	57.4
East: ANDREWS ROAD														
4	L2	620	2.0	620	2.0	0.719	8.9	LOS A	2.5	17.6	0.91	1.07	1.27	46.8
5	T1	57	2.0	57	2.0	0.244	5.6	LOS A	0.5	3.4	0.76	0.80	0.76	54.0
6	R2	96	2.0	96	2.0	0.244	13.0	LOS B	0.5	3.4	0.76	0.80	0.76	55.1
Approach		773	2.0	773	2.0	0.719	9.2	LOS A	2.5	17.6	0.88	1.02	1.17	49.2
North: CASTLEREAGH ROAD														
7	L2	117	2.0	117	2.0	0.601	5.2	LOS A	2.2	15.6	0.69	0.50	0.71	54.5
8	T1	1327	2.0	1327	2.0	0.601	5.0	LOS A	2.2	15.6	0.70	0.55	0.73	49.2
9	R2	17	2.0	17	2.0	0.601	12.8	LOS B	2.2	15.6	0.71	0.59	0.76	57.8
Approach		1461	2.0	1461	2.0	0.601	5.1	LOS A	2.2	15.6	0.70	0.54	0.73	50.0
West: OLD CASTLEREAGH ROAD														
10	L2	15	2.0	15	2.0	0.018	5.2	LOS A	0.0	0.2	0.58	0.58	0.58	55.4
11	T1	15	2.0	15	2.0	0.020	3.9	LOS A	0.0	0.3	0.57	0.52	0.57	56.2
12	R2	7	2.0	7	2.0	0.020	11.3	LOS B	0.0	0.3	0.57	0.52	0.57	48.7
Approach		37	2.0	37	2.0	0.020	5.9	LOS A	0.0	0.3	0.58	0.54	0.58	54.9
All Vehicles		3260	2.0	3260	2.0	0.719	6.2	LOS A	2.5	17.6	0.63	0.62	0.71	52.8

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

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

# MOVEMENT SUMMARY

Site: 101 [EX PM LUGARD - CASTLEREAGH]

Network: N101 [EX PM PEAK]

18210 - PENRITH LAKES, PENRITH

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	Aver. Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: CASTLEREAGH ROAD														
1	L2	60	2.0	60	2.0	0.779	36.4	LOS D	25.3	180.5	0.88	0.82	1.03	34.8
2	T1	1459	2.0	1459	2.0	0.779	30.3	LOS C	25.5	181.6	0.88	0.82	0.95	27.6
Approach		1519	2.0	1519	2.0	0.779	30.5	LOS C	25.5	181.6	0.88	0.82	0.96	28.0
North: CASTLEREAGH ROAD														
8	T1	1267	2.0	1267	2.0	0.470	9.4	LOS A	11.4	81.5	0.47	0.43	0.47	51.1
9	R2	71	2.0	71	2.0	0.219	24.1	LOS C	1.2	8.7	0.74	0.74	0.74	39.1
Approach		1338	2.0	1338	2.0	0.470	10.2	LOS B	11.4	81.5	0.49	0.45	0.49	50.3
West: LUGARD STREET														
10	L2	75	2.0	75	2.0	0.187	45.1	LOS D	3.0	21.6	0.79	0.76	0.79	18.9
12	R2	94	2.0	94	2.0	0.187	52.4	LOS D	3.0	21.6	0.85	0.76	0.85	27.4
Approach		168	2.0	168	2.0	0.187	49.1	LOS D	3.0	21.6	0.82	0.76	0.82	24.5
All Vehicles		3025	2.0	3025	2.0	0.779	22.6	LOS C	25.5	181.6	0.70	0.65	0.74	37.9

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian Distance				
					ped m				
P3	North Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
All Pedestrians		105	64.3	LOS F			0.96	0.96	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Organisation: TRANSPORT AND TRAFFIC PLANNING ASSOCIATES | Processed: Tuesday, November 6, 2018 8:04:30 PM

Project: C:\Users\meg\Desktop\18210 - PENRITH LAKES, PENRITH 181106.sip8



# MOVEMENT SUMMARY

Site: 101 [EX AM LUGARD - CASTLEREAGH]

Network: N101 [EX AM PEAK]

18210 - PENRITH LAKES, PENRITH

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	Aver. Vehicles	Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		veh	m				km/h
South: CASTLEREAGH ROAD														
1	L2	52	2.0	52	2.0	0.492	31.2	LOS C	12.6	90.0	0.72	0.67	0.85	37.2
2	T1	880	2.0	880	2.0	0.492	25.4	LOS C	12.8	91.4	0.72	0.65	0.78	30.2
Approach		932	2.0	932	2.0	0.492	25.7	LOS C	12.8	91.4	0.72	0.65	0.78	30.7
North: CASTLEREAGH ROAD														
8	T1	1835	2.0	1835	2.0	0.761	15.3	LOS B	27.1	192.7	0.69	0.64	0.69	46.7
9	R2	71	2.0	71	2.0	0.168	18.0	LOS B	1.1	7.7	0.59	0.70	0.59	42.6
Approach		1905	2.0	1905	2.0	0.761	15.4	LOS B	27.1	192.7	0.69	0.64	0.69	46.5
West: LUGARD STREET														
10	L2	27	2.0	27	2.0	0.094	44.6	LOS D	1.5	10.3	0.77	0.72	0.77	19.0
12	R2	62	2.0	62	2.0	0.094	47.7	LOS D	1.5	10.3	0.80	0.73	0.80	28.7
Approach		89	2.0	89	2.0	0.094	46.7	LOS D	1.5	10.3	0.79	0.73	0.79	26.5
All Vehicles		2926	2.0	2926	2.0	0.761	19.7	LOS B	27.1	192.7	0.70	0.65	0.72	41.6

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue	Prop. Queued	Effective Stop Rate		
		ped/h	sec		Pedestrian Distance				
					ped m				
P3	North Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
All Pedestrians		105	64.3	LOS F			0.96	0.96	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# MOVEMENT SUMMARY

 Site: 101 [EX PM OLD CASTLEREAGH - CASTLEREAGH - ANDREWS]

 Network: N101 [EX PM PEAK]

New Site  
Site Category: (None)  
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	Aver. Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed	
		Total veh/h	HV %	Total veh/h	HV %	v/c	sec		Vehicles	Distance			km/h	
South: CASTLEREAGH ROAD														
1	L2	1	2.0	1	2.0	0.502	3.4	LOS A	1.4	9.9	0.31	0.29	0.31	56.6
2	T1	940	2.0	940	2.0	0.502	2.8	LOS A	1.4	9.9	0.31	0.34	0.31	58.4
3	R2	504	2.0	504	2.0	0.502	10.4	LOS B	1.3	9.5	0.33	0.57	0.33	56.2
Approach		1445	2.0	1445	2.0	0.502	5.5	LOS A	1.4	9.9	0.32	0.42	0.32	57.6
East: ANDREWS ROAD														
4	L2	487	2.0	487	2.0	0.425	4.6	LOS A	1.0	7.0	0.66	0.58	0.67	50.1
5	T1	31	2.0	31	2.0	0.172	4.5	LOS A	0.3	2.1	0.59	0.75	0.59	54.1
6	R2	103	2.0	103	2.0	0.172	11.9	LOS B	0.3	2.1	0.59	0.75	0.59	55.3
Approach		621	2.0	621	2.0	0.425	5.8	LOS A	1.0	7.0	0.64	0.61	0.65	51.8
North: CASTLEREAGH ROAD														
7	L2	101	2.0	101	2.0	0.367	5.8	LOS A	1.2	8.7	0.71	0.56	0.71	54.4
8	T1	679	2.0	679	2.0	0.367	5.5	LOS A	1.2	8.7	0.71	0.58	0.71	49.1
9	R2	9	2.0	9	2.0	0.367	13.1	LOS B	1.1	7.9	0.71	0.60	0.71	57.8
Approach		789	2.0	789	2.0	0.367	5.6	LOS A	1.2	8.7	0.71	0.58	0.71	50.3
West: OLD CASTLEREAGH ROAD														
10	L2	44	2.0	44	2.0	0.061	6.9	LOS A	0.1	0.9	0.72	0.70	0.72	54.6
11	T1	49	2.0	49	2.0	0.062	5.4	LOS A	0.2	1.1	0.74	0.60	0.74	55.5
12	R2	15	2.0	15	2.0	0.062	12.7	LOS B	0.2	1.1	0.74	0.60	0.74	47.7
Approach		108	2.0	108	2.0	0.062	7.0	LOS A	0.2	1.1	0.73	0.64	0.73	54.4
All Vehicles		2964	2.0	2964	2.0	0.502	5.6	LOS A	1.4	9.9	0.51	0.51	0.51	54.9

