TRANSPORT REPORT

Proposed Vincentia Coastal Village and District Centre

January 2006

Prepared for
Stockland Trust

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Contents

1. Introduction 1

2. Background Situation 2
   - 2.1 The Area and its Population 2
     - 2.1.1 Description of Bay and Basin Area 2
     - 2.1.2 Population Strategy 2
     - 2.1.3 The Site 4
     - 2.1.4 Proposed New Schools 5
   - 2.2 The Transport System 5
     - 2.2.1 The Road System 5
     - 2.2.2 Public Transport 6
     - 2.2.3 Cycle and Pedestrian Provisions 6
   - 2.3 Traffic Conditions 7
     - 2.3.1 Traffic Volumes 7
     - 2.3.2 Intersection Operations 10
   - 2.4 Travel Patterns 12
   - 2.5 Jervis Bay Settlement Strategy 12
     - 2.5.1 Road Hierarchy 13
     - 2.5.2 Pedestrians and Cyclists 13
     - 2.5.3 Public Transport 13
   - 2.6 Transport Issues Raised in Community Consultation 13
   - 2.7 Section 94 Contributions Plan 14

3. Proposed Development 15
   - 3.1 Masterplan 15
   - 3.2 Development Mix 15
   - 3.3 Vehicular Access 16
   - 3.4 Parking Provision 17
   - 3.5 Bicycle and Pedestrian Access 17

4. Traffic Implications 19
   - 4.1 Overview of Forecasting Methodology 19
   - 4.2 Cases Considered 19
   - 4.3 Traffic Generation 20
     - 4.3.1 Residential Villages 20
     - 4.3.2 District Centre 20
     - 4.3.3 Village East/Leisure Centre 23
     - 4.3.4 Combined Traffic Generation 23
   - 4.4 Traffic Distribution 24
   - 4.5 Effects without Development 25
   - 4.6 Local Effects with Development 26
     - 4.6.1 Traffic Volumes 26
     - 4.6.2 Intersection Analysis 31
     - 4.6.3 Internal Residential Villages Traffic Volumes 32
   - 4.7 Traffic Effects on Jervis Bay Road 36

4.8 Effects on Jervis Bay Road/Princes Highway Intersection 38
4.9 Road Improvement Requirements 38

5. Other Transport Implications 40
5.1 Land Use and Transport Interaction 40
5.2 Public Transport 40
5.3 Bicycle and Pedestrian Routes 41

6. Timing and Responsibility for Works 42
6.1 Intersections 42
6.2 Other Works 45

7. Summary 47
7.1 Background Situation 47
7.2 Proposed Development 48
7.3 Traffic Implications 48
7.4 Other Transport Implications 49
7.5 Conclusions 49

Appendix A - MWT *Traffic Forecasting Report* (November 2005) A-1

Appendix B - Saturday Traffic Counts B-1

Appendix C - Improvements Extract from *Jervis Bay Settlement Strategy* Relating to Access C-1

Appendix D - Notes on Community Open Day No. 1 (Saturday 20 September 2003) D-1

Appendix E - Proposed Masterplan E-1

Appendix F - Proposed Public Transport, Cycle and Pedestrian Routes F-1

Appendix G - Intersection Concept Plan for Jervis Bay Road/Huskisson Road/Pine Forest Road G-1

Appendix H - Advice to the RTA on Princes Highway/Jervis Bay Road Intersection H-1

1. Introduction

This report addresses the transport aspects of the proposed development of a new district centre with adjoining residential villages at the intersection of Naval College Road and The Wool Road at Vincentia. The site lies within the collection of villages within the Jervis Bay area, which are referred to colloquially as the "Bay and Basin" area. The location of the site is indicated on **Figure 1**.

The proposed development of the Vincentia Village and District Centre (herein referred to as Vincentia V & DC) comprises a mix of dwellings, civic and leisure facilities and a shopping centre.

The Masterplan has been prepared in accordance with the requirements of the City of Shoalhaven.

The development application for the Vincentia V & DC seeks project approval for the residential components (Village West and Village Central) and concept approval for the other components (District Centre and Village East). Details of the district centre design such as parking area layouts, service vehicle provisions and the traffic circulation system will be resolved in subsequent applications.

This report is an updated version of the MWT report *Development Masterplan for Land on The Wool Road and Naval College Road, Vincentia – Transport Report* presented to Shoalhaven Council, the Roads and Traffic Authority and other Government authorities in February 2005. It includes information from subsequent reports undertaken by MWT including *Proposed Vincentia District Centre – Report on Road Improvement Requirements* (November 2005) and *Development Masterplan for Land on The Wool Road and Naval College Road, Vincentia – Traffic Forecasting Report* (November 2005). These were prepared at the request of Shoalhaven Council to develop and present traffic forecasts in a different manner. This report incorporates minor changes to the development footprint and land use development statistics that have resulted from environmental constraints and further thinking on the development mix.

The remainder of the report consists of the following sections:

- Chapter 2 describes the site location, the population strategy of the area and the existing transport conditions.
- Chapter 3 describes the proposed Masterplan.
- Chapter 4 calculates the traffic generation and parking provisions and assesses the traffic implications.
- Chapter 5 assesses the impacts on public transport, and bicycle and pedestrian conditions.
- Chapter 6 determines the timing and responsibility of works related to the development.
- Chapter 7 provides a summary and conclusions.

2. Background Situation

2.1 The Area and its Population

2.1.1 Description of Bay and Basin Area

Jervis Bay is located within the City of Shoalhaven Local Government Area on the New South Wales south coast. It is a major recreational and tourist area with a diverse range of environmental and natural features.

2.1.2 Population Strategy

Shoalhaven is divided into five planning areas. Each area links together towns with similar geographical and topographical features. Most of Jervis Bay is included in Area 3. The population statistics and annual growth rates for the settlements in Jervis Bay are shown in Table 2-1. These figures were ascertained from the 2001 Census of Population and Housing.

Table 2-1 – Jervis Bay Settlement Populations and Growth Rates

Settlement	Population (2001)	1996-2001 Yearly Growth Rate (%)
Woollamia	159	9.3
Huskisson	775	-2.3
Vincentia	2,534	0.4
Hyams Beach	130	-3.8
Old Erowal Bay	914	4.5
Erowal Bay/Wrights Beach	592	4.2
Sanctuary Point	5,866	3.8
St Georges Basin	1,756	9.3
Basin View	1,206	3.7
Tomerong	210	-6.3
Area 3 Rural	2106	0.0
Total Area 3	**16,248**	**2.7**

Source: Shoalhaven City Council (January 2003) *Jervis Bay Settlement Strategy*

With a population of 16,248 Area 3 is the fastest growing area in Shoalhaven. Between 1991 and 1996 there was a considerable population increase in the settlements of Basin View, St. Georges Basin and Vincentia. People aged 40 years and over accounted for 40% of the influx. In recent years this population growth has been supplemented by high weekender and other holiday accommodation. This leads to significant population increases during holiday periods.

Table 2-2 below presents projected population growth to 2016 in Area 3. Based on these growth rates the population of Area 3 will be between 24,500 and 25,200 by 2016.

Table 2-2 – Population Projections for Area 3

Projection	1996	2001	2006	2011	2016
1	14,217	16,248	19,190	22,180	25,240
2	14,217	16,245	18,910	21,660	24,520

Source: Shoalhaven City Council (January 2003) *Jervis Bay Settlement Strategy*
Notes: Projection 1 – Assumes net migration 1986–1996; Projection 2 – Assumes net migration 1991–1996

The distribution of this population growth was not directly provided in the Strategy however projections have been made on the dwelling capacity of each area. The "existing year", as presented in the Strategy, was assumed to be the census year 2001 and the future year 2016 or beyond. These projections are shown in Table 2-3.

Table 2-3 - Development Potential of the Bay and Basin Area

Township	Existing	Dwellings	Future	Dwellings	Total Dwelling Capacity
	No.	*%*	*No.*	*%*	
Woollamia	61	0.7%	41	1.2%	102
Huskisson	543	6.5%	174	4.9%	717
Vincentia	1868	22.4%	320	9.0%	2188
Old Erowal Bay	427	5.1%	428	12.0%	855
Sanctuary Point	3282	39.4%	1260	35.4%	4542
St. Georges Basin	788	9.4%	954	26.8%	1742
Basin View	609	7.3%	214	6.0%	823
Tomerong	121	1.5%	89	2.5%	210
Hyams Beach	220	2.6%	11	0.3%	231
Erowal Bay/Wrights Beach	420	5.0%	70	2.0%	490
Total	**8339**	**100%**	**3561**	**100%**	**11900**

Source: Shoalhaven City Council (January 2003) *Jervis Bay Settlement Strategy*

Proportional dwelling growth in each township has been used as a factor by which to estimate growth in background traffic on roads near the Vincentia V & DC. The details are provided in the MWT *Traffic Forecasting Report* in **Appendix A**.

A combination of the potential dwelling capacity in each township and the total population projections were used as the basis to determine the distribution of future population. In this regard a direct relationship between the dwelling capacity of the townships and the overall total population for the area was assumed. Therefore the future growth in population was calculated based on the percentage distribution of future dwellings and the projected future total population for the area. For the purpose of this assessment the higher population projection has been used. Also, it was deemed appropriate to include the townships of Sussex Inlet and the rural hinterland as these towns would fall into the catchment of the district centre.

The anticipated population growth in each township is indicated below in Table 2-4 and was used to determine the distribution of future district centre traffic.

Table 2-4 – Estimated Future Population in each Township

Township	Existing 2001 Population*	Estimated Population Increase	Estimated Future Population**
Woollamia	159	104	263
Huskisson	775	439	1214
Vincentia	2534	808	3342
Old Erowal Bay	914	1081	1995
Sanctuary Point	5866	3182	9048
St. Georges Basin	1756	2409	4165
Basin View	1206	540	1746
Tomerong	210	225	435
Sussex Inlet	2106	1500	3606
Hyams Beach	130	28	158
Erowal Bay/Wrights Beach	592	177	769
Rural	2106	0	2106
Total	**18354**	**11992**	**30346**

Notes: * Source: Shoalhaven City Council (January 2003) *Jervis Bay Settlement Strategy*
** Future Populations does not include Vincentira V & DC residential population

Given the diminishing land supply and the need to protect the area's environmental features there are limited opportunities to expand existing settlements to accommodate further population growth.

Within Area 3 Shoalhaven City Council has identified the already zoned but undeveloped residential land on the subject site as being suitable to accommodate some of this growth and has projected that this area has the potential for up to 850 new dwellings. Population associated with this is not included in the population totals in Table 2-4.

2.1.3 The Site

The site of the proposed development is located to the west of The Wool Road and to the north of Naval College Road. The site is located in Vincentia with easy access to Huskisson, St Georges Basin, Sanctuary Point and a number of other settlements in the area. It is situated about 12km from the Princes Highway and about 30km from Nowra. (See **Figures 1** and **2**).

The Bay and Basin Leisure Centre is located on the northern boundary of the site to the west of The Wool Road. A number of swimming pools, a gymnasium, a shop and a café are provided within the centre. Directly opposite the leisure centre on the eastern side of The Wool Road is Vincentia High School. Vincentia Public School is located approximately 500 metres to the north of the high school.

To the east of the site along Jervis Bay Road there is an existing rural residential development. To the north of the proposed development there is a national park and a series of wetlands.

2.1.4 Proposed New Schools

It is proposed that a new Anglican College and Baptist School be developed opposite each other on The Wool Road, on sites immediately to the south of Naval College Road/Jervis Bay Road. Council's traffic engineer has recommended that vehicular access to these be as follows:

- Baptist School, east of The Wool Road
  - access off Jervis Bay Road.

- Anglican College, west of The Wool Road
  - signalised right and left in/left out only access on The Wool Road (right turn exits via a u-turn at The Wool Road/Naval College Road roundabout after an initial left turn exit from the site);
  - left in/left out off Naval College Road; and
  - right turns for Naval College Road access to be via u-turns at roundabouts at intersections on either side (The Wool Road to the east and recommended district centre access roundabout to the west).

Details of staging, school numbers for each stage, anticipated traffic generation and the certainty of development were not available at the time of writing. However, in general the school's afternoon peak would not coincide with shopping centre peaks or adjacent traffic peak periods and shopping centre traffic generation would be low during the school's morning peak. Furthermore there would be minimal school traffic during seasonal peak conditions (school and public holidays). Therefore traffic related to the two schools would not materially influence road system capacity planning for the Vincentia V & DC. Access requirements for the schools and their responsibilities for contributions towards general road network upgrading will still need resolution. However, this should not hold up traffic planning for the Vincentia V & DC.

2.2 The Transport System

2.2.1 The Road System

The Wool Road forms a major north-south link between Vincentia and Naval College Road/Jervis Bay Road. It provides access to the Vincentia High School and Vincentia Public School which lie on its eastern side and the leisure centre which lies on its western side. Within Vincentia The Wool Road forms unsignalised intersections with Beach Street and St George Avenue. It has a single lane roundabout controlled intersection with Barton Street and Elizabeth Drive. There is a cycle/foot path along the western side of The Wool Road. This has an underpass beneath Naval College Road.

Naval College Road is a two lane rural road. It has a winding alignment and as such overtaking is difficult between Huskisson Road and The Wool Road. It forms part of the link between Princes Highway near Falls Creek and Jervis Bay as the stretch of road between Princes Highway and Huskisson Road is called Jervis Bay Road, between Huskisson Road and The Wool Road it is Naval College Road and it returns to Jervis Bay Road from The Wool Road to past Wreck Bay Road.

Huskisson Road is a two lane rural road that forms a link between Jervis Bay Road and the township of Huskisson.

2.2.2 Public Transport

The low population of the Shoalhaven area provides a number of challenges in providing a comprehensive public transport service for the area. In June 2002 Shoalhaven Council issued the *Shoalhaven Integrated Transport Strategy* which describes some of the challenges and solutions of making public transport a feasible alternative to cars. The strategy incorporates an implementation plan which presents eleven actions for implementation by the Council. These include coordination of public transport information systems, public transport marketing, promotion of park and ride schemes and provision of bus routes, footpaths and cycleways in all new housing development areas.

Rail
The nearest railway station to the Bay and Basin area is in Bomaderry, north of Nowra. Thus there is effectively no rail service to the area.

Bus Services
The Vincentia area is serviced by Nowra Coaches. It operates bus route 732 which runs five and six times a day on week days to and from Nowra respectively and three times a day on weekends. The route connects Nowra, Falls Creek, Tomerong, Woollamia, Huskisson, Vincentia, Old Erowal Bay, Sanctuary Point and Basin View. It also operates bus route 733 which runs once or twice a day on Tuesdays and Fridays to and from Nowra respectively, connecting Erowal Bay Village, Hyams Beach, Jervis Bay Village and Nowra.

2.2.3 Cycle and Pedestrian Provisions

Bicycles
In 1997 Shoalhaven Council adopted the *Shoalhaven Bicycle Strategy*. The aim of this strategy was to recognise the needs of cyclists and to identify a network of cycleways. Since 1997 an annual amount of between $150,000 and $250,000 has been allocated to the provision of cycleways and bicycle facilities. As a result of this, there are now extensive bicycle facilities in the areas surrounding the proposed site including Huskisson/Vincentia, Sanctuary Point, St Georges Basin and Basin View.

There is a cycle/foot path along the western side of The Wool Road that links the proposed development to Vincentia.

Pedestrians
The *Shoalhaven City Council Management Plan 1999-2000* has identified the need to prepare a Pedestrian Access and Mobility Plan (PAMP). The overall objective of the plans is to integrate walking into the transport system as a legitimate form of transport and thus encourage more walking.

The council has identified the following ways to do this including:

- The provision of safe and well lit pathways.
- The provision of appropriate sign posting.
- The ability of walkways to be shared with bicycles and skate riders.

In October 2001 a PAMP was adopted for Jervis Bay/St Georges Basin. Part of this plan includes the shared pedestrian/cycleway on the westside of The Wool Road. The subject development would logically link to this.

2.3 Traffic Conditions

2.3.1 Traffic Volumes

Automatic Traffic Counts
A number of daily traffic counts have been undertaken by Shoalhaven Council in recent years. Table 2-5 summarises the daily two-way traffic volumes on The Wool Road and Jervis Bay Road.

Table 2-5 - Daily Two-way Traffic Volumes (vpd)

Road	Date	Mon	Tue	Wed	Thu	Fri	Sat	Sun
The Wool Rd north of Naval College Rd	11/1999	7,724	7,174	7,476	8,241	8,476	7,913	6,325
The Wool Rd south of Naval College Rd	06/2002	6,620	4,931	8,112	8,770	9,062	8,450	8,953
Naval College Rd west of The Wool Rd	11/1999	3,451	3,301	3,380	3,536	4,013	3,069	3,065

The results indicate that Friday is typically the busiest day on The Wool Road and Naval College Road. In the vicinity of the subject site The Wool Road carries between 6,600 and 9,000 vehicles a day, while Naval College Road carries between 3,000 and 4,000 vehicles a day. The data collected also indicates that heavy vehicles make up between 3% and 5% of all vehicles on Naval College Road and The Wool Road.

Intersection Traffic Counts
In order to examine existing traffic conditions, intersection turning movement count surveys were carried out at the following intersections on Thursday 25th September 2003:

- Naval College Road /Huskisson Road
- The Wool Road /Naval College Road
- The Wool Road /Leisure Centre
- The Wool Road /High School
- The Wool Road /Primary School (George Caley Place)
- The Wool Road /Beach Street
- The Wool Road/Elizabeth Drive

The morning peak hour occurred between 8:00 and 9:00 AM and the evening peak hour between 4:00 and 5:00 PM. Following consultation with Council's traffic engineer some of the counts were adjusted upwards to reflect perceived low volumes at certain locations.

Peak hour traffic flows thus determined are summarised below in Table 2-6 and illustrated in **Figure 3**.

A separate count was conducted at the intersection of Princes Highway with Jervis Bay Road on Thursday, 23 September 2004. These results are presented in Table 2-6.

Naval College Road/Jervis Bay Road carries between 360 and 380 vehicles per hour east of Huskisson Road and between 530 and 580 vehicles per hour west of Huskisson Road. The Wool Road carries between 750 and 800 vehicles per hour in the morning and evening peak adjacent to the site and the high school. This is the most heavily trafficked road in the area.

The high school and primary school entrances have much higher volumes of traffic in the morning peak than in the evening peak. This is because the school's afternoon peak activity occurs prior to the road system's evening peak hour.

Table 2-6- Existing Surveyed Peak Traffic Flows (vehicles per hour)

Road	Location	AM Peak Two Way	PM Peak Two Way
Jervis Bay Road	East of Princes Highway	590	609
Jervis Bay Road	West of Huskisson Road	533	580
Naval College Road	East of Huskisson Road	381	358
Naval College Road	West of The Wool Road	354	359
Jervis Bay Road	East of The Wool Road	272	375
The Wool Road	North of Naval College Road	786	767
The Wool Road	South of Naval College Road	778	741
The Wool Road	North of High School Entrance	731	793
The Wool Road	South of High School Entrance	758	797
The Wool Road	North of George Caley Place	784	796
The Wool Road	South of George Caley Place	753	785
The Wool Road	South of Beach Street	802	791
Huskisson Road	North of Jervis Bay Road	270	325
High School Access	East of The Wool Road	157	36
Primary School Access	East of The Wool Road	201	31
Beach Street	West of The Wool Road	199	222
Elizabeth Drive	West of The Wool Road	205	374
Princes Highway	North of Jervis Bay Road	1,597	1,682
Princes Highway	South of Jervis Bay Road	1,047	1,099

Beach Street and Elizabeth Street are within the Vincentia township and carry approximately 200 vehicles per hour in the morning peak and between 220 and 380 vehicles per hour in the evening peak.

It was found that Saturday peak hourly traffic volumes are typically of the same order as weekday peak hour traffic volumes. For this study a check count was conducted at the intersection of Naval College Road and The Wool Road on the public holiday Saturday of 4th October 2003. A count on Saturday, 17 January 2004 yielded lower results.

Traffic volumes recorded during the two Saturdays are provided in **Appendix B**. Volumes for the higher Saturday are provided in Table 2-7.

Table 2-7 Existing Holiday Saturday Traffic Flows (vehicles per hour)

Road	Location	Peak Hour Traffic Two Way
Naval College Road	West of The Wool Road	402
Jervis Bay Road	East of the Wool Road	328
The Wool Road	North of Naval College Road	833
The Wool Road	South of Naval College Road	913

These holiday peak Saturday volumes were about 20% above the normal weekday peak hour volumes indicated in Table 2-6.

Seasonal Patterns

Due to Jervis Bay's diverse range of environmental and natural features and its relative proximity to Sydney, it is a popular holiday location. The RTA has a traffic count station on Jervis Bay Road east of the Princes Highway and the annual count in 2000 produced the following data:

Average Daily Flow (AADT)	6965 vehicles/day
Average Weekend Flow (AADT)	6174 vehicles/day

Over the course of the year the weekday average was higher than the weekend. This reflects high egress from the area for work, shopping and personal business on weekdays.

Seasonal patterns are also reflected by weekly traffic counts as follows:

Typical week (50^{th} percentile) =	1.90 % of annual traffic
Typical January school holiday week =	2.30 % of annual traffic
Busiest week (Christmas) =	2.43 % of annual traffic

The typical holiday traffic volume is therefore approximately 20% more than typical non-holiday traffic. This order of traffic increase in holiday periods was confirmed by Council's traffic engineer.

Further analysis of the RTA count data indicated that:

- average annual daily traffic volume = 6965 vehicles per day
- average Saturday traffic volume = 6448 vehicles per day
- average Friday traffic volume = 8107 vehicles per day
- average Thursday traffic volume = 7541 vehicles per day
- 95^{th} percentile Thursday = 8721 vehicles per day
- 95^{th} percentile Thursday = 16% higher than lower than normal Thursdays
- 85^{th} percentile of all days = 7488 vehicles/day
- 85^{th} percentile of all days = 8% higher than normal days

From this it is concluded that application of a 20% peaking factor to typical Thursday traffic volumes would provide a reasonable basis for assessment of peak holiday flows.

In relation to the busiest hours in the week, the RTA data indicated the following relativities:

mean weekday AM peak hour volume:	586 vehicle/hour
mean weekday PM peak hour volume:	627 vehicle/hour
mean Saturday peak hour volume:	604 vehicle/hour
mean Sunday peak hour volume:	571 vehicle/hour

This indicates that peak hourly volumes are similar on each day of a normal week.

This information was confirmed by previous Shoalhaven Council counts (November 1999) on The Wool Road, north and south of Naval College Road, and for which the following peak hourly volumes are found:

	S of Naval College Rd	N of Naval College Rd
Weekday average am peak hour	291 veh/hr	708 veh/hr
Weekday average pm peak hour	320 veh/hr	667 veh/hr
Saturday peak hour	280 veh/hr	731 veh/hr
Sunday peak hour	320 veh/hr	606 veh/hr

2.3.2 Intersection Operations

Intersections are the critical points which control the capacity of the road network. This is due to the need for conflicting traffic movements to share the same road space at these locations.

The intersections in the vicinity of the subject site were analysed using the SIDRA intersection analysis program. SIDRA determines the average delay that vehicles encounter and provides a measure of the level of service. Table 2-8 provides operational performance criteria and Table 2-9, Table 2-10 and Table 2-11 show the results of the analysis for the various peak hours for a typical day and a seasonal day. Saturday peak hour results are only presented for the two intersections at which counts were conducted.

Table 2-8 – Level of Service Criteria

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

Adapted from RTA Guide to Traffic Generating Developments, 1993.

