West Culburra Subdivision Development

Transport and Accessibility Impact Assessment

transportation planning, design and delivery

GTAconsultants

West Culburra Subdivision Development

Transport and Accessibility Impact Assessment

Issue: E 14/03/13

Client: Reality Realizations Pty Ltd
Reference: 12S1231000
GTA Consultants Office: NSW

Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By
A	17/10/12	Final	Justin Murphy	Ken Hollyoak	
B	31/10/12	Final	Justin Murphy	Ken Hollyoak	
C	22/11/12	Final	Justin Murphy	Ken Hollyoak	
D	01/03/13	Final	Justin Murphy	Ken Hollyoak	
E	14/03/13	Final	Justin Murphy	Ken Hollyoak	

GTAconsultants
Quality ISO 9001
MELBOURNE • SYDNEY • BRISBANE • CANBERRA
ADELAIDE • GOLD COAST • TOWNSVILLE
www.gta.com.au

Table of Contents

1. Introduction **1**

1.1 Background 1

1.2 Purpose of this Report 2

1.3 References 2

2. Existing Conditions **4**

2.1 Road Network 5

2.2 Traffic Volumes 6

2.3 Relevant Transport Studies 10

2.4 Public Transport 11

2.5 Pedestrian Infrastructure 12

2.6 Cycle Infrastructure 12

2.7 Crash Analysis 13

2.8 Intersection Operation 18

2.9 Performance of Rural Road Network 25

3. Development Proposal **26**

3.1 Land Uses 26

3.2 Vehicle Access 29

3.3 Pedestrian and Bicycle Facilities 29

3.4 Parking 30

4. Vehicle Access **31**

4.1 Introduction 31

4.2 Intersection Assessment and Concept Design 31

5. Sustainable Transport Infrastructure **33**

5.1 Policy and Planning Guidelines 33

5.2 Bus Routes 35

5.3 Bus Stops 36

5.4 Walking and Cycling Network 37

5.5 Sustainable Transport Infrastructure Summary 42

6. Loading Facilities **44**

7. Traffic Impact Assessment **45**

7.1 Traffic Generation 45

7.2 Distribution and Assignment 47

7.3 Traffic Impact 59

7.4 Possible Traffic Impact In Culburra 63

8. Rural Road Assessment 64

8.1 Austroads Cross-Section Warrants 64

8.2 Existing Daily Traffic 67

8.3 Anticipated Daily Development Traffic 68

8.4 S94 Requirements 70

8.5 Warrants for Overtaking Lanes 71

8.6 Summary 73

9. Conclusion 74

Appendices

A: Survey Results

B: RMS Crash Data

C: Calculation of Traffic Growth Factors & Trip Generation Rates (Shoalhaven City Council)

D: SIDRA INTERSECTION Results

E: SIDRA INTERSECTION Layouts

F: Preliminary Intersection Concept Design

G: Bus Operator Correspondence

Figures

Figure 2.1: Subject Site and Its Environs 5

Figure 2.2: Traffic Count and Travel Time Survey Locations 7

Figure 2.3: Existing AM / PM Peak Hour Traffic Volumes 8

Figure 2.4: Existing Saturday Peak Hour Traffic Volumes 9

Figure 2.5: Proposed Golf Course, Long Bow Point, Culburra 10

Figure 2.6: Public Bus Services 12

Figure 2.7: Prince Edward Avenue Existing Shared Path, Proposed and Possible Future Cycleways 13

Figure 2.8: Reported Crashes – Greenwell Point Rd/ Mayfield Rd intersection (July 2007 – June 2012) 15

Figure 2.9: Reported Crashes – Princes Highway/ Kalandar Street intersection (July 2007 – June 2012) 15

Figure 2.10: Reported Crashes – Princes Highway/ Moss Street intersection (July 2007 – June 2012) 16

Figure 2.11: Reported Crashes – Princes Highway/ Forest Road intersection (July 2007 – June 2012) 16

Figure 2.12: Princes Highway at Forest Road (looking south) 17
Figure 2.13: Princes Highway at Forest Road (looking north) 17
Figure 2.14: Princes Highway/ Forest Road Intersection – Proposed Seagull Arrangement 17
Figure 2.15: Existing Friday AM Peak Hour Traffic Volumes (May 2012), 120th HH Growth Factor and Equivalent 120th HH Traffic Volumes 21
Figure 2.16: Existing Friday PM Peak Hour Traffic Volumes (May 2012), 120th HH Growth Factor and Equivalent 120th HH Traffic Volumes 22
Figure 2.17: Existing Saturday Peak Hour Traffic Volumes (May 2012), 120th HH Growth Factor and Equivalent 120th HH Traffic Volumes 23
Figure 3.1: West Culburra Subdivision - Proposed Stages 26
Figure 3.2: Indicative Subdivision Concept Layout 28
Figure 3.3: Proposed Collector Road and Access Locations 29
Figure 3.4: Proposed Cycleways 30
Figure 4.1: Eastern Access Preliminary Concept Layout 31
Figure 5.1: Potential bus stop locations and indicative 400 metre walking catchment 37
Figure 5.2: Street Patterns and Accessibility 38
Figure 5.3: Appropriate cycling facilities based on vehicle speeds and volumes 40
Figure 5.4: Methods of Separation 40
Figure 5.5: Four Types of Cyclists 41
Figure 7.1: Bureau of Transport Statistics Travel Zone 48
Figure 7.2: 2006 Census Journey to Work Destinations 49
Figure 7.3: Directional Distribution Analysis – Road Network Entry/Exit Locations 50
Figure 7.4: Directional Distribution – Friday AM Peak Hour 53
Figure 7.5: Directional Distribution – Friday PM Peak Hour 54
Figure 7.6: Directional Distribution – Saturday Peak Hour 55
Figure 7.7: Weekday AM Equivalent 120th Highest Hour Volumes plus Development Traffic 56
Figure 7.8: Weekday PM Equivalent 120th Highest Hour Volumes plus Development Traffic 57
Figure 7.9: Saturday Equivalent 120th Highest Hour Volumes plus Development Traffic 58
Figure 8.1: Austroads Table 4.5: Single carriageway rural road widths (m) 64
Figure 8.2: Existing AADT and Seasonal Traffic Volumes 67
Figure 8.3: Anticipated Development Daily Traffic 69
Figure 8.4: Anticipated Post Development Daily Traffic 70
Figure 8.5: Existing Speed Limit and Road Section Lengths 72

Tables

Table 1.1:	DGR's and Relevant Report Sections	1
Table 2.1:	Princes Highway Projected Traffic Volumes (Princes Highway Upgrade REF, 2009)	11
Table 2.2:	Route 729 Bus Service Frequency	11
Table 2.3:	Reported Crash Summary (July 2007 – June 2012)	14
Table 2.4:	SIDRA INTERSECTION Level of Service Criteria	19
Table 2.5:	Growth Factors to be Applied to May 2012 Recorded Flows to Calculate 120th HH Flows	20
Table 2.6:	Existing Operating Conditions (Equivalent 120th Highest Annual Hour)	24
Table 3.1:	Indicative Development Schedule	27
Table 5.1:	Pros and Cons for Shared and Separated Paths	40
Table 5.2:	Non-regular cyclists preference for separation from vehicles	41
Table 5.3:	Separated Path Widths	42
Table 7.1:	Estimated Development Traffic Generation (RMS Rates)	45
Table 7.2:	Empirical Traffic Generation Rates (Shoalhaven City Council)	46
Table 7.3:	Estimated Development Traffic Generation (Shoalhaven City Council Empirical Traffic Generation Rates)	46
Table 7.4:	Existing Directional Distribution – Friday AM Peak Hour (May 2012 Traffic Counts)	50
Table 7.5:	Existing Directional Distribution – Friday PM Peak Hour (May 2012 Traffic Counts)	51
Table 7.6:	Existing Directional Distribution – Saturday Peak Hour (May 2012 Traffic Counts) Development Traffic Distribution	51
Table 7.7:	Empirical Traffic Generation Rates and 120th HH Directional Splits (Shoalhaven City Council)	51
Table 7.8:	Proposed Directional Distribution – Friday AM Peak Hour	52
Table 7.9:	Proposed Directional Distribution – Friday PM Peak Hour	52
Table 7.10:	Proposed Directional Distribution – Saturday Peak Hour	52
Table 7.11:	Future Operating Conditions (Equivalent 120th HH plus Development Traffic)	60
Table 7.12:	Signalised Intersection Traffic Volume Comparison	61
Table 7.13:	Post-Development Intersection Operating Conditions – Three Arm Roundabout	62
Table 7.14:	Post-Development Intersection Operating Conditions – Four Arm Roundabout	62
Table 8.1:	Summary of Existing Rural Road Characteristics	65
Table 8.2:	Summary of Existing Rural Road Characteristics	66
Table 8.3:	Design AADT and Existing Daily Traffic	68

1. Introduction

1.1 Background

The West Culburra development involves a mixed use subdivision development over approximately 110 hectares (ha) on land bounded to the north by the Crookhaven River, Lake Woollumboola and the existing urban area of Culburra to the east, Jervis Bay National Park to the south and Coonamia Road to the west.

The proposed subdivision is comprised of six key stages, proposed to be undertaken in stages over a period of approximately 10 years. On completion, the West Culburra Development will include a mixture of medium density housing types, ranging from small lots for the 55+ aged group to multi-storey units. A Collector Road is proposed to provide access to the development from Culburra Road.

A major project application (no. 09–0088) was lodged with the NSW Department of Planning and Infrastructure in April 2010 seeking approval for the Concept Plan under Part 3A of the Environmental Planning and Assessment Act 1979.

GTA Consultants was commissioned by Reality Realizations Pty Ltd in May 2012 to undertake a transport and accessibility impact assessment for the proposed development and in particular to address Section 5 (Traffic and Access) of the Director-General's Environmental Assessment Requirements (DGR's) dated 27 May 2010 as follows. Table 1.1 lists the DGR's and the corresponding sections of the report where these are addressed.

Table 1.1: DGR's and Relevant Report Sections

Section 5 – Traffic and Access	**Addressed in**
5.1) Prepare a Transport and Accessibility Impact Study in accordance with Table 2.1 of the RMS's Guide to Traffic Generating Developments, having regard to the principles of the NSW Planning Guidelines for Walking and Cycling and the NSW State Plan (2010) to include:	-
a) Details and analysis of proposed access to the site.	Section 4
b) Network modelling using TRACKS.	Section 2.8 & 7
c) Appropriate arrangements for the provision of road and public transport infrastructure needed to service the site. Specifically in relation to the Nowra/Culburra bus service, inclusive of the feasibility of the proposed diversion of the existing service, early provision of the service and funding.	Section 5.2
e) An assessment based on the current speed zonings, with consideration of safe spacing of intersections within 100km/hr speed zones.	Section 4.2.1
f) An assessment of the impacts on the surrounding road network.	Section 7.3
5.2) Provide for a road network allows for (potential) future public access to the coastal foreshore.	Section 5.4
5.3) Demonstrate consistency of the proposal with the NSW Government's Integrating Land Use & Transport policy package.	Section 5

1.2 Purpose of this Report

This report sets out an assessment of the anticipated transport implications of the proposed development, including consideration of the following:

i existing traffic conditions surrounding the site
ii pedestrian and bicycle requirements
iii the traffic generating characteristics of the proposed development
iv suitability of the proposed access arrangements for the site
v the transport impact of the development proposal on the surrounding road network.