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

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

# MOVEMENT SUMMARY

 **Site: 101 [FUT AM LUGARD - CASTLEREAGH]**

18210 - PENRITH LAKES, PENRITH

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: CASTLEREAGH ROAD												
1	L2	123	2.0	0.548	31.2	LOS C	23.5	167.4	0.74	0.72	0.86	36.8
2	T1	915	2.0	0.548	25.9	LOS C	24.2	172.6	0.75	0.69	0.80	40.2
Approach		1038	2.0	0.548	26.5	LOS C	24.2	172.6	0.75	0.69	0.81	39.8
North: CASTLEREAGH ROAD												
8	T1	1908	2.0	0.849	17.7	LOS B	56.0	399.0	0.74	0.70	0.75	45.1
9	R2	155	2.0	0.402	20.3	LOS C	4.1	29.2	0.68	0.75	0.68	41.2
Approach		2063	2.0	0.849	17.9	LOS B	56.0	399.0	0.74	0.70	0.75	44.8
West: LUGARD STREET												
10	L2	47	2.0	0.158	45.4	LOS D	4.1	29.3	0.79	0.75	0.79	30.3
12	R2	104	2.0	0.158	48.6	LOS D	4.1	29.3	0.81	0.75	0.81	28.5
Approach		152	2.0	0.158	47.6	LOS D	4.1	29.3	0.80	0.75	0.80	29.1
All Vehicles		3253	2.0	0.849	22.0	LOS C	56.0	399.0	0.74	0.70	0.77	42.2

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P3	North Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
All Pedestrians		105	64.3	LOS F			0.96	0.96	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

# MOVEMENT SUMMARY

 **Site: 101 [FUT PM LUGARD - CASTLEREAGH]**

18210 - PENRITH LAKES, PENRITH

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 140 seconds (Site User-Given Phase Times)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: CASTLEREAGH ROAD												
1	L2	79	2.0	0.818	37.4	LOS D	44.9	319.8	0.91	0.86	1.06	34.4
2	T1	1517	2.0	0.818	31.3	LOS C	45.2	322.1	0.91	0.85	0.98	37.8
Approach		1596	2.0	0.818	31.6	LOS C	45.2	322.1	0.91	0.85	0.99	37.6
North: CASTLEREAGH ROAD												
8	T1	1323	2.0	0.494	9.6	LOS A	20.2	143.7	0.48	0.44	0.48	50.9
9	R2	94	2.0	0.301	26.0	LOS C	2.9	20.7	0.79	0.76	0.79	38.1
Approach		1417	2.0	0.494	10.7	LOS B	20.2	143.7	0.50	0.46	0.50	49.9
West: LUGARD STREET												
10	L2	117	2.0	0.364	46.7	LOS D	8.2	58.4	0.82	0.78	0.82	30.0
12	R2	157	2.0	0.364	53.9	LOS D	8.2	58.4	0.87	0.78	0.87	27.0
Approach		274	2.0	0.364	50.8	LOS D	8.2	58.4	0.85	0.78	0.85	28.2
All Vehicles		3286	2.0	0.818	24.2	LOS C	45.2	322.1	0.73	0.68	0.77	41.0

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate	
P3	North Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
P4	West Full Crossing	53	64.3	LOS F	0.2	0.2	0.96	0.96	
All Pedestrians		105	64.3	LOS F			0.96	0.96	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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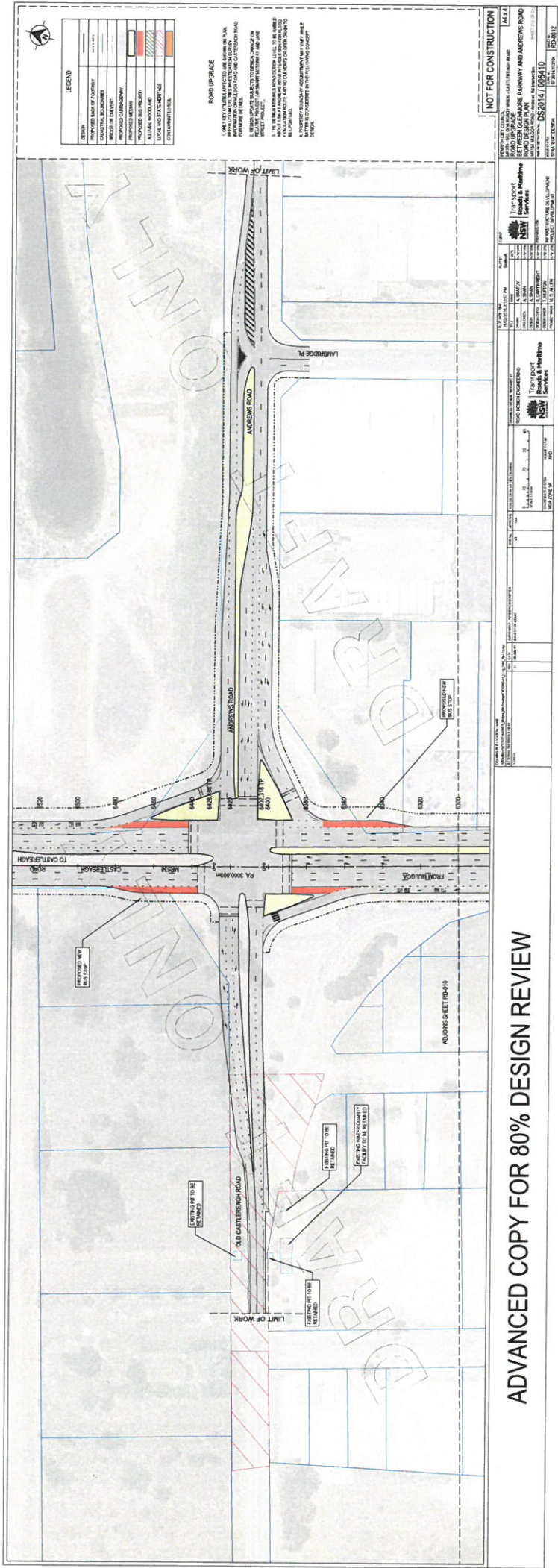
Organisation: TRANSPORT AND TRAFFIC PLANNING ASSOCIATES | Processed: Tuesday, November 6, 2018 8:51:33 PM