Table 2-9 – Existing AM Peak Hour Intersection Operation

Intersection	Intersection Control	Typical		Seasonal	
		LOS	Delay	LOS	Delay
Naval College Rd/ Huskisson Rd/	Signs (Give-way)	A	13.9	B	17.4
Naval College Rd/ Pine Forest Rd	Signs (Give-way)	A	8.5	A	8.9
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	A	10.1	A	8.6
The Wool Rd/ Leisure Centre/ High School[1]	Signs	n/a	n/a	n/a	n/a
The Wool Rd/ George Caley Pl	Signs (Give-way)	A	9.9	A	11.0
The Wool Rd/ Beach St/ St. Georges Ave	Signs (Give-way)	B	21.1	C	32.0

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.

Table 2-10 – Existing PM Peak Hour Intersection Operation

Intersection	Intersection Control	Typical		Seasonal	
		LOS	Delay	LOS	Delay
Naval College Rd/ Huskisson Rd/	Signs (Give-way)	A	13.4	B	16.4
Naval College Rd/ Pine Forest Rd	Signs (Give-way)	A	8.7	A	9.1
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	A	8.6	A	9.3
The Wool Rd/ Leisure Centre/ High School[1]	Signs	n/a	n/a	n/a	n/a
The Wool Rd/ George Caley Pl	Signs (Give-way)	A	10.8	A	12.1
The Wool Rd/ Beach St/ St. Georges Ave	Signs (Give-way)	B	20.5	C	32.2

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.

Table 2-11 – Existing Saturday Peak Hour Intersection Operation

Intersection	Intersection Control	Typical		Seasonal	
		LOS	Delay	LOS	Delay
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	A	9.0	A	8.9
The Wool Rd/ Leisure Centre/ High School[1]	Signs	n/a	n/a	n/a	n/a

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.

[1] This intersection currently operates as two separate unsignalised T intersections and will operate as a signalised 4-way intersection in the future.

Analysis indicates that the existing peak hour operation of the intersections in the study area during normal periods ranges from good (Level of Service A) to acceptable (Level of Service C). The intersections have spare capacity and vehicles experience only a short delay.

During the seasonal peak the level of service at the intersection of Naval College Road and Huskisson Road drops from LOS A to B and The Wool Road and Beach Street intersection reduces from LOS B to LOS C.

2.4 Travel Patterns

The 2001 Census produced details of work travel and workforce patterns in the Bay and Basin area. The travel zones in this area had the following characteristics:

population	- 16,248
workforce (employed people in the area)	- 4,253
employment (jobs in the area)	- 2,098

On Census day the following journey to work patterns were recorded:

1.	Persons that live and work in Bay and Basin area	- 1,727
2.	Persons that live in Bay and Basin area and work elsewhere in Shoalhaven	- 1,839
3.	Persons that live in Bay and Basin area and work outside Shoalhaven	- 687
4.	Persons that live elsewhere in Shoalhaven and work in Bay and Basin area	- 371
5.	Persons that live outside Shoalhaven and work in Bay and Basin area	- 121

Thus in 2001 about 40% of employed persons in the Bay and Basin area were employed in the area, with the rest having to travel to work outside the area. Persons not living in the area took up nearly 25% of jobs in it.

This highlights a need for more local employment in the Bay and Basin area to better balance jobs and workforce.

Separately, weekday peak period traffic volumes collected for this study were analysed to determine the proportion of peak travel to/from the Nowra direction. Based on population figures and traffic counts at intersections it is estimated that there are about 0.1 vehicle trips per person per peak hour generated by residents of Vincentia, Huskisson, Erowal Bay and Hyams Beach travelling to or from Princes Highway to the north. This has relevance to the distribution of travel for residents that would live on the subject site.

2.5 Jervis Bay Settlement Strategy

The *Jervis Bay Settlement Strategy* that was adopted by Shoalhaven Council in 2003 provides a background to Council's understanding of the operation and needs of the transport system in the area.

Relevant information provided in the strategy is summarised below.

2.5.1 Road Hierarchy

Regional roads which provide the main connections and for which there is some RTA funding responsibility are:

- Princes Highway
- Jervis Bay Road
- St. Georges Basin Bypass

Collector roads of relevance to the subject proposal are:

- Huskisson Road to Elizabeth Drive
- The Wool Road

2.5.2 Pedestrians and Cyclists

Council has adopted the *Shoalhaven Bicycle Strategy* (1997). In accordance with this, the cycleway was developed along The Wool Road. The Pedestrian Access and Mobility Plan (PAMP) applies for the main urban areas. Similar measures would be appropriate for new or extended urban areas.

2.5.3 Public Transport

Public transport provision in the area is low and consists of school buses, taxis and a limited commercial bus service (as described above). The *Shoalhaven Integrated Transport Strategy* (August 2000) seeks to improve public transport through planning that will facilitate new services.

The Settlement Strategy identifies a series of actions to promote transport access for the Jervis Bay Area. For ease of reference this is reproduced in **Appendix C** of this report.

2.6 Transport Issues Raised in Community Consultation

During Community Open Days held to discuss the project with members of the community (see separate consultation report) a number of issues relating to transport were raised. Some of these were contradictory however; this is to be expected in consultation with a diverse range of interest groups.

Transport issues raised are outlined in **Appendix D**. Principal issues of concern to the proposed development are:

- condition of Jervis Bay Road
- summer traffic conditions
- need to coexist with/protect 1300 students at the high school on The Wool Road

During a follow up Community Open Day held in March 2004 further comments received were as follows:

- The volume and speed of traffic along The Wool Road is of concern. Residents would like to see more access points along Naval College Road to reduce access and hence congestion near schools.

- More detail is needed on how this proposal will improve public transport in the area.
- Roads and services provided for this development must not affect amenity of existing areas.
- Traffic along Jervis Bay Road has decreased substantially (anecdotally 50%) since the Sanctuary Point bypass was completed last year. [Note this was not confirmed by the surveys conducted for this study but may have been a short term outcome.]

2.7 Section 94 Contributions Plan

Shoalhaven Council *Contributions Plan 1993 (Amendment No. 29)* provides for developer contributions to be collected to fund necessary road works and other infrastructure improvements. The plan includes a number of projects in respect of relevance to the Vincentia V & DC, which falls into Planning Area 3. These are listed below.

1. 03 Road 0006 construct Jervis Bay Road and The Wool Road Roundabout
2. 03 Road 0007 strengthen 1 km Jervis Bay Road pavement, north of The Wool Road
3. 03 Road 0008 strengthen 500 metres of The Wool Road pavement, west of Jervis Bay Road
4. 03 Road 0021 construct St. Georges Basin By-pass
5. 03 Road 0033 re-align and reconstruct Jervis Bay Road (Pine Forest Road to The Wool Road) - approx. 4.8 km
6. 03 CRAC 0003 Recreational and Cultural Centre at Vincentia High School

The plan was adopted in March 1997 and is based on the following assumptions:

- 700 additional residential allotments
- Residential population of 26,500 in 2011 and 30,000 in 2016
- New district retail and commercial centre at The Crossroads
- New district community facilities, sporting fields and the proposed district Leisure Centre to cater for population increases.
- The existing primary and secondary schools on The Wool Road
- Planned TAFE on The Wool Road
- Additional traffic demands based on growth
- On Jervis Bay Road the poor geometric alignment, many weak and narrow sections, low speed capacity and a poor safety record warrants the re-alignment and reconstruction of Jervis Bay Road, near Huskisson Road and Pine Forest Road.

3. Proposed Development

3.1 Masterplan

The Vincentia V & DC development has a site area of some 126ha of which around 60ha (47% of the site) will be retained for open space and conservation purposes. This represents an increase of around 13ha in open space/conservation land provision compared to that previously proposed. The district centre is to be located adjacent to "The Crossroads" roundabout of The Wool Road and Jervis Bay Road. This will incorporate a mix of retail, business and community facilities. The residential areas to the west of the district centre will contain mainly detached dwellings with a strong focus on integration into the bushland surroundings. Finally the "Village East" development is proposed to incorporate a mixture of residential development types adjacent to the Bay and Basin Leisure Centre on The Wool Road. This part of the development will provide up to 136 dwellings with an emphasis on adaptable housing.

A copy of the proposed Masterplan is provided in **Appendix E**.

It is envisaged that a mix of 600-700 full time, part time and casual jobs would be created on the Masterplan site.

3.2 Development Mix

Residential Area
The Village West and Village Central areas are proposed to have around 604 dwellings. These will be predominantly free standing.

District Centre
This has been planned in several stages. The first stage is proposed to have about 20,000 sqm of floor space incorporating a range of retail, commercial and leisure services. The second stage is proposed to have a total of about 32,000 sqm of similar floor space. The second stage is not likely to be completed before 2013.

A third stage is also proposed on the eastern edge of the district centre. The content of this has not yet been defined but is likely to comprise freestanding ancillary development such as bulky goods retail. The area set aside for this is relatively small and this traffic generation would be small compared to that of the other two stages.

In the absence of a specific plan for this area no attempts have been made to quantify the traffic generation. However, the intent for some development in this area does suggest that where there may be some doubt about the timing of necessary local road improvements, it would be prudent to err on the side of these being earlier rather than later.

Leisure Centre Precinct Development
Village East near the leisure centre (formerly referred to in the concept proposal as the Civic Precinct) is indicatively expected to provide about 136 multi-dwelling residential units. Expansion of the Leisure Centre is also proposed by Council.

3.3 Vehicular Access

Because of the spread out nature of development along the Naval College Road frontage, arising from topographic and ecological constraints, it is proposed to provide three points of access. One is proposed to serve the district centre and two to serve the residential area.

Two points of access to the residential area are desirable to provide suitable points of address and to provide an alternative access in the event of bushfire or some other disruption to one of the accesses. It is proposed that the western access point (Access A-Village West) be controlled by a roundabout. This would demarcate the start of the urban area and would afford safe access to both the new residential area and to a nursery on the southern side of Naval College Road. The eastern residential access (Access B- Village Central) would be formed as a high standard "Type C" intersection with separate right and left turn lanes in Naval College Road.

It is also desirable that the district centre have two points of access. This would spread traffic loads, allow direct truck access to loading areas and allow a flow through traffic system which would efficiently load different ends of the car parks. Provision of two access points would serve to reduce congestion at the Naval College Road/The Wool Road intersection and would allow traffic to balance itself so as to reduce impacts on the road system.

It is recommended that the Naval College Road access (Access C-District Centre) be designed as a "seagull" type intersection, with a sheltered right turn bay into the site at the proposed Moona Creek Road and an acceleration lane for right turns out of Moona Creek Road. Where appropriate improvements would be made to the alignment of Naval College Road to ensure required sight distances are available and provision would be made in the construction for future signalisation, as and when traffic loads necessitated this treatment. Subject to costing and design, a roundabout would also provide a suitable control solution.

The Wool Road access (Access D-District Centre) would be located at a point 150m to the north of the Naval College Road intersection roundabout. This access would be signalised to facilitate motor vehicle access from the site at the proposed Main Street (central spine road) and facilitate pedestrian and cycle crossings of The Wool Road. Main Street will connect with Moona Creek Road at the northwest corner of the district centre.

It is proposed that the access to Village East/Leisure Centre be from The Wool Road frontage via a new signalised access formed as a four-way intersection opposite the access to the high school. This would provide improved access to the leisure centre and would facilitate cycle and pedestrian movements across The Wool Road between the high school on one side and the leisure centre and district centre on the other. With this in place the existing leisure centre access on the Wool Road would be closed. Closure of this is necessary for flora and fauna protection reasons.

The access strategy for the site was developed following detailed discussions with Council officers and the RTA and having regard to environmental constraints, which have significantly influenced the development pattern on the site.

Considerable thought was given to the possibility of consolidating the proposed southern access into the district centre off Naval College Road with the western one off The Wool

Road into a single access road that would connect to the roundabout at The Wool Road/Naval College Road intersection. This would have improved the directness of access from the main population centres in the catchment and had less environmental impact. However, the authorities had serious reservations about the operation of a five-way roundabout and analysis found that a five-way signalised intersection would provide insufficient long term capacity.

Other access locations were dictated by the need to retain access to driveways opposite the site, the need to facilitate access to the high school and the need to provide appropriate address points for the residential precincts.

3.4 Parking Provision

It is proposed that parking for the district centre be provided to meet or exceed Shoalhaven Council's Development Control Plan. Exact details of parking provision would be resolved with individual development applications. Indicatively the following parking is required by the DCP for the retail commercial area in stages 1 and 2:

16570m^2 shops @ 1 space/24m^2	=	690 spaces
7687m^2 supermarket @ 1 space/19m^2	=	405 spaces
1350m^2 bulky retail @ 1 space/50m^2	=	27 spaces
630m^2 medical centre @ 1 space/24m^2	=	26 spaces
600m^2 childcare say	=	10 spaces
4400m^2 office @ 1 space/40m^2	=	110 spaces
Total		**1268 spaces**

The Masterplan will accommodate its parking requirement. It will also provide some large spaces for cars with trailers or recreational vehicles. Details of these will be resolved at the development application stage. However, it is noted that as presently drawn the plans indicate about 1400 spaces on Stages 1 and 2. Stage 3 would provide its own parking.

Parking for multi-unit development in Village East adjacent to the Leisure Centre will be provided in accordance with the DCP.

It is also proposed that appropriate bicycle parking be provided in the district centre. Final details of bicycle parking have not been resolved but would be agreed with the consent authority with each project approval application.

Parking for residential development will also be provided in accordance with the DCP with at least two off-street spaces per detached dwelling.

3.5 Bicycle and Pedestrian Access

An extensive network of bicycle and pedestrian connections are proposed throughout the whole development site. These will integrate the various precincts on the site and are shown on the concept plan which is presented in **Appendix F** of this report. The routes are indicative only and will be finalised in agreement with Council.

The proposed traffic signals on The Wool Road at the new Leisure Centre/High School access will provide a major bicycle and pedestrian crossing point to/from the school and cycle/pedestrian path along the southern side of The Wool Road.

This crossing of The Wool Road will be supplemented by traffic signals at the new access intersection on The Wool Road north of the roundabout. This will provide connections to/from the shared pedestrian/cycle path along the eastern side of The Wool Road. Two shared cycle/pedestrian ways and a raised walkway are proposed to connect this crossing and the leisure centre area to the other parts of the site.

Two cross connections are proposed to interconnect the two main residential development areas.

Subject to a suitable funding arrangements with Shoalhaven Council, it is also proposed to provide a major north-south shared pedestrian/cycleway from Naval College Road through a biodiversity corridor to link up with a track past the sewage treatment plant to Jervis Bay Foreshore. This link is indicatively shown in **Appendix F**.

The Masterplan thus proposes a high degree of pedestrian and bicycle accessibility.

4. Traffic Implications

4.1 Overview of Forecasting Methodology

As discussed in the MWT Masterplan traffic report (February 2005), it is noted that preparation of traffic forecasts for a brand new district centre in an established area where one does not exist is difficult. This is because to a large extent the new centre would merely refocus trips that would otherwise be made elsewhere by the local population.

Because of the complexity of pre-existing travel patterns, it is difficult to determine which trips would be intercepted fully, which would be intercepted but continue on a journey that would be made anyway and which would be newly drawn to the area.

The analysis is also complicated by the fact that the focussing of traffic on the district centre would necessitate some traffic works in the vicinity of the district centre, but would reduce the need for works on roads relieved by the redirection of traffic.

For the purposes of this report no attempt has been made to assess traffic benefits due to traffic relief away from the district centre other than in respect of Naval College Road as discussed above. However, this effect is a material consideration when considering the extent of roadworks attributable to the district centre, even if it cannot be quantified.

The analysis that has been employed has involved assessment of background traffic growth based on factoring of surveyed traffic flows by the proportional increase in population in the area, as provided in the *Jervis Bay Settlement Strategy* of 2003.

District centre traffic flows were then added to this background traffic growth making only the basic traffic interception allowances as per RTA guidelines. This is a very conservative approach as it does not fully take into account the redistribution effects that will follow from the development of a major district centre, in an area that does not currently have one.

4.2 Cases Considered

At the request of Shoalhaven Council, the traffic effects of the proposed Vincentia District Centre were re-assessed based on a series of traffic overlays which build up the pattern of traffic from existing conditions in 2003, when traffic surveys were conducted, up to 2016 when full development (ultimate development) as presently contemplated was completed. The scenarios examined were as follows:

- 2011 without District Centre;
- 2011 with District Centre;
- 2016 without District Centre; and
- 2016 with District Centre.

Traffic estimates were made for each case for:

- Thursday morning;
- Thursday evening; and
- Saturday late morning.

Assessments of these cases were undertaken for normal conditions and peak summer conditions.

Since the MWT *Traffic Forecasting Report* was prepared, there have been some changes to land use assumptions. These include:

- Adaptable Housing – a reduction of 24 units on the concept proposal
- Residential Villages – a reduction of 44 dwellings from the concept proposal
- District Centre – the total provision is roughly the same as previously proposed however the composition has changed. Most notably the quantums of bulky retail and commercial areas have been reduced, and the discount department store, supermarkets and specialty retail areas have increased.

4.3 Traffic Generation

4.3.1 Residential Villages

Based on RTA guidelines the residential development would be expected to generate 0.85 vehicle trips per dwelling per peak hour. Dwellings covered by the RTA in its guidelines would tend to have household occupancies of between 3.0 and 3.5 persons per household. Dwelling occupancies in the Bay and Basin area are around 2.4 per dwelling. Thus use of 0.85 vehicle trips per dwelling per peak hour in this area may represent a high estimate but has been used to provide a conservatively high traffic generation estimate.

Using this rate the proposed 604 dwellings would generate about 514 vehicle trips per peak hour. The MWT *Traffic Forecasting Report* assumed 648 dwellings, therefore the revised proposal reduces the number of trips from 550 to 514 i.e. by 36 vehicles per hour.

At an occupancy rate of 2.4 persons per dwelling there would be 1,450 persons living in the residential area. These would generate about 140 vehicle trips per peak hour to/from Princes Highway and Nowra if current travel patterns were to continue (see subsection 2.4 above). Thus about 375 residential vehicle trips per peak hour would be confined to the Bay and Basin area road system.

4.3.2 District Centre

Development of the district centre is expected to take place over an interim stage (Stage 1) and an ultimate stage (Stage 2). The proposed development in Stage 1 and Stage 2 is shown in Table 4.1.

Table 4-1 – Proposed District Centre

Use	Development in Stage 1	Development in Stage 2	Total at end Stage 2
Discount Dept. Store	6,670		6,670
Supermarket 1	4,187		4,187
Supermarket 2		3,500	3,500
Library	1,650		1,650
Commercial	2,750		2,750
F & B Restaurant	650		650
Medical Centre	630		630
Child Care	600		600
Nursery	400	*	*
Bulky Goods		1,350	1,350
Specialty Retail (incl. food court)	7,000	2,250	9,250
Total	**24,537**	**7,100**	**31,237**

NOTES: * Nursery terminated in Stage 1

In light of the staging of the development, Council previously requested traffic analysis at the end of the interim stage and at ultimate development. It has also requested further details on the trip generation rate assumptions. These have been described in detail in the MWT *Traffic Forecasting Report*, which is provided in **Appendix A** for ease of reference.

The assumed trip rates and resulting vehicle trips for Stages 1 and 2 for Thursday AM and PM peaks and Saturday AM peak are presented in Table 4-2 and Table 4-3 respectively.

Table 4-2 – Trip Generation at Stage 1

	Retail	Nursery	Library	Comm.	Medical Centre	Child Care Centre	Total Vehicle Trips
Sqm/Unit	18507	400	1650	2750	630	600 (50 children)	
Thursday AM							
Vehicle Trips	463	14	33	55	55	20	**640**
Thursday PM							
Vehicle Trips	1407	14	20	34	34	12	**1521**
Saturday AM							
Vehicle Trips	1388	14	15	Closed	13	Closed	**1430**

Table 4-3 – Trip Generation at End of Stage 2

	Retail	Bulky Retail	Library	Comm.	Medical Centre	Child Care Centre	Total Vehicle Trips
Sqm/Unit	24257	1350	1650	2750	630	600 (50 children)	
Thursday AM							
Vehicle Trips	485	11	33	55	55	20	**659**
Thursday PM							
Vehicle Trips	1431	34	16	26	27	10	**1543**
Saturday AM							
Vehicle Trips	1819	61	15	Closed	13	Closed	**1908**

It is noted that the original traffic forecasting analysis used aggregate RTA traffic generation rates for shopping centres. These take into account the effects of increasing shared purposed units with reducing unit traffic generation as the size of a centre increases.

This reflects the very transport efficiencies arising from concentrations of urban activities that good transport and town planning seeks to achieve.

Application of the RTA rates to the above development mixes yields the following alternative traffic generation forecasts for ultimate development:

Thursday AM = (35% x 31,237) / (100 x 4.6 veh/hr/100sqm) = 503 veh/hr
Thursday PM = 31,237 / (100 x 4.6 veh/hr/100sqm) = 1437 veh/hr
Saturday Peak Hour = 31,237 / (100 x 6.1 veh/hr/100sqm) = 1405 veh/hr

These are considerably below the estimates calculated in Table 4-3 e.g. the adopted Stage 2 Saturday traffic generation rate is 35% higher than the rate yielded by the application of the RTA's overall rate for a centre of the size proposed.

For Stage 1 development direct application of RTA shopping centre rates yields traffic generation rates generally comparable to those in Table 4-2 as follows:

Thursday AM = (35% x 19,537) / (100 x 7.6 veh/hr/100sqm) = 520 veh/hr
Thursday PM = 19,537/ (100 x 7.6 veh/hr/100sqm) = 1485 veh/hr
Saturday Peak Hour = 19,537/ (100 x 7.5 veh/hr/100sqm) = 1465 veh/hr

In relation to RTA traffic generation rates it is noted that they are based on traffic surveys conducted in about 1990. Since 1990 there have been considerable changes in retail patterns as follows:

- Late night trading supermarkets has taken considerable pressure off late afternoon trading;
- Sunday trading has become much more important and in many cases surpasses weekday trading; and
- Thursday evening trading is much less popular than it used to be.

By and large it is considered that RTA traffic generation rates remain suitable for Saturday peak traffic generation predictions but tend to over predict Thursday evening traffic generation. This finding is supported by results of two surveys that are relevant to retail patterns in holiday areas.

- Firstly, Council's surveys of Nowra Fair have found Thursday evening traffic generation to be 11 per cent lower than would be predicted by RTA rates, and

- Secondly, a survey of the Stockland Foster Shopping Centre in peak pre-Christmas conditions (Friday December 12, 2003) found an evening peak traffic generation rate of 7.6 vehicle trips per 100 sqm for 18,350 sqm of retail area. This is exactly the RTA guidelines rate but given pre-Christmas conditions it would have been expected to be perhaps 20 per cent higher.

Overall it is considered that the predicted Thursday evening peak hour traffic generation volumes, as presented in Table 4-2 and Table 4-3, are significantly above those that will occur in practice. Accordingly, determination of road improvement needs based just on these will need to be undertaken with caution and in most cases peak Saturday conditions should be the prime development of improvement requirements.

Council's traffic engineer has queried the applicability of the RTA's Saturday traffic generation rate for the local area given that in 2001 the RTA's rates were found to under predict traffic generation at Nowra Fair Shopping Centre. However, this concern is not supported for the following reasons:

- The trading catchment of Nowra is very much bigger than that of Vincentia.

- Shoalhaven is presently significantly under provided with retail hence established shops in Nowra are heavily overtrading. This is evidenced by the fact that as a whole, Nowra has about 50,000 sqm of retail area and there are currently proposals for about 18,500 sqm of retail in Vincentia within the Nowra trading catchment and further retail development of about 30,000 sqm in Nowra.

- The survey of Stockland Foster Shopping Centre on a Saturday (December 13, 2003) found a pre-Christmas traffic generation rate of 7.1 vehicle trips per 100 sqm, which is in fact below the RTA rate of 7.5 vehicle trips per 100 sqm of retail floor area.

Having regard to these considerations the traffic generation assumptions provided in Table 4-2 and Table 4-3 are considered to be conservatively high, especially for the Thursday evening.