1.3 References

In preparing this report, reference has been made to the following:

- an inspection of the site and its surrounds
- Austroads Guide to Road Design, Part 4B: Roundabouts (second edition), 2011
- Austroads Part 6A: Pedestrian and Cyclist Paths, 2009
- Comments from Scott Wells (Traffic and Transport Unit, Shoalhaven City Council) on Long Bow Point Golf Course Traffic and Parking Assessment, dated 31 May 2012
- Environmetrics, 2006, Sydney Cycling Research: Internet Survey. For the City of Sydney
- Integrating Land Use and Transport, NSW Department of Urban Affairs and Planning, 2001
- NSW Bicycle Guidelines, Roads and Maritime Services, 2005
- NSW 2021: A Plan to Make NSW Number One, 2011
- NSW 2021: A Plan to Make NSW Number One, Regional Action Plan: Illawarra Community Discussion Paper, 2011
- NSW Planning Guidelines for Walking and Cycling, Department of Infrastructure, Planning and Natural Resources, 2004
- NSW Speed Zoning Guidelines (RMS, 2011).
- Portland Bureau of Transportation (PBT), 2010, Four Types of Transportation Cyclists. Assessed at: http://www.portlandonline.com/transportation/index.cfm?a=158497&c=44671
- Shoalhaven City Council, Traffic and Transport Unit, Calculation of Traffic Growth Factors & Trip Generation Rates, correspondence dated 19 February 2013
- Shoalhaven City Council Subdivision Code (DCP 100), 2002
- Shoalhaven City Council Car Parking Code, Development Control Plan (DCP) 18, 1996.
- Shoalhaven City Council DCP No. 67, Culburra Expansion Area, 1996
- Shoalhaven Draft Local Environmental Plan (LEP) 2009
- Shoalhaven LEP 1985
- Shoalhaven Integrated Transport Strategy, 2000
- Traffic and Parking Assessment - Proposed 18 Hole Championship Golf Course, Long Bow Point, Culburra, prepared by Traffic Solutions Pty Ltd, March 2012
- traffic surveys undertaken by Skyhigh in May 2012 as referenced in the context of this report
- plans for the proposed development site constraints prepared by Allen, Price and Associates: Site Constraints, revision P04, dated 25 July 2012

- plans for the proposed development site constraints prepared by John Toon Pty Ltd, plan no's 1 – 6, dated April 2010
- other documents and data as referenced in this report.

2. Existing Conditions

The subject site is located at Culburra, 180km south of Sydney and 20km east of Nowra.

The West Culburra subdivision development, as specified in the Part 3A submission, covers an area of approximately 110 ha. The land area is currently unoccupied and subject to the following land use classifications under Shoalhaven City Council Local Environmental Plan (LEP) 1985 (amendment no. 41):

- 2(c) – Residential 'C' (Living Area)
- 3(f) – Business 'F' (Village)
- 4(a) – Industrial 'A' (General).

Under Shoalhaven Draft LEP 2009, which was exhibited in July 2011, the land area is subject to the following land use classifications:

- R1 – General Residential
- IN1 – General Industrial
- B2 – Local Centre.

In addition to these, certain land areas within the development area are subject to a zoning of E2 – Environmental Conservation. The overall effect of the of Draft LEP 2009 was to confine the area allocated to residential development to the Crookhaven River catchment whilst maintaining the non-residential uses as proposed in LEP 1985.

The surrounding properties predominantly include residential and commercial uses to the east. The location of the subject site and its surrounding environs is shown in Figure 2.1.

Figure 2.1: Subject Site and Its Environs

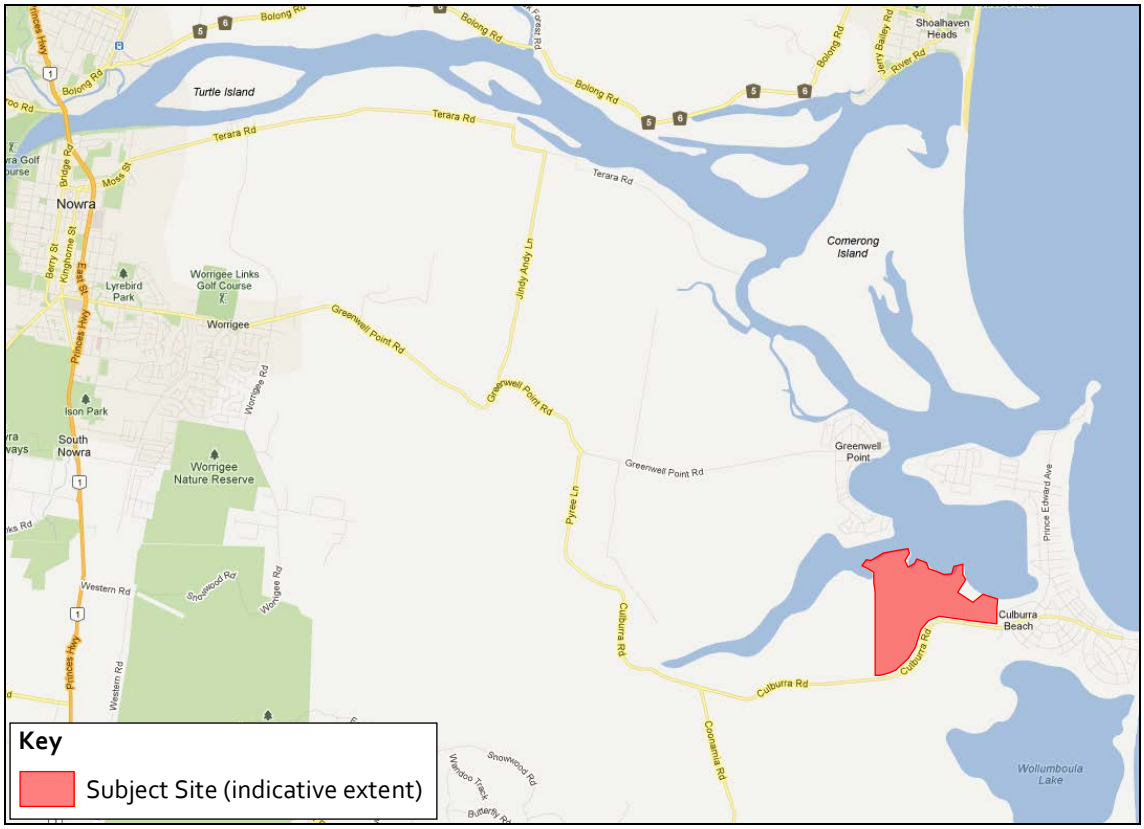


Image Source: Google Maps

2.1 Road Network

2.1.1 Adjoining Roads

Culburra Road

Culburra Road is a Regional Road (RR7632) generally aligned in an east-west direction and carries approximately 5,200 vehicles per day[1]. It is a two-way, 7 metre wide road set within a 20 metre wide road reserve (approx.), configured with one lane in each direction. Culburra Road is the key link between Culburra and Nowra to the west and in the vicinity of the subject site is subject to a 100km/hr posted speed limit. North of Mayfield Road, the name of the road changes to Pyree Lane.

Pyree Lane

Pyree Lane is a Regional Road (RR7632) aligned in a north-south direction and carries approximately 5,200 vehicles per day[1]. It is a two-way, 6 metre wide road set within an 11 metre wide road reserve (approx.), configured with one lane in each direction. Pyree Lane is the key link between Culburra and Nowra to the west and is subject to a 100km/hr posted speed limit. South of Mayfield Road, the name of the road changes to Culburra Road.

1 Based on the peak hour traffic counts undertaken by Skyhigh in May 2012 and assuming a peak-to-daily ratio of 8% for arterial roads and 10% for local roads.

Coonamia Road

Coonamia Road is a Local Road to the west of the site and is aligned in a north-south direction. It is a two-way, 7 metre wide road set within a 20 metre wide road reserve (approx.), configured with one lane in each direction and carries approximately 2,600 vehicles per day[1]. Coonamia Road is the sole link between Culburra and the coastal villages of Callala Bay, Callala Beach and Currarong to the south.

Greenwell Point Road/ Kalandar Street

Greenwell Point Road is a Regional Road (RR7632) aligned in an east-west direction. It is a two-way, 6 metre wide road set within a 13 metre wide road reserve (approx.), configured with one lane in each direction and carries approximately 6,000 vehicles per day[1]. Greenwell Point Road provides the sole road access between Nowra and the coastal village of Greenwell Point. West of McKay Street in East Nowra, the name of the road changes to Kalandar Street.

Forest Road

Forest Road is a Local Road aligned in an east-west direction. It is a two-way, 7 metre wide road set within a 20 metre wide road reserve (approx.), configured with one lane in each direction and carries approximately 2,600 vehicles per day[1]. Forest Road is the key link between the coastal villages of Callala and Currarong and the Princes Highway. Forest Road was recently upgraded as a flood free connection to the Princes Highway.

Princes Highway

The Princes Highway is a State Road (HW1) aligned in a north-south direction and is the key coastal route between Sydney and the Victorian border. Through Nowra, the Princes Highway is a two-way, 12.8 metre wide road set within a 22 metre wide road reserve (approx.), configured with two lanes in each direction and carries approximately 35,000 vehicles per day[1].

2.1.2 Surrounding Intersections

The following key intersections currently exist in the vicinity of the site:

- Culburra Road/ Coonamia Road (unsignalised)
- Pyree Lane/ Greenwell Point Road (unsignalised)
- Princes Highway/ Kalandar Street (signalised)
- Princes Highway/ Forest Road (unsignalised).