Project: C:\Users\meg\Desktop\18210 - PENRITH LAKES, PENRITH 181106.sip8

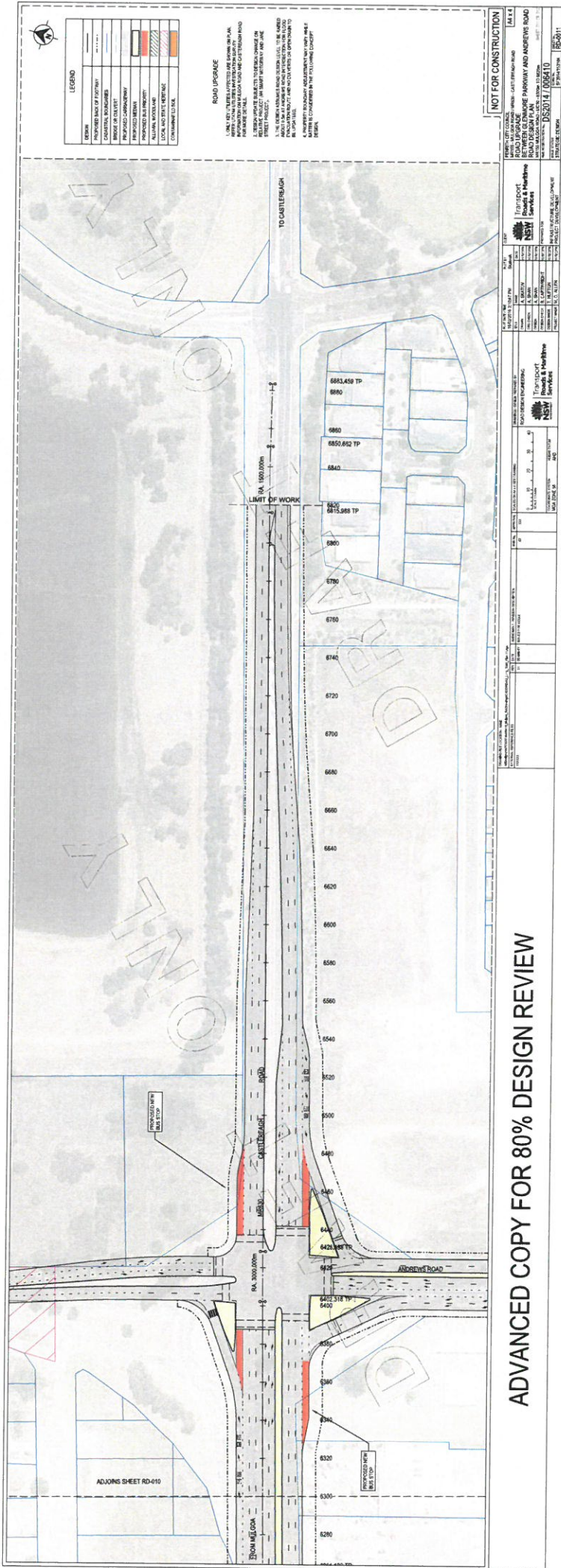
**APPENDIX D**

**CONCEPT DESIGN FOR ROAD UPGRADE**





# ADVANCED COPY FOR 80% DESIGN REVIEW



**ADVANCED COPY FOR 80% DESIGN REVIEW**

**LEGEND**

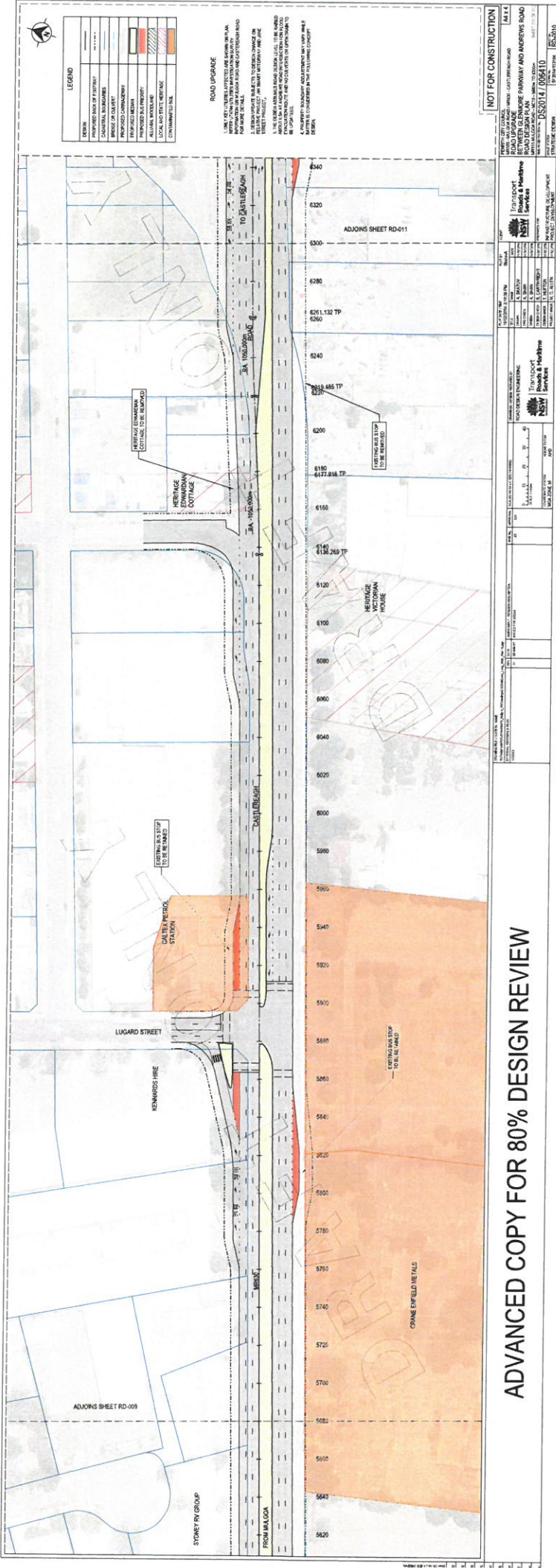
EXISTING	
PROPOSED WORK	
EXISTING ROAD	
EXISTING FOOTPATH	
PROPOSED CONCRETE	
PROPOSED ASPHALT	
PROPOSED GRASS	
PROPOSED EXISTING	
PROPOSED GATE	
PROPOSED TANK	

**ROAD UPGRADE**

- ONLY THE PROPOSED WORK IS TO BE SHOWN ON PLAN.
- EXISTING ROAD CONDITIONS ARE TO BE MAINTAINED UNLESS OTHERWISE STATED.
- THE EXISTING ROAD BOUNDARIES, LEVELS, THE LINED AND UNLINED DRIVEWAYS AND THE ADJACENT LOT TO BE UPGRADED ARE TO BE MAINTAINED UNLESS OTHERWISE STATED.
- A PROPOSED GATE TO BE LOCATED AT THE POSITION SHOWN IN THIS PLAN.

**NOT FOR CONSTRUCTION**

PROJECT NO: DSK014.006410  
 DRAWN: DSK014.006410  
 CHECKED: RSK011  
 DATE: 15/03/2024  
 PROJECT TITLE: ROAD UPGRADE BETWEEN LEONGARDE PARKWAY AND ANDREWS ROAD  
 DRAWING NO: DSK014.006410  
 DESIGNER: DSK014.006410  
 PROJECT NO: DSK014.006410



**LEGEND**

PROPOSED BACK OF PAVEMENT	(Symbol)
EXISTING BACK OF PAVEMENT	(Symbol)
PROPOSED CONDUIT	(Symbol)
PROPOSED MEDIUM	(Symbol)
EXISTING MEDIUM	(Symbol)
PROPOSED SIDEWALK	(Symbol)
EXISTING SIDEWALK	(Symbol)
PROPOSED DRIVE	(Symbol)
EXISTING DRIVE	(Symbol)
PROPOSED DRIVE	(Symbol)
EXISTING DRIVE	(Symbol)
PROPOSED DRIVE	(Symbol)
EXISTING DRIVE	(Symbol)
PROPOSED DRIVE	(Symbol)
EXISTING DRIVE	(Symbol)

**ROAD UPGRADE**

NOTE: ALL THE INFORMATION SHOWN ON THIS PLAN IS THE PROPERTY OF THE CLIENT AND IS NOT TO BE REPRODUCED OR USED FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF THE CLIENT.

1. THE CLIENT HAS ADVISED THAT THE INFORMATION SHOWN ON THIS PLAN IS THE PROPERTY OF THE CLIENT AND IS NOT TO BE REPRODUCED OR USED FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF THE CLIENT.