4.3.3 Village East/Leisure Centre

This area is proposed to be developed with about 136 adaptable houses or three storey apartments. This is expected to generate about 43 vehicle trips per hour. The reduction in proposed adaptable units from 160 to 136, results in approximately 7 less vehicle trips per hour.

A survey of the leisure centre found that it generates about 45 vehicles per hour in the morning peak and about 80 vehicles per hour in the evening peak. This traffic generation most likely has seasonal highs and lows. For planning purposes it has been assumed that expansion of the leisure centre would generate about 50 per cent more traffic.

4.3.4 Combined Traffic Generation

Table 4-4 presents combined estimates of proposed development traffic generation and compares them with the mix of development previously analysed in the MWT November 2005 report *Development Masterplan for Land on The Wool Road and Naval College Road, Vincentia – Traffic Forecasting Report*.

Table 4-4 indicates that the overall effect of the changed development mix would be to reduce or only fractionally increase forecast traffic generation for the end state (Stage 2).

For stage 1 the changed mix would result in peak period traffic increase of 150 to 160 vehicles per hour. These represent about 8 per cent of previously forecast traffic generation.

Table 4-4 – Summary of Trip Generation

		Residential (Village West & Central)	Adaptable Housing (Village East)	District Centre (Stage 1)	District Centre (Stage 2)	Total at end Stage 1	Total at end Stage 2
Quantum	Previous	648 units	160 units	22,055sqm	32,805sqm		
	Current	604 units	136 units	19,537sqm	31,237sqm		
	Change	(-44 units)	(-24 units)	(-2,518sqm)	(-1,568sqm)		
Thursday AM	Previous	550	50	568	729	1168	1329
	Current	514	43	640	659	1197	1216
	Change	(-36)	(-7)	(+72)	(-70)	(+29)	(-113)
Thursday PM	Previous	550	50	1316	1484	1916	2084
	Current	514	43	1521	1543	2078	2100
	Change	(-36)	(-7)	(+205)	(+59)	(+162)	(+16)
Saturday	Previous	550	50	1236	1844	1836	2444
	Current	514	43	1430	1908	1987	2465
	Change	(-36)	(-7)	(+194)	(+64)	(+151)	(+21)

4.4 Traffic Distribution

The methodology used in determining the trip distribution for the proposed development involved a detailed process for each element of the development and is provided in the MWT *Traffic Forecasting Report* in **Appendix A**.

In summary the basis of the trip distribution was:

- About 25% of residential trips were assumed to be internal to the residential area and district centre.
- External distribution of residential trips was based on prevailing traffic patterns.
- The access/egress point of residential trips was proportionally related to the number of dwellings in each village and the direction of travel.
- 20% of district centre trips were intercepted from traffic already on the network (as per RTA guidelines).
- District centre trips coming from the primary and secondary catchment areas of the centre, were distributed onto the most direct route to/from the site pro rata with population in different tributary areas.
- The access/egress point of new district centre trips was the closest point of access.

It is noted that the district centre traffic distribution assumed that 12 per cent of trips in 2016 could be to/from the west, reflecting the proportion of persons living in the rural part of Area 3. The population in this area is about 2,100.

In retrospect it is likely that only half of this population would shop regularly at Vincentia with the balance being closer to Nowra. Thus the proportion of shoppers coming from the west, along Naval College Road from Pine Forest Road or Jervis Bay Road, would more likely be 5 or 6 per cent.

However, it is noted that this over estimate may be offset by traffic generated by the two new schools proposed at the intersection of Naval College Road/The Wool Road.

Thus for the purposes of analysis of intersections on Naval College Road, between The Wool Road and Huskisson Road, the exaggerated allocation of district centre trips to Naval College Road west were applied. Therefore conservatively high traffic volumes have been used in the analysis.

As will be discussed below in section 4.7, traffic growth on Jervis Bay Road, east of Princes Highway has been estimated using different assumptions and thus is not influenced by the district centre traffic distribution assumptions made for the purposes of examining impacts on local intersections in Vincentia.

Of course if there was to be less retail traffic than allowed for on Naval College Road, west of the site, then this would be offset by a greater proportion of retail traffic in other directions, particularly on The Wool Road. The increase in any one direction would be relatively small. Nevertheless this is considered in section 4.6.2 below in relation to the analysis of impacts on other roads.

4.5 Effects without Development

The initial assessment was conducted on the effects of traffic growth in the absence of the Vincentia V & DC. As discussed, this analysis was necessarily somewhat simplistic because if the Vincentia V & DC was not to proceed on the site on which it has long been nominated, then inevitably there would be alternative development scattered throughout the local area, to provide for the retail and service demand that would still apply. Depending on how this was to take place, there would be concentrations of traffic that would be more intense than would be the case on the assumption of uniform traffic growth.

Nevertheless for the purposes of this exercise, a background traffic growth case was developed assuming that traffic growth on Jervis Bay Road, Naval College Road and the Wool Road, adjacent to the site would grow in the areas served by each leg of the intersection.

Future traffic volumes calculated in this way for typical and seasonal (early to mid January) conditions are presented in **Figures 5 through 8** for year 2016. Year 2011 forecasts are provided in the Appendices of the forecasting report. Two-way traffic flows at key points are presented in Table 4-5, Table 4-6 and Table 4-7.

Intersection analysis was undertaken to determine the intersection operations without development, the results of which are presented in Table 4-8, Table 4-9 and Table 4-10 and are discussed in sections 4.6 and 4.7.

The results indicate that continued residential development in the area will result in significant traffic growth even if the Vincentia V & DC was not developed and that existing holiday peak capacity deficiencies at The Wool Road/Beach Street intersection would extend to normal periods as well. Improvements would be needed at these intersections. Other intersections would operate within capacity for this scenario.

4.6 Local Effects with Development

4.6.1 Traffic Volumes

The future traffic volumes at Stage 1 and 2 for Thursday AM and PM and Saturday peaks for a typical day and seasonal day, including traffic generated by the residential villages and the district centre (including 20% intercepted traffic), in addition to background traffic growth are presented in **Figures 9 through 12** for year 2016. Year 2011 forecasts are provided in the Appendices of the forecasting report.

The two-way traffic flows at key points are presented in Table 4-5, Table 4-6 and Table 4-7. Two-way traffic flows at key points without the district centre and residential villages and for the existing base years are also presented for ease of comparison.

It is noted that the forecasts presented are for the previous development mix. As discussed in subsection 4.3.4 the year 2011 traffic forecasts for the current development mix in the Vincentia V & DC are about 8 per cent higher than those previously forecast. However, when added to forecast background traffic growth they would reflect only about a 6 per cent increase on traffic volumes at the critical The Wool Road/Jervis Bay Road intersection compared to those previously forecast.

For ultimate development in 2016 the increase would be negligible. Accordingly, because traffic changes would be very low and for consistency with previous analyses, the forecasts were not changed.

The provision of a roundabout at the intersection of the Village West (Access A) with Naval College Road will signify the transition point from rural conditions to the west to essentially urban conditions to the east, along the frontage of the district centre, and leading up to new schools at the intersection of Naval College Road with The Wool Road. In the context of this urban section of Naval College Road the normal capacity of an urban road lane is 900 vehicles per hour (AustRoads *Guide to Traffic Engineering – Part II Road Capacity*).

Table 4-5, Table 4-6, and Table 4-7 present forecast midblock traffic volumes for the various scenarios assessed. This indicates that midblock traffic flows on Naval College Road would not exceed this capacity and therefore this section of roadway would operate satisfactorily with one lane in each direction (except where widened at intersections).

It is noted that, notwithstanding this, the Section 94 Contributions Plan collects money towards the realignment and upgrading of Naval College Road. There may be savings to Council through parts of Naval College Road being upgraded as part of the Vincentia V & DC access intersection works. If so, Council may wish to allocate any surplus Section 94 funds towards the improvement of Jervis Bay Road, west of Huskisson Road.

On The Wool Road, north of Naval College Road, peak seasonal traffic flows would remain below about 900 vehicles per hour in one direction. Thus except where dictated by intersection capacity or lane continuity between adjacent intersections, only one traffic lane would be needed each way. Intersection configurations are considered in section 4.4.2.

On The Wool Road, south of Naval College Road, traffic volumes will exceed 900 vehicles per hour in one direction. Thus in conjunction with the two schools it would be appropriate to widen the road to four lanes along their frontages. This would be necessary to suit the new set of traffic signals suggested by Council as a means of access to the school on the western side and to assist pedestrians. The two lanes so provided would then connect in with the upgrading of The Wool Road/Naval College Road roundabout to two lane operation as discussed below.

Table 4-5 - Future Traffic Volumes Thursday AM Peak (veh/hr two-way)

Road	Location	Existing		Future 2011 – Stage 1				Future 2016 – Stage 2			
				Without District Centre		With District Centre		Without District Centre		With District Centre	
		Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal
Naval College Rd	West of Huskisson Rd	533	640	600	720	780	907	634	761	830	967
Naval College Rd	West of Pine Forest Rd	425	510	492	590	672	777	526	632	722	837
Naval College Rd	West of Access A[2]	381	457	448	537	628	725	482	579	678	785
Naval College Rd	West of Access B[2]	368	441	435	521	638	732	469	563	688	792
Naval College Rd	West of Access C[2]	354	425	421	505	642	733	455	546	691	792
Naval College Rd	West of The Wool Rd	354	425	421	505	720	827	455	546	803	927
Jervis Bay Rd	East of The Wool Rd	272	326	295	354	323	383	307	368	338	401
The Wool Rd	North of Naval College Rd	786	943	933	1119	1073	1283	1008	1210	1198	1433
The Wool Rd	South of Naval College Rd	778	934	948	1138	1355	1589	1036	1244	1538	1809
The Wool Rd	North of Access D[3]	773	928	933	1119	1079	1271	1008	1210	1178	1390
The Wool Rd	South of Leisure Centre[4]	755	906	902	1082	1105	1359	977	1173	1200	1482
The Wool Rd	North of High School	731	877	878	1053	1053	1298	953	1144	1146	1422
The Wool Rd	South of High School[4]	758	910	905	1085	1079	1271	980	1176	1178	1390
The Wool Rd	North of George Caley Pl	784	941	931	1117	1060	1253	1006	1208	1151	1363
The Wool Rd	South of George Caley Pl	753	904	900	1080	1029	1216	975	1171	1120	1325
The Wool Rd	South of Beach St	802	962	949	1139	1078	1275	1024	1229	1169	1384
The Wool Rd	South of Elizabeth Dr.	464	557	574	689	671	791	631	757	739	873
Huskisson Rd	North of Naval College Rd	270	324	270	324	270	324	270	324	270	324
Pine Forest Rd	South of Naval College Rd	112	134	112	134	112	134	112	134	112	134
Leisure Centre	West of The Wool Rd	45	54	65	78	115	128	75	89	125	139
High School	East of The Wool Rd	157	188	205	246	205	246	230	277	230	277
George Caley Pl	East of The Wool Rd	201	241	201	241	201	241	201	241	201	241
Beach St	West of The Wool Rd	199	239	236	283	268	317	255	306	291	344
Elizabeth Drive	West of The Wool Rd	243	292	243	292	243	292	243	292	243	292

[2] Existing counts at Access A have been estimated based on the total volumes to/from the Naval College Rd/Pine Forest Rd intersection, at Access C they are based on total volumes to/from the Naval College Rd/The Wool Rd and at Access B they are based on the average total volumes to/from Access A and C intersections.
[3] Existing counts estimated based on the average of total volumes to/from Naval College Rd/The Wool Rd and The Wool Rd/Leisure Centre intersections, adjacent to Access D.
[4] In future years with the District Centre, this intersection becomes a four-leg intersection to form The Wool Rd/Leisure Centre/High School intersection.

Table 4-6 - Future Traffic Volumes Thursday PM Peak (veh/hr two-way)

Road	Location	Existing		Future 2011 – Stage 1				Future 2016 – Stage 2			
				Without District Centre		With District Centre		Without District Centre		With District Centre	
		Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal
Naval College Rd	West of Huskisson Rd	580	696	645	773	896	1047	678	813	946	1106
Naval College Rd	West of Pine Forest Rd	423	508	488	585	739	859	521	625	789	918
Naval College Rd	West of Access A[2]	358	430	423	507	674	781	456	547	724	840
Naval College Rd	West of Access B[2]	359	430	423	508	699	805	456	548	748	865
Naval College Rd	West of Access C[2]	359	431	424	508	727	836	457	548	765	881
Naval College Rd	West of The Wool Rd	359	431	424	508	950	1103	457	548	1035	1205
Jervis Bay Rd	East of The Wool Rd	375	450	406	488	447	532	423	507	466	555
The Wool Rd	North of Naval College Rd	767	920	904	1085	1272	1522	975	1170	1394	1668
The Wool Rd	South of Naval College Rd	741	889	900	1079	1749	2062	982	1178	1930	2280
The Wool Rd	North of Access D[3]	784	940	904	1085	1130	1333	975	1170	1217	1437
The Wool Rd	South of Leisure Centre[4]	802	962	939	1127	1223	1410	1010	1212	1315	1517
The Wool Rd	North of High School	793	952	930	1116	1255	1381	1001	1202	1288	1489
The Wool Rd	South of High School[4]	797	956	934	1121	1130	1333	1005	1206	1217	1437
The Wool Rd	North of George Caley Pl	796	955	933	1120	1134	1343	1004	1205	1221	1447
The Wool Rd	South of George Caley Pl	785	942	922	1107	1123	1329	993	1192	1210	1434
The Wool Rd	South of Beach St	791	949	928	1114	1129	1337	999	1199	1216	1441
The Wool Rd	South of Elizabeth Dr.	398	478	494	593	640	755	544	653	702	829
Huskisson Rd	North of Naval College Rd	325	390	325	390	325	390	325	390	325	390
Pine Forest Rd	South of Naval College Rd	105	126	105	126	105	126	105	126	105	126
Leisure Centre	West of The Wool Rd	77	92	101	121	151	171	113	136	163	186
High School	East of The Wool Rd	36	43	44	52	44	52	46	55	46	55
George Caley Pl	East of The Wool Rd	31	37	31	37	31	37	31	37	31	37
Beach St	West of The Wool Rd	222	266	263	316	318	376	284	341	343	406
Elizabeth Drive	West of The Wool Rd	374	449	374	449	374	449	374	449	374	449

Table 4-7 - Future Traffic Volumes Saturday Peak (veh/hr two-way)

Road	Location	Existing		Future 2011 – Stage 1				Future 2016 – Stage 2			
				Without District Centre		With District Centre		Without District Centre		With District Centre	
		Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal
Naval College Rd	West of Huskisson Rd										
Naval College Rd	West of Pine Forest Rd										
Naval College Rd	West of Access A[2]					748	700			847	859
Naval College Rd	West of Access B[2]					772	724			871	883
Naval College Rd	West of Access C[2]					817	739			886	898
Naval College Rd	West of The Wool Rd[5]	424	402	504	436	1005	1001	545	524	1231	1311
Jervis Bay Rd	East of The Wool Rd	265	328	287	355	326	398	299	370	348	424
The Wool Rd	North of Naval College Rd	697	833	824	903	1168	1310	889	1073	1418	1702
The Wool Rd	South of Naval College Rd	678	913	833	989	1634	1914	913	1221	2073	2578
The Wool Rd	North of Access D[3]	697	833	824	903	1057	1141	889	1073	1166	1381
The Wool Rd	South of Leisure Centre[4]	699	833	826	903	1107	1167	891	1073	1235	1407
The Wool Rd	North of High School										
The Wool Rd	South of High School										
The Wool Rd	North of George Caley Pl										
The Wool Rd	South of George Caley Pl										
The Wool Rd	South of Beach St										
The Wool Rd	South of Elizabeth Dr.										
Huskisson Rd	North of Naval College Rd										
Pine Forest Rd	South of Naval College Rd										
Leisure Centre[6]	West of The Wool Rd	77	92	101	121	151	172	111	132	161	182
High School	East of The Wool Rd										
George Caley Pl	East of The Wool Rd										
Beach St	West of The Wool Rd										
Elizabeth Drive	West of The Wool Rd										

[5] Seasonal Saturday traffic volumes on the Naval College Rd approach to The Wool Rd were lower than on typical days. For all other approaches at the intersection seasonal volumes were higher than typical days.

[6] Note traffic volumes at the Leisure Centre on a Saturday peak are assumed to be the same as Thursday PM peak.

4.6.2 Intersection Analysis

Intersection analysis to determine the intersection operations under future traffic loads was undertaken and these results are presented in Table 4-8, Table 4-9 and Table 4-10.

The intersections of potential concern are those with a Level of Service D or lower. Given the local circumstances, Level of Service D would normally be acceptable during summer peak conditions because it is not usual to provide the same Level of Service during these times, as it is during other times of the year.

The analysis results indicate the following:

- site access intersections would operate satisfactorily under proposed traffic controls even up to 2016.

  Proposed controls are:

  - The Wool Road/Leisure Centre/High School intersection: traffic signals
  - Naval College Road/ Village West (Access A) : one lane roundabout
  - Naval College Road/ Village Central (Access B) : unsignalised Type C intersection
  - Naval College Road/District Centre (Access C) : seagull intersection[7]
  - The Wool Road/District Centre (Access D) : traffic signals

- This finding is not sensitive to traffic generation or traffic distribution variations as discussed above, because operating levels of service were found to be good.

- The intersection of Naval College Road/Huskisson Road would require upgrading by 2016 to cater for peak summer traffic.

- The intersection of The Wool Road/Beach Street will require upgrading by 2011 to meet peak summer requirements even without the district centre.

- The roundabout controlled intersection of Naval College Road/The Wool Road/Jervis Bay Road is likely to require improvement to accommodate peak summer traffic by 2011.

The upgrade requirement for the Naval College Road/The Wool Road roundabout would apply for the Thursday evening peak seasonal condition, rather than the Saturday morning condition. As discussed above, the Thursday evening traffic forecasts are believed to be somewhat high due to changed retail patterns. The peak seasonal district centre traffic could be 11 per cent higher, based on Council's Nowra Fair analysis, or 20 per cent higher based on the Foster Shopping Centre traffic survey.

Against this would be the increased traffic generation assessed above for the changed development mix, the likelihood that the district centre traffic distribution would be higher along The Wool Road than assessed, and the possibility that some Stage 3 development, albeit small, could come on stream before Stage 2.

[7] A seagull intersection is proposed, and subject to costing and design a roundabout would also be suitable. For analysis purposes a seagull intersection has been assumed.

In view of this it is considered prudent that the Naval College Road/The Wool Road intersection be upgraded in time for the opening of Stage 1. The preferred improvement would be to widen the roundabout to have two circulating lanes and two lanes on each of The Wool Road and the Naval College Road approaches. The Jervis Bay Road approach could remain with a one lane approach as little population growth is forecast for this leg and current traffic volumes are relatively low.

Analysis of the Naval College Road/Huskisson Road intersection indicates that it would operate within capacity if the Huskisson Road approach was widened to provide separate left and right turn lanes, for traffic turning out of Huskisson Road. To avoid queue interference between vehicles turning right into Huskisson Road with those turning right into Pine Forest Road it would be desirable to extend each of the two right turn bays over the full length between the two intersections. The suggested upgrade to these intersections is provided in **Appendix G**.

4.6.3 Internal Residential Villages Traffic Volumes

Peak traffic volumes on the residential access roads leading off Naval College Road are expected to be around 300 vehicles per hour or less. These volumes are consistent with the RTA's collector road environmental goal of 300 vehicles per hour and collector road environmental limit of 500 vehicles per hour.

It is noted that during a bushfire emergency it would be possible for residents in the area to evacuate the area within about 15 minutes even if two of the four potential points of access to the residential area were closed.

Table 4-8 - Future Intersection Operations Thursday AM Peak

Intersection	Intersection Control	Existing				Future 2011 – Stage 1								Future 2016 – Stage 2							
						Without District Centre				With District Centre				Without District Centre				With District Centre			
		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Naval College Rd/ Huskisson Rd/	Signs (Give-way)	A	13.9	B	17.4	B	15.9	B	21.1	B	23.8	C	36.9	B	17.1	B	23.4	B	27.0	D	48.6
Naval College Rd/ Pine Forest Rd	Signs (Give-way)	A	8.5	A	8.9	A	8.9	A	9.4	A	10.0	A	10.8	A	9.1	A	9.7	A	10.4	A	11.3
Naval College Rd/ Access A (Village West)	Roundabout (1-Lane)	-	-	-	-	-	-	-	-	A	7.1	A	7.2	-	-	-	-	A	7.2	A	7.4
Naval College Rd/ Access B (Village Central)	Signs (Give-way)	-	-	-	-	-	-	-	-	B	16.5	B	19.3	-	-	-	-	B	17.9	B	21.4
Naval College Rd/ Access C (District Centre)	Signs (Seagull)	-	-	-	-	-	-	-	-	B	20.0	B	21.6	-	-	-	-	B	20.7	B	22.5
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	A	10.1	A	8.6	A	8.6	A	9.8	A	11.9	B	17.6	A	9.1	A	10.5	B	14.8	C	33.9
The Wool Rd/ Access D (District Centre)	Signals	-	-	-	-	-	-	-	-	A	11.3	A	11.5	-	-	-	-	A	12.7	A	11.5
The Wool Rd/ Leisure Centre/ High School	Signals	-	-	-	-	-	-	-	-	A	10.2	A	10.6	-	-	-	-	A	10.6	A	11.1
The Wool Rd/ George Caley Pl	Signs (Give-way)	A	9.9	A	11.0	A	10.9	A	12.6	A	12.0	B	14.5	A	11.5	A	13.7	A	12.9	B	16.4
The Wool Rd/ Beach St/ St. Georges Ave	Signs (Give-way)	B	21.1	C	32.0	C	30.1	E	68.4	D	47.3	F	> 120	C	37.8	F	> 120	F	86.2	F	> 120

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.
Extensive queuing on The Wool Rd north approach at Naval College Rd.

Table 4-9 - Future Intersection Operations Thursday PM Peak

Intersection	Intersection Control	Existing				Future 2011 – Stage 1								Future 2016 – Stage 2							
						Without District Centre				With District Centre				Without District Centre				With District Centre			
		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Naval College Rd/ Huskisson Rd/	Signs (Give-way)	A	13.4	B	16.4	B	14.9	B	19.3	C	25.3	C	38.1	B	16.0	B	21.0	B	28.4	D	46.5
Naval College Rd/ Pine Forest Rd	Signs (Give-way)	A	8.7	A	9.1	A	9.1	A	9.7	A	11.1	A	12.0	A	9.4	A	9.9	A	11.6	A	12.7
Naval College Rd/ Access A (Village West)	Roundabout (1-Lane)	-	-	-	-	-	-	-	-	A	8.1	A	8.5	-	-	-	-	A	8.3	A	7.4
Naval College Rd/ Access B (Village East)	Signs (Give-way)	-	-	-	-	-	-	-	-	B	18.6	B	22.2	-	-	-	-	B	20.2	B	24.7
Naval College Rd/ Access C (District Centre)	Signs (Seagull)	-	-	-	-	-	-	-	-	B	19.6	B	21.2	-	-	-	-	B	20.2	B	22.2
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	A	8.6	A	9.3	A	9.3	A	10.4	B	17.6	F	93.4	A	9.8	A	11.2	C	31.8	F	> 120
The Wool Rd/ Access D (District Centre)	Signals	-	-	-	-	-	-	-	-	B	17.4	B	18.0	-	-	-	-	B	18.0	B	19.4
The Wool Rd/ Leisure Centre/ High School	Signals	-	-	-	-	-	-	-	-	A	9.0	A	9.5	-	-	-	-	A	9.2	A	9.7
The Wool Rd/ George Caley Pl	Signs (Give-way)	A	10.8	A	12.1	A	12.0	A	13.9	A	14.4	B	17.3	A	12.8	B	15.1	B	15.7	B	19.4
The Wool Rd/ Beach St/ St. Georges Ave	Signs (Give-way)	B	20.5	C	32.2	C	29.9	F	106	F	> 120	F	> 120	C	39.2	F	> 120	F	> 120	F	> 120

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.

