Better Transport Futures

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Transport Planning & Engineering

Proposed Marina and Mixed Use Development, Trinity Point NSW

Johnson Property Group Pty Ltd

Traffic Impact Statement

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1. Introduction

Better Transport Futures was commissioned by Johnson Property Group to prepare a traffic impact assessment for the proposed marina and village development at Trinity Point, NSW. This report is required as part of the development submission for the land to the Department of Planning and Lake Macquarie City Council. The application is for Concept Plan only, to provide the broad overview of what is proposed and to establish the framework for future project applications - which will include greater details and opportunities for further assessment.

This report presents the findings of the traffic investigations and assessment of the proposal. It is structured as follows:

- **Chapter 2** outlines the existing situation in the vicinity of the subject site, including discussion on the planned development growth within the vicinity and road network changes to support it.

- **Chapter 3** describes the traffic and parking features of the proposal.

- **Chapter 4** details the assessment of traffic operations related to the proposal.

- **Chapter 5** summarises the findings of this investigation, outlining conclusions and recommendations for the traffic operations of the site to support the development application for the proposal.

2. Existing Situation

2.1 Background and Site Location

The subject site is located on a parcel of land to the east of Morisset, on the peninsula into Lake Macquarie. It is bounded to the north, east and south by Lake Macquarie, with the only lane access to the west via existing road connections. The subject site is currently vacant with open land and limited trees. Access to the subject site is provided via Trinity Point Drive and Henry Road.

The location of the site is shown below in **Figure 2.1**.

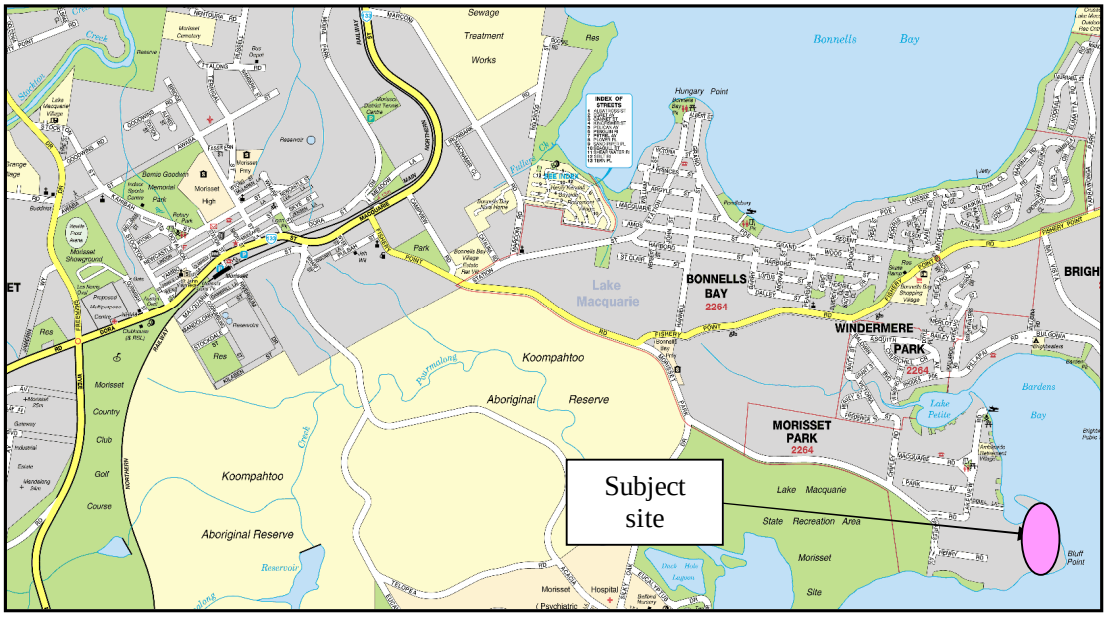

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Figure 2.1 – Site Location

2.2 Local Road System

2.2.1 Road Characteristics

Access to the site is currently available via Trinity Point Drive and Henry Road. Henry Road provides a single lane in each direction and allows parking along the majority of its length. It provides an overall width in the order of 6.5 m and there are no concrete footpaths on either side. There are a number of street lights and the posted speed limit is 50 km/h. Existing land use to both sides is residential lots.