2. THE CLIENT HAS ADVISED THAT THE INFORMATION SHOWN ON THIS PLAN IS THE PROPERTY OF THE CLIENT AND IS NOT TO BE REPRODUCED OR USED FOR ANY OTHER PURPOSE WITHOUT THE WRITTEN PERMISSION OF THE CLIENT.

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**NOT FOR CONSTRUCTION**

PROJECT NO. 15/2014

CLIENT: ROAD & PORTLAND

DRAWN BY: J. SMITH

CHECKED BY: M. SMITH

DATE: 15/01/2014

SCALE: 1:100

PROJECT LOCATION: 15/2014

PROJECT DESCRIPTION: ROAD UPGRADE

PROJECT SHEET: RD-009

PROJECT SHEET: RD-010

PROJECT SHEET: RD-011

PROJECT SHEET: RD-012

PROJECT SHEET: RD-013

PROJECT SHEET: RD-014

PROJECT SHEET: RD-015

PROJECT SHEET: RD-016

PROJECT SHEET: RD-017

PROJECT SHEET: RD-018

PROJECT SHEET: RD-019

PROJECT SHEET: RD-020

PROJECT SHEET: RD-021

PROJECT SHEET: RD-022

PROJECT SHEET: RD-023

PROJECT SHEET: RD-024

PROJECT SHEET: RD-025

PROJECT SHEET: RD-026

PROJECT SHEET: RD-027

PROJECT SHEET: RD-028

PROJECT SHEET: RD-029

PROJECT SHEET: RD-030

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**APPENDIX E**

**EXTRACTS FROM RMS DOCUMENT**



Survey area ID	Sydney areas			
	Site 1 Erskine Park Industrial Estate, Erskine	Site 2 Helensburgh Business Park, Helensburgh	Site 3 Wonderland Business Park, Eastern Creek	Site 4 Riverwood Business Park, Riverwood
Date of survey	29/03/2012	28/03/2012	27/03/2012	28/03/2012
Day of survey	Thursday	Wednesday	Tuesday	Wednesday
Duration of survey	06:00-19:00	07:00-19:00	07:00-19:00	07:00-19:00
<b>Surrounding area characteristics:</b>				
Surrounding landuse (eg residential, commercial, open space, etc)	Commercial	Residential	Residential	Residential
Indicative Public Transport Accessibility Score	2	2	4	8
Principal adjacent road- AM peak period (weekday)	8.00 to 9.00 am	8.30 to 9.30 am	7.30 to 8.30 am	8.15 to 9.15 am
Principal adjacent road - PM peak period (weekday)	3.30 to 4.30pm	4.30 to 5.30pm	4.15 to 5.15pm	5.00 to 6.00pm
Principal adjacent road – daily peak period (weekend)	1.00 to 2.00 pm	11.00 am to 12.00 pm	12.15 to 1.15 pm	1.15 to 2.15 pm
<b>Estate characteristics:</b>				
Year opened	2003	2011	2007	2004
Total site area (hectares)	326.9	0.6	114.6	4.7
No. of units/lots (including vacant units/lots)	38	21	26	16
No. of occupied units/lots	36	13	22	16
<b>Predominant business types within estate:</b>				
no. of factories	5	0	0	0
no. of factories/warehouses	2	0	0	0
no. of warehouses	27	0	20	15
no. of offices	1	9	0	1
no of retailers	0	0	0	0
no. of workshops	1	0	0	0
no. of manufacturers	0	3	2	0
no. of others commercial businesses	0	1	0	0
Gross Floor Area in estate m <sup>2</sup> (occupied)	693,605	1,605	406,600	29,983
No. of employees	incomplete data from businesses			231
<b>Person Trips:</b>				
Peak 1-hour person-trips	1294	29	927	173
Time of peak 1-hour person-trips	14:45-15:45	14:45-15:45	14:00-15:00	08:15-09:15
Peak person-trips per business	35.9	2.2	42.1	10.8
Peak person-trips per hectare	4	49.4	8.1	37.0
Peak person-trips per 100 m <sup>2</sup> of GFA	0.187	1.807	0.228	0.577
Peak person-trips per employee	incomplete data from businesses			0.749
Total daily person-trips	14056	168	9929	1410
Total daily person-trips per business	390.4	13.0	451.3	88
Total daily person-trips per hectare	43.0	287.0	86.6	301.5
Total daily person-trips per 100 m <sup>2</sup> of GFA	2.026	10.492	2.442	4.703
Total daily person-trips per employee	incomplete data from businesses			6.105
Person-trips during adjacent road AM peak	976	24	789	173
Person-trips during adjacent road PM peak	1073	7	858	94
<b>Vehicle Trips:</b>				
Peak 1-hour vehicle-trips	1128	24	820	129
Time of peak 1-hour vehicle-trips	14:45-15:45	14:45-15:45	08:00-09:00	08:15-09:15
Peak vehicle-trips per business	31	1.8	37.3	8.1
Peak vehicle-trips per hectare	3.5	40.9	7.2	27.6
Peak vehicle-trips per 100 m <sup>2</sup> of GFA	0.163	1.495	0.202	0.430
Peak vehicle-trips per employee	incomplete data from businesses			0.558
Total daily vehicle-trips	13125	168	9384	1116
Total daily vehicle-trips per business	364.6	12.9	426.5	69.75
Total daily vehicle-trips per hectare	40.1	286.3	81.9	238.6
Total daily vehicle-trips per 100 m <sup>2</sup> of GFA	1.892	10.467	2.308	3.722
Total daily vehicle-trips per employee	incomplete data from businesses			4.83
Vehicle-trips in adjacent road AM peak (Average)	1165	126	2749	1608
Vehicle-trips in adjacent road PM peak (Average)	972	149	2593	1613
Vehicle-trips during adjacent road AM peak	929	19	724	129
Vehicle-trips during adjacent road PM peak	965	5	714	69
Average vehicle occupancy	1.10	1.10	1.12	1.16
<b>% of total trips by principal mode:</b>				
% Car (as driver)	62.5%	81.9%	63.2%	68.8%
% Car (as passenger)	8.0%	8.3%	8.3%	12.3%
% Commercial Vehicles	28.3%	4.2%	25.9%	12.6%
% Bus	0.8%	0.0%	2.1%	0.5%
% Cycle	0.1%	0.0%	0.3%	0.1%
% Motorbike	0.1%	0.0%	0.0%	0.0%
% On foot	0.1%	5.6%	0.2%	5.7%
% Other	0.0%	0.0%	0.0%	0.0%