Table 4-10 - Future Intersection Operations Saturday Peak

Intersection	Intersection Control	Existing				Future 2011 – Stage 1								Future 2016 – Stage 2							
						Without District Centre				With District Centre				Without District Centre				With District Centre			
		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Naval College Rd/ Access A (Village West)	Roundabout (1-Lane)	-	-	-	-	-	-	-	-	A	8.8	A	7.8	-	-	-	-	A	9.2	A	8.3
Naval College Rd/ Access B (Village East)	Signs (Give-way)	-	-	-	-	-	-	-	-	B	20.8	B	25.6	-	-	-	-	B	24.8	B	25.2
Naval College Rd/ Access C (District Centre)	Signs (Seagull)	-	-	-	-	-	-	-	-	B	20.3	C	40.5	-	-	-	-	B	22.7	B	23.2
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	A	9.0	A	8.9	A	10.1	A	9.3	B	23.8	B	19.2	A	10.7	A	10.5	F	> 120	F	> 120
The Wool Rd/ Access D (District Centre)	Signals	-	-	-	-	-	-	-	-	B	17.1	B	18.3	-	-	-	-	B	19.9	B	22.1
The Wool Rd/ Leisure Centre/ High School	Signals	-	-	-	-	-	-	-	-	A	8.1	A	8.8	-	-	-	-	A	8.1	A	8.5
Alternative Intersection Layouts																					
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane with left slip from south)											B	18.6								
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane with left turn lanes)																			D	53.8
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (2-Lanes)																			B	17.6

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.
Saturday count conducted at Naval College Rd/The Wool Rd/Jervis Bay Rd on a Seasonal Day

4.7 Traffic Effects on Jervis Bay Road

Officers of Shoalhaven Council have expressed concerns about the possible effects of the Vincentia V & DC on Jervis Bay Road between Huskisson Road and Princes Highway.

Officers of the Roads and Traffic Authority have expressed concern regarding potential impacts on the Princes Highway/Jervis Bay Road intersection.

In view of this a separate appraisal of resulting traffic changes was conducted for these road sections. This considers the traffic containment effect of the district centre.

The intention of the Vincentia district centre is to provide a range of retail, business and other services for residents of the Bay and Basin area that would otherwise only be obtainable in Nowra. The district centre will thus reduce the need for residents to travel to Nowra.

Retail analysts Mapinfo-Dimasi has analysed the retail expenditure interception implications of the district centre and this provides a guide as to how travel to and from Nowra would be influenced.

The Mapinfo-Dimasi analysis[8] has found that for the year 2009:

- Stage 1 of the district centre would reduce escape expenditure from the Vincentia trade area by $43 million per annum,
- of this 70% would otherwise have been directed to Nowra;
- this represents about $30 million per annum, and
- assuming residents were to spend $30 per transaction, the number of transactions per day reduced from Nowra in 2009, would be about 2,750 transactions.

It is estimated that at least 60 per cent of movements related to these transactions would take place along Naval College Road/Jervis Bay Road. About 40 per cent would take place along Princes Highway south of Jervis Bay Road.

Allowing for the purposes of this analysis that multiple transactions might be conducted on a visit to Nowra, and that some would be conducted on joint purpose visits, it is considered reasonable to allow say 5 transactions per purpose journey to/from Nowra. This equates to 550 journeys per day being intercepted to/from Nowra, of which an estimated 220 (40%) would be on Princes Highway, south of Jervis Bay Road and 330 (60%) would be on Naval College Road/Jervis Bay Road. As each journey involves a return trip, the equivalent traffic on these two roads would be 440 and 660 vehicle movements per day.

In addition to customer traffic, the provision of employment in the district centre would reduce journey to work travel along Naval College Road/Jervis Bay Road. Mapinfo-Dimasi estimates that the district centre would provide over 600 jobs.

According to the 2001 Census, on Census day 4253 employed persons in the area went to work but there were only 2098 jobs in the Bay and Basin area. There was thus a significant out-migration of persons travelling to work. In fact, only 1727 employed

[8] Dimasi Strategic Research Personal Communication

persons who lived in the area went to work in the area, with 2526 persons travelling to work outside the area and 371 persons travelling into the area to work.

Most retail jobs are taken up by persons living in relatively close proximity to their place of work. Thus, allowing for retail jobs to be 7 day a week jobs and allowing for a typical 5 days per week per permanent job, there would be around 430 new jobs each day, representing a 20% increase in local employment compared to 2001.

The provision of 430 local jobs would reduce external travel by this amount. This equates to about 290 vehicle trips to Nowra each day (at 1.5 persons per car) and about 580 vehicle trips per day (sum of trips each way).

Due to the fact that retail jobs tend to be taken up by persons living relatively local, it is expected that about 80% of this traffic (460 vehs/day) would otherwise have used Naval College Road/Jervis Bay Road and 20% (120 vehs/day) would otherwise have used Princes Highway.

Thus in total, combining both employment and retail trip reductions, the district centre would indicatively remove about 790 vehicle trips per day from Naval College Road/Jervis Bay Road and about 360 vehicle trips per day from Princes Highway.

This reduction in travel to/from Nowra could be offset by increased travel to/from Nowra for work and other purposes by residents of the villages, adjacent to the district centre.

In 2000 the Annual Average Traffic Volume (AADT) on Jervis Bay Road was 6392 vehicles per day. In 2003 it was 6965 vehicles per day. By interpolation the AADT in 2001 was 6583. The tributary population in the catchment served by Jervis Bay Road in 2001 is estimated to be about 12,500 persons. This equates to about 0.5 vehicle trips per day per resident in the catchment. This outwards traffic generation rate reflects the relatively low rate of employment and retail travel containment in the area. Once better containment of retail and work travel as discussed above is taken into account, it is likely that there would be a reduction of this rate by at least 10%. Accordingly, an outwards travel rate of 0.45 vehicle trips per person per day has been used for assessing the effects of increased district centre population.

The residential villages are expected to have up to 740 dwellings of which about 136 would be adaptable dwellings in the Village East (leisure centre area) and would be essentially for older persons. The population of dwellings in the Village East would be up to 200 persons (at 1.5 persons per dwelling).

The remaining dwellings in the West and Central Villages are expected to have about 1450 residents (at 2.4 persons per dwelling). Thus the population increase would be about 1650 persons.

Adopting the rate of 0.45 vehicle trips per day per person for resident related traffic on Naval College Road, it could be seen that the village residents would generate about 740 additional vehicle trips per day on Naval College Road. This compares with expected traffic relief of 790 vehicles per hour as calculated above.

The analysis indicates that the Vincentia V & DC would add additional residential generated traffic onto Jervis Bay Road but that this would be more than off set by reduced shopping travel by the local population to Nowra. This is not surprising as the very reason for the district centre in the first place was to provide a range of services locally that are presently not available in the area.

As indicated in the analysis above, there would be a net benefit for the Princes Highway in terms of reduced traffic due to the district centre containing activity locally.

This analysis indicates that the Vincentia V & DC will not contribute to the need to upgrade either Jervis Bay Road (Huskisson Road to Princes Highway) or its intersection with Princes Highway.

4.8 Effects on Jervis Bay Road/Princes Highway Intersection

For the record, it is noted that the intersection of Jervis Bay Road/Princes Highway has been the subject of discussion with the RTA.

Initial analysis found low impact on the intersection but that upgrading works would be needed anyway due to continuing background traffic growth.

The RTA responded by requesting further analysis, however the response was made prior to receipt of the Dimasi retail assessment. The analysis was conducted and advice was presented to the RTA in August 2005. A copy of the MWT letter to the RTA is provided in **Appendix H**.

In summary this advice concluded that the intersection required upgrading as a result of normal background traffic growth, that the proposed residential component of the development will not necessitate any works, which would not otherwise be needed and that if anything the proposed district centre would reduce traffic through the intersection.

Based on further consideration of reduced traffic generation on Jervis Bay Road as discussed above, it is still concluded that:

- the Jervis Bay Road/Princes Highway intersection will need upgrading in the future;
- this will be needed irrespective of the Vincentia V & DC; and
- the Vincentia V & DC will not materially affect the operation of the intersection.

4.9 Road Improvement Requirements

From the analysis above it is concluded that there are some existing road operating issues and that with traffic growth in the future there will be a need for staged capacity improvements. These are outlined below:

Existing

- Intersections of The Wool Road/Beach Road/St. Georges Avenue – There are reported capacity issues now and upgrading will be needed by 2011 irrespective of the district centre.

- Intersections of The Wool Road/High School Access/Leisure Centre – There are existing issues for pedestrians crossing the road to/from the high school and to/from the leisure centre. The original leisure centre plan provided for a four-way intersection and Council's Section 94 plan for the leisure centre includes the cost of traffic signals at this location.
- Jervis Bay Road (Huskisson Road to Princes Highway) – Over taking opportunities are limited. As discussed above this is a matter for resolution irrespective of the proposed Vincentia V & DC.

Future 2011 for Villages and District Centre Stage 1

- Site accesses with appropriate tie ins to The Wool Road and Naval College Road will need to be provided as per the site Masterplan.
- The relocated leisure centre access/High School Access/The Wool Road intersection should be formed and signalised.
- The Wool Road/Naval College Road/Jervis Bay Road intersection will need to be upgraded for peak seasonal conditions to a two lane roundabout with two lane approaches on all but the Jervis Bay Road approach.

Future 2016 for District Centre Stage 2

- The intersections of Jervis Bay Road/Huskisson Road and Naval College Road/Pine Forest Road should be upgraded (mainly for safety reasons) by 2016.

5. Other Transport Implications

5.1 Land Use and Transport Interaction

The subject site has been nominated as the location for a district centre for some time. It was selected because of its central location in the Bay and Basin area and because a significant amount of land was required and is available on the site for a district centre.

The central location of the site will promote transport sustainability outcomes by minimising trip lengths and providing an activity node that will allow trips for different purposes to be combined.

The provision of a comprehensive retail centre in the area will provide two other transport benefits. These are:

- reduction in travel out of the area for shopping – at present at least half of the retail expenditure generated by residents of the area takes place elsewhere, and
- provision of local jobs that will reduce the need for residents to travel out of the area for work.

The proposed Masterplan will thus be highly beneficial in terms of broad transport outcomes.

5.2 Public Transport

At present the Bay and Basin area has only a rudimentary public transport service because the spread out nature of development and absence of an activity centre, meaning that public transport patronage levels are not sufficiently concentrated to sustain high service levels.

The proposed Masterplan will provide an activity focal point that will substantially strengthen the viability of local bus services. Existing bus services serving the development arc through the local area serves Basin View in the west through Sanctuary Point and Vincentia to Huskisson and Woollamia in the northeast, with Nowra a final connection.

The proposed district centre is at a midway point on this arc. Over time it is expected that the current service will evolve with possibly regular direct services to the district centre, from both the east and west, to supplement the existing through service to Nowra.

A logical point for services to meet would be as central as possible within the district centre. The provision of access to the district centre from both the Naval College Road and The Wool Road with a through link will provide a positive, minimum delay route for buses travelling in all directions.

Provision has also been made for a bus route to operate through the Village West and Village Central. This route is illustrated in **Appendix F**.

The proposed road system will provide potential bus routes within 400m of 90 per cent of dwellings in accordance with desirable design standards.

5.3 Bicycle and Pedestrian Routes

The Masterplan has especially focused on promoting walking and cycling. A high degree of connectivity is proposed for these modes (see **Appendix F**).

It is considered that the Masterplan will especially foster cycling between the residential areas and the district centre, the leisure centre and the high school. The indicative routes shown in **Appendix F** will be finalised in agreement with Council.

The provision of a shared cycle/pedestrian way to the Jervis Bay Foreshore, subject to suitable funding arrangement between Council and Stockland, is envisaged to serve mainly as a recreational cycleway. The provision of such a facility is expected to foster walking and cycling generally. It will also be a desirable feature that will entice people to want to live in the area.

As discussed above, Shoalhaven Council has advised that applications are imminent to develop schools on either side of The Wool Road, south of Naval College Road/Jervis Bay Road. These will intensify pedestrian movements from these locations to/from the district centre. The Council has formulated a strategy to deal with these, incorporating a new set of traffic signals on The Wool Road that will facilitate vehicular access to one of the schools and provide a safe crossing of The Wool Road for pedestrians. The second part of the strategy involves continuation of the pedestrian route via an underpass beneath Naval College Road, north of The Wool Road. This measure is supported as long as the two schools and new traffic signals on The Wool Road also proceed and a continuous pedestrian route is provided, which will justify the need for the underpass.

6. Timing and Responsibility for Works

Chapter 4 of this report indicates requirements for road system improvements. Section 6.1 below discusses required timing and suggested responsibilities for intersection improvements. Section 6.2 considers other works that Council has suggested maybe related to the proposed Vincentia V & DC.

6.1 Intersections

The Wool Road/Beach Road/St. Georges Avenue Intersection
In a stakeholder briefing on this intersection in 2003 Council officers advised that this was a problem intersection during peak times. The analysis above indicates that this will need upgrading prior to 2011 even without the Vincentia V & DC.

It is therefore considered that this is a project that Council should assume responsibility for exclusively. However, to the extent that the proposed Vincentia V & DC development was to bring forward the need for works (by say 3 years) it should reasonably make a contribution (say 10% of $300,000 over 3 years = $90,000).

The Wool Road/Leisure Centre/High School Intersection
This will require signalisation because it will be a four-way intersection on a busy road and will facilitate school children crossing The Wool Road. Arguably the leisure centre access and high school driveway should have been aligned opposite each other in the first place as per the original leisure centre concept plan. It is understood that this was not done for environmental reasons as then perceived. Subsequent environmental research now suggests that this is the most appropriate arrangement.

The new intersection will serve the school, the leisure centre and the Village East adjacent to the leisure centre. Relative traffic contributions for those for a typical day in 2011 are shown in Table 6-1.

Table 6-1 – Sources of traffic through The Wool Rd/Leisure Centre/High School Intersection

	Weekday Morning (vph)	Weekday Evening (vph)	Average (vph)
School	205	44	125
Leisure Centre	65	101	83
Adaptable Housing (Village East)	43	43	43
Total	**313**	**188**	**251**

On this basis the Vincentia V & DC should fund 17% of the cost of the new intersection.

It is noted that the cost of the actual traffic signals are included in the Section 94 Contributions levy for the leisure centre and so should not be included in the intersection cost calculation (both capital and capitalised maintenance).

District Centre (Access D)/The Wool Road Intersection
This is solely needed to serve the Vincentia V & DC and should be fully funded by it.

Naval College Road/The Wool Road/ Jervis Bay Road Intersection
Vincentia V & DC is required to make a Section 94 contribution as a back payment towards the provision of the roundabout that has already been constructed.

The analysis indicates that this roundabout is likely to need additional capacity for 2011. Intersection analysis results show that in 2011 peak seasonal conditions the intersection operates at a level of service F.

Given that Vincentia V & DC already has an obligation towards provision of the initial roundabout through a Section 94 contribution, it is unreasonable that it should then have to fully fund future upgrading as well. It must have a substantial claim on the capacity of the existing roundabout.

As the roundabout will serve all future development in the local area, a possible way of apportioning costs would be to determine the percentage traffic contribution by the proposed development at peak times in 2016, compared to that of other sources.

A critical time would be a Saturday in 2016. Relative sources of traffic through the intersection for a peak summer day during the peak hour are estimated to be as shown in Table 6-2. This calculation allows for the change in development mix on the site and the possible increased distribution of traffic along The Wool Road, as discussed previously.

Table 6-2 – Sources of traffic through Naval College Rd/Jervis Bay Rd Intersection

	Volume (vph)	Percent
Vincentia Villages & District Centre	1521	48%
Other Traffic (including background growth)	1616	52%
Total	**3137**	**100%**

On this basis the Vincentia V & DC should be responsible for 48% of the cost of upgrading. This would be on top of its Section 94 contribution in respect of the construction of the original roundabout.

Naval College Road/District Centre (Access C) Intersection
Analysis indicates that this would operate satisfactorily under priority (Stop or Give Way) controls. However, for road alignment reasons the current proposal is to construct a "seagull" type intersection.

It has been suggested by Council that a roundabout may be more appropriate to facilitate left in/left out movements at the proposed school on Naval College Road, opposite the site. A one lane roundabout would suffice for this. The suggestion from Shoalhaven Council is that the school make a 10% contribution in respect of the cost of this roundabout.

Estimates of school traffic generation are not available but this proportional contribution is considered reasonable given that the school is proposed to also have vehicular access off The Wool Road.

To enforce left in/left out only access for the school off Naval College Road it would be necessary to provide a median in Naval College Road. This would be the sole responsibility of the school as it would afford no particular benefit to the proposed development.

Naval College Road/ Village Central (Access B) Intersection
This is solely related to the residential village and should be fully funded by Vincentia V & DC.

Naval College Road/Village West (Access A) Intersection
This intersection is proposed as a one lane roundabout. The main function will be to provide access to the new residential area and should be fully funded by Vincentia V & DC. It is however noted that the roundabout will confer a secondary benefit in terms of demarcating the start of the Vincentia urban area. This will indicate to drivers the need to change from rural to urban driving behaviour. As such it may be appropriate to allocate some credit for this improvement towards other less defined obligations of the Vincentia V & DC.

Naval College Road/Pine Forest Road/Huskisson Road Intersection
Council has suggested that the Vincentia V & DC should fully fund upgrading of this intersection.

Given the fact that Huskisson and Woollamia only have the potential for about 215 more dwellings, there is not likely to be significant traffic growth on Huskisson Road. There is also likely to be low growth on Pine Forest Road now the Sanctuary Point bypass is complete. In fact traffic volumes may have dropped on this road since the bypass was opened.

As indicated above, it is expected that the containment of shopping trips in the area by the district centre's commercial component will offset any additional trips to/from the Princes Highway due to the residential component of the proposed development.

In view of this, the only additional trips through the intersection arising from the development would be due to the attraction of persons living in rural residential areas south or west of the intersection that would otherwise have travelled to Nowra to shop. As discussed in section 4.4, this was estimated to be about 12 per cent on the basis that all of the rural population of 2,100 was in the centre's catchment. In fact the Mapinfo-Dimasi report indicates that the centre's catchment would have the Princes Highway as its western boundary. Accordingly the distribution of district centre trips was reviewed and is now considered that 5% of trips to/from district centre to/the west would be more appropriate. These additional trips were added to to the Naval College Road/Jervis Bay Road intersections with Pine Forest Road and Huskisson Road.

Having regard to the previously assumed proportional distribution of shopping centre traffic to the west now being considered too high, background traffic growth and safety considerations, the minimum required improvement to the intersection would be:

- widening the approach of Huskisson Road to provide separate right and left turn lanes; and
- providing side by side right turn lanes in Naval College Road between the two intersections to safely cater for right turns into each side road.

Again it is considered that relative traffic contributions should be made pro rata on total future traffic. Based on this approach the contribution of traffic through the intersection on a peak seasonal weekday in 2016 would be as indicated in Table 6-3.

Table 6-3 – Sources of traffic through Naval College Rd/Huskisson Rd/Pine Forest Rd Intersection (Peak Season 2016)

	Weekday Morning (vph)	Weekday Evening (vph)	Average (vph)	Percent
Vincentia Village & District Centre Traffic	28	65	47	5%
Other Traffic	900	939	947	95%
Total	**928**	**1004**	**994**	**100%**

Thus it is recommended that the district centre fund 5% of the upgrading works.

A possible upgrading concept plan is provided in **Appendix G** of this report.

6.2 Other Works

Naval College Road – The Wool Road to Pine Forest Road
As the one directional flow along this section of road is not expected to exceed 900 vehicles per hour (the nominal capacity of an urban traffic lane – Level of Service D, according to RTA guidelines) even in peak summer conditions with the district centre operating, it will operate satisfactorily with one through lane in each direction.

Widening to provide sheltered turn lanes at intersections would be needed as appropriate and these would be incorporated into intersection designs.

In practice it is noted that west of the district centre access two-way flows are not forecast to exceed about 900 vehs/hr. As indicated below, this reflects an adequate level of service for peak holiday conditions even on a rural road.

Jervis Bay Road – Huskisson Road to Princes Highway
Two-way traffic volumes on this section of road are expected to be at or below about 1100 vehicles per hour, even during peak summer conditions. This is at Level of Service D, which for this section of road represents a volume below 1120 vehicles per hour. Level of Service C occurs below about 630 vehicles per hour. This volume is already exceeded in summer peak conditions. It is expected that it would be exceeded by 2011 on normal weekdays even without the Vincentia V & DC.

In view of this it is considered that Naval College Road will in due course require upgrading, irrespective of the proposed development, and should not be reliant on it for funding. This is particularly so due to the neutral effect that the Vincentia V & DC would have on Naval College Road, as indicated in Chapter 4 of this report.

There is no nexus between the proposed Vincentia V & DC and any upgrading requirement for this section of road. Accordingly it would not be appropriate to require a development contribution in respect of such upgrading. This is especially so as Council's Section 94 Plan did not require contributions for such works from any other development. The plan was premised on a future population of 26,500 persons (30,000 population by 2016) plus the new district centre and a new TAFE by 2011 in the Bay and Basin area. Environmental constraints identified subsequently to its preparation will now contain growth to an expected ceiling of about 25,000 by 2016.

As indicated above, there may be the potential to transfer some of the Section 94 funds that Council is presently collecting towards the re-alignment and reconstruction of Naval College Road, between Pine Forest Road and The Wool Road, towards the provision of overtaking opportunities on Jervis Bay Road, between Huskisson Road and Princes Highway.

Pedestrian Underpass beneath Naval College Road
This is suggested as a way of connecting the district centre to the proposed school on the southern side of Naval College Road and to the western side of The Wool Road, south of Naval College Road.

Shoalhaven Council's suggested funding is 50% on behalf of the district centre and 50% by the school. This cost apportionment is considered reasonable.

Pedestrian Path around the Eastern and Southern Perimeters
Council suggestion is understood to involve shared footpaths alongside both The Wool Road and Naval College Road frontages. This treatment is considered inappropriate as it would encourage midblock pedestrian crossing movements and in particular could encourage pedestrian movements at the Naval College Road/The Wool Road intersection.

The residential layout has been designed to allow permeability for pedestrians and will provide a network of footpaths and cycle ways. This will adequately cater for new residents and those moving through and around the district centre.

A summary of the recommended works and apportionment of costs is provided in Table 6-4 below.

Table 6-4 – Summary of Recommended Works and Apportionment of Costs

	Works	Responsibility	Timing
1.	Upgrade Intersection The Wool Rd/Beach Rd/St. George Ave	Council – 100% Stockland – cost to bring forward work by 3 years	Prior to opening of District Centre Stage 1
2.	Signalise Intersection The Wool Rd/High School/Leisure Centre	Stockland – 17% Council – 83%	Prior to opening of District Centre Stage 1
3.	The Wool Road /District Centre Access D Intersection	Stockland – 100%	Prior to opening of District Centre Stage 1
4.	Widen the Naval College Rd/Jervis Bay Rd/The Wool Rd roundabout to a two lane roundabout	Stockland – 48% Council & Schools – 52%	Prior to opening of District Centre Stage 1
5.	Naval College Rd/District Centre Access C Intersection – One lane roundabout OR Seagull intersection	Stockland – 90% School – 10% Stockland – 100%	Prior to opening of District Centre Stage 1
6.	Naval College Rd/East Village Access B intersection	Stockland – 100%	Prior to occupation of Dwellings Served
7.	Naval College Rd/West Village Access A intersection	Stockland – 100%	Prior to occupation of Dwellings Served
8.	Naval College Rd/Huskisson Rd/Pine Forest Rd intersection – widen Huskisson Rd approach and provide extended right turn bays in Naval College Rd	Stockland – 5% Council – 95%	After Stage 1 subject to review
9.	Pedestrian underpass on Naval College Rd	Stockland – 50% School – 50%	Prior to opening of District Centre Stage 1

7. Summary

7.1 Background Situation

- The subject site is located to the west of The Wool Road and to the north of Naval College Road within Vincentia, with easy access to Huskisson, St Georges Basin, Sanctuary Point and a number of other settlements.