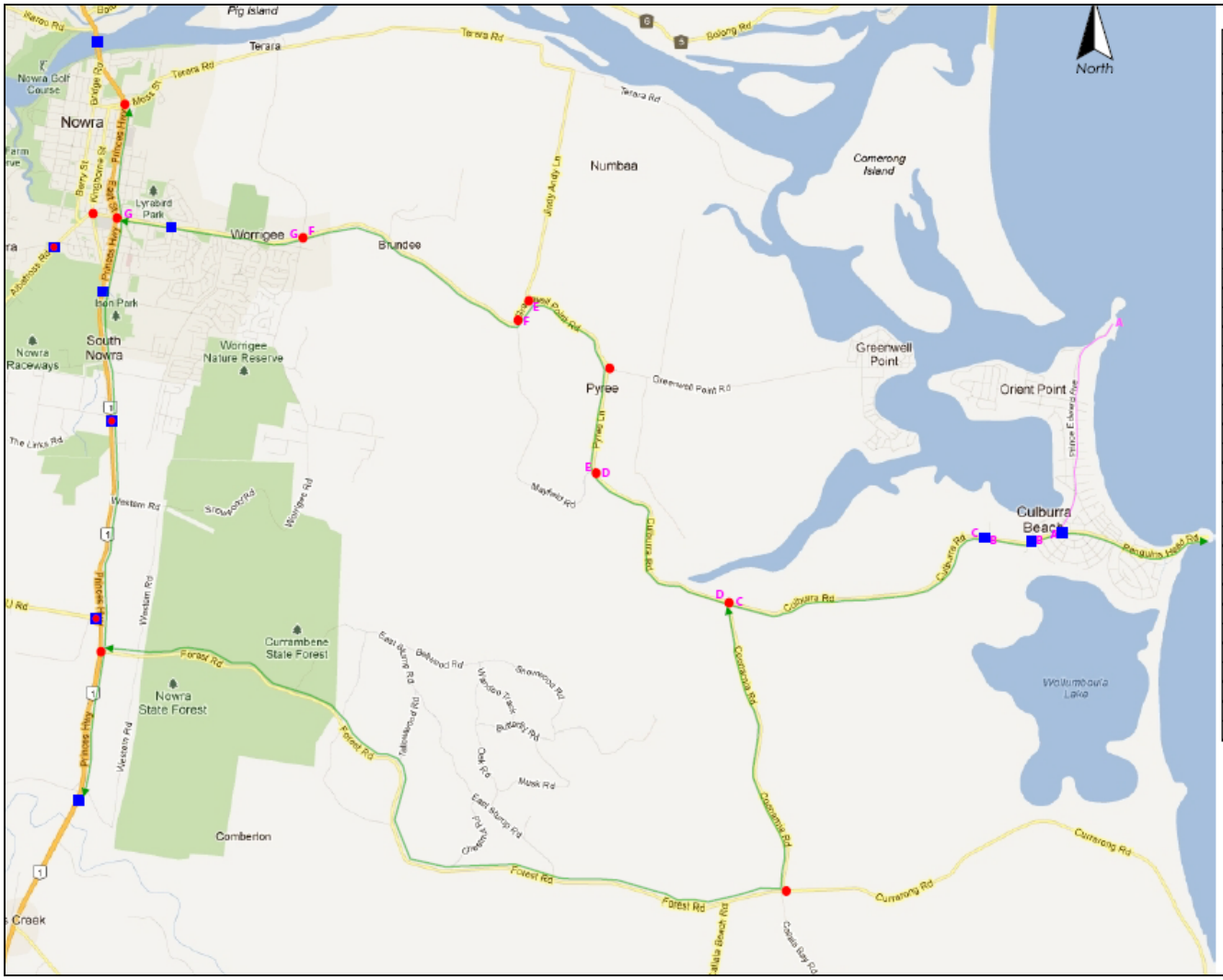
2.2 Traffic Volumes

GTA Consultants commissioned traffic movement counts and travel time surveys on key intersections and roads surrounding the site as shown in Figure 2.2. The intersection traffic movement counts were undertaken by Skyhigh during the following peak periods:

- Friday 04 May 2012: 7:00am to 9:00am and 4:00pm to 6:00pm
- Saturday 05 May 2012: 12:00pm to 2:00pm.

The existing weekday AM and PM peak hour traffic volumes are summarised in Figure 2.3 with Saturday peak hour traffic volumes summarised in Figure 2.4. Full results of the traffic movement counts are contained in Appendix A.

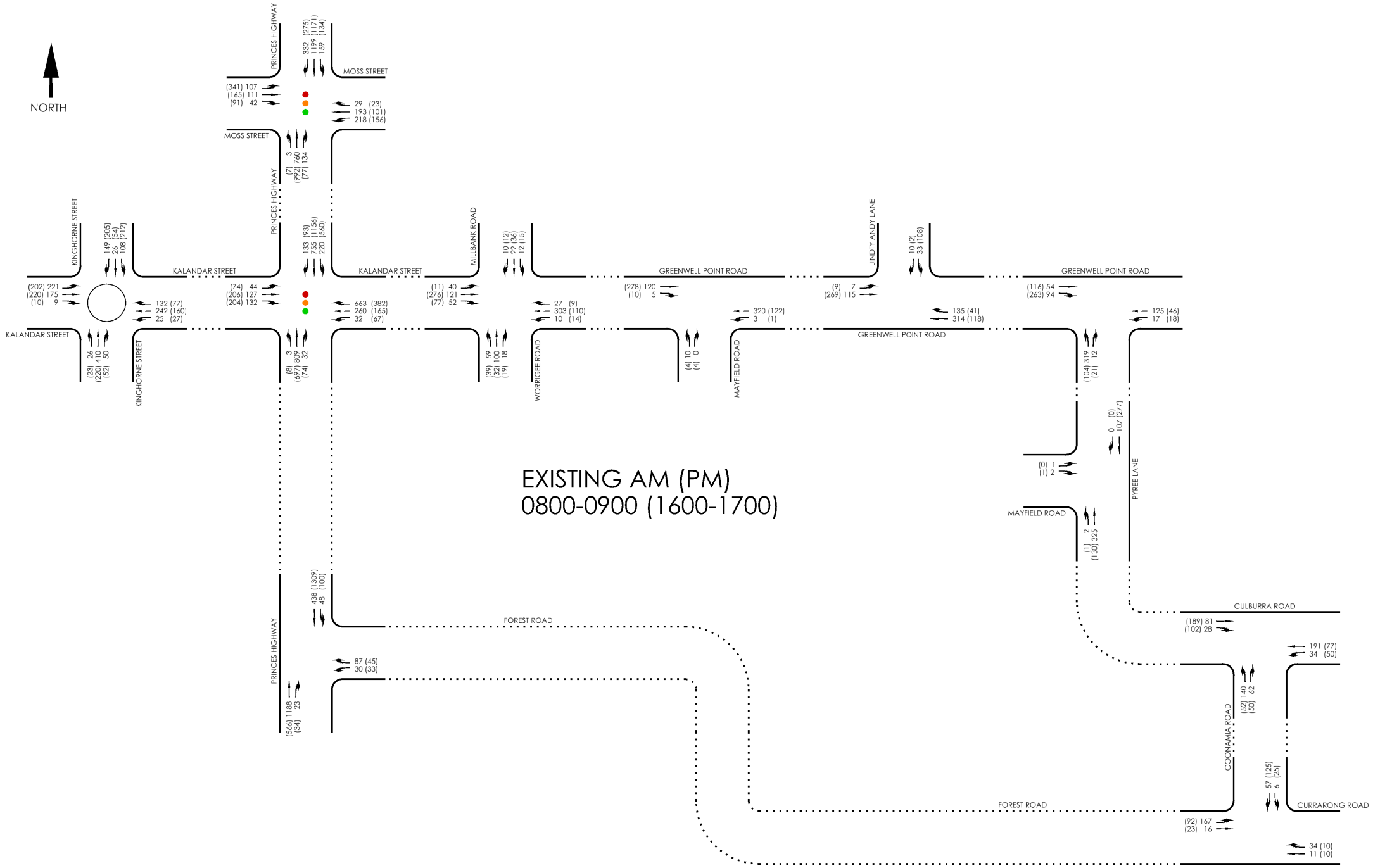
Figure 2.2: Traffic Count and Travel Time Survey Locations

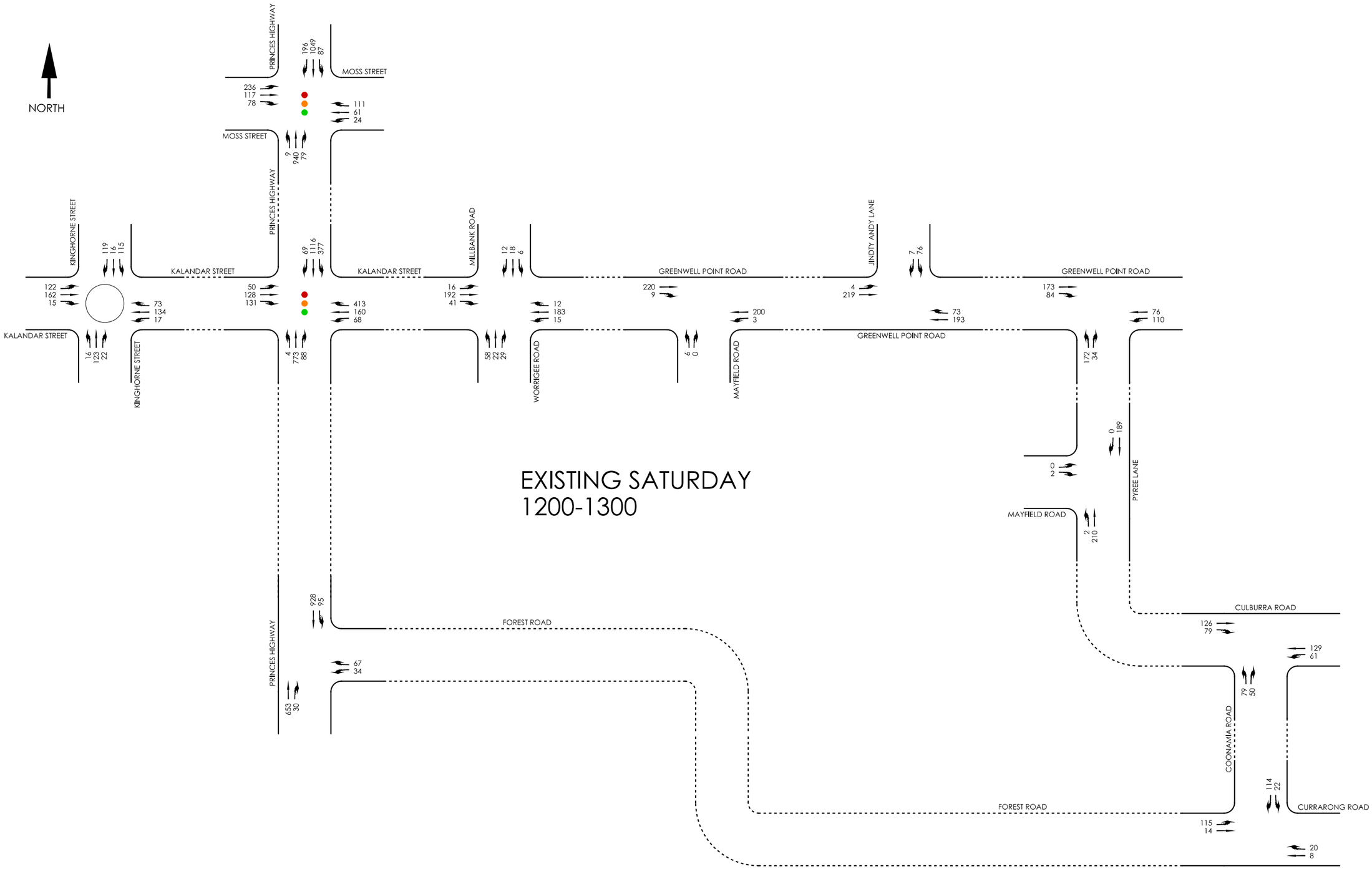


Traffic Counts		
Road/Intersection	**Location**	**Count**
1.The Lake Circuit	W of Ingle Ring	Link
2.Culburra Rd	W of West Cres	Link
3.Culburra Rd	W of Strathstone St	Link
4.Culburra Rd/Coonamia Rd		Movement
5.Culburra Rd/Mayfield Rd		Movement
6.Pyree Ln/Greenwell Pt Rd		Movement
7.Greenwell Pt Rd/Jindy Andy Ln		Movement
8.Greenwell Pt Rd/Mayfield Rd		Movement
9.Greenwell Pt Rd/Millbank Rd		Movement
10.Kalandar St/Princes Hwy		Movement
11.Greenwell Pt Road	W of McKay St	Link
12.Coonamia Rd/Currarong Rd		Movement
13.Kalandar St/Kinghorne St		Movement
14.Princes Hwy	S of Kinghorne St	Link
15.Princes Hwy/Forest Rd		Movement
16.Coonamia Rd/Forest Rd		Movement
17.Princes Hwy/Moss St		Movement
18.Princes Hwy	S of Parma Road	Link
19.Princes Hwy	Shoalhaven River	Link
20.Albatross Rd	E of Yalwal Rd	Link/Movement
21.BTU Rd	W of Princes Hwy	Link/Movement
22.Princes Hwy	S of Central Ave	Link/Movement
Travel time survey		
1.Penguins Head Rd East to Princess Hwy via Greenwell Pt Rd		
2.Coonamia Road North to Princess Hwy via Forest Rd		
3.Princes Hwy between Moss St and Parma Road		
Sub-sections travel time		
A.Prince Edward Ave	Northern end to Culburra Rd	
B.Culburra Rd	West Cres to Strathstone St	
C.Culburra Rd	Strathstone St to Coonamia Rd	
D.Culburra Rd	Coonamia Rd to Mayfield Rd	
E.Pyree Ln	Mayfield Rd to Greenwell Pt Rd	
F.Greenwell Point Rd	Jindy Andy Ln to Millbank Rd	
G.Greenwell Point Rd/Kalandar St	Millbank Rd to Princes Hwy	