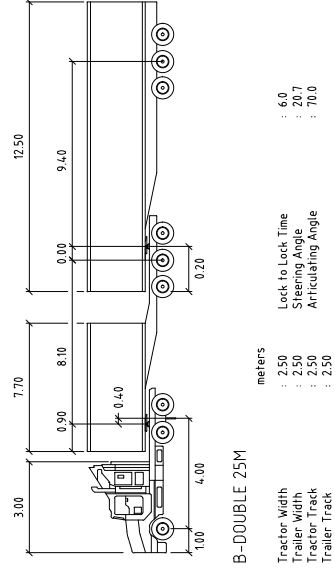
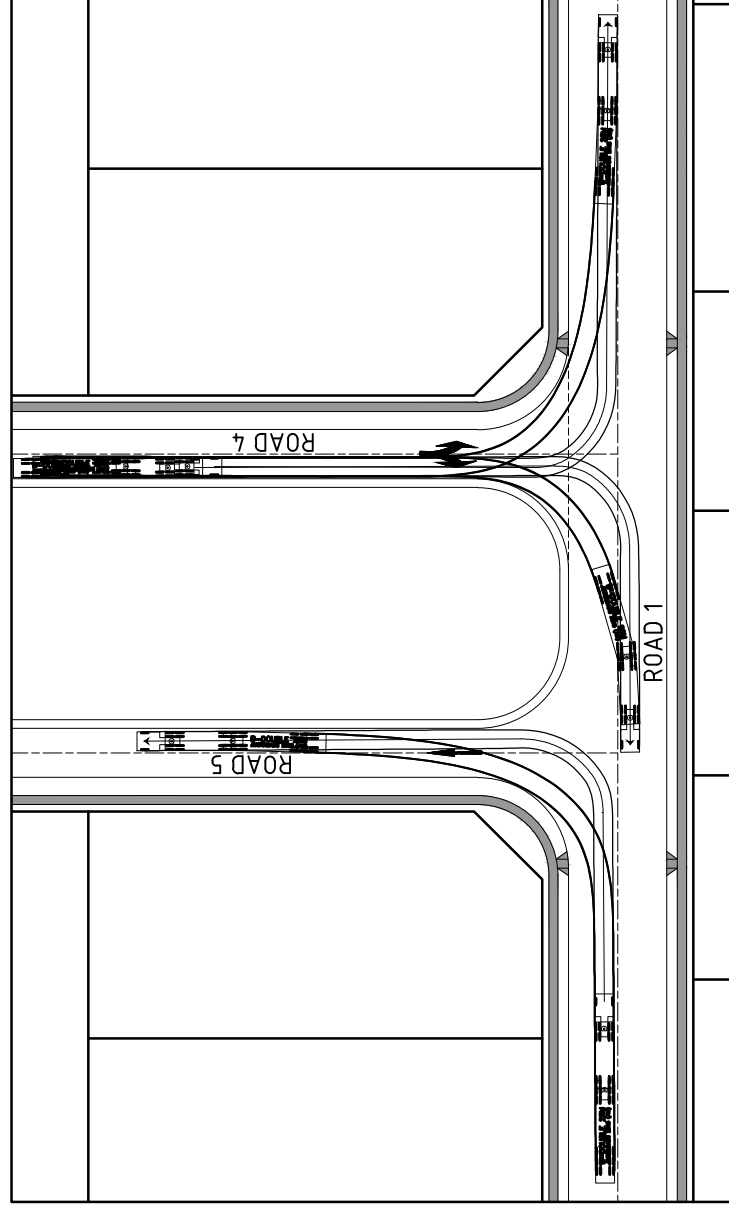
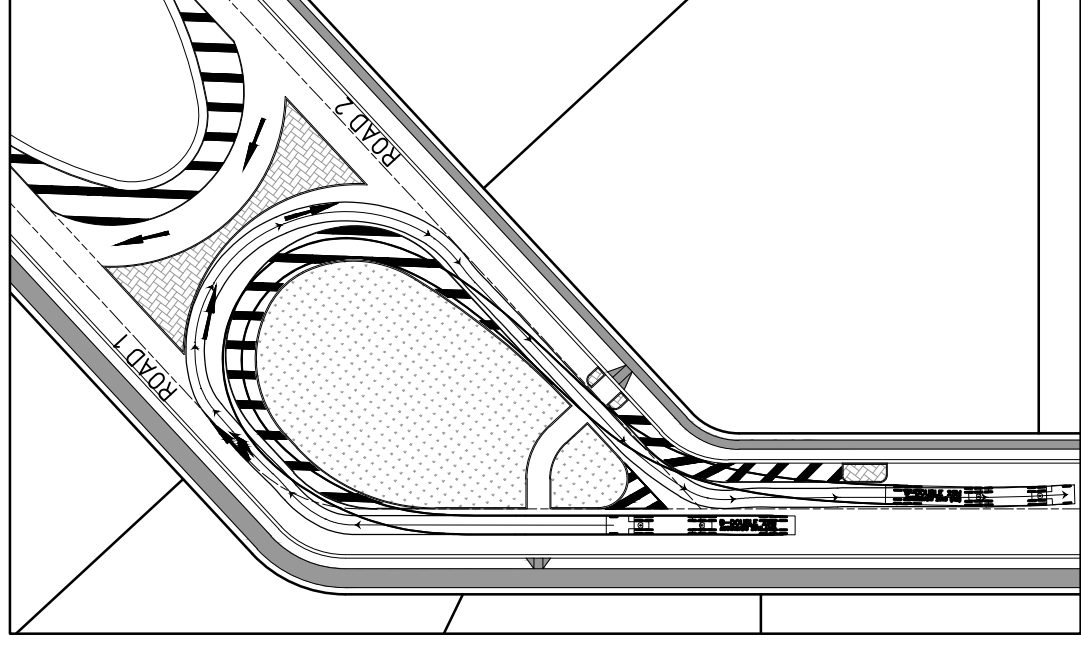
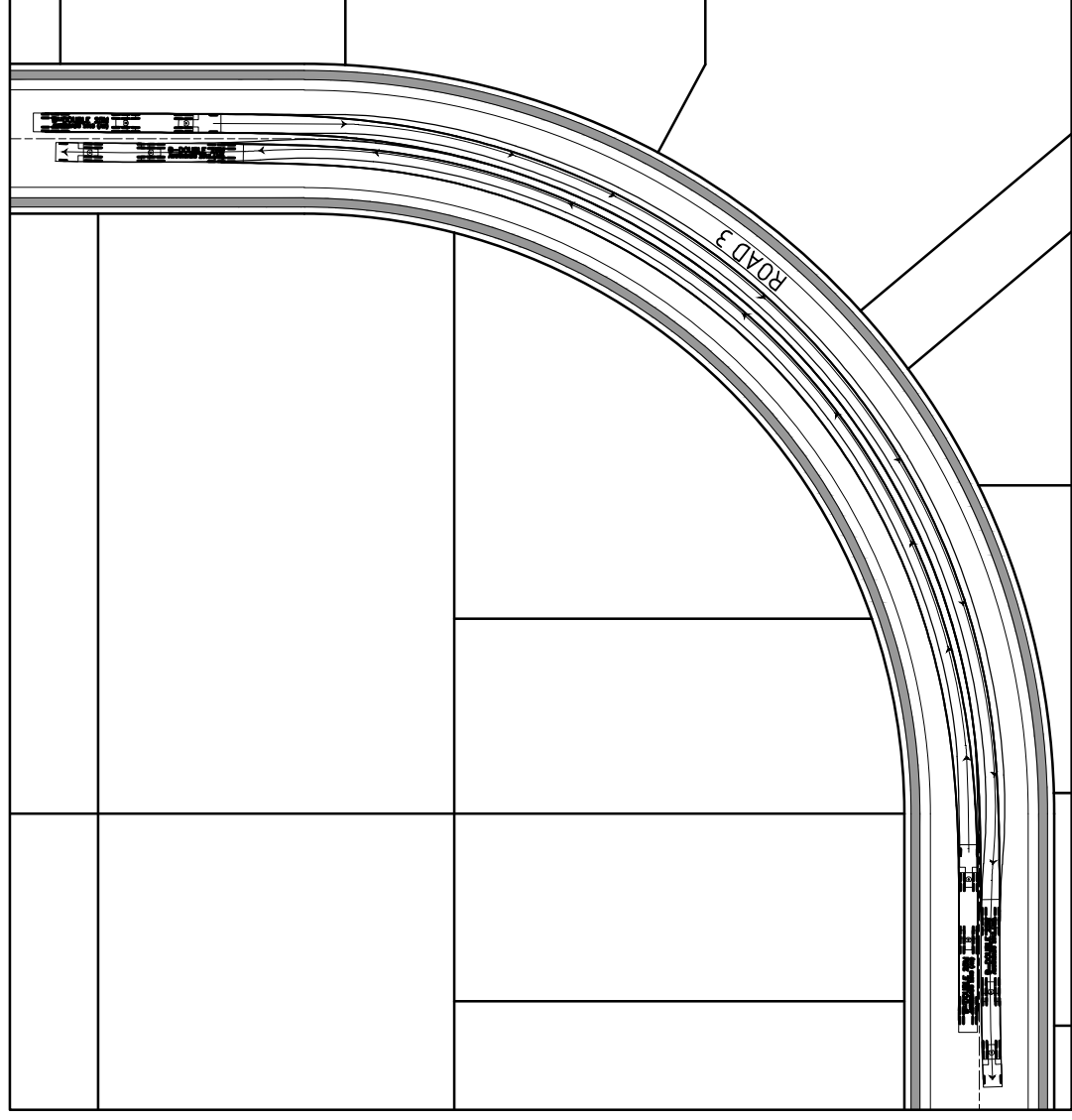
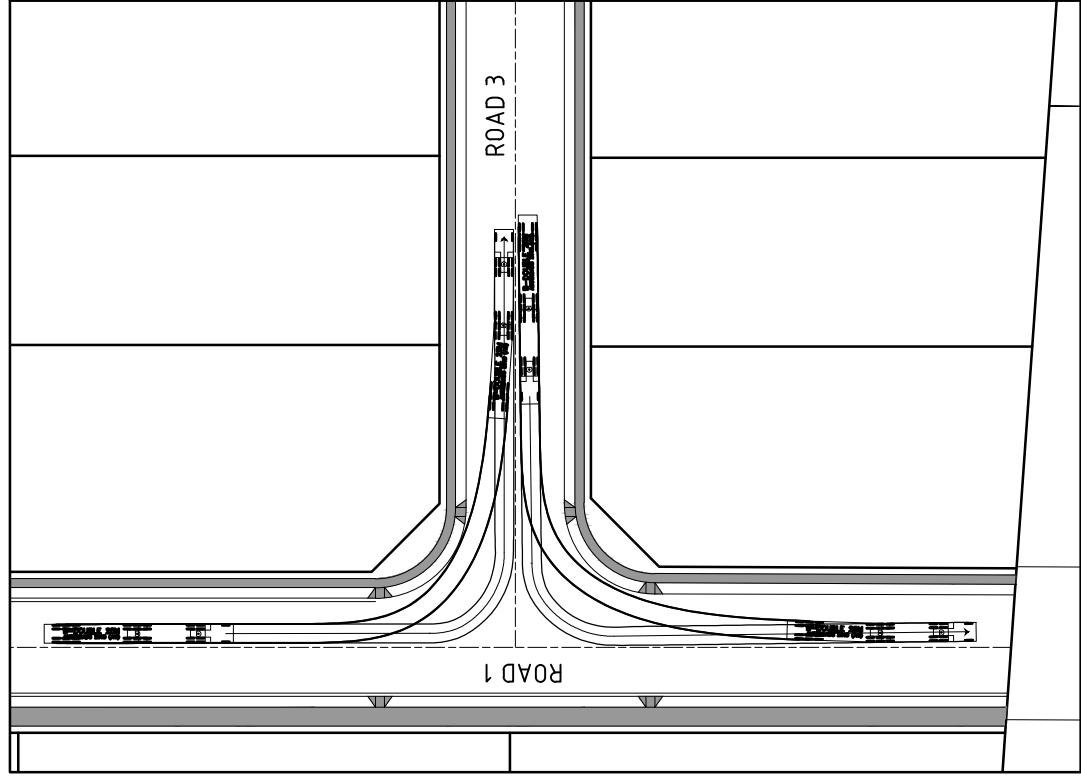
Site ID	Sydney areas			
	Site 1 Erskine Park Industrial Estate, Erskine Park	Site 2 Helensburgh Business Park, Helensburgh	Site 3 Wonderland Business Park, Eastern Creek	Site 4 Riverwood Business Park, Riverwood
Gross Floor Area in estate m <sup>2</sup>	693,605	1,605	406,600	29,983
<b>Person-based trips</b>				
Site AM peak hour	1148	28	885	173
Trips per 100 m <sup>2</sup> of GFA	0.17	1.74	0.22	0.58
Site PM peak hour	1294	29	927	157
Trips per 100 m <sup>2</sup> of GFA	0.19	1.81	0.23	0.52
Vehicle network AM peak hour	976	24	743	173
Trips per 100 m <sup>2</sup> of GFA	0.14	1.50	0.18	0.58
Vehicle network PM peak hour	1073	7	822	94
Trips per 100 m <sup>2</sup> of GFA	0.15	0.44	0.20	0.31