- The Wool Road forms a major north-south link between Vincentia and Naval College Road. Naval College Road/Jervis Bay Road is a two lane rural road which provides a link between Princes Highway and Jervis Bay. The two roads are controlled by a roundabout to the south east of the subject site.

- The Vincentia area is serviced by Nowra Coaches which operates a bus route that connects population centres in the Jervis Bay area.

- Peak hourly traffic flows on roads adjacent to the site are in the order of 300 to 350 vehicles per hour on Naval College Road and 700 to 800 vehicles per hour on The Wool Road.

- RTA counts on Jervis Bay Road and the Princes Highway indicate that typical holiday traffic volumes are approximately 20% greater than typical non-holiday traffic.

- Analysis indicates that the intersections in the local road network currently operate at good levels of service during normal peak hours.

- However the intersection of Jervis Bay Road with Princes Highway experiences capacity problems during holiday peak periods.

- Shoalhaven Council has adopted a number of initiatives in order to try and improve transport in the area, these include:
    - The *Shoalhaven Bicycle Strategy* (1997)
    - The *Pedestrian Access and Mobility Plan* (2000)
    - The *Shoalhaven Integrated Transport Strategy* (2000)

- Community Open Days were held to discuss the project with members of the community. Some of the transport issues raised included:
    - The conditions and increased traffic volumes on Jervis Bay Road.
    - The capacity of The Wool Road north of Naval College Road to cater for future traffic growth.
    - The summer traffic volumes.
    - The need to coexist with/protect the 1300 students at the high school on The Wool Road.

7.2 Proposed Development

- The proposed Masterplan includes:
    - Approximately 604 free standing dwellings
    - A range of retail, commercial and leisure services including a shopping centre which is to be developed over a 10 year period
    - Approximately 136 adaptable multi dwelling units
    - Retention of over 60ha for open space and conservation purposes.

- It is envisaged that a mix of 600-700 full time, part time and casual jobs would be created on the Masterplan site.

- It is proposed that there be one point of access to the shopping centre and two to the residential area, off Naval College Road. It is proposed that the Village West access be controlled by a roundabout, which would provide a gateway point at the start of the Vincentia urban area, the Village Central access be a give-way control and a seagull access be designed for the district centre access.

- It is proposed that a second access to the shopping centre be provided on The Wool Road about 150m north of Naval College Road. This would be controlled by traffic signals.

- It is proposed to create a new access to the leisure centre and the Village East adjacent to it by signalising the high school access intersection on The Wool Road and providing a new road towards the leisure centre as a fourth leg to the intersection.

- The existing leisure centre access on The Wool Road would be closed.

- It is proposed that parking be provided to meet or exceed Shoalhaven Council's DCP.

- An extensive network of bicycle and pedestrian connections are proposed throughout the whole development site

7.3 Traffic Implications

- Analysis indicates that in the absence of development of the proposed district centre most intersections in the local road network would continue to operate at satisfactory levels of service and acceptable delays in the future (2016).

- However there would be capacity problems at the intersection of The Wool Road/Beach Street which would require change of control. This would be needed irrespective of the district centre proposal.

- The intersection of Princes Highway with Jervis Bay Road would also require changed control. Signalisation would be sufficient. The V & DC traffic implications are neutral in this regard and these works would be needed irrespective of the Vincentia V & DC proposal.

- Additional capacity would be required for The Wool Road/Naval College Road intersection roundabout by 2011. A two-lane roundabout with two approach lanes on all legs except the Jervis Bay Road approach is recommended.

- Midblock traffic volumes would remain below nominal urban road capacities of 900 vehicles per lane per hour.

- The intersection of Naval College Road and Huskisson Road would operate satisfactorily in holiday periods in 2016 if moderately upgraded (see **Appendix G**).

7.4 Other Transport Implications

- The central location of the site will promote transport sustainability outcomes by minimising trip lengths and providing an activity node that will allow multi-purpose trips to be combined.

- The proposed Masterplan will facilitate the improvement of the local public transport by providing an activity focal point for the local bus services.

- Provision has been made for a bus route to operate through the Masterplan residential area.

- The Masterplan is especially focused on the promotion of cycling and walking.

- Pedestrian and cycle access through the area would be significantly improved.

7.5 Conclusions

The proposed Masterplan is in keeping with prior planning for the local area which provides for a district centre to be developed on the site. This would provide residential, retail, business and community facilities. Creation of a district centre will provide considerable transport benefits to the area by providing a focal point for transport services and by allowing multi-purpose visits which would minimise the need for car travel.

The spreading of traffic access to the site as proposed in the Masterplan will minimise traffic concentrations around the site and will thus allow the transport benefits to be realised without traffic congestion.

Overall it is concluded that transport aspects of the proposal will be beneficial. However the following recommendations are made to ensure that the road system in the area operates satisfactorily in the long term:

- Signalisation of the new four-way intersection of The Wool Road/High School/Leisure Centre.

- Upgrade The Crossroads intersection of Naval College Road/Jervis Bay Road/The Wool Road. By 2011 a two-lane roundabout will be required with two approach lanes on all but the Jervis Bay Road approach, which could remain with one approach lane.

- Shoalhaven Council should undertake a study of the desired future role of Beach Street between Naval College Road and Elizabeth Drive and implement modified traffic control at the intersection of Beach Street with The Wool Road in accordance with this.

- Upgrade the Naval College Road intersections with Pine Forest Road and Huskisson Road. At minimum it is recommended that the Huskisson Road approach is widened to provide separate left and right turn lanes and side by side right turn lanes are provided in Naval College Road, between the two intersections, to safely cater for right turns into each side road.

- Provision of a 1-lane roundabout at the Village West (Access A) intersection.

- Provision of Give-Way controls at the Village Central (Access B) intersection.

- Provision of a roundabout or 'seagull' type intersection at the Naval College Road/District Centre Access C.

- Provision of traffic signals at the intersection of The Wool Road and the District Centre Access D.

- The Roads and Traffic Authority should develop and implement a strategy for the long term provision of appropriate capacity at the intersection of Princes Highway with Jervis Bay Road.

Chapter 6 of this report suggests an apportionment of costs for recommended works.

SITE LOCATION

VINCENTIA DEVELOPMENT

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Figure 1

Filename: 032132di06.ai

Date: 29 November 2005

SITE LOCATION

VINCENTIA DEVELOPMENT

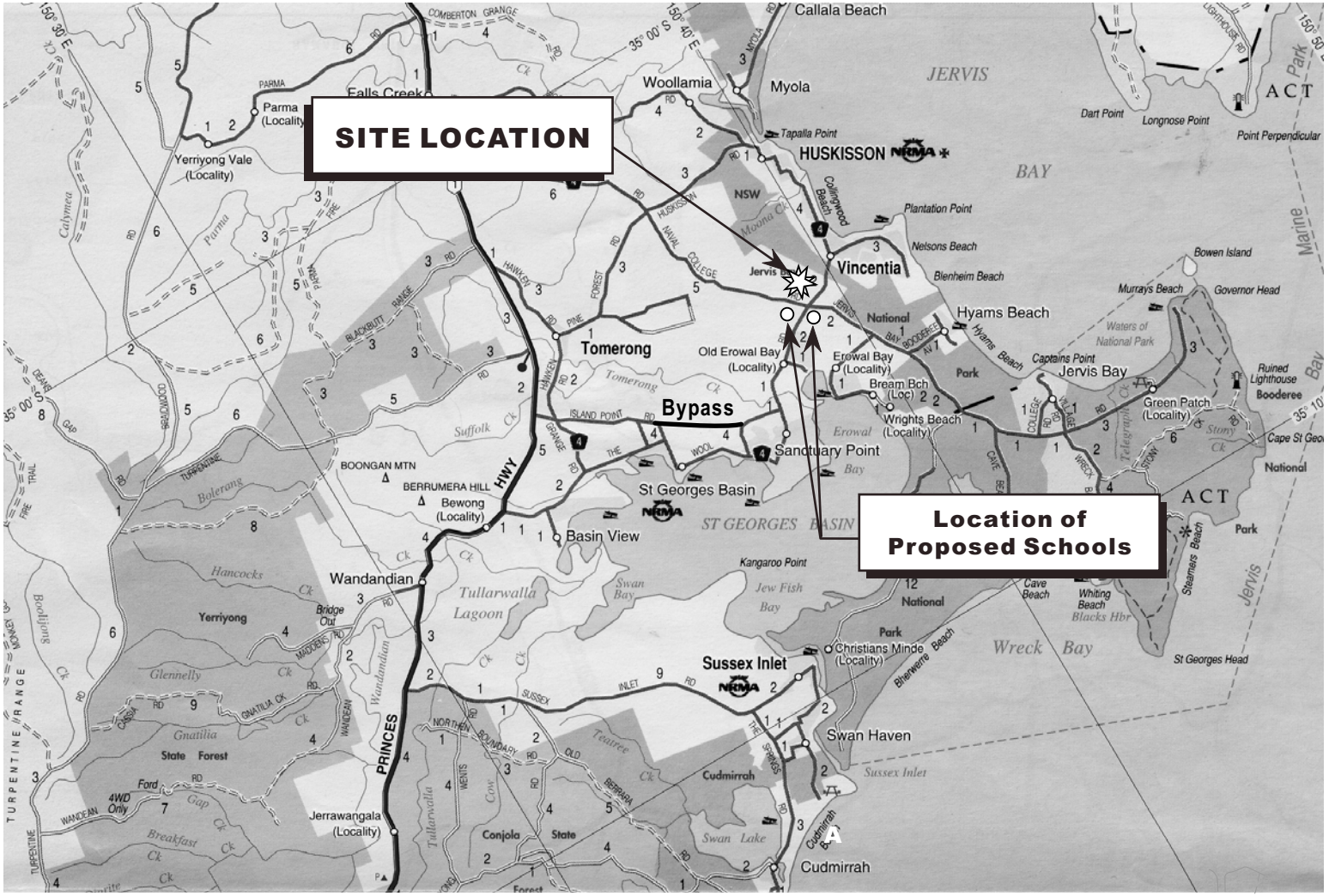

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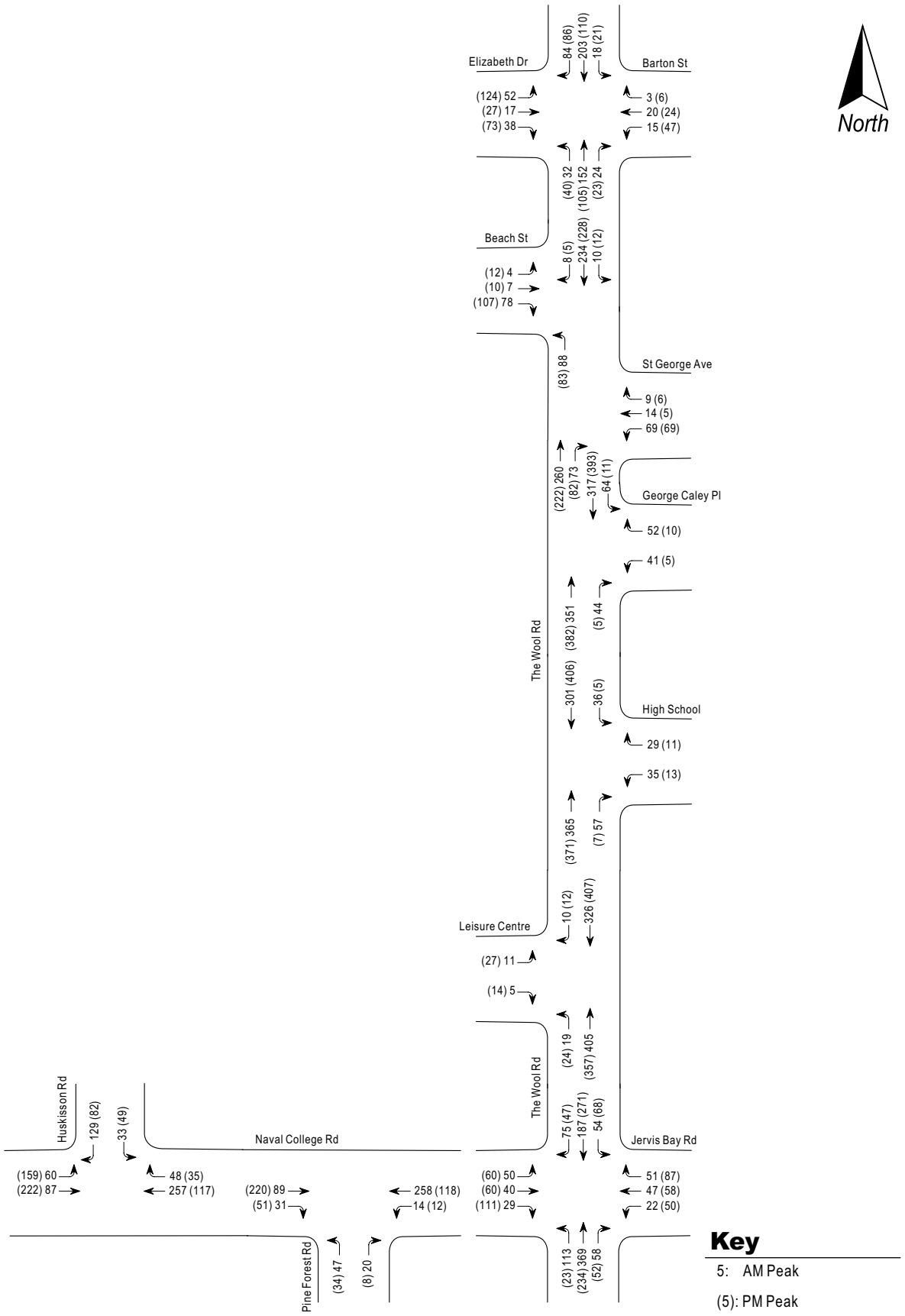
Figure 2

Filename: 032132di16.ai

Date: 29 November 2005

EXISTING THURSDAY PEAK HOUR TRAFFIC FLOWS

VINCENTIA DEVELOPMENT



MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

Figure 3

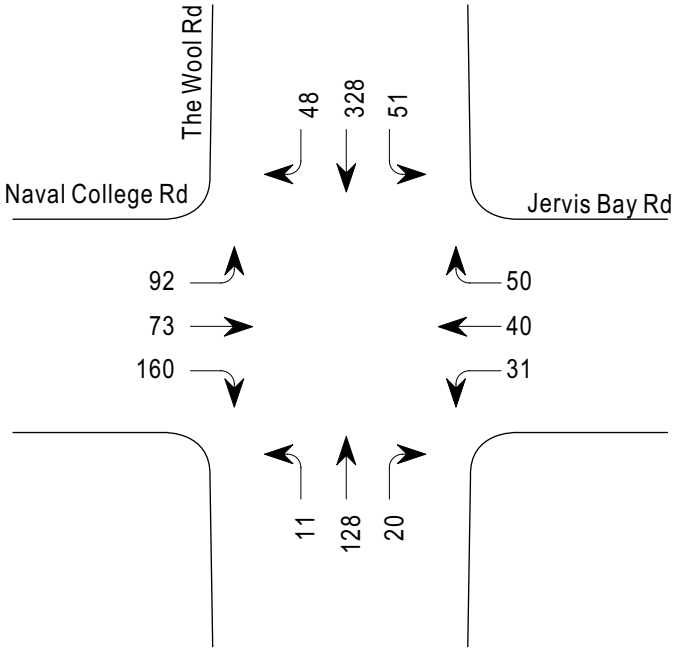
Filename: 032132di17.ai

Date: 29 November 2005

EXISTING SATURDAY PEAK HOUR TRAFFIC FLOWS

VINCENTIA DEVELOPMENT

North



Key

Saturday

5 Peak 11am-12noon

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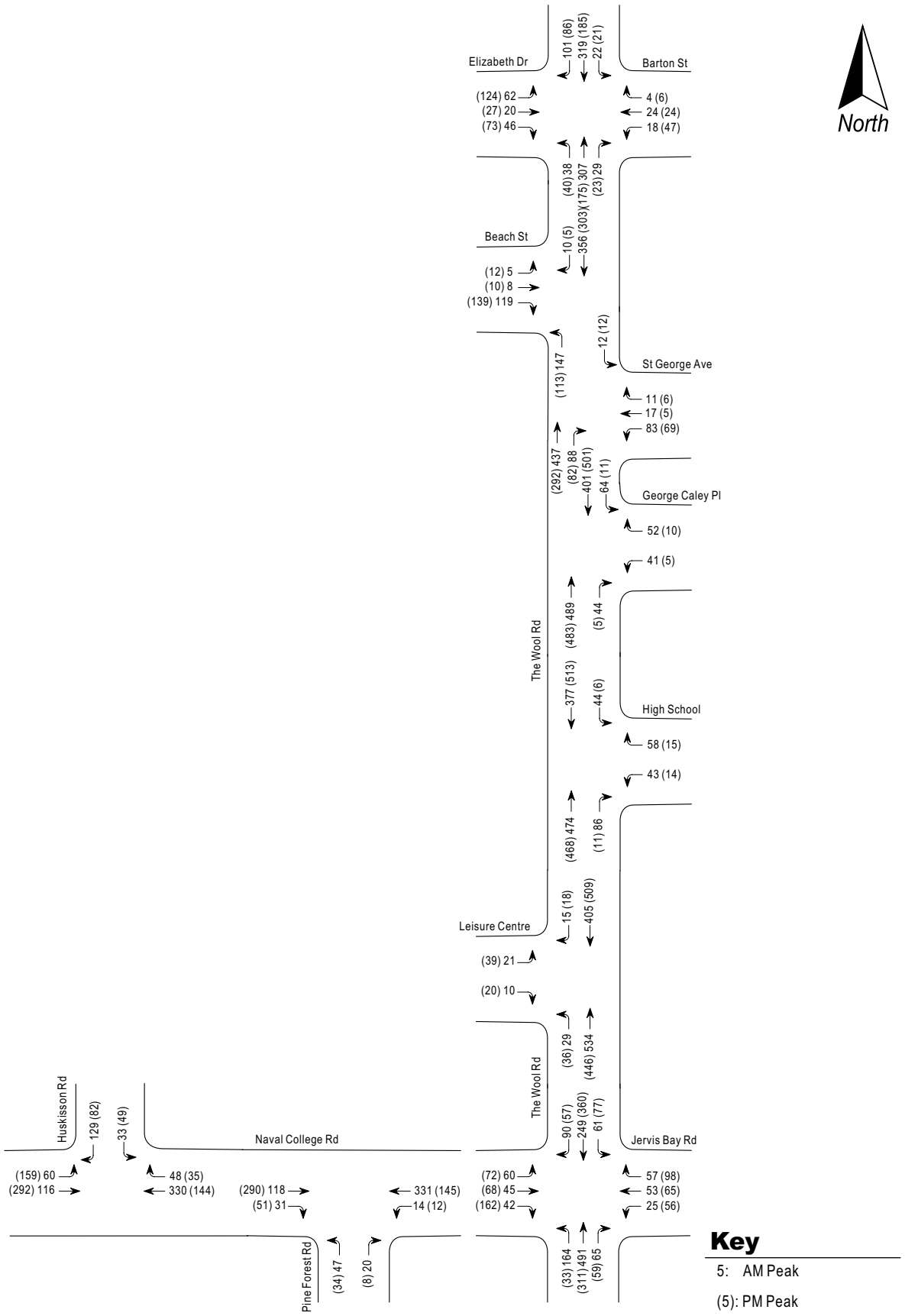
Figure 4

Filename: 032132di18.ai

Date: 29 November 2005

FUTURE 2016 THURSDAY (PEAK HOUR) BACKGROUND TRAFFIC FLOWS (TYPICAL DAY)

VINCENTIA DEVELOPMENT



MASSON | WILSON | TWINEY
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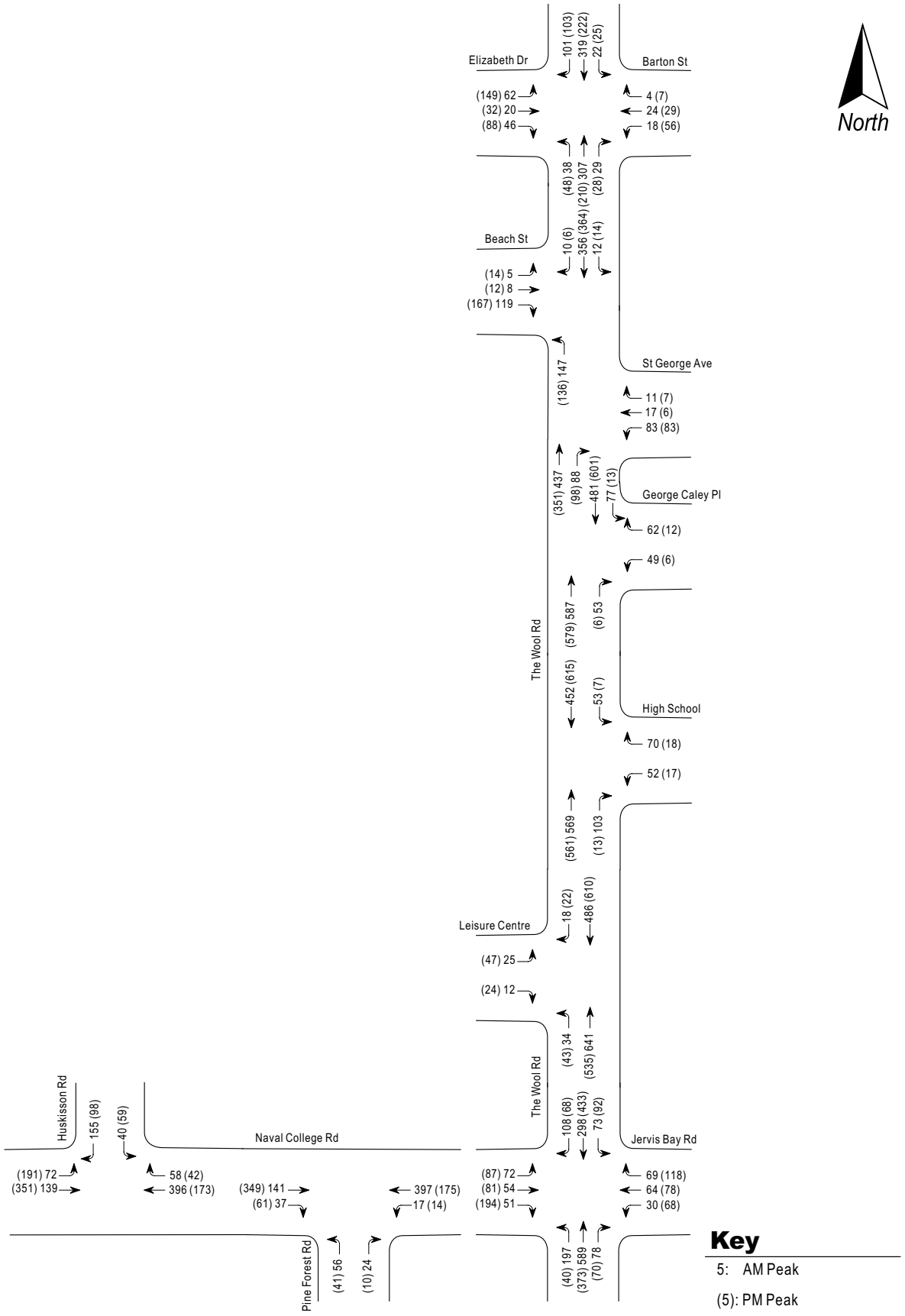
Figure 5