Key

- Classified Link Count (Tube count)
- Turning movement Count
- Classified Link / Turning movement Count
- Main route travel time survey
- A—A Section travel time survey


NORTH
EXISTING AM (PM)
0800-0900 (1600-1700)
PRINCES HIGHWAY
MOSS STREET
KINGHORNE STREET
KALANDAR STREET
MILLBANK ROAD
GREENWELL POINT ROAD
JINDTY ANDY LANE
WORRIGEE ROAD
MAYFIELD ROAD
PYREE LANE
FOREST ROAD
CULBURRA ROAD
COONAMIA ROAD
CURRARONG ROAD


NORTH
PRINCES HIGHWAY
MOSS STREET
KINGHORNE STREET
KALANDAR STREET
MILLBANK ROAD
WORRIGEE ROAD
MAYFIELD ROAD
JINDY ANDY LANE
GREENWELL POINT ROAD
PYREE LANE
FOREST ROAD
COONAMIA ROAD
CULBURRA ROAD
CURRARONG ROAD
EXISTING SATURDAY
1200-1300

SATURDAY

2.3 Relevant Transport Studies

2.3.1 Long Bow Point Golf Course, Traffic and Parking Assessment

A traffic and parking assessment was prepared by Traffic Solutions Pty Ltd in March 2012 to support a Development Application (DA) for a proposed 18 hole championship golf course at Long Bow Point, Culburra. The proposed golf course is located west of the established residential areas of Culburra on the southern side of Culburra Road as shown in Figure 2.5.

The report states that vehicle access to the golf course is proposed directly from Culburra Road via a new intersection approximately 1km west of Strathstone Street as shown in Figure 2.5.

Figure 2.5: Proposed Golf Course, Long Bow Point, Culburra

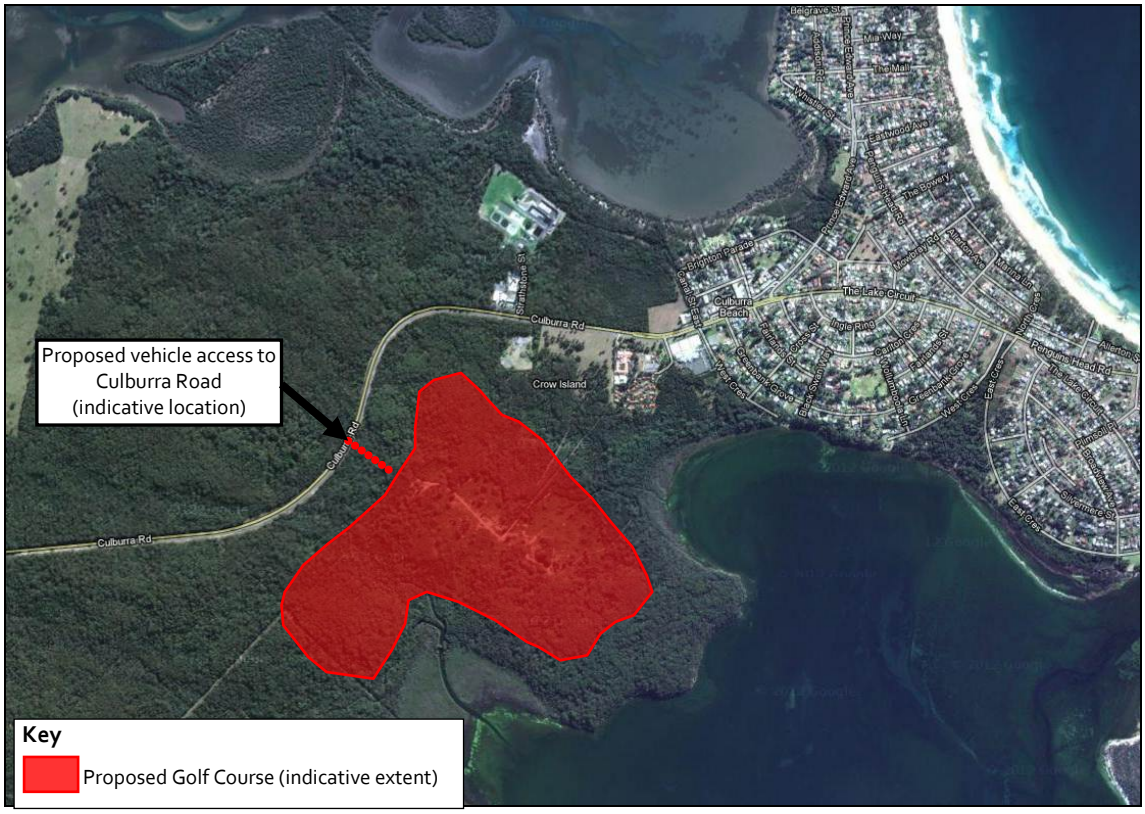


Image Source: Google Maps

Traffic generation estimates for the proposed golf course development were based on surveys undertaken on a Wednesday and Saturday at Nowra Golf Club. It was estimated that the proposed golf course would generate 33 and 53 vehicle movements (two-way) during the weekday AM and PM peak periods, and 66 vehicle movements (two-way) during a Saturday peak hour.

As GTA Consultants understands it, the DA (DA11/1728) for the development has been submitted to Shoalhaven City Council and is currently under review.

2.3.2 Princes Highway Upgrade REF

Construction works for the upgrade of a 6.3km section of the Princes Highway between Kinghorne Street and Forest Road, south of Nowra have commenced. Key features of the upgrade include:

- Duplication of the Princes Highway from two to four lanes
- Realignment of the Princes Highway between Warra Warra Road and Forest Road, west of the roads present alignment
- Reconstructing the Forest Road intersection to allow all turning movements
- Relocation of the BTU Road intersection approximately 400 metres north of its existing location
- New pedestrian and cycling facilities.

On completion the upgrade will provide consistent four lane conditions between Bomaderry and Jervis Bay Road (4.5km south of Forest Road).

The Review of Environmental Factors (REF) for the project was completed in November 2009 and estimated a 2.5% linear growth rate in traffic volumes on this section of the Princes Highway up to 2028. This growth rate was based on the recorded Annual Average Daily Traffic (AADT) counts taken on the Princes Highway (station number 07.707) over a five year period; 25,636 in 2003 to 27,888 in 2008. The REF projected traffic volumes are summarised in Table 2.1.

Table 2.1: Princes Highway Projected Traffic Volumes (Princes Highway Upgrade REF, 2009)

Year	Annual Average Daily Traffic (AADT)
2012	29,511
2018	33,688
2022	34,919
2028	39,250

2.4 Public Transport

Culburra is served by one public bus service, route 729, which operates between Bomaderry Railway Station, Nowra, Orient Point and Culburra Beach via Greenwell Point Road, Pyree Lane and Culburra Road as shown in Figure 2.6. This service is operated by Kennedy's Bus and Coach with the weekday frequency summarised in Table 2.2. The nearest bus stops to the proposed development are located on Prince Edward Avenue in the vicinity of Culburra shops, east of the site.

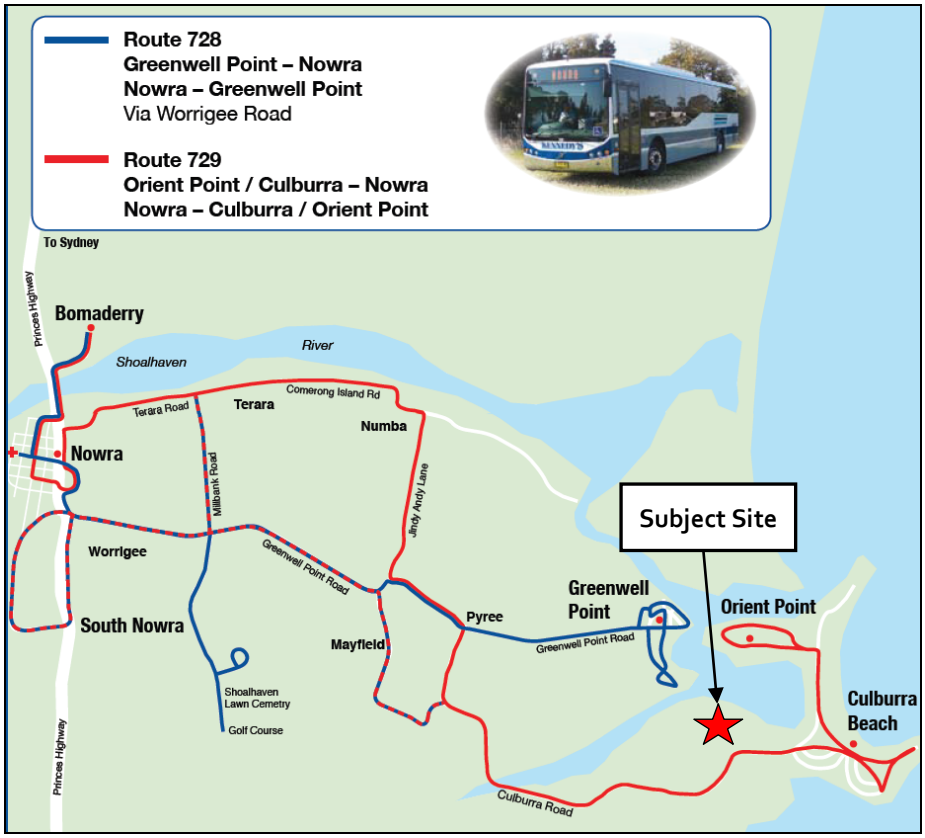
Table 2.2: Route 729 Bus Service Frequency

Direction	No. of AM Weekday Services	No. of PM Weekday Services
Culburra to Nowra	3	2
Nowra to Culburra	2	3

It is noted that this service does not operate on weekends or public holidays.

Kennedy's Bus and Coach also provide school bus services to Culburra and Orient Point.