Daily total person trips:				
During Survey Times	0600 to 1900	0700 to 1900	0700 to 1900	0700 to 1900
24 hours	11750	144	7654	1344
Trips per 100 m <sup>2</sup> of GFA (24hrs)	14056	168	9929	1410
Trips per 100 m <sup>2</sup> of GFA (24hrs)	2.03	10.49	2.44	4.70
<b>Vehicle-based trips</b>				
Site AM peak hour	1046	21	820	129
Trips per 100 m <sup>2</sup> of GFA	0.15	1.31	0.20	0.43
Site PM peak hour	1128	24	763	123
Trips per 100 m <sup>2</sup> of GFA	0.16	1.50	0.19	0.41
Network AM peak hour	929	19	679	129
Trips per 100 m <sup>2</sup> of GFA	0.13	1.18	0.17	0.43
Network PM peak hour	965	5	703	69
Trips per 100 m <sup>2</sup> of GFA	0.14	0.31	0.17	0.23
Daily total vehicle trips				
During Survey Times	0600 to 1900	0700 to 1900	0700 to 1900	0700 to 1900
24 hours	11036	146	7327	1059
Trips per 100 m <sup>2</sup> of GFA (24hrs)	13125	168	9384	1116
Trips per 100 m <sup>2</sup> of GFA (24hrs)	1.89	10.47	2.31	3.72