Filename: 032132di19.ai

Date: 29 November 2005

FUTURE 2016 THURSDAY (PEAK HOUR) BACKGROUND TRAFFIC FLOWS (SEASONAL DAY)

VINCENTIA DEVELOPMENT



MASSON | WILSON | TWINEY

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Figure 6

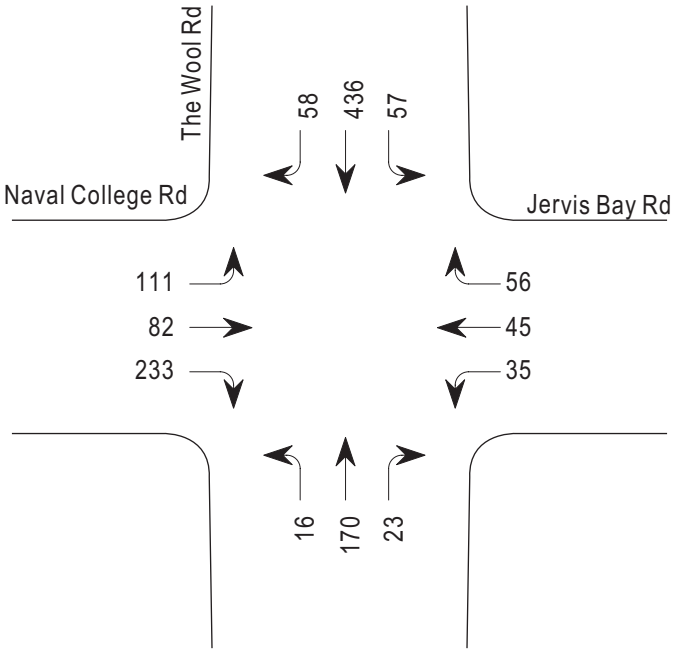
Filename: 032132di20.ai

Date: 29 November 2005

FUTURE 2016 SATURDAY (PEAK HOUR) BACKGROUND TRAFFIC FLOWS (TYPICAL DAY)

VINCENTIA DEVELOPMENT

North



MASSON | WILSON | TWINEY
TRAFFIC AND TRANSPORT CONSULTANTS

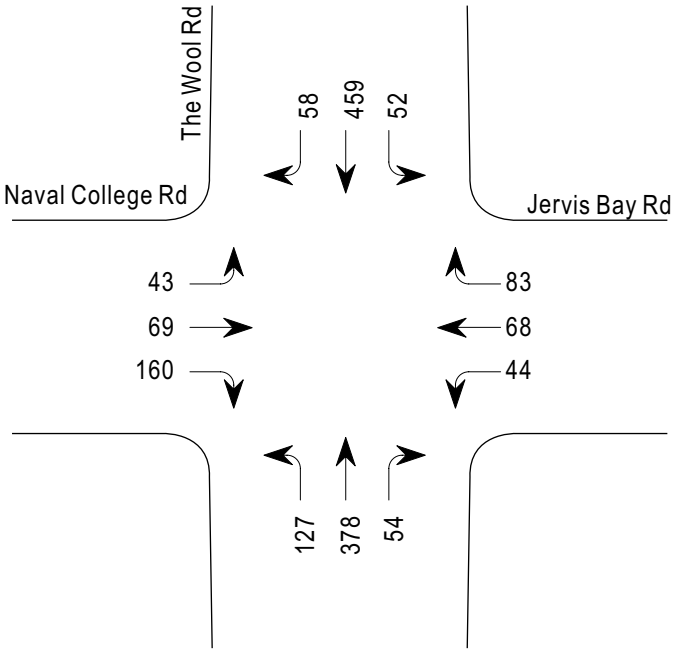
Figure 7

Filename: 032132di21.ai

Date: 29 November 2005

FUTURE 2016 SATURDAY (PEAK HOUR) BACKGROUND TRAFFIC FLOWS (SEASONAL DAY)

VINCENTIA DEVELOPMENT



MASSON | WILSON | TWINEY
TRAFFIC AND TRANSPORT CONSULTANTS

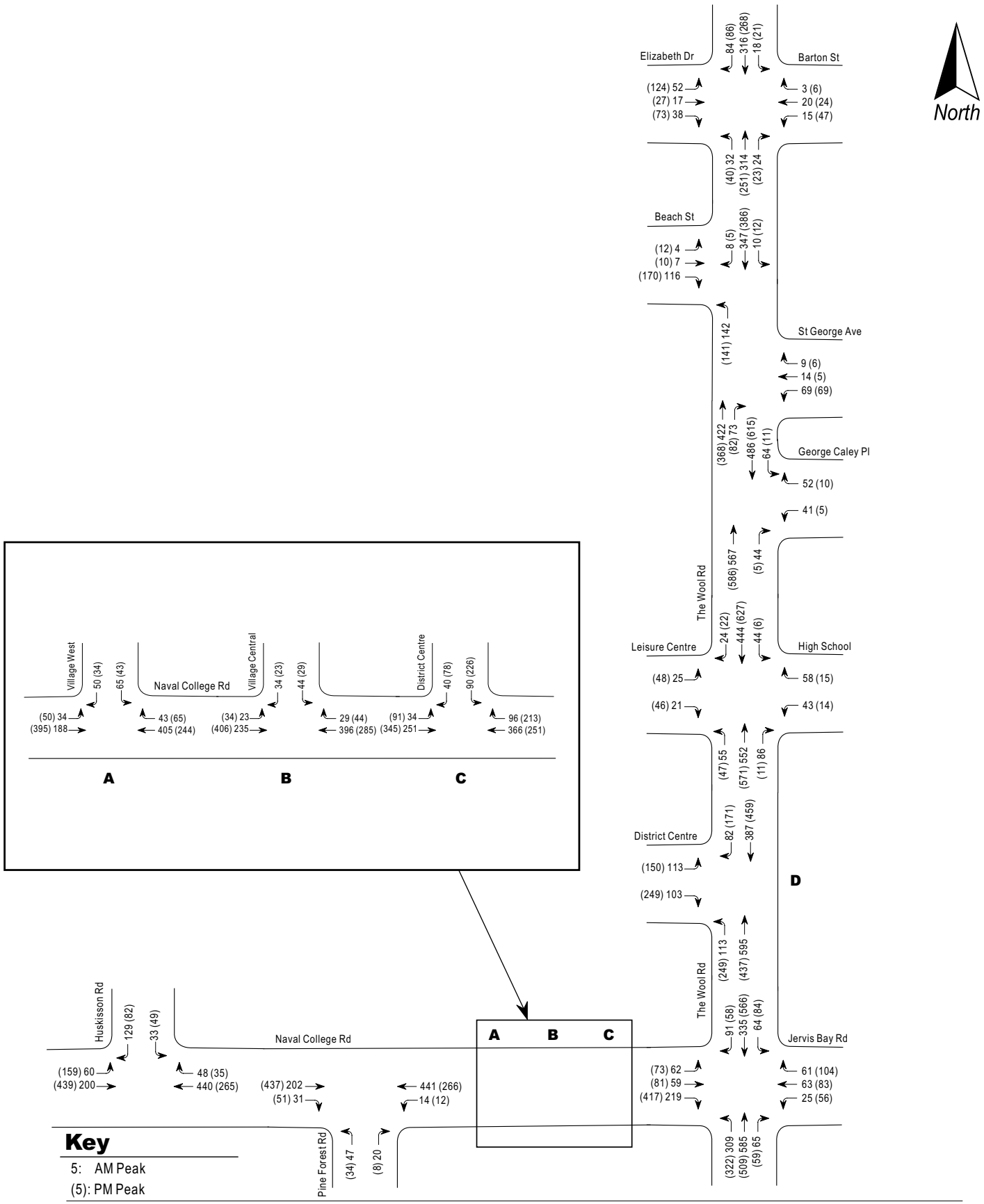
Figure 8

Filename: 032132di29.ai

Date: 29 November 2005

FUTURE 2016 THURSDAY (PEAK HOUR) TRAFFIC FLOWS (SEASONAL DAY)

VINCENTIA DEVELOPMENT



MASSON | WILSON | TWINEY
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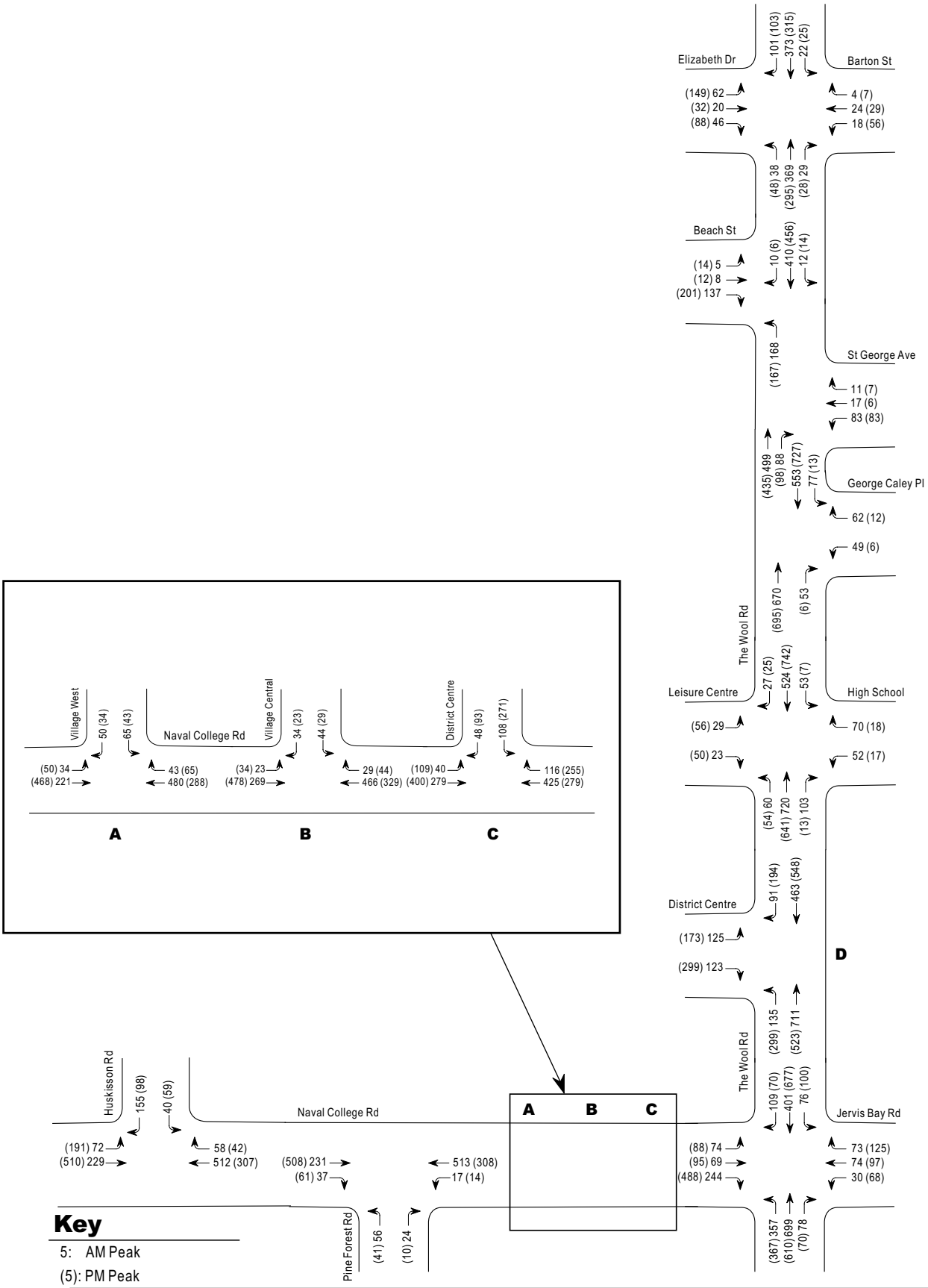
Figure 9

Filename: 032132di22.ai

Date: 29 November 2005

FUTURE 2016 THURSDAY (PEAK HOUR) TRAFFIC FLOWS (SEASONAL DAY)

VINCENTIA DEVELOPMENT



Key

5: AM Peak

(5): PM Peak

MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

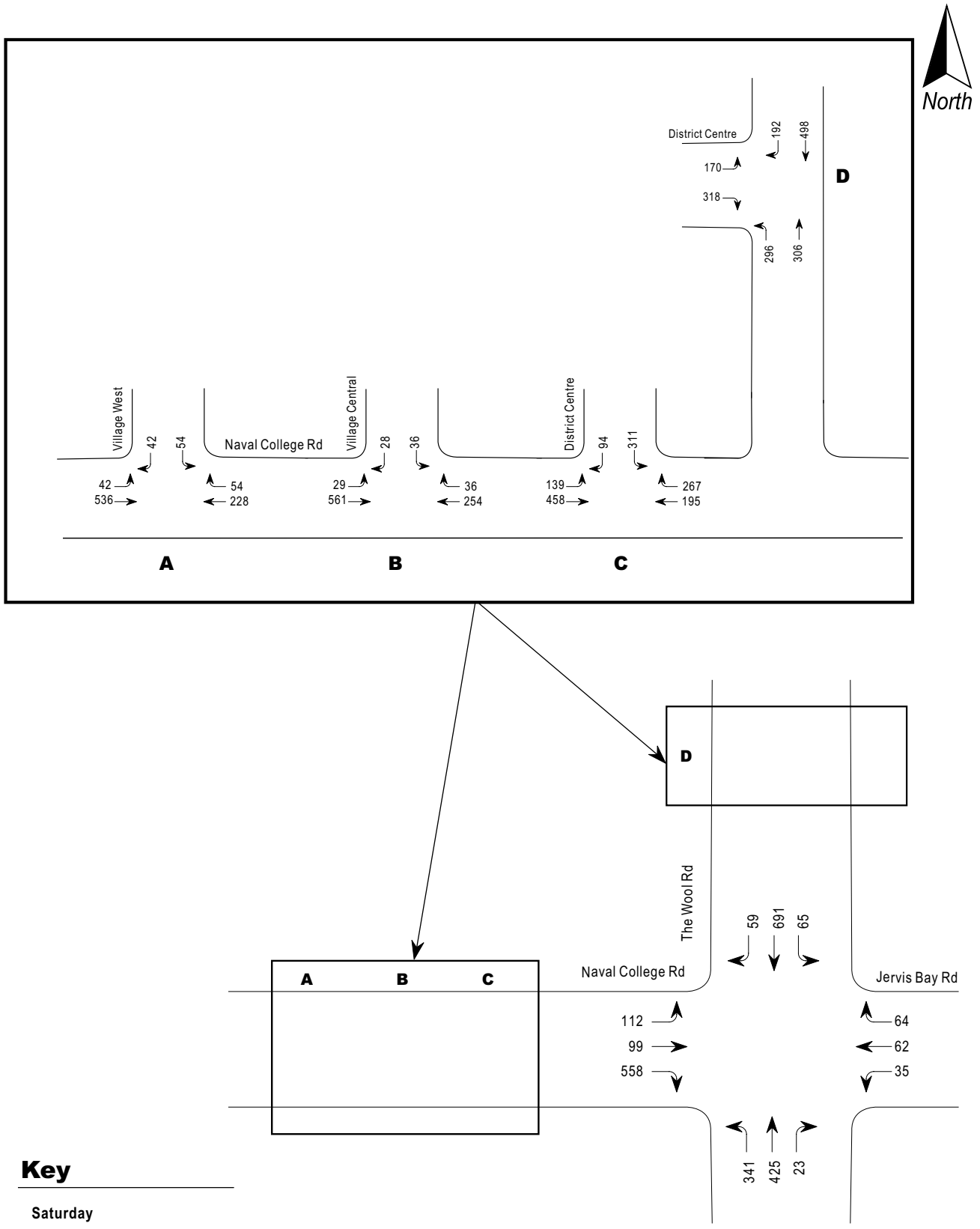
Figure 10

Filename: 032132di23.ai

Date: 29 November 2005

FUTURE 2016 SATURDAY (PEAK HOUR) TRAFFIC FLOWS (TYPICAL DAY)

VINCENTIA DEVELOPMENT



Key

Saturday

5 Peak 11am-12noon

MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

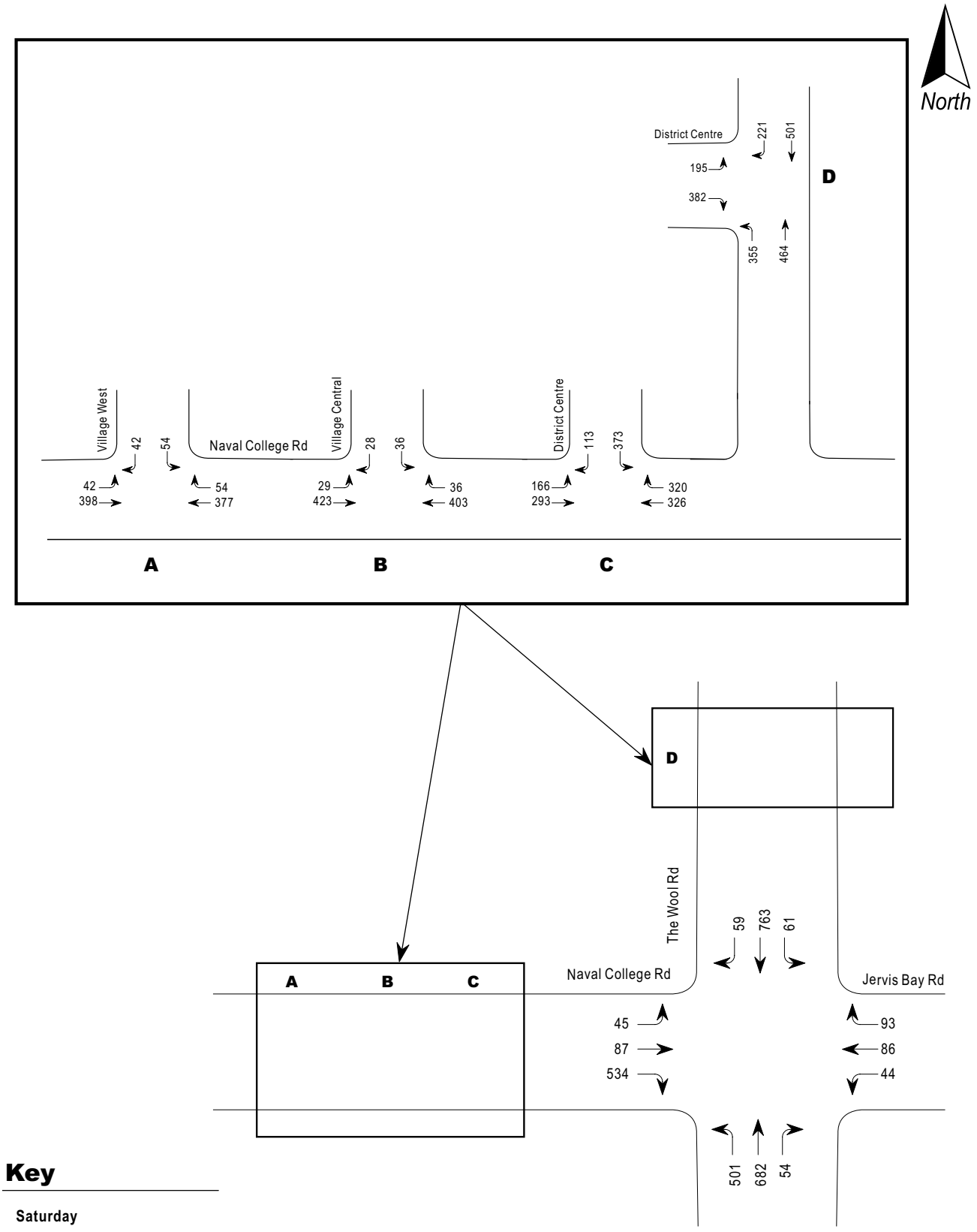
Figure 11

Filename: 032132di24.ai

Date: 29 November 2005

FUTURE 2016 SATURDAY (PEAK HOUR) TRAFFIC FLOWS (SEASONAL DAY)

VINCENTIA DEVELOPMENT



Key

Saturday

5 Peak 11am-12noon

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Figure 12

Filename: 032132di25.ai

Date: 29 November 2005

Appendix A - MWT *Traffic Forecasting Report* (November 2005)

TRAFFIC FORECASTING REPORT

Development Masterplan for Land on The Wool Road and Naval College Road, Vincentia

November 2005

Prepared for
Stockland Trust

MASSON | *WILSON* | **TWINEY**

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Contents

1. Introduction 1

2. Existing and Background Traffic 2
2.1 Existing Traffic Conditions 2
2.1.1 Seasonal patterns 2
2.2 Future Traffic Conditions without the District Centre 2
2.2.1 Future Background Traffic 2
2.2.2 Leisure Centre 5
2.2.3 High School 5
2.2.4 Total Future Background Traffic 5
2.3 Population Growth 5

3. Proposed Development 7
3.1 Traffic Generation 7
3.1.1 Residential Village 7
3.1.2 Civic Precinct 7
3.1.3 District Centre 7
3.2 Traffic Distribution 10
3.2.1 Residential Village 10
3.2.2 Civic Precinct 11
3.2.3 District Centre 11
3.3 Future Traffic Flows 12
3.4 Future Intersection Operations 16

Appendix A - Existing Seasonal Traffic Volumes A-1

Appendix B - Future Traffic Volumes (without District Centre) B-1

Appendix C - Calculation of Intercepted Trips C-1

Appendix D - Future Traffic Volumes (with District Centre) D-1

1. Introduction

This document presents amended traffic forecasts from the Masson Wilson Twiney Masterplan Traffic Report *Development Masterplan for Land on The Wool Road and Naval College Road, Vincentia* (February 2005).

The proposed Masterplan development is located north of Naval College Road and west of The Wool Road in Vincentia (as shown in **Figure 1**) and comprises of:

- 648 dwellings – 260 dwellings in the east village and 388 in the west village,
- a district centre including a mix of retail, bulky goods retail, commercial and community use space totalling about 32,805 sqm; and
- 160 multi dwelling units at the civic precinct near the leisure centre.

Expansion of the leisure centre is also proposed by Council.

Four new access points are proposed to serve the development, three on Naval College Road, west of The Wool Road, two serving the residential villages and one serving the district centre. The fourth access is proposed on The Wool Road, north of Naval College Road/Jervis Bay Road. This will service the district centre and provide access through to the residential villages. It is also proposed that the existing access into the leisure centre be closed and a new access be provided opposite the high school access to form a four way intersection.

At the request of Council, MWT were requested to revisit the projected traffic volumes presented in the Masterplan report and revise the assumptions made in making those projections. This report therefore presents step-by-step the new assumptions being made to determine future traffic volumes on the surrounding road network and the revised traffic impact assessment.

The structure of the report is as follows:

- Chapter 2 provides the existing traffic volumes and describes the background traffic growth.
- Chapter 3 presents the traffic generation calculations for the proposed development.
- Chapter 4 presents revised intersection analysis calculations.

A separate MWT report entitled *Proposed Vincentia District Centre, Report on Road Improvement Requirements*, November 2005 has been prepared to examine the implications of these forecasts.

2. Existing and Background Traffic

2.1 Existing Traffic Conditions

To determine the base year traffic volumes, traffic counts were previously conducted on Thursday 25th September, 2003 at the following intersection:

- Naval College Road/Huskisson Road;
- Naval College Road/The Wool Road/Jervis Bay Road;
- The Wool Road/Basin Leisure Centre;
- The Wool Road/High School;
- The Wool Road/George Caley Place (Primary School);
- The Wool Road/Beach Street/St. George Avenue; and
- The Wool Road/Elizabeth Street/Barton St.