Figure 2.6: Public Bus Services



Source: Kennedy's Bus and Coach website: www.kennedystours.com.au/ (accessed 06 September 2012)

2.5 Pedestrian Infrastructure

There is no pedestrian infrastructure in the immediate vicinity of the subject site. The nearest dedicated pedestrian infrastructure is located in the established residential areas of Culburra to the east of the proposed development. The footpath network within the urban area of Culburra is limited with many streets having wide verges in lieu of paved footpaths.

2.6 Cycle Infrastructure

The nearest dedicated cycle infrastructure to the site is a 2.5 metre wide shared path adjacent to Prince Edward Avenue between The Lake Circuit and Penguins Head Road as shown in Figure 2.7. Further discussion on cycling infrastructure is contained in Section 3 and Section 5.

Figure 2.7: Prince Edward Avenue Existing Shared Path, Proposed and Possible Future Cycleways

Source of Base Plan: Bicycle Information NSW website www.bicycleinfo.nsw.gov.au/maps/ (accessed 06 September 2012)

2.7 Crash Analysis

GTA Consultants obtained vehicle crash data from RMS for the following eleven key intersections between Culburra and Nowra for the five year period to June 2012:

i Culburra Road/ Coonamia Road
ii Culburra Road/ Mayfield Road
iii Greenwell Point Road/ Pyree Lane
iv Greenwell Point Road/ Jindy Andy Lane
v Greenwell Point Road/ Mayfield Road
vi Greenwell Point Road/ Millbank Road/ Worrigee Road
vii Princes Highway/ Kalandar Street
viii Coonamia Road/ Currarong Road/ Forest Road

ix Kalandar Street/ Kinghorne Street/ Albatross Road
x Princes Highway/ Forest Road
xi Princes Highway/ Moss Street.

The accident history within 100m of the approaches to the above intersections were analysed to determine whether there any accident clusters or safety issues at these locations. The results of the crash analysis are presented below and full details are contained in Appendix B.

Table 2.3: Reported Crash Summary (July 2007 – June 2012)

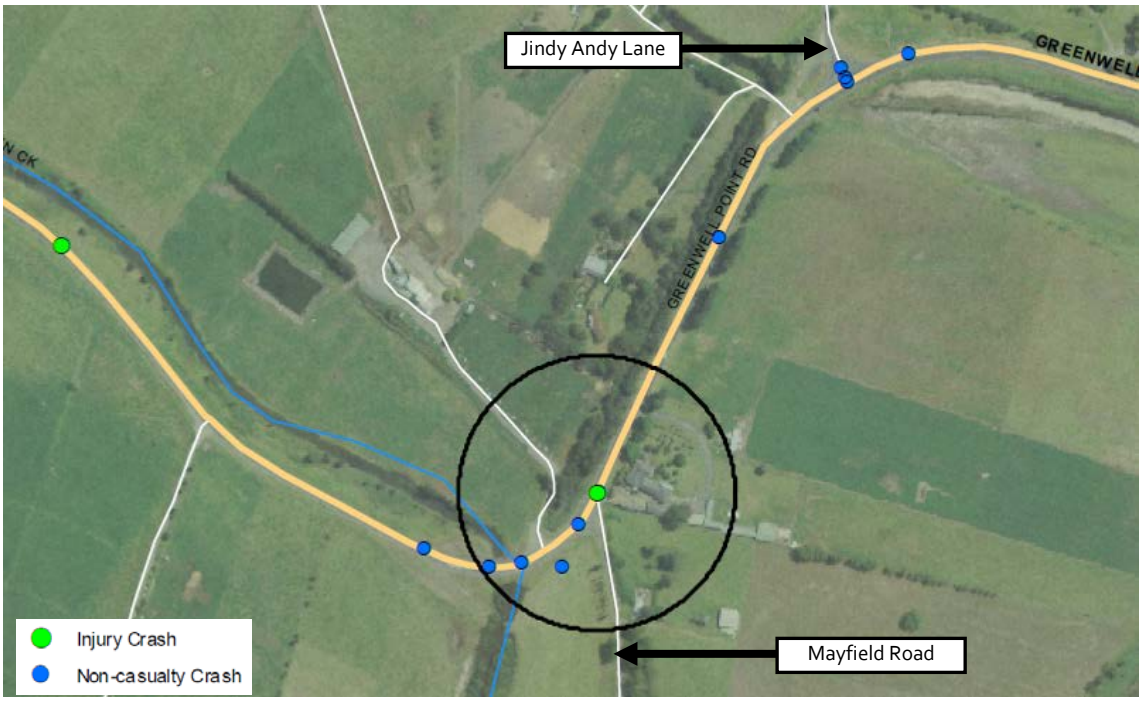
Intersection	No. of Crashes (within 100m of intersection)
Culburra Road/ Coonamia Road	2 (resulting in 3 people injured)
Culburra Road/ Mayfield Road	2 (resulting in 1 person injured)
Greenwell Point Road/ Pyree Lane	2 (resulting in 2 people injured)
Greenwell Point Road/ Jindy Andy Lane	5 (resulting in no injuries)
Greenwell Point Road/ Mayfield Road	8 (resulting in 1 person injured)
Greenwell Point Road/ Millbank Road/ Worrigee Road	4 (resulting in 4 people injured)
Princes Highway/ Kalandar Street	18 (11 injury crashes resulting in 13 people injured)
Coonamia Road/ Currarong Road/ Forest Road (includes Forest Road/ Callala Bay Road intersection)	4 (1 injury crash resulting in 1 person injured)
Kalandar Street/ Kinghorne Street	4 (3 injury crashes resulting in 3 people injured)
Princes Highway/ Forest Road	18 (12 injury crashes resulting in 22 people injured)
Princes Highway/ Moss Street	29 (13 injury crashes resulting in 14 people injured)

As shown in Table 2.3 the more notable accident clusters occurred at the following intersections:

- Greenwell Point Road/ Mayfield Road
- Princes Highway/ Kalandar Street
- Princes Highway/ Moss Street
- Princes Highway/ Forest Road.

The location of crashes in the vicinity of these intersections is shown graphically in Figure 2.8 to Figure 2.11.

Figure 2.8: Reported Crashes – Greenwell Point Rd/ Mayfield Rd intersection (July 2007 – June 2012)



Source: RMS

Figure 2.9: Reported Crashes – Princes Highway/ Kalandar Street intersection (July 2007 – June 2012)

Source: RMS

Figure 2.10: Reported Crashes – Princes Highway/ Moss Street intersection (July 2007 – June 2012)

Source: RMS

Figure 2.11: Reported Crashes – Princes Highway/ Forest Road intersection (July 2007 – June 2012)

Source: RMS

The Princes Highway/ Forest Road intersection is currently a painted seagull arrangement as shown in Figure 2.12 and Figure 2.13.

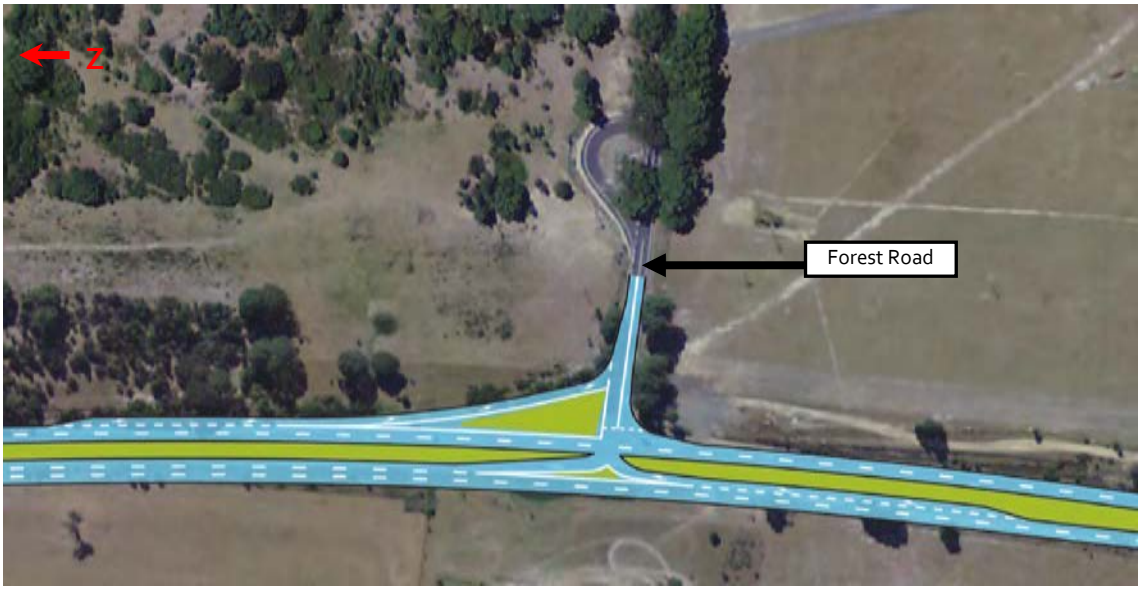
Figure 2.12: Princes Highway at Forest Road (looking south)

Figure 2.13: Princes Highway at Forest Road (looking north)

Image Source: Google Maps

As stated in Section 2.3.2, works have commenced for the upgrade of the Princes Highway between Kinghorne Street and Forest Road. As part of these upgrade works the Forest Road intersection will be upgraded to a kerbed seagull intersection allowing all turning movements as shown in Figure 2.14.

Figure 2.14: Princes Highway/ Forest Road Intersection – Proposed Seagull Arrangement



Source: RMS

The upgraded works will significantly improve safety at the intersection by providing a dedicated left turn slip lane from the Princes Highway and a vegetated median along the Princes Highway, providing greater protection for turning vehicles.

The intersections of Princes Highway with Kalandar Street and Moss Street are the most heavily trafficked and congested intersections in the study area. Due to these significantly higher traffic volumes and the congestion, which results in many rear end shunts, it is not unexpected that there are more crashes at this location.

The road alignment on the eastbound approach to Mayfield Road is relatively tight and warning signage (Reduce Speed, 45km/h advisory signage and Chevron Alignment Markers & safety barrier has been provided to try and minimise the crash risk.

2.8 Intersection Operation

The Director-General's Environmental Assessment Requirements (DGR's) dated 27 May 2010 stipulated that network modelling be undertaken using TRACKS modelling software to assess the current (and future) performance of the intersections in the study area.

TRACKS is a suite of software programs produced by Gabites Porter Consultants of Christchurch, New Zealand. The traffic authority has a TRACKS model of the area that is required for use as the basis of our analysis. However, we have been unable to obtain a model to date. On 14th May 2012, Scott Wells, Traffic and Transport Unit Manager, Shoalhaven City Council wrote:

"There has been an ITUC meeting to discuss third party use of TRACKS models, I am yet to see the minutes, however there was general acceptance, subject to conditions. It was agreed there would be no fee for use however a condition would be to ensure the level of model validation in the area required for testing was improved prior to use. Engagement for that purpose would be by Council at your clients cost, the updated model and all data would be Council's. Once the model is updated and agreed sufficient for use for your purposes, and all costs to achieve the improved level of validation have been paid for, you could then use the model subject to conditions."

Negotiations between GTA Consultants and Shoalhaven City Council took place for the release of the TRACKS model to undertake to the required network modelling. In subsequent correspondence Scott Wells wrote on 24th January 2013:

"...we (Council Traffic Unit) never asked for TRACKS modelling, it was an RMS request for DPI to include in DGRs and this was included in the DGRs without consultation with Council. The only available TRACKS model that covers this area is an AADT model and there has never been specific validation in the area subject of assessment. This means without checking against field data there is no high level confidence in regards to the strategic distributions to/from the site and Princes Highway.... For the purposes of your study use of SIDRA at Princes Highway/Moss street and Princes Highway/Kalandar Street should suffice in my view".