**APPENDIX F**

**TRUCK TURNING ASSESSMENT**

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PRELIMINARY ISSUE  
NOT FOR CONSTRUCTION



Project No  
**18255C**

Proposed Subdivision  
**PENRITH LAKES INDUSTRIAL**  
**PENRITH**

Vehicle Turning Movements (1 OF 3)

Drawing No  
**C08**

Revision  
**1**

Client

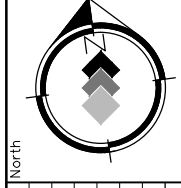
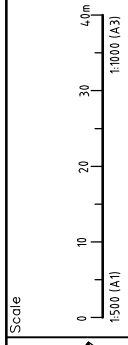
Cad Reference  
 18255 C08 r1

Designed  
 KS

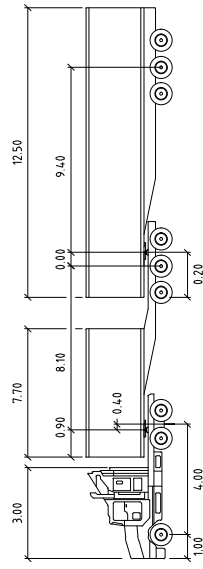
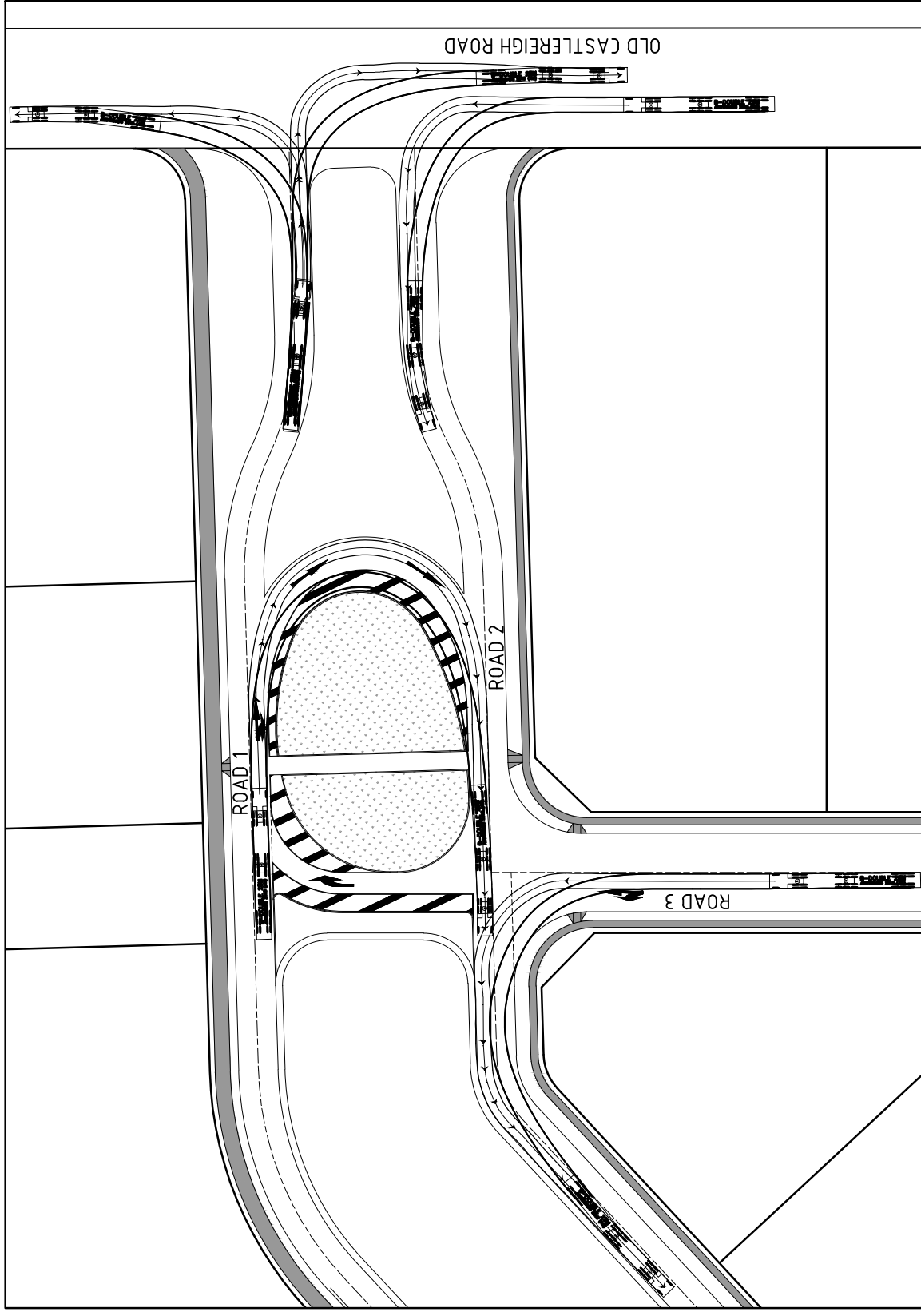
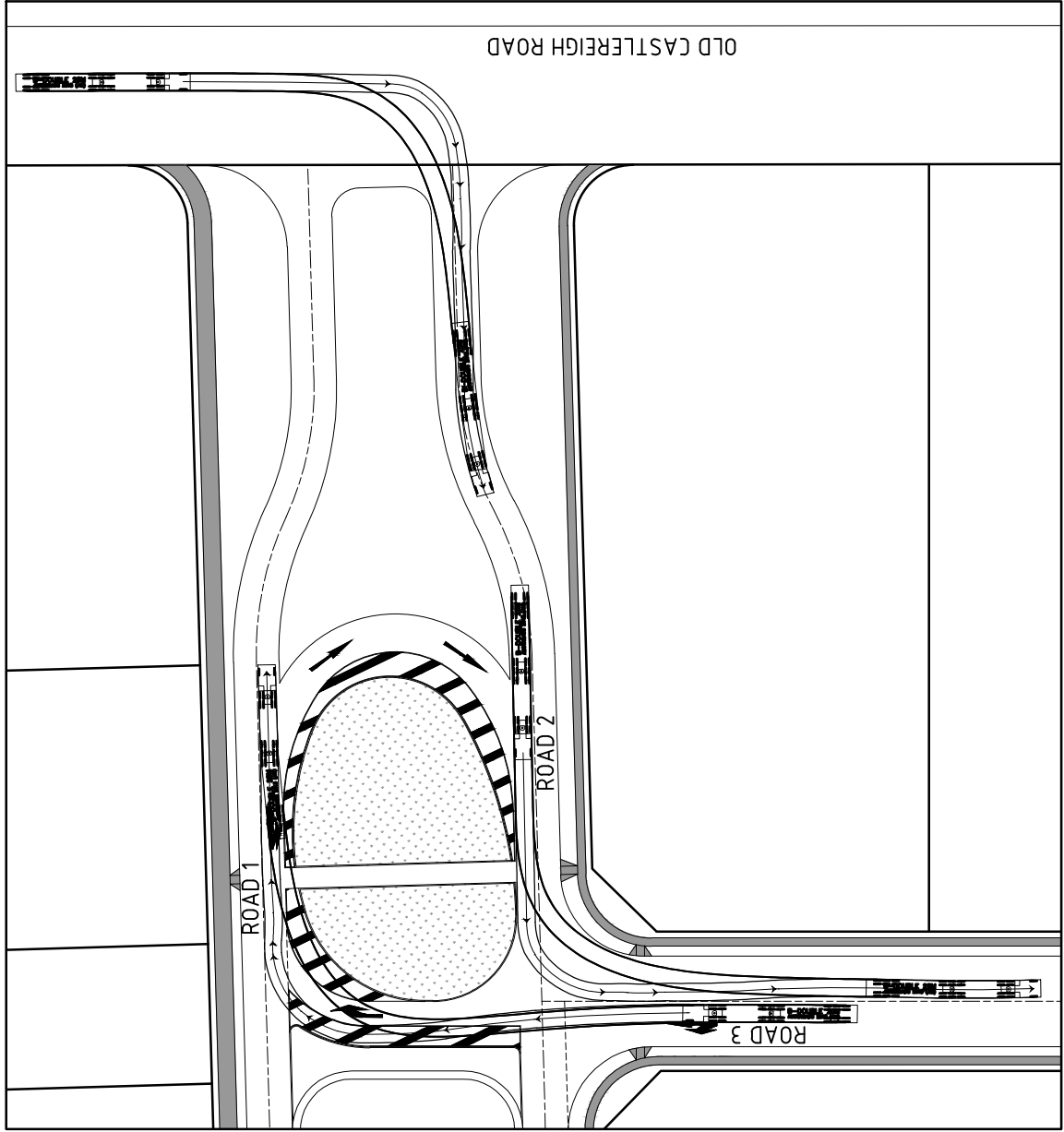
Scale  
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Project Approval  
 IAN HILL (B.E)  
 Consulting Civil Engineer

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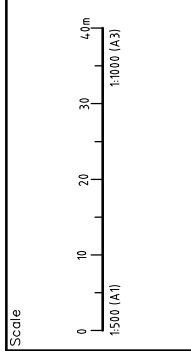
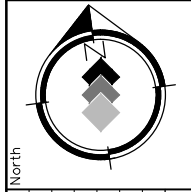
Amendment	Description	Drawn	App'd	Date
1	ORIGINAL ISSUE	DB	AS	19/11/18



B-DOUBLE 25M  
meters

- Tractor Width : 2.50
- Tractor Track : 2.50
- Trailer Width : 2.50
- Trailer Track : 2.50
- Lock to Lock Time : 6.0
- Steering Angle : 20.7
- Articulating Angle : 70.0

Amendment	DESCRIPTION	DATE	APP'D	DATE
1	ORIGINAL ISSUE	19-11-18	AS	
		DB	AS	



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Designed  
KS  
Scale  
1:500  
Project Approval  
IAN HILL (B.E)  
Consulting Civil Engineer