From the counts, the morning peak was determined to be from 8:00 am to 9:00 am and the evening peak from 4:00 pm to 5:00 pm. Following consultation with Council's traffic engineer some of the counts were adjusted upwards to reflect perceived low volumes at certain locations.

A traffic check count was also conducted at Naval College Road/The Wool Road on Saturday 4 October 2003 (Labour Day weekend in NSW), Saturday 29 May 2004 and Saturday 17 January 2004. The count conducted in May was considered to be on the low side. Therefore typical Saturday volumes were estimated based on an actual January peak summer traffic count.

Existing typical Thursday AM and PM peak hour traffic flows are presented in **Figure 2** and Saturday typical peak hour flows are presented in **Figure 3**.

2.1.1 Seasonal patterns

The Masterplan Traffic Report concluded that the typical holiday traffic volume is approximately 20% greater than typical non-holiday traffic. A 20% growth factor was thus applied to the Thursday morning and evening peak hour traffic volumes to provide a reasonable basis for assessment of peak holiday traffic conditions.

Existing seasonal Thursday AM and PM peak hour traffic flows and Saturday seasonal peak hour traffic flows are presented in **Appendix A**.

2.2 Future Traffic Conditions without the District Centre

2.2.1 Future Background Traffic

The Shoalhaven City Council *Jervis Bay Settlement Strategy*, January 2003 provided projections in potential dwelling capacity for the townships in the Bay and Basin area. As the increase in traffic, within the vicinity of the development, is likely to occur in line with population and dwelling increases, the dwelling potential projections given in the Strategy were used to growth background traffic surrounding the development. The "existing

year", as presented in the Strategy, was assumed to be 2001 and the future year 2016 or beyond. The dwelling potential throughout the Bay and Basin area are given in Table 2-1.

Table 2-1 – Development Potential of the Bay and Basin Area

Direction of Travel	Township	Existing	Dwellings	Future	Dwellings	Total Dwelling Capacity
		No.	*%*	*No.*	*%*	
North	Woollamia	61	0.7%	41	1.2%	102
North	Huskisson	543	6.5%	174	4.9%	717
North	Vincentia	1868	22.4%	320	9.0%	2188
South	Old Erowal Bay	427	5.1%	428	12.0%	855
South	Sanctuary Point	3282	39.4%	1260	35.4%	4542
South	St. Georges Basin	788	9.4%	954	26.8%	1742
South	Basin View	609	7.3%	214	6.0%	823
South	Tomerong	121	1.5%	89	2.5%	210
East	Hyams Beach	220	2.6%	11	0.3%	231
East	Erowal Bay/Wrights Beach	420	5.0%	70	2.0%	490
Total		**8339**	**100%**	**3561**	**100%**	**11900**

Source: Shoalhaven City Council (January 2003) *Jervis Bay Settlement Strategy*

Proportional dwelling growth in each township was used as a factor by which to estimate growth in background traffic on roads near the District Centre.

The growth was firstly determined for 2016 and 2011 was then interpolated from the 2016 results i.e. 2011 was assumed to be 66% of 2016.

The potential exists for an additional 494 dwellings (20.5% increase) to/from the North (Huskisson and Vincentia); thus traffic volumes turning left on the west approach (Naval College Road) and right on the north approach (The Wool Road) were increased by 20.5%. The 2011 scenario assumed 13.5% growth.

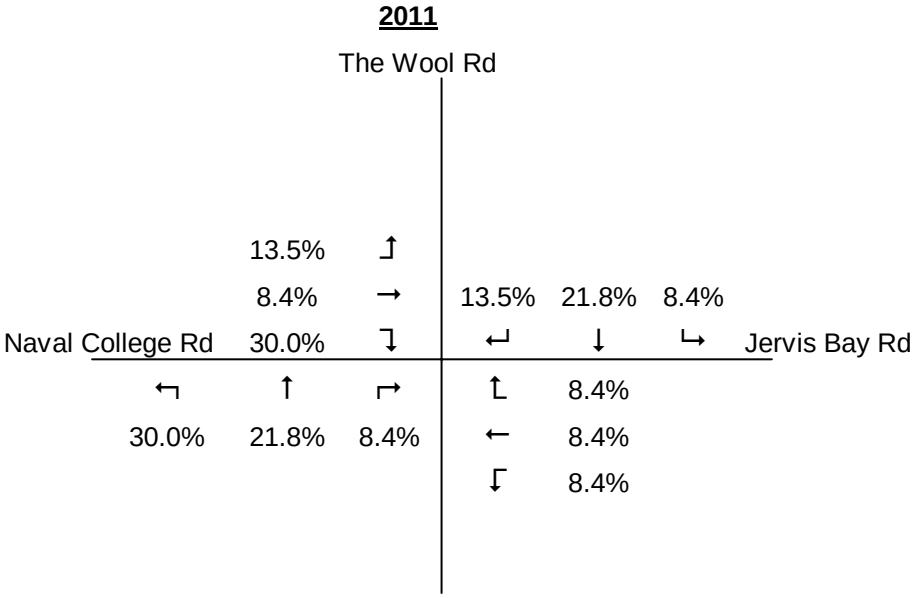
Similarly an additional 81 dwellings (12.7% increase) is predicted to/from the East (Hyams Beach, Erowal Bay and Wrights Beach). Therefore all traffic volumes on the east approach, the south approach right, north approach left and west approach through volumes were increased by 12.7%. The 2011 scenario assumed 8.4% growth.

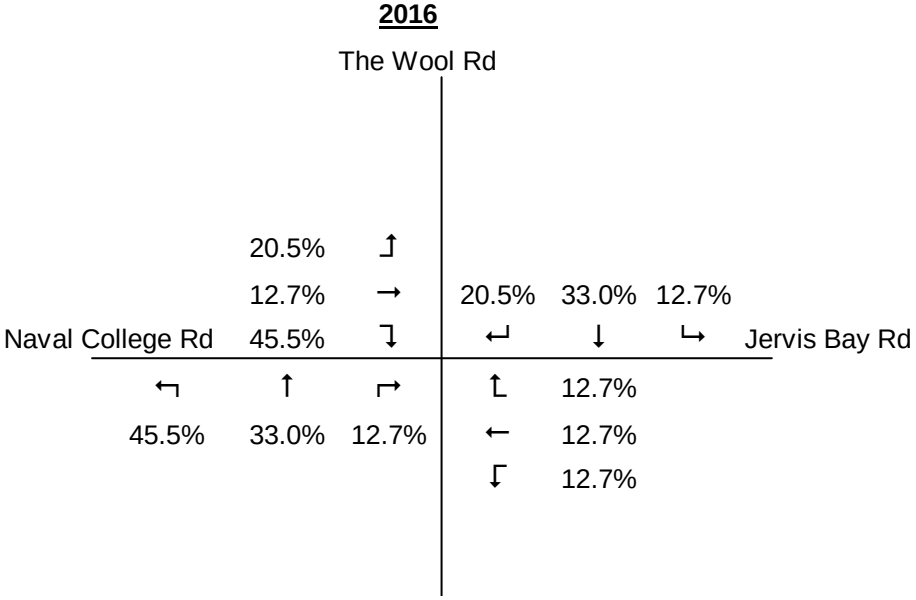
A total of 1688 potential dwellings (45.5%) are predicted for the South (Old Erowal Bay and Sanctuary Point), as such traffic volumes on left turns from the south approach and right turns from the west approach were growthed by 45.5%. The 2011 scenario assumed 30.0% growth.

Finally, the through traffic volumes from the north and south approaches were increased by 33% (the average increase of the combined north and south dwelling increases). The 2011 scenario assumed 21.8% growth.

These assumptions are summarised in the chart below.

2011 and 2016 Background Traffic Growth





North-south through movements volumes at each intersection along The Wool Road were consequently growthed and distributed. At The Wool Road/Beach Street intersection trips were distributed pro rata with existing counts (25% to/from Beach Street and 75% to/from The Wool Road in the AM peak and in the PM peak 30% and 70% to/from Beach Street and The Wool Road respectively). Similarly east-west through movements along Naval College Road to Huskisson Road were growthed accordingly.

These increases were applied to the existing Thursday AM and PM peak hour and Saturday peak hour counts to determine the increase in traffic from 2003 to 2011 and to 2016. Similarly they were applied to the existing Thursday AM and PM peak hour and Saturday peak hour seasonal traffic flows to determine 2011 and 2016 traffic flows.

2.2.2 Leisure Centre

As discussed in the Masterplan Traffic Report the expansion of the leisure centre is likely to increase traffic at the leisure centre by 50%. A survey of the leisure centre determined that it generated about 45 vehicle trips per hour in the AM peak and 80 in the evening peak, and it is likely that there will be seasonal variations on these figures.

This 50% traffic growth was accounted for in the future background traffic growth discussed above; however it was necessary to reflect the turning movements into and out of the Leisure Centre.

It was assumed that the 50% growth rate would be for 2016 and that 30% growth would be appropriate for 2011.

2.2.3 High School

It is anticipated that traffic to/from the High School will increase in line with population increases in the surround townships. As with the leisure centre, it was assumed that the growth was accounted for, in the future background traffic growth, however it was necessary to reflect turning movements into/out of the high school. In this regard turning movements in or out of the high school from or to the north (Vincentia, Huskisson and Woollamia) were increased by 22%, and to/from the south (remaining Bay and Basin areas) were increased by 50%.

It was assumed that the 22% and 50% growth rates would be for 2016 and that 14% and 33% growth would be appropriate for 2011.

2.2.4 Total Future Background Traffic

Combining the future background traffic, leisure centre traffic and high school traffic, the resulting future traffic volumes without development for Thursday AM and PM peak hours and Saturday peak hour for typical and seasonal conditions are provided in **Appendix B**.

2.3 Population Growth

An estimate of population growth in the townships was needed in order to determine the distributional spread of future District Centre traffic. The *Jervis Bay Settlement Strategy* reports aggregate population projections in the area to be those shown in Table 2-2.

Table 2-2 – Population Projections

Year	1996	2001	2006	2011	2016
Volume 1*	14,217	16,248	19,190	22,180	25,240
Volume 2**	14,217	16,245	18,910	21,660	24,520

Source: Shoalhaven City Council (January 2003) *Jervis Bay Settlement Strategy*
Notes: * Assumes net migration 1986-1996
** Assumes net migration 1991-1996

A combination of the potential dwelling capacity in each township and the total population projections was used as the basis to determine the distribution of future population. In this regard a direct relationship between the dwelling capacity of the townships and the overall total population for the area was assumed. Therefore the future growth in population was calculated based on the percentage distribution of future dwellings and the projected future total population for the area. For the purpose of this assessment the higher population projection has been used and it was assumed that the potential future dwellings are

estimated for 2016. Also, it was deemed appropriate to include the townships of Sussex Inlet and the rural hinterland as these towns would fall into the catchment of the District Centre.

The anticipated population growth in each township is indicated below in Table 2-3 and was used to determine the distribution of future district centre traffic, which will be discussed below.

Table 2-3 – Anticipated Future Population in each Township

Direction of Travel	Township	Existing Population*	Estimated Population Increase	Estimated Future Population
North	Woollamia	159	104	263
North	Huskisson	775	439	1214
North	Vincentia	2534	808	3342
South	Old Erowal Bay	914	1081	1995
South	Sanctuary Point	5866	3182	9048
South	St. Georges Basin	1756	2409	4165
South	Basin View	1206	540	1746
South	Tomerong	210	225	435
South	Sussex Inlet	2106	1500	3606
East	Hyams Beach	130	28	158
East	Erowal Bay/Wrights Beach	592	177	769
West	Rural	2106	0	2106
Total		**18354**	**11992**	**30346**

Notes: * Source: Shoalhaven City Council (January 2003) *Jervis Bay Settlement Strategy*

3. Proposed Development

3.1 Traffic Generation

The trip generation assumptions made in the Masterplan report for the residential components of the development have been accepted by Council and are summarised here for ease of reference. The revised assumptions for the district centre are described below.

3.1.1 Residential Village

The RTA vehicle trip rate of 0.85 per dwelling was applied to determine the trip generation for the 648 residential dwellings. This results in about 550 vehicle trips per peak hour. Assuming current travel patterns continue it is estimated that approximately 150 of these trips would be between Princes Highway and Nowra (27%) and the remaining 400 confined to the Bay and Basin Area, of which approximately 150 would be internal to the Masterplan area.

3.1.2 Civic Precinct

As stated in the Masterplan report, the adaptable housing residential component of the development in the Civic Precinct is expected to generate about 50 vehicle trips per hour.

3.1.3 District Centre

Development of the District Centre is expected to take place over 7 staging periods as shown in Table 3-1.

Table 3-1 – Proposed District Centre

Stage / Use	1	1a	2	2a	3	3a	4	Total at end of Stage 2a	Total at end of Stage 4
Discount Dept. Store	5500							5500	5500
Supermarket 1	3800							3800	3800
Supermarket 2							3200	0	3200
Commercial/Library		1950						1950	1950
Commercial				1900				1900	1900
F & B Restaurant			650					650	650
Medical Centre/Police			1000			1300		1000	2300
Child Care				600				600	600
Nursery			400			*	*	400	*
Petrol Station	350							350	350
Pad Sites					200			0	200
Bulky Goods					4800			0	4800
Food Court	310							310	310
Specialty Retail	5595						1650	5595	7245
Total	**15555**	**1950**	**2050**	**2500**	**5000**	**1300**	**4850**	**22055**	**32805**

NOTES: * Nursery terminated in Stage 3a

In light of the staging of the development Council has requested traffic analysis at the end of Stage 2a and at ultimate development. It has also requested further details on the trip generation rate assumptions. These are described below.

For the purposes of the trip generation calculations the RTA rate for a shopping centre has been used to calculate the number of trips generated by the total space comprised of the discount department store, supermarkets, restaurant, pad sites, food court and specialty retail. The Thursday AM rate is expected to be approximately one third of the PM rate.

Based on RTA guidelines the Thursday AM and PM peak hour trip generation rates will reduce at the ultimate development stage because the overall floor space of the shopping centre then falls into the next category of 20,000 to 30,000 sqm. This reflects customers being able to undertake more activities on an individual trip, thus reducing the number of trips generated per square metre. The adopted traffic generation rates are provided in Table 3.2 and 3.3.

The trip generation rates applied to the bulky retail have been determined from RTA surveys.

It has been assumed that the petrol station would capture trips already at the shopping centre, rather than purpose trips; therefore there are no separate trip generation calculations for the petrol station.

There is no RTA rate for police or library; therefore rates for commercial space have been applied. In addition the medical centre/police use has been separated because different trip rates apply. It has been assumed that there will be approximately 400sqm of police space. There is no trip rate for medical centre on Saturday; therefore half of the RTA's surveyed Monday evening peak (the busiest time of the week) rate has been applied. In this regard, it is expected that not all medical services would be available on a Saturday.

An assumption has also been made that the child care centre will function as a long day care centre to cater for approximately 50 children, based on 600 sqm.

For all other uses the standard RTA rate has been applied.

It has been assumed that the primary commercial use and child care centre are closed on Saturday.

Given that there will be some shared retail and non-retail trips during shopping centre peak, it has been assumed that 62% of all non-retail trips during the Thursday PM peak and 46% of Saturday AM peak are shared trips in Stage 2a and 48% of all non-retail trips during the Thursday PM peak and 46% of Saturday AM peak are shared trips at ultimate development. These discount rates have been calculated as follows based on the trip rate of the size of the shopping centre at that stage of development compared to the highest rate for a shopping centre 0-10,000 sqm.

Thursday PM Peak

Stage 2A discount = $\frac{7.6}{12.3}$ (Rate for 10,000-20,000 sqm) / (Rate for <10,000 sqm) = 62%

Ultimate Development discount = $\frac{7.5}{16.3}$ (Rate for 20,000-30,000 sqm) / (Rate for <10,000 sqm) = 46%

Saturday Peak

Stage 2A discount = 5.9 (Rate for 10,000-20,000 sqm)
12.3 (Rate for <10,000 sqm) = 48%

Ultimate Development discount = 7.5 (Rate for 20,000-30,000 sqm)
16.3 (Rate for <10,000 sqm) = 46%

These discounts are considered appropriate because, as indicated above, as a centre grows there is increasing potential for multi-purpose trips. In addition increased employment provides a customer base whose trips have already been accounted for in retail trip generation rates.

The assumed trip rates and resulting vehicle trips for Stage 2A and ultimate development for Thursday AM and PM peaks and Saturday AM peak are presented in Table 3-2 and Table 3-3 respectively.

Table 3-2 – Trip Generation at Stage 2a

	Retail	**Nursery**	**Comm./ Library**	**Comm.**	**Medical Centre**	**Police**	**Child Care Centre**	**Total Vehicle Trips**
Sqm/Unit	15855	400	1950	1900	600	400	600 (50 children)	
Thursday AM								
Rate/100sqm	*2.5*	*3.4*	*2.0*	*2.0*	*8.8*	*2.0*	*0.4/child*	
Original Vehicle Trips	396	14	39	38	53	8	20	**568**
Thursday PM								
Rate	*7.6*	*3.4*	*2.0*	*2.0*	*8.8*	*2.0*	*0.4/child*	
Original Vehicle Trips	1205	14	39	38	53	8	20	1376
Discounted Vehicle Trips[1]	1205	14	24	24	33	5	12	**1316**
Saturday AM								
Rate	*7.5*	*3.4*	*2.0*		*4.4*	*2.0*		
Original Vehicle Trips	1189	14	39	Closed	26	8	Closed	1276
Discounted Vehicle Trips[2]	1189	14	18	Closed	12	4	Closed	**1236**

[1] Non-retail trips discounted by 62%
[2] Non-retail trips discounted by 46%

Table 3-3 – Trip Generation at Ultimate Development

	Retail	Bulky Retail	Comm./ Library	Comm.	Medical Centre	Police	Child Care Centre	Total Vehicle Trips
Sqm/Unit	20905	4800	1950	1900	1900	400	600 (50 children)	
Thursday AM								
Rate/100sqm	*2.0*	*0.8*	*2.0*	*2.0*	*8.8*	*2.0*	*0.4/child*	
Original Vehicle Trips	418	38	39	38	167	8	20	**729**
Thursday PM								
Rate	*5.9*	*2.5*	*2.0*	*2.0*	*8.8*	*2.0*	*0.4/child*	
Original Vehicle Trips	1233	120	39	38	167	8	20	1626
Discounted Vehicle Trips[3]	1233	120	19	18	80	4	10	**1484**
Saturday AM								
Rate	*7.5*	*4.5*	*2.0*		*4.4*	*2.0*		
Original Vehicle Trips	1568	216	39	Closed	84	8	Closed	1914
Discounted Vehicle Trips[3]	1568	216	18	Closed	38	4	Closed	**1844**

3.2 Traffic Distribution

For this analysis traffic impacts have been assessed for Thursday morning and evening and Saturday peak hours for a typical day and a high season day at Stage 2a of the development and upon completion of the development.

For simplicity in matching the staging of development with available data on population and dwelling projections, Stage 2a was assumed to be 2011 and ultimate development to be 2016.

3.2.1 Residential Village

As described in Section 3.1.1 above the residential village of 650 dwellings is expected to generate 550 trips, of which 400 trips would be within the Bay and Basin Area. It has been assumed that distribution of trips in the AM is 40% in and 60% out and in the PM, 60% in and 40% out. On Saturday it is assumed to be 50% in and 50% out.

Of the total traffic generated by the residential village the assignments to the road network have been assumed to be as follows:

- Internal – 27% (150 trips)
- West – 27% (150 trips)
- North-South-East – 46% (250 trips)

Of the external traffic the trip distribution assumed was as follows:

- North – 20%
- South – 40%
- East – 5%
- West – 35%

[3] Non-retail trips discounted by 48%

Immediate access to the residential village is provided at:

- Access A (West Village Access on Naval College Road);
- Access B (East Village Access on Naval College Road); and
- Access D (Shared residential/District Centre access along The Wool Road).

It was therefore assumed that all trips to/from the north would enter/exit at Access D and all other trips would access at A or B. Given that the proportion of lots in the West and East Villages are approximately 60:40, it was assumed that 60% of total trips to/from the south, east and west would enter/exit at Access A, at the West Village and the remaining 40% would enter/exit at Access B, at the East Village.

There has been no seasonal adjustment because it is expected that this development will be the primary residence for its occupants and as the development is anticipated to be completed by 2011, the 2016 scenario will have the same volumes as 2011.

3.2.2 Civic Precinct

The Civic Precinct comprising of 160 adaptable dwellings is estimated to generate 50 trips during the peak hours. It has been assumed that the distribution of trips in the AM is 30% in and 70% out and in the PM, 70% in and 30% out. On Saturday it is assumed to be 50% in and 50% out.

Of the total traffic generated by the Civic Precinct the assignments to the road network have been assumed to be as follows:

- To/from District Centre – 25%
- To/from Vincentia – 25%
- To/from Erowal Bay – 5%
- To/from Rural Hinterland – 5%
- To/from Sanctuary Point – 40%

All traffic enters and exits the Civic Precinct at the new access into the leisure centre, which will form a four-way intersection with the High School.

As with the residential village there is no seasonal adjustment and the development is anticipated to be completed by 2011, thus the volumes for 2016 are the same as for 2011.

3.2.3 District Centre

Firstly, it has been assumed that 20% of traffic generated by the District Centre will come from traffic already in the network. This is in accordance with RTA guidelines. The number of trips intercepted to enter/exit on either The Wool Road or Naval College Road was calculated based on the background traffic volumes on these routes. The calculations are summarised in **Appendix C**. In addition it has been assumed that there is a 50% in and 50% out distribution.

To distribute the remaining District Centre traffic, it has been assumed that the District Centre will have two catchment areas, primary and secondary. It is anticipated that 100% of the population in the primary catchment will use the District Centre; these include the following townships and the direction of travel:

- North – Vincentia, Huskisson, Woollamia
- South – Old Erowal Bay to Basin View

- East – Erowal Bay/Wrights Beach and Hyams Beach
- West – Rural hinterland

From the secondary catchment i.e. Sussex Inlet and surrounding areas, it is anticipated that the population will utilise the District Centre only to the extent of 50% of the trip making frequency of residents in the primary catchment. These residents would most likely do a greater proportion of their convenience shopping locally. These trips will most likely be to and from the south along The Wool Road.

From Table 2-3 the distribution of District Centre traffic in 2016 is determined to be as follows:

- North – 12%
- South – 74%
- East – 2%
- West – 12%[4]

Taking the 2011 population projection for the area and applying the same distribution of dwelling increase to each township (as for 2016 scenario) the following distribution of District Centre traffic in 2011 is determined to be as follows:

- North – 10%
- South – 71%
- East – 2%
- West – 17%[4]

It has been assumed that all traffic from the North enters at Access D on The Wool Road, all traffic from the West enters at Access C on Naval College Road and all traffic from the South and East enters Access C and D equally (50:50).

A 20% increase in the District Centre traffic for a typical day has been added to account for seasonal increases in traffic.

3.3 Future Traffic Flows

The future traffic flows in 2011 and 2016 for Thursday AM and PM and Saturday peaks for a typical day and seasonal day, including traffic generated by the residential village, the Civic Precinct, the District Centre (including 20% intercepted traffic), in addition to background traffic growth is presented in **Appendix D**.

The two-way traffic flows at key points are presented in Table 3-4, Table 3-5 and Table 3-6. Two-way traffic flows at key points without the District Centre, residential village and the Civic Precinct and for the existing base years are also presented here.

[4] It was later considered that the percentage distribution of traffic to/from the west was too high and thus re-examined in preparation of the Masterplan Report (Masson Wilson Twiney (January 2006) *Proposed Vincentia Coastal Village and District Centre*). The revised trip distribution is discussed in chapter 4 of the January 2006 report.