Consequently, assessment of the traffic impact of the proposed development has been undertaken using SIDRA INTERSECTION[2], a computer based modelling package which calculates intersection performance on an individual intersection basis. Conversely TRACKS software assesses traffic impacts on a network wide scale.

The commonly used measure of intersection performance, as defined by Roads and Maritime Services (RMS), is vehicle delay. SIDRA INTERSECTION determines the average delay that vehicles encounter and provides a measure of the level of service.

Table 2.4 shows the criteria that SIDRA INTERSECTION adopts in assessing the level of service.

[2] Program used under license from Akcelik & Associates Pty Ltd.

Table 2.4: SIDRA INTERSECTION Level of Service Criteria

Level of Service (LOS)	Average Delay per vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Sign
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	Near capacity	Near capacity, accident study required
E	57 to 70	At capacity, at signals incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70	Extra capacity required	Extreme delay, major treatment required

The road network under consideration as part of this assessment is shown in Figure 2.3 and Figure 2.4 and includes the following eleven intersections:

i Culburra Road/ Coonamia Road (priority controlled)
ii Culburra Road/ Mayfield Road (priority controlled)
iii Greenwell Point Road/ Pyree Lane (priority controlled)
iv Greenwell Point Road/ Jindy Andy Lane (priority controlled)
v Greenwell Point Road/ Mayfield Road (priority controlled)
vi Greenwell Point Road/ Millbank Road/ Worrigee Road (stop controlled)
vii Princes Highway/ Kalandar Street (signalised)
viii Coonamia Road/ Currarong Road/ Forest Road (priority controlled)
ix Kalandar Street/ Kinghorne Street (roundabout)
x Princes Highway/ Forest Road (priority controlled)
xi Princes Highway/ Moss Street (signalised).

2.8.1 Base Scenario - 120th Highest Annual Hour

As stated in Section 2.2, traffic volumes were recorded in May 2012. The queuing at the intersection was also recorded so that the base year model could be validated.

However, as the NSW South Coast is a popular tourist destination subject to influxes of tourists over long weekends and during school holidays, particularly during the summer school holidays. To reflect this seasonal increase in traffic volumes in the vicinity of the development site, the 120th highest annual hour (HH) has been used as the Design Hourly Volume (DHV) for the base traffic scenario as instructed by Scott Wells of Shoalhaven City Council in correspondence dated 24th January 2013:

"We would also consider the assessment incomplete without undertaking adjustment of the surveyed flows to equivalent 120th HH demand flow levels consistent with AUSTROADS guidelines".

Use of the 120th HH as the DHV reflects a peak hour within the highest 1% of all hourly volumes recorded over a year and as such represents a period of high seasonal traffic volumes.

The traffic counts undertaken as part of this assessment were undertaken in May 2012 during a period of low tourist activity. Subsequently, the recorded peak hour traffic flows require application of an appropriate growth factor to represent the 120th HH.

Calculation of Growth Factors

The calculation of an appropriate growth factor to be applied to the May 2012 recorded traffic flows was undertaken by the Traffic and Transport Unit of Shoalhaven City Council. The growth factors were calculated by analysing 2008 annual hourly traffic volume data from Greenwell Point Road and Forest Road as well as data from the RMS permanent traffic count stations at Falls Creek, north of Jervis Bay Road (approximately 4km south of Forest Road, count station 07.053). The growth factors to be applied to the recorded May 2012 traffic flows are summarised below with further details of the calculation of growth factors contained in Appendix C:

Table 2.5: Growth Factors to be Applied to May 2012 Recorded Flows to Calculate 120th HH Flows

Road	Friday AM Peak Hour (8-9am)	Friday PM Peak Hour (4-5pm)	Saturday Peak Hour (12-1pm)
Local Roads & Traffic to/ from Princes Highway	1.12	1.41	1.25
Princes Highway through traffic (north-south movements)*	1.13	1.07	1.18

* Relates to the Princes Highway intersections with Moss Street, Kalandar Street and Forest Road.
Source: Shoalhaven City Council (Appendix C)

Application of the growth factors shown in Table 2.5 to the surveyed May 2012 peak hour volumes and the equivalent 120th HH traffic flows used for the base scenario assessments of the Friday AM, Friday PM and Saturday Peak hours are shown graphically in Figure 2.15, Figure 2.16 and Figure 2.17 respectively.

2.8.2 Existing Intersection Operation

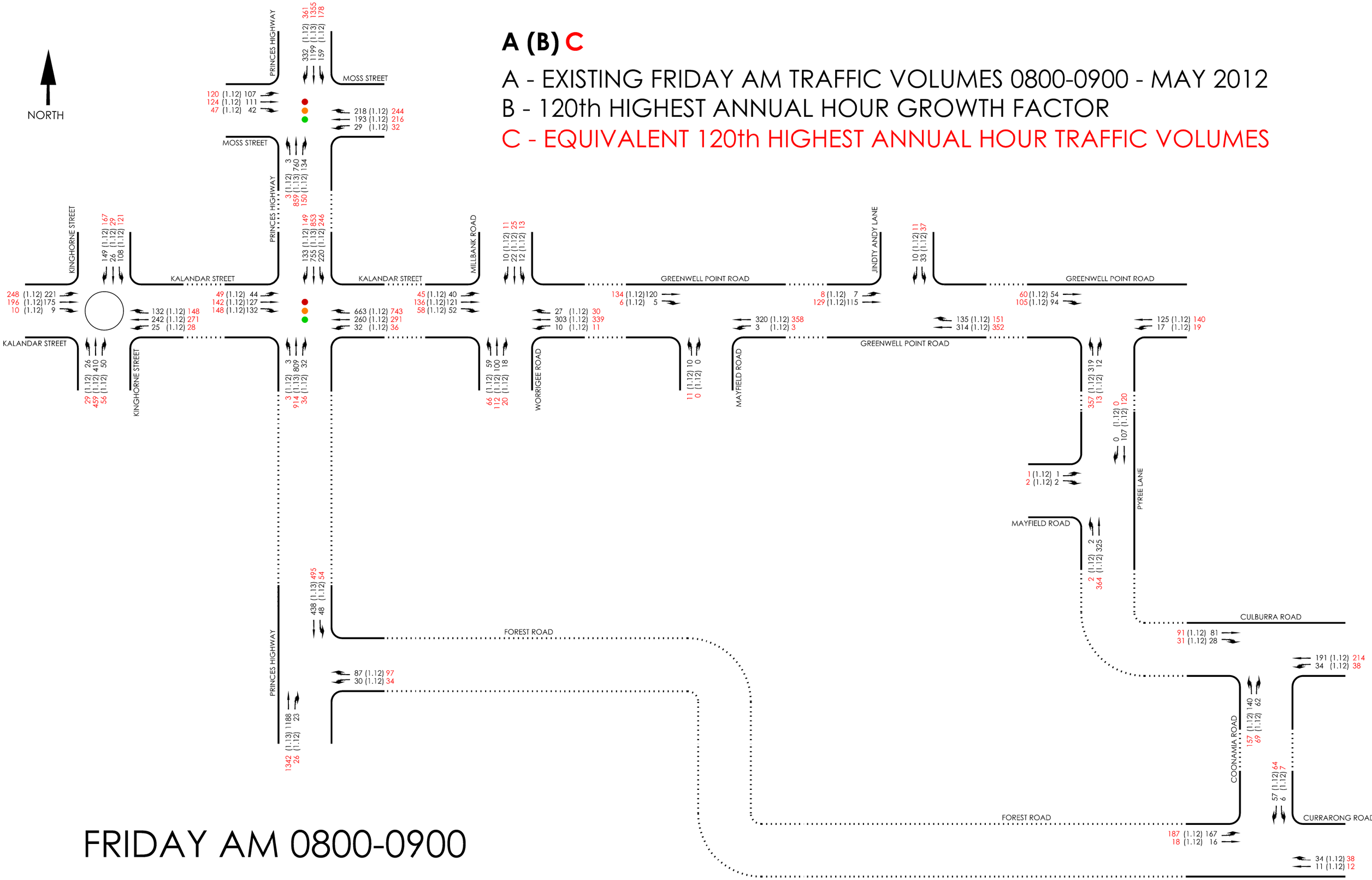
Table 2.6 presents a summary of the existing operation of the eleven intersections within the road network under consideration using 120th HH traffic volumes to account for the seasonal growth in traffic in the region. Full results presented in Appendix D of this report while the intersection layouts from SIDRA are contained in Appendix E.

A (B) C

A - EXISTING FRIDAY AM TRAFFIC VOLUMES 0800-0900 - MAY 2012

B - 120th HIGHEST ANNUAL HOUR GROWTH FACTOR

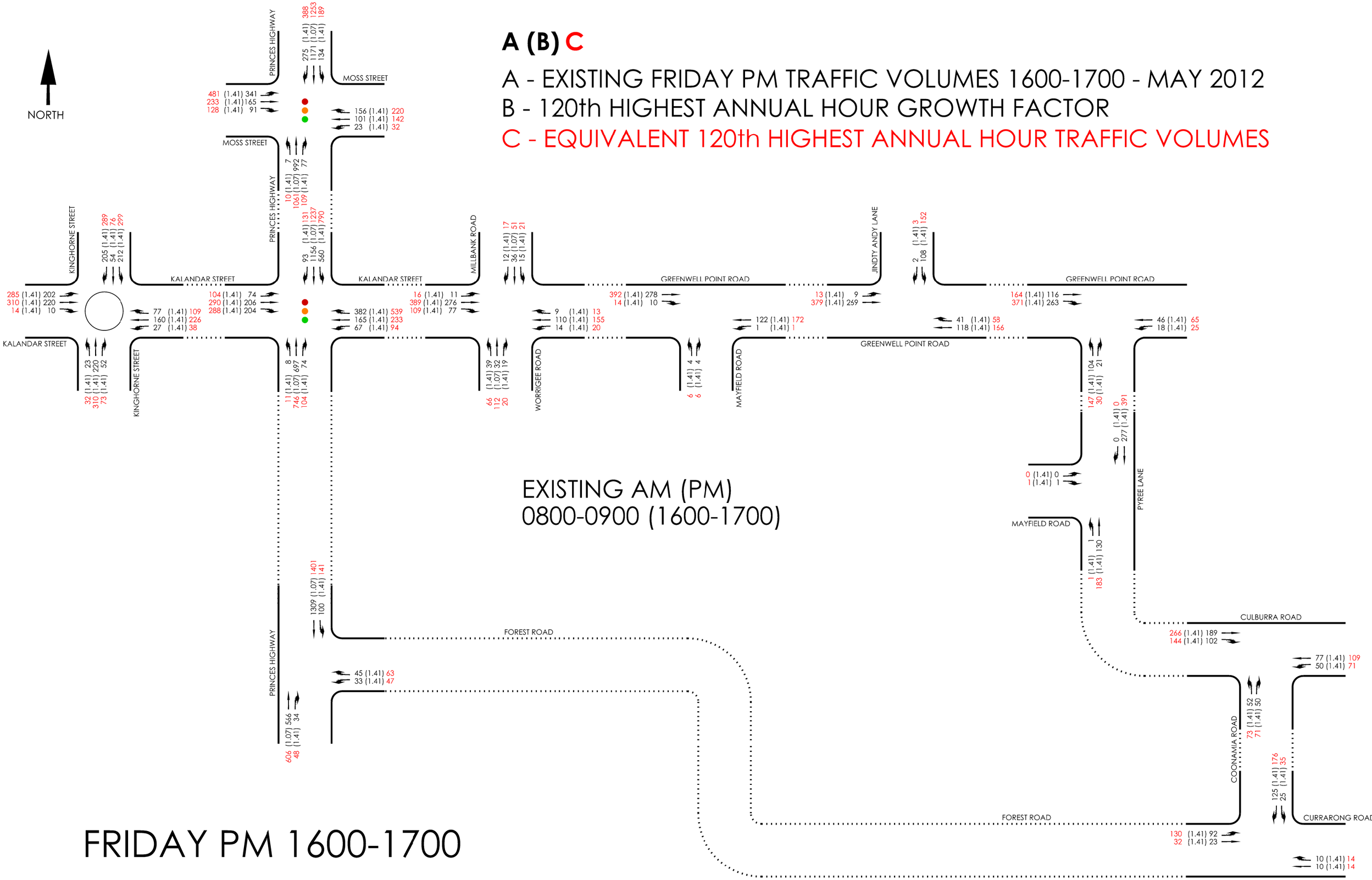
C - EQUIVALENT 120th HIGHEST ANNUAL HOUR TRAFFIC VOLUMES