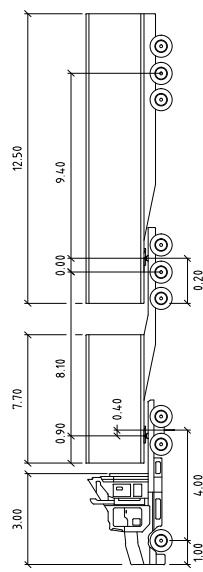
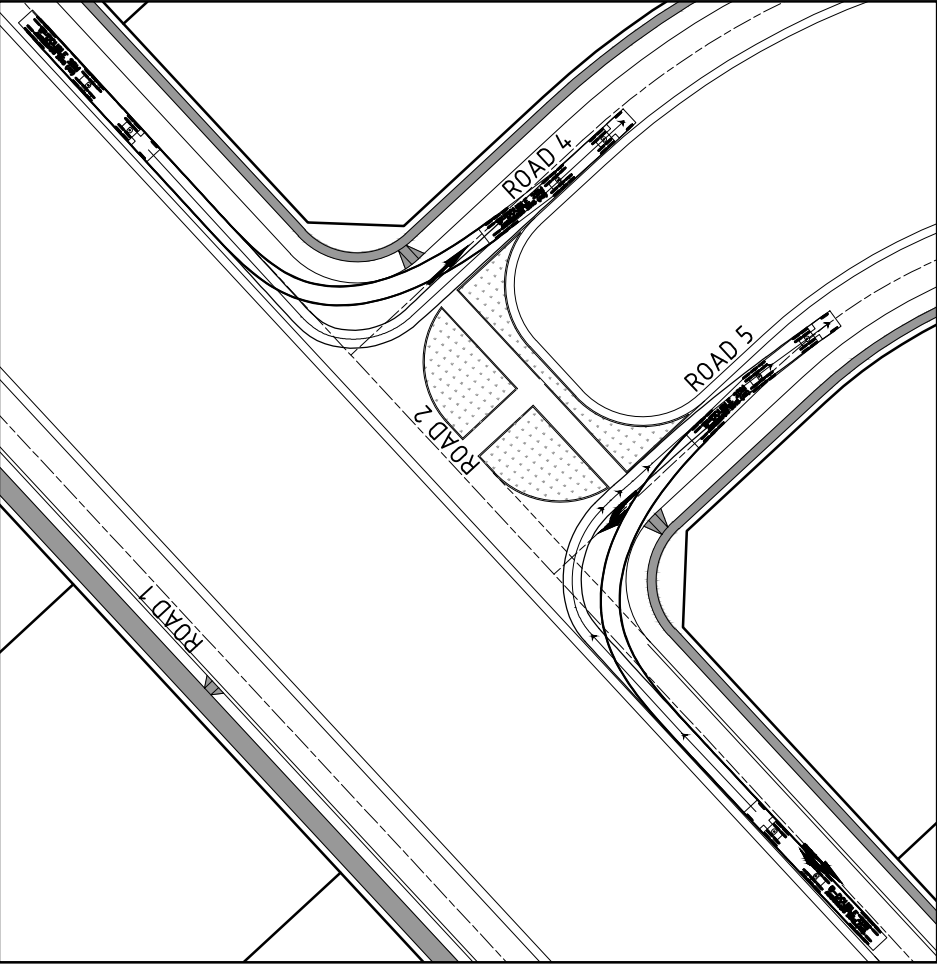
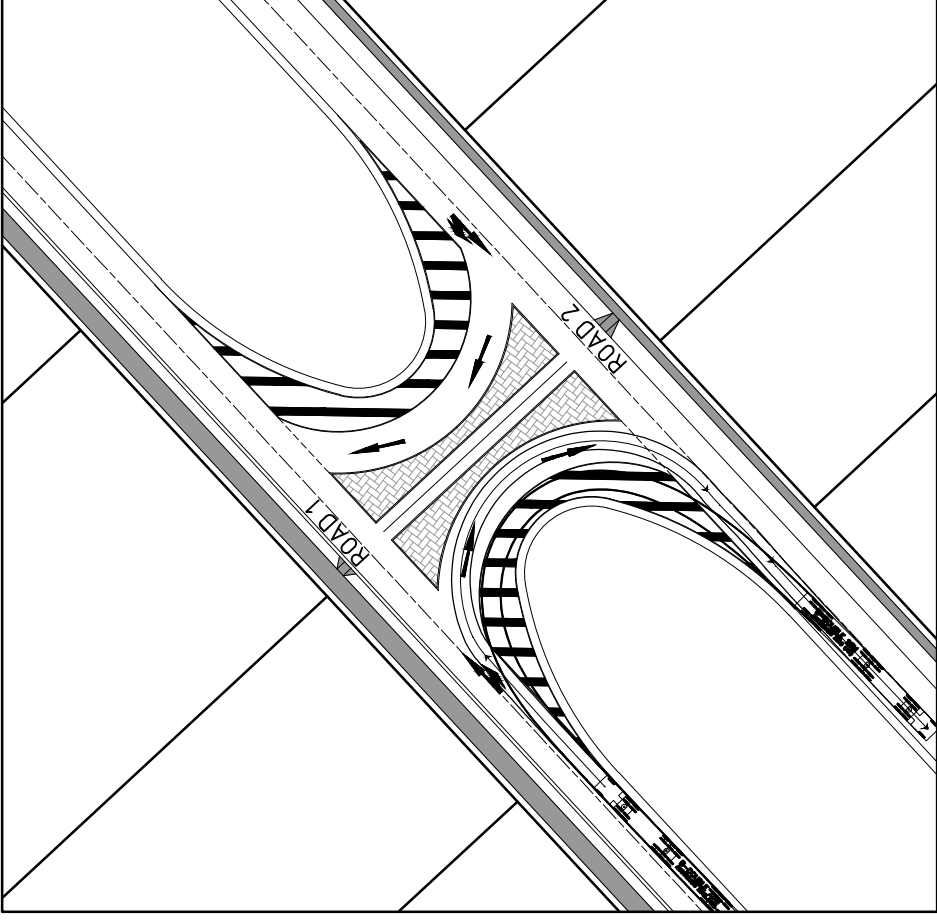
Cad Reference  
18255 C09 r1  
**A1 SHEET**

Client

**GCA**  
ENGINEERING SOLUTIONS  
A.B.N. 92 086 017 745  
1 HARTLEY DRIVE, THORNTON NSW 2322  
PO BOX 3337, THORNTON NSW 2322  
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Project No  
**18255C**  
Drawing No  
**C09**  
Revision  
**1**

**PRELIMINARY ISSUE**  
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**B-DOUBLE 25M**  
 meters  
 Tractor Width : 2.50  
 Tractor Track : 2.50  
 Trailer Width : 2.50  
 Trailer Track : 2.50  
 Lock to Lock Time : 6.0  
 Steering Angle : 20.7  
 Articulating Angle : 70.0

**PRELIMINARY ISSUE**  
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Project No <b>18255C</b>		Revision <b>1</b>	
Drawing No <b>C10</b>		Project No <b>18255C</b>	
<b>PROPOSED SUBDIVISION</b> <b>PENRITH LAKES INDUSTRIAL</b> <b>PENRITH</b> VEHICLE TURNING MOVEMENTS (3 OF 3)		<b>GCA</b> <b>ENGINEERING SOLUTIONS</b> A.B.N. 92 086 017 745 1 HARTLEY DRIVE, THORNTON NSW 2322 PO BOX 3337, THORNTON NSW 2322 PHONE: (02) 4964 1811 ♦ FAX: (02) 4964 1822	
Client		Cad Reference 18255 C10 r1	
Designed KS		Scale 1:500	
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Scale 0 10 20 30 40m 1:500 (A1) 1:1000 (A3)		North 	
Amendment		Description	
1	ORIGINAL ISSUE	DB	AS
		Drawn	App'd
		Date	Date
		19-11-18	