Table 3-4 - Future Traffic Volumes Thursday AM Peak

Road	Location	Existing		Future 2011 – Stage 2a				Future 2016 – Ultimate Development			
				Without District Centre		With District Centre		Without District Centre		With District Centre	
		Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal
Naval College Rd	West of Huskisson Rd	533	640	600	720	780	907	634	761	830	967
Naval College Rd	West of Pine Forest Rd	425	510	492	590	672	777	526	632	722	837
Naval College Rd	West of Access A[4]	381	457	448	537	628	725	482	579	678	785
Naval College Rd	West of Access B[4]	368	441	435	521	638	732	469	563	688	792
Naval College Rd	West of Access C[4]	354	425	421	505	642	733	455	546	691	792
Naval College Rd	West of The Wool Rd	354	425	421	505	720	827	455	546	803	927
Jervis Bay Rd	East of The Wool Rd	272	326	295	354	323	383	307	368	338	401
The Wool Rd	North of Naval College Rd	786	943	933	1119	1073	1283	1008	1210	1198	1433
The Wool Rd	South of Naval College Rd	778	934	948	1138	1355	1589	1036	1244	1538	1809
The Wool Rd	North of Access D[5]	773	928	933	1119	1079	1271	1008	1210	1178	1390
The Wool Rd	South of Leisure Centre[6]	755	906	902	1082	1105	1359	977	1173	1200	1482
The Wool Rd	North of High School	731	877	878	1053	1053	1298	953	1144	1146	1422
The Wool Rd	South of High School[6]	758	910	905	1085			980	1176		
The Wool Rd	North of George Caley Pl	784	941	931	1117	1060	1253	1006	1208	1151	1363
The Wool Rd	South of George Caley Pl	753	904	900	1080	1029	1216	975	1171	1120	1325
The Wool Rd	South of Beach St	802	962	949	1139	1078	1275	1024	1229	1169	1384
The Wool Rd	South of Elizabeth Dr.	464	557	574	689	671	791	631	757	739	873
Huskisson Rd	North of Naval College Rd	270	324	270	324	270	324	270	324	270	324
Pine Forest Rd	South of Naval College Rd	112	134	112	134	112	134	112	134	112	134
Leisure Centre	West of The Wool Rd	45	54	65	78	115	128	75	89	125	139
High School	East of The Wool Rd	157	188	205	246	205	246	230	277	230	277
George Caley Pl	East of The Wool Rd	201	241	201	241	201	241	201	241	201	241
Beach St	West of The Wool Rd	199	239	236	283	268	317	255	306	291	344
Elizabeth Drive	West of The Wool Rd	243	292	243	292	243	292	243	292	243	292

[4] Existing counts at Access A have been estimated based on the total volumes to/from the Naval College Rd/Pine Forest Rd intersection, at Access C they are based on total volumes to/from the Naval College Rd/The Wool Rd and at Access B they are based on the average total volumes to/from Access A and C intersections.

[5] Existing counts estimated based on the average of total volumes to/from Naval College Rd/The Wool Rd and The Wool Rd/Leisure Centre intersections, adjacent to Access D.

[6] In future years with the District Centre, this intersection becomes a four-leg intersection to form The Wool Rd/Leisure Centre/High School intersection.

Table 3-5 - Future Traffic Volumes Thursday PM Peak

Road	Location	Existing		Future 2011 – Stage 2a				Future 2016 – Ultimate Development			
				Without District Centre		With District Centre		Without District Centre		With District Centre	
		Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal
Naval College Rd	West of Huskisson Rd	580	696	645	773	896	1047	678	813	946	1106
Naval College Rd	West of Pine Forest Rd	423	508	488	585	739	859	521	625	789	918
Naval College Rd	West of Access A[4]	358	430	423	507	674	781	456	547	724	840
Naval College Rd	West of Access B[4]	359	430	423	508	699	805	456	548	748	865
Naval College Rd	West of Access C[4]	359	431	424	508	727	836	457	548	765	881
Naval College Rd	West of The Wool Rd	359	431	424	508	950	1103	457	548	1035	1205
Jervis Bay Rd	East of The Wool Rd	375	450	406	488	447	532	423	507	466	555
The Wool Rd	North of Naval College Rd	767	920	904	1085	1272	1522	975	1170	1394	1668
The Wool Rd	South of Naval College Rd	741	889	900	1079	1749	2062	982	1178	1930	2280
The Wool Rd	North of Access D[5]	784	940	904	1085	1130	1333	975	1170	1217	1437
The Wool Rd	South of Leisure Centre[6]	802	962	939	1127	1223	1410	1010	1212	1315	1517
The Wool Rd	North of High School	793	952	930	1116	1255	1381	1001	1202	1288	1489
The Wool Rd	South of High School[6]	797	956	934	1121			1005	1206		
The Wool Rd	North of George Caley Pl	796	955	933	1120	1134	1343	1004	1205	1221	1447
The Wool Rd	South of George Caley Pl	785	942	922	1107	1123	1329	993	1192	1210	1434
The Wool Rd	South of Beach St	791	949	928	1114	1129	1337	999	1199	1216	1441
The Wool Rd	South of Elizabeth Dr.	398	478	494	593	640	755	544	653	702	829
Huskisson Rd	North of Naval College Rd	325	390	325	390	325	390	325	390	325	390
Pine Forest Rd	South of Naval College Rd	105	126	105	126	105	126	105	126	105	126
Leisure Centre	West of The Wool Rd	77	92	101	121	151	171	113	136	163	186
High School	East of The Wool Rd	36	43	44	52	44	52	46	55	46	55
George Caley Pl	East of The Wool Rd	31	37	31	37	31	37	31	37	31	37
Beach St	West of The Wool Rd	222	266	263	316	318	376	284	341	343	406
Elizabeth Drive	West of The Wool Rd	374	449	374	449	374	449	374	449	374	449

Table 3-6 - Future Traffic Volumes Saturday Peak

Road	Location	Existing		Future 2011 – Stage 2a				Future 2016 – Ultimate Development			
				Without District Centre		With District Centre		Without District Centre		With District Centre	
		Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal	Typical	Seasonal
Naval College Rd	West of Huskisson Rd										
Naval College Rd	West of Pine Forest Rd										
Naval College Rd	West of Access A[4]					748	700			847	859
Naval College Rd	West of Access B[4]					772	724			871	883
Naval College Rd	West of Access C[4]					817	739			886	898
Naval College Rd	West of The Wool Rd[7]	424	402	504	436	1005	1001	545	524	1231	1311
Jervis Bay Rd	East of The Wool Rd	265	328	287	355	326	398	299	370	348	424
The Wool Rd	North of Naval College Rd	697	833	824	903	1168	1310	889	1073	1418	1702
The Wool Rd	South of Naval College Rd	678	913	833	989	1634	1914	913	1221	2073	2578
The Wool Rd	North of Access D[5]	697	833	824	903	1057	1141	889	1073	1166	1381
The Wool Rd	South of Leisure Centre[6]	699	833	826	903	1107	1167	891	1073	1235	1407
The Wool Rd	North of High School										
The Wool Rd	South of High School										
The Wool Rd	North of George Caley Pl										
The Wool Rd	South of George Caley Pl										
The Wool Rd	South of Beach St										
The Wool Rd	South of Elizabeth Dr.										
Huskisson Rd	North of Naval College Rd										
Pine Forest Rd	South of Naval College Rd										
Leisure Centre[8]	West of The Wool Rd	77	92	101	121	151	172	111	132	161	182
High School	East of The Wool Rd										
George Caley Pl	East of The Wool Rd										
Beach St	West of The Wool Rd										
Elizabeth Drive	West of The Wool Rd										

[7] Seasonal Saturday traffic volumes on the Naval College Rd approach to The Wool Rd were lower than on typical days. For all other approaches at the intersection seasonal volumes were higher than typical days.

[8] Note traffic volumes at the Leisure Centre on a Saturday peak are assumed to be the same as Thursday PM peak.

3.4 Future Intersection Operations

Intersection analysis at surrounding intersections for future scenarios with and without the District Centre for 2011 and 2016, for Thursday AM and PM and Saturday peaks was undertaken using SIDRA intersection analysis. The results are presented in Table 3-7, Table 3-8, and Table 3-9.

Table 3-10 provides a standard RTA table which explains the implications of the intersection analysis results.

Table 3-10 - Level of Service Criteria

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

Adapted from RTA Guide to Traffic Generating Developments, 1993

These results are provided here only for completeness. Their implications are discussed in the separate MWT report *Proposed Vincentia District Centre – Report on Road Improvement Requirements*, November 2005.

Table 3-7 - Future Intersection Operations Thursday AM Peak

Intersection	Intersection Control	Existing		Future 2011 – Stage 2a								Future 2016 – Ultimate Development							
				Without District Centre				With District Centre				Without District Centre				With District Centre			
				Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay			LOS	Delay
Naval College Rd/ Huskisson Rd/	Signs (Give-way)	B	19.4	B	15.9	B	21.1	B	23.8	C	36.9	B	17.1	B	23.4	B	27.0	D	48.6
Naval College Rd/ Pine Forest Rd	Signs (Give-way)	B	16.7	A	8.9	A	9.4	A	10.0	A	10.8	A	9.1	A	9.7	A	10.4	A	11.3
Naval College Rd/ Access A (West Village)	Roundabout (1-Lane)	-	-	-	-	-	-	A	7.1	A	7.2	-	-	-	-	A	7.2	A	7.4
Naval College Rd/ Access B (East Village)	Signs (Give-way)	-	-	-	-	-	-	B	16.5	B	19.3	-	-	-	-	B	17.9	B	21.4
Naval College Rd/ Access C (District Centre)	Signs (Seagull)	-	-	-	-	-	-	B	20.0	B	21.6	-	-	-	-	B	20.7	B	22.5
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	A	13.0	A	8.6	A	9.8	A	11.9	B	17.6	A	9.1	A	10.5	B	14.8	C	33.9
The Wool Rd/ Access D (District Centre)	Signals	-	-	-	-	-	-	A	11.3	A	11.5	-	-	-	-	A	12.7	A	11.5
The Wool Rd/ Leisure Centre/ High School	Signals	-	-	-	-	-	-	A	10.2	A	10.6	-	-	-	-	A	10.6	A	11.1
The Wool Rd/ George Caley Place	Signs (Give-way)	-	-	A	10.9	A	12.6	A	12.0	B	14.5	A	11.5	A	13.7	A	12.9	B	16.4
The Wool Rd/ Beach St/ St. Georges Ave	Signs (Give-way)	B	22.2	C	30.1	E	68.4	D	47.3	F	> 120	C	37.8	F	> 120	F	86.2	F	> 120

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.
Extensive queuing on The Wool Rd north approach at Naval College Rd.

Table 3-8 - Future Intersection Operations Thursday PM Peak

Intersection	Intersection Control	Existing		Future 2011 – Stage 2a								Future 2016 – Ultimate Development							
				Without District Centre				With District Centre				Without District Centre				With District Centre			
				Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Naval College Rd/ Huskisson Rd/	Signs (Give-way)	B	19.5	B	14.9	B	19.3	C	25.3	C	38.1	B	16.0	B	21.0	B	28.4	D	46.5
Naval College Rd/ Pine Forest Rd	Signs (Give-way)	B	16.8	A	9.1	A	9.7	A	11.1	A	12.0	A	9.4	A	9.9	A	11.6	A	12.7
Naval College Rd/ Access A (West Village)	Roundabout (1-Lane)	-	-	-	-	-	-	A	8.1	A	8.5	-	-	-	-	A	8.3	A	7.4
Naval College Rd/ Access B (East Village)	Signs (Give-way)	-	-	-	-	-	-	B	18.6	B	22.2	-	-	-	-	B	20.2	B	24.7
Naval College Rd/ Access C (District Centre)	Signs (Seagull)	-	-	-	-	-	-	B	19.6	B	21.2	-	-	-	-	B	20.2	B	22.2
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	B	14.1	A	9.3	A	10.4	B	17.6	F	93.4	A	9.8	A	11.2	C	31.8	F	> 120
The Wool Rd/ Access D (District Centre)	Signals	-	-	-	-	-	-	B	17.4	B	18.0	-	-	-	-	B	18.0	B	19.4
The Wool Rd/ Leisure Centre/ High School	Signals	-	-	-	-	-	-	A	9.0	A	9.5	-	-	-	-	A	9.2	A	9.7
The Wool Rd/ George Caley Place	Signs (Give-way)	-	-	A	12.0	A	13.9	A	14.4	B	17.3	A	12.8	B	15.1	B	15.7	B	19.4
The Wool Rd/ Beach St/ St. Georges Ave	Signs (Give-way)	B	22.0	C	29.9	F	106	F	> 120	F	> 120	C	39.2	F	> 120	F	> 120	F	> 120

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.

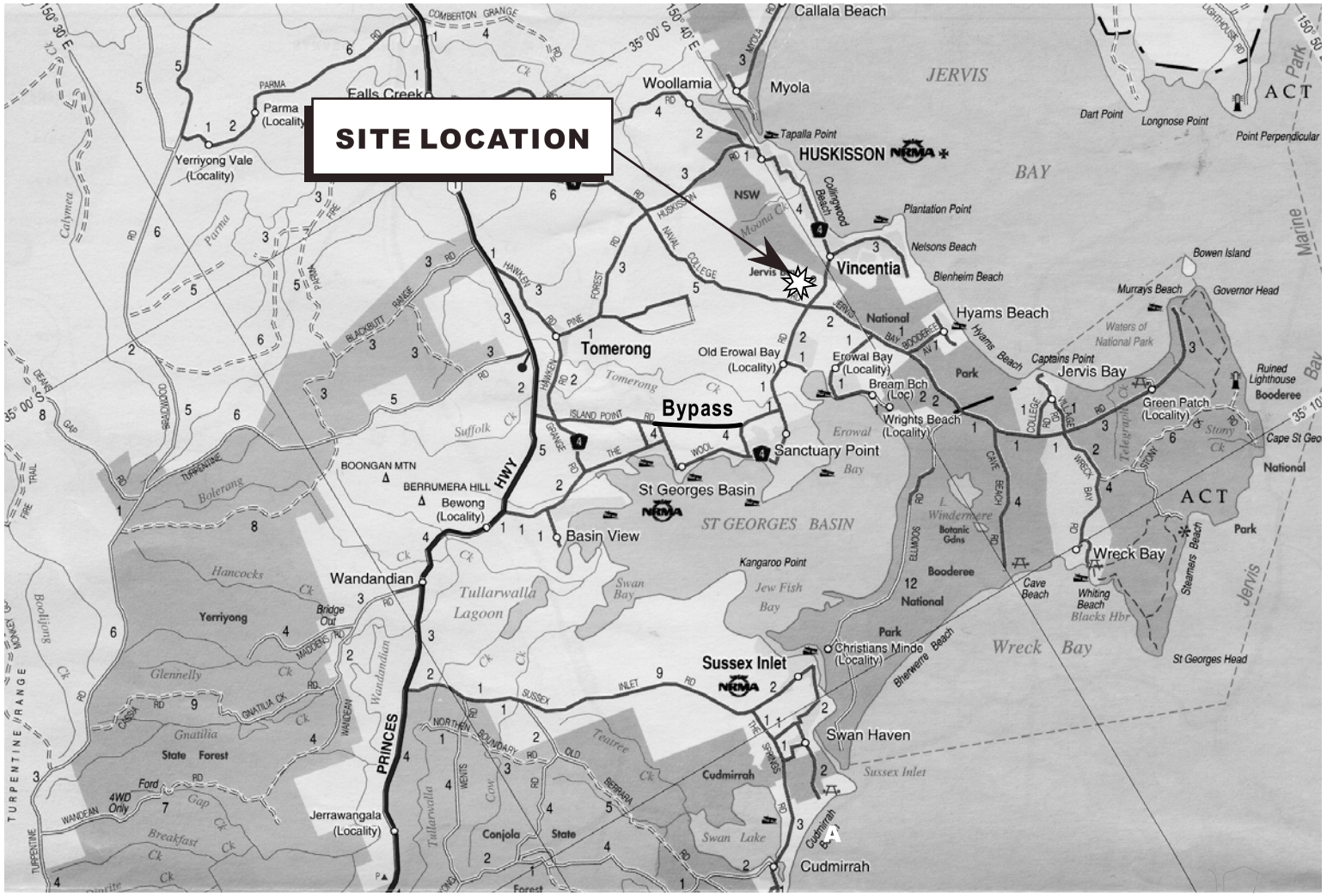
Table 3-9 - Future Intersection Operations Saturday Peak

Intersection	Intersection Control	Existing		Future 2011 – Stage 2a								Future 2016 – Ultimate Development							
				Without District Centre				With District Centre				Without District Centre				With District Centre			
				Typical		Seasonal		Typical		Seasonal		Typical		Seasonal		Typical		Seasonal	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Naval College Rd/ Access A (West Village)	Roundabout (1-Lane)	-	-	-	-	-	-	A	8.8	A	7.8	-	-	-	-	A	9.2	A	8.3
Naval College Rd/ Access B (East Village)	Signs (Give-way)	-	-	-	-	-	-	B	20.8	B	25.6	-	-	-	-	B	24.8	B	25.2
Naval College Rd/ Access C (District Centre)	Signs (Seagull)	-	-	-	-	-	-	B	20.3	C	40.5	-	-	-	-	B	22.7	B	23.2
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane)	B	14.9	A	10.1	A	9.3	B	23.8	B	19.2	A	10.7	A	10.5	F	> 120	F	> 120
The Wool Rd/ Access D (District Centre)	Signals	-	-	-	-	-	-	B	17.1	B	18.3	-	-	-	-	B	19.9	B	22.1
The Wool Rd/ Leisure Centre/ High School	Signals	-	-	-	-	-	-	A	8.1	A	8.8	-	-	-	-	A	8.1	A	8.5
Alternative Intersection Layouts																			
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane with left slip from south)									B	18.6								
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (1-Lane with left turn lanes)																	D	53.8
The Wool Rd/ Naval College Rd/ Jervis Bay Rd	Roundabout (2-Lanes)																	B	17.6

Notes: Delay at unsignalised and roundabout controlled intersections is calculated on the worst movement and for signalised intersections delay is calculated as the average for the intersection.
Saturday count conducted at Naval College Rd/The Wool Rd/Jervis Bay Rd on a Seasonal Day

SITE LOCATION

VINCENTIA DEVELOPMENT



MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

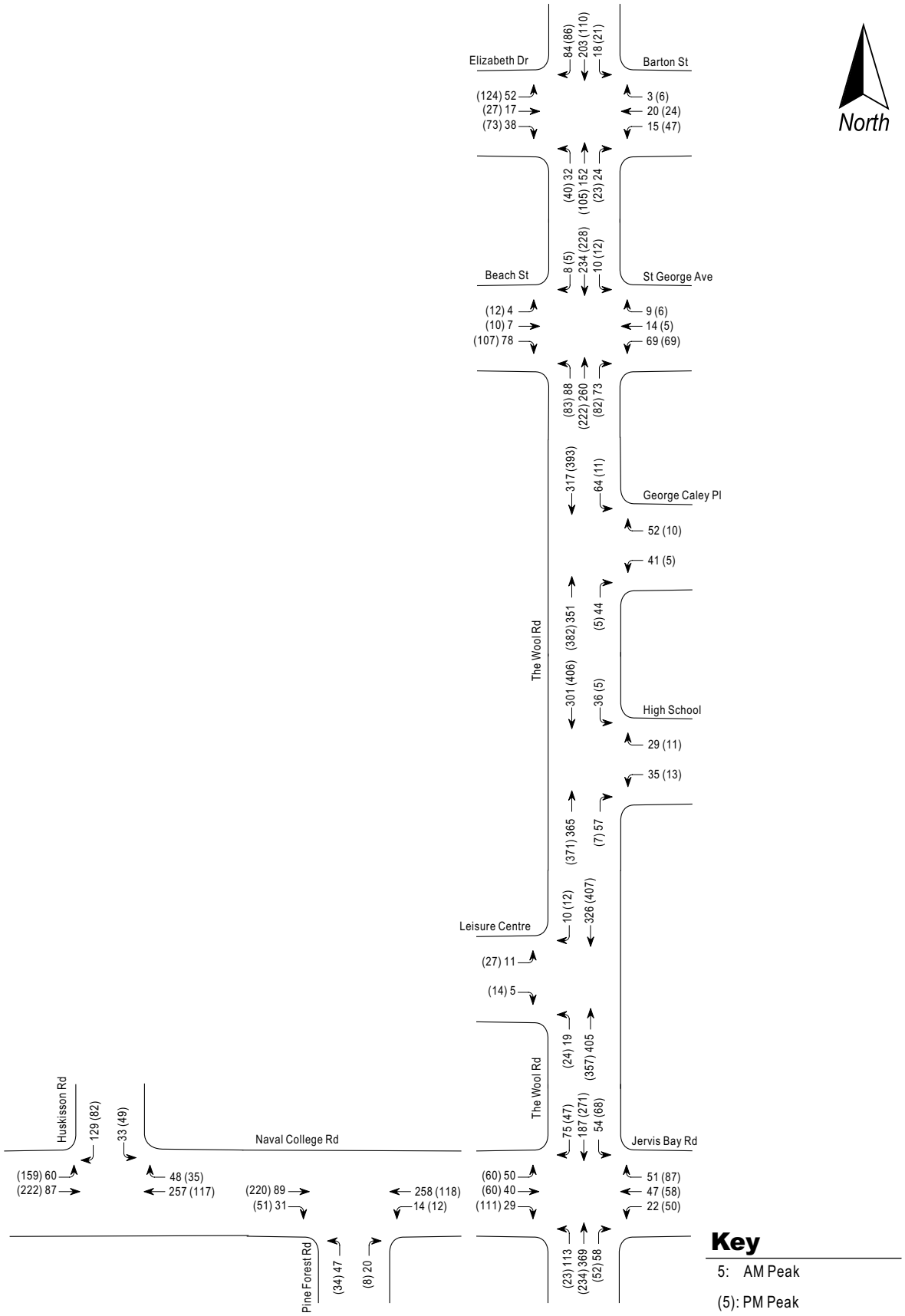
Figure 1

Filename: 032132di16.ai

Date: 29 November 2005

EXISTING THURSDAY PEAK HOUR TRAFFIC FLOWS

VINCENTIA DEVELOPMENT



MASSON | WILSON | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

Figure 2

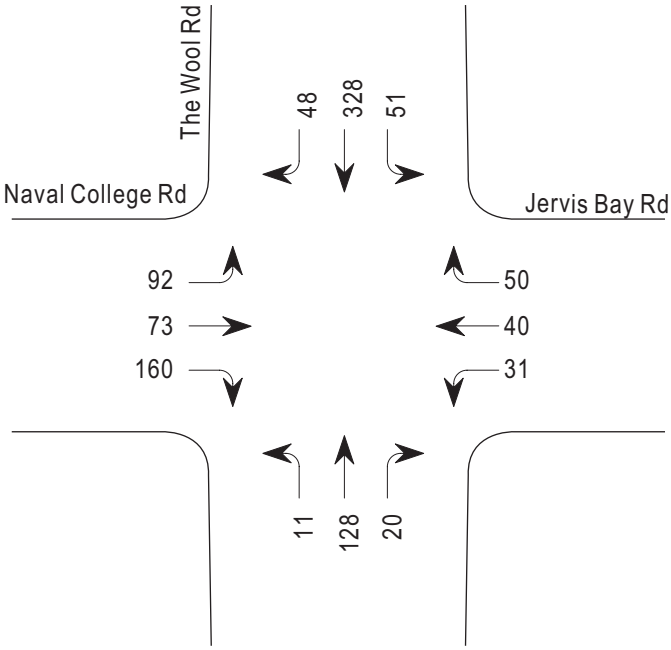
Filename: 032132di17.ai

Date: 29 November 2005

EXISTING SATURDAY PEAK HOUR TRAFFIC FLOWS

VINCENTIA DEVELOPMENT

North



Key

Saturday

5 Peak 11am-12noon

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Figure 3

Filename: 032132di18.ai

Date: 29 November 2005