FRIDAY AM 0800-0900

A (B) C

A - EXISTING FRIDAY PM TRAFFIC VOLUMES 1600-1700 - MAY 2012
B - 120th HIGHEST ANNUAL HOUR GROWTH FACTOR
C - EQUIVALENT 120th HIGHEST ANNUAL HOUR TRAFFIC VOLUMES

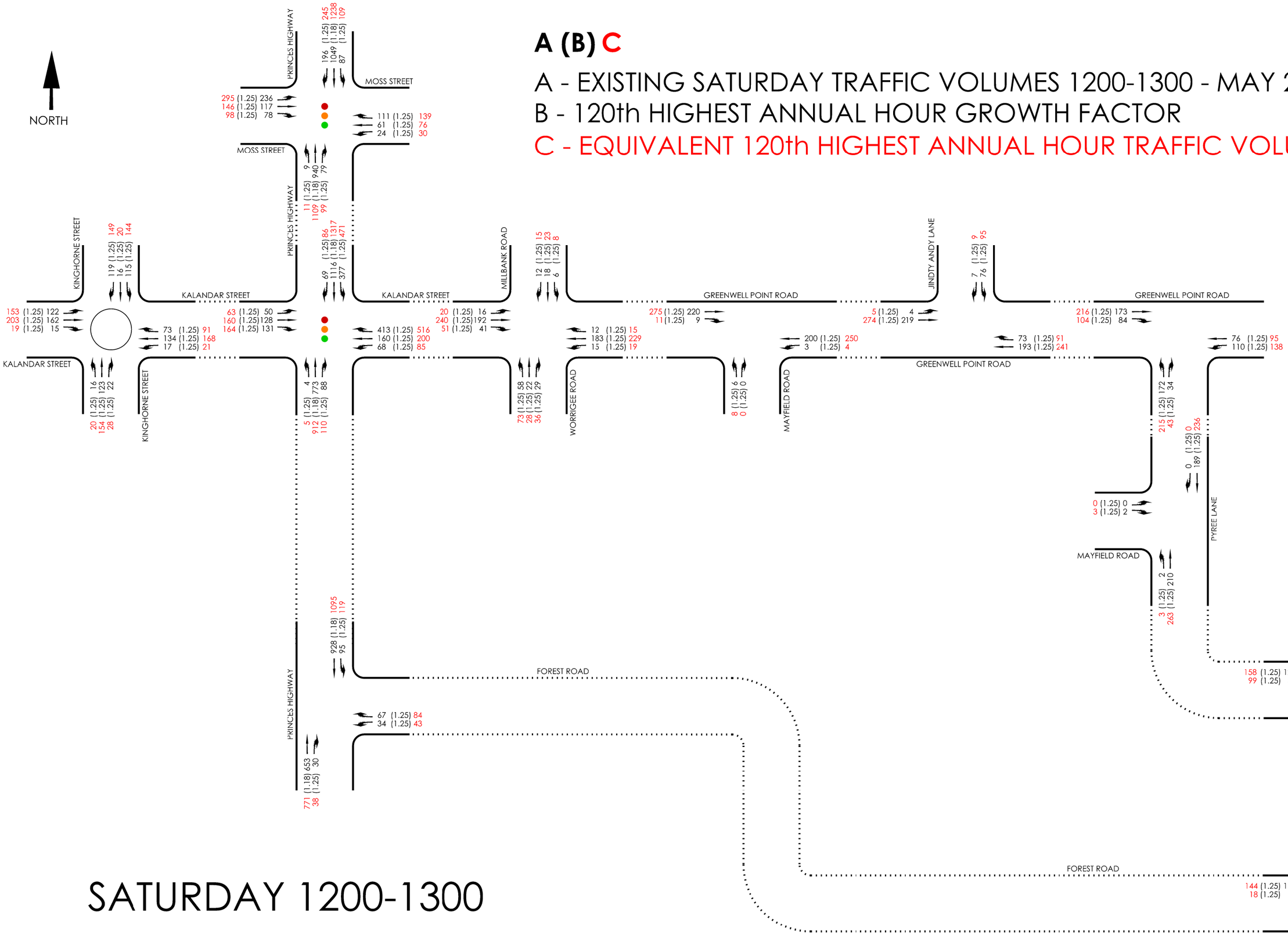


A (B) C

A - EXISTING SATURDAY TRAFFIC VOLUMES 1200-1300 - MAY 2012

B - 120th HIGHEST ANNUAL HOUR GROWTH FACTOR

C - EQUIVALENT 120th HIGHEST ANNUAL HOUR TRAFFIC VOLUMES



SATURDAY 1200-1300

Table 2.6: Existing Operating Conditions (Equivalent 120th Highest Annual Hour)

Intersection	Peak	Degree of Saturation (DOS)	Delay (sec)	95th Percentile Queue (m)	Level of Service (LOS)
Culburra Road/ Coonamia Road	Friday AM	0.223	6.8	5	NA
	Friday PM	0.145	6.4	4	NA
	Saturday	0.140	6.7	3	NA
Culburra Road/ Mayfield Road	Friday AM	0.198	0.6	4	NA
	Friday PM	0.214	0.8	11	NA
	Saturday	0.144	0.8	7	NA
Greenwell Point Road/ Pyree Lane	Friday AM	0.224	8.9	7	NA
	Friday PM	0.558	10.0	37	NA
	Saturday	0.212	7.5	6	NA
Greenwell Point Road/ Jindy Andy Lane	Friday AM	0.227	3.5	7	NA
	Friday PM	0.215	4.1	6	NA
	Saturday	0.181	3.6	5	NA
Greenwell Point Road/ Mayfield Road	Friday AM	0.200	1.8	9	NA
	Friday PM	0.235	2.3	21	NA
	Saturday	0.170	2.3	15	NA
Greenwell Point Road/ Millbank Road/ Worrigee Road	Friday AM	0.391	7.5	15	NA
	Friday PM	0.235	6.2	7	NA
	Saturday	0.153	5.6	4	NA
Princes Highway/ Kalandar Street	Friday AM	1.049	86.4	403	F
	Friday PM	1.101	119.6	558	F
	Saturday	0.968	63.3	389	E
Coonamia Road/ Currarong Road/ Forest Road	Friday AM	0.117	11.9	3	NA
	Friday PM	0.249	12.1	8	NA
	Saturday	0.202	12.2	6	NA
Kalandar Street/ Kinghorne Street	Friday AM	0.729	15.4	69	B
	Friday PM	0.774	15.7	78	B
	Saturday	0.373	9.8	18	A
Princes Highway/ Forest Road	Friday AM	0.739	2.0	5	NA
	Friday PM	0.766	4.7	17	NA
	Saturday	0.598	3.2	13	NA
Princes Highway/ Moss Street	Friday AM	1.025	89.2	388	F
	Friday PM	1.237	199.9	796	F
	Saturday	0.887	49.5	200	D

On the basis of the above assessment, under equivalent 120th HH traffic volumes:

- the priority controlled intersections operate well during the three respective peak periods with minimal delays and queues on all approaches

- it is clear from this analysis that the existing Princes Highway intersections at Kalandar Street and Moss Street experience significant delays during these peak periods, particularly during the Friday AM and Friday PM peak periods. The other intersections in the study area currently operate satisfactorily.

2.9 Performance of Rural Road Network

GTA Consultants undertook an assessment of the existing local road network surrounding the development site to assess road design aspects (cross-section parameters) for compliance with AUSTROADS Standards and RMS Guidelines in relation to:

- Lane widths
- Rural turning lanes
- Intersection configurations
- Warrants for overtaking lanes.

As advised in correspondence from Scott Wells dated 19th February 2013, this assessment was to be limited to the local road network surrounding the site as a similar assessment of the State Road network in the vicinity of the site (i.e. the Princes Highway) was not required.

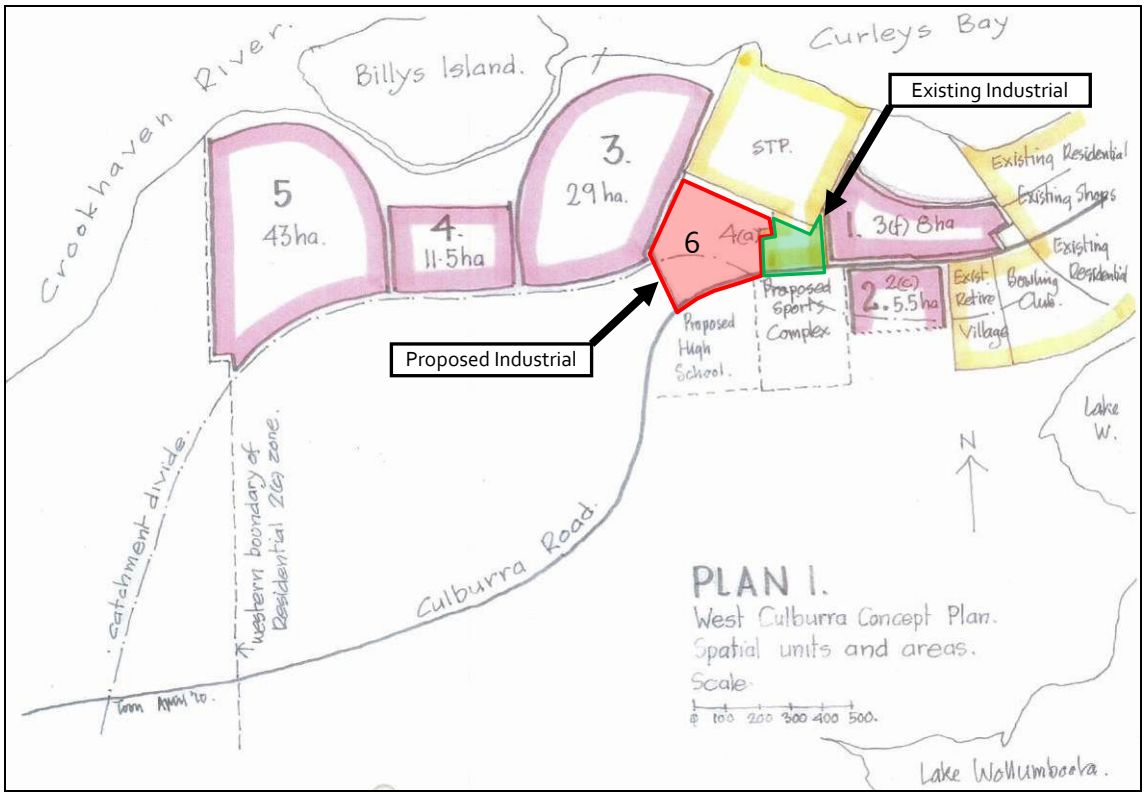
This issue is considered in detail at Section8.

3. Development Proposal

3.1 Land Uses

The proposed mixed use subdivision development is comprised of six stages as shown in Figure 3.1.

Figure 3.1: West Culburra Subdivision - Proposed Stages



Background Image Source: John Toon Pty Ltd, 2010

As GTA Consultants understands it, the main areas to be developed are Stages 3, 4 and 5 which have an indicative capacity of approximately 800 dwellings and units on lots ranging from 550m^2 to 900m^2. It is anticipated that these areas will be constructed and sold in about an eight years period from 2014.

Stage 1 is proposed for 60 small-lot housing units for the 55 plus aged group and three five-storey apartment buildings as well as commercial and tourist-orientated uses. It is anticipated that this development will commence at the end of 2013 and be completed within three years.

Stage 2, south of Culburra Road, is proposed as the site for 80 small-lot housing units for the 55 plus aged group, six five-storey apartment blocks with each block estimated to contain 40 two bedroom apartments. It is anticipated that the development of the five-storey apartments will be developed over a 20 year period.

It is understood that 26 industrial lots are also proposed as part of the development over an area of 6.8ha (approx.) in Stage 6. This area is located on the northern side of Culburra Road, east of the existing industrial area as shown in Figure 3.1.

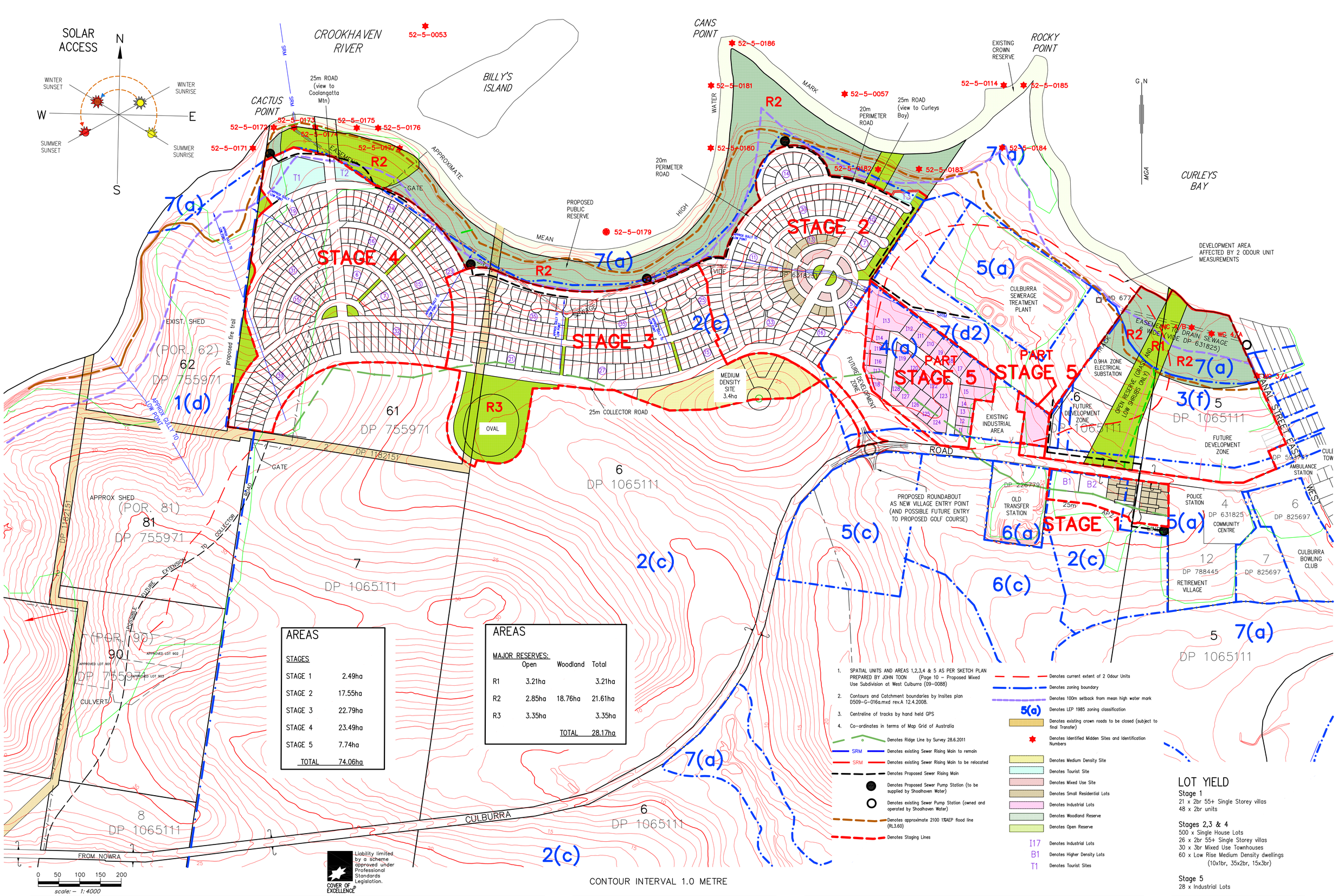
An indicative development schedule is summarised in Table 3.1.

Table 3.1: Indicative Development Schedule

Stage	Area (approx)	Zoning (LEP 1985)	Zoning (Draft LEP 2009)	Land Use/ Capacity
1	1 ha	3(f) Business Zone	B2 Local Centre	Tourist/ commercial use
2	1.6 ha	2(c) Residential	R1 General Residential E2 Environmental Conservation	48 x 2 bedroom apartments 21 x small-lot 2 bedroom single storey villas for the 55+ aged group
3-5	83.5 ha	2(c) Residential	R1 General Residential	500 x dwelling houses 30 x mixed-use, 3 bedroom town houses (The Circus) 26 x 2 bedroom small lot dwellings for the 55+ aged group (behind The Circus) 10 x 1 bedroom units 35 x 2 bedroom units 15 x 3 bedroom units 3 x tourist sites (1.25 ha total area) – motel, cafe, gift shop and restaurant
6	6.8 ha	4(a) Industrial	IN1 General Industrial	28 industrial lots
			Total	Tourist/ commercial use 83 x 2 bedroom apartments 47 x small-lot 2 bedroom single storey villas for the 55+ aged group 500 x dwelling houses 30 x mixed-use, 3 bedroom town houses (The Circus) 10 x 1 bedroom units 15 x 3 bedroom units 3 x tourist sites (1.25 ha total area) – motel, cafe, gift shop and restaurant 28 industrial lots

As shown in Table 3.1 following full site development, Stage 2 to 5 will contain 685 residential dwellings and Stage 6 will contain 28 industrial lots. The development will be phased with Stages 3-5 developed over a period of approx. 8 years.

An indicative concept layout of the West Culburra subdivision is shown in Figure 3.2.



AREAS	
STAGES	
STAGE 1	2.49ha
STAGE 2	17.55ha
STAGE 3	22.79ha
STAGE 4	23.49ha
STAGE 5	7.74ha
TOTAL	74.06ha

AREAS			
MAJOR RESERVES:	Open	Woodland	Total
R1	3.21ha		3.21ha
R2	2.85ha	18.76ha	21.61ha
R3	3.35ha		3.35ha
		TOTAL	28.17ha

1. SPATIAL UNITS AND AREAS 1,2,3,4 & 5 AS PER SKETCH PLAN PREPARED BY JOHN TOON (Page 10 – Proposed Mixed Use Subdivision at West Culburra (09–0088)
2. Contours and Catchment boundaries by Insites plan D509–G–016a.mxd rev.A 12.4.2008.
3. Centreline of tracks by hand held GPS
4. Co–ordinates in terms of Map Grid of Australia

Denotes Ridge Line by Survey 28.6.2011
Denotes existing Sewer Rising Main to remain
Denotes existing Sewer Rising Main to be relocated
Denotes Proposed Sewer Rising Main
Denotes Proposed Sewer Pump Station (to be supplied by Shoalhaven Water)
Denotes existing Sewer Pump Station (owned and operated by Shoalhaven Water)
Denotes approximate 2100 1%AEP flood line (RL3.60)
Denotes Staging Lines

Denotes current extent of 2 Odour Units
Denotes zoning boundary
Denotes 100m setback from mean high water mark
Denotes LEP 1985 zoning classification
Denotes existing crown roads to be closed (subject to final Transfer)
Denotes Identified Midden Sites and Identification Numbers
Denotes Medium Density Site
Denotes Tourist Site
Denotes Mixed Use Site
Denotes Small Residential Lots
Denotes Industrial Lots
Denotes Woodland Reserve
Denotes Open Reserve
I17 Denotes Industrial Lots
B1 Denotes Higher Density Lots
T1 Denotes Tourist Sites

LOT YIELD

Stage 1
21 x 2br 55+ Single Storey villas
48 x 2br units

Stages 2,3 & 4
500 x Single House Lots
26 x 2br 55+ Single Storey villas
30 x 3br Mixed Use Townhouses
60 x Low Rise Medium Density dwellings
(10x1br, 35x2br, 15x3br)

Stage 5
28 x Industrial Lots

CONTOUR INTERVAL 1.0 METRE

Liability limited by a scheme approved under Professional Standards Legislation.
COVER OF EXCELLENCE®

RATIO: 1 : 4000 (AT A1 SIZE) (1:8000 AT A3 SIZE)

DATUM:
ORIGIN:
DATE OF PLAN: 13.2.2013

	SURVEY	AERIAL PHOTOGRAPHY
DESIGN	JT/MP	
DRAWN	CEG/DS	
CHECK'D	MJP	

	REVISION	BY	DATE
01	AREAS AND STAGES ADDED, NW LAYOUT AMENDED	MJP	06.03.2013
02	AREAS AND LAYOUT AMENDED	MJP	12.03.2013
03	LOT YIELD AND STAGES ADDED TO PLAN	MJP	14.03.2013

allen, price & associates
land and development consultants
75 plunkett street, nowra, nsw. 2541
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

SKETCH PLAN SHOWING SITE CONSTRAINTS & PROPOSED SUBDIVISION OVER PART OF DP 1065111, LOT 2 DP 1182151 AND PORTIONS 61, 81 & 90 DP 755971 AT WEST CULBURRA FOR REALTY REALIZATIONS

REF. No. 25405–30

SHEET 1 OF 1 SHEETS REVISION 03