Photo 1 – View east showing typical section along Henry Road.

Henry Road connects with Morisset Park Road to provide a connection to the greater road network. Morisset Park Road provides a single lane of travel in both directions

Photo 2 – Typical view showing typical cross section of Morisset Park Road

There are no concrete footpaths along Morisset Park Road Street lights are provided on Morisset Park Road at key locations over intersections and the posted speed limit is a mixture of 50 and 70 km/h. Land use along the length of Morisset Park Road is mainly residential and open space, with Bonnells Bay Primary school located on the intersection of Morisset Park Road and Fishery Point Road.

Connection to the main road network is then provided via Fishery Point Road to Macquarie Street. Fishery Point Road provides a single lane of travel in both directions and connects with Macquarie Street via a give way controlled intersection. Fishery Point Road provides an overall width in the order of 7.5 metres with a footway/cycleway provided along one side. There are street lights located along its length in a number of locations.

Photo 3 – View showing typical section of Fishery Point Road

The main road through the general locality is Macquarie Street. Macquarie Street provides an important north-south link between major centres along the western boundary of Lake Macquarie and the F3 Sydney to Newcastle Freeway. Macquarie Street is classified as Main Road number 217 and is controlled by the Roads and Traffic Authority of NSW (RTA).

Macquarie Street in the general vicinity of the site provides a single lane of travel in both directions, with localised widening at intersections to ensure adequate capacity is maintained. Through the centre of Morisset the posted speed limit is 50 km/h. There are footpaths provided to both sides of the road through the centre of Morisset but to the north and south of the town there are only isolated sections of single footpath. There are street lights provided along the length of the road through Morisset.

2.3 Traffic Volumes

2.3.1 Traffic Survey

Traffic volume data for the project has been collected during a survey of traffic movements at the key intersections:

- Silky Oak Drive and Morisset Park Road
- Morisset Park Road and Fishery Point Road
- Fishery Point Road and Macquarie Street.

These surveys were completed on Tuesday 30th October 2007.

The results of the survey are summarised in **Table 2.1** below with full results provided in Appendix C.

Table 2.1 – Traffic Volumes

Road	Direction	Peak flow (1)	Mid-Block Road Capacity (2)	Volume / Capacity
Morisset Park Road (east of Silky Oak Drive)	Eastbound	78 (AM) 119 (PM)	900 (one-way)	0.086 AM 0.132 PM
	Westbound	58 (AM) 42 (PM)	900 (one-way)	0.064 AM 0.467 PM
Fishery Point Road (west of Morisset Park Road)	Eastbound	185 (AM) 603 (PM)	900 (one-way)	0.205 AM 0.670 PM
	Westbound	519 (AM) 227 (PM)	900 (one-way)	0.577 AM 0.252 PM
Fishery Point Road (east of Macquarie Street)	Eastbound	217 (AM) 671 (PM)	900 (one-way)	0.241 AM 0.745 PM
	Westbound	593 (AM) 351 (PM)	900 (one-way)	0.659 AM 0.390 PM

Notes: 1. Peak flow from October 2007 traffic survey results by Mark Waugh Pty Ltd
2. RTA 2002, Urban Road Conditions Level of Service D

Table 2.1 demonstrates that the current peak hour traffic flows on the road system in the general vicinity of the site are relatively low and well within the capacity of the local road network. The results indicate there is spare capacity in the local road network. It can be seen however that Fishery Point Road is currently operating to the higher end of its capacity as it provides the only road link to the Morisset Peninsula.

Using Table 4.5 from the RTA Guide to Traffic Generating Developments (reproduced below), it can be seen that the ultimate capacity for Fishery Point Road in this location is around 1,400 vehicles per hour one-way. For the current observed traffic flows along Fishery Point Road at its western end it can be seen that the level of service for road users is C / D.

Table 2.2 - Urban Road peak hour flows per direction

Level of service	One Lane (vehs per hour)	Two Lanes (vehs per hour)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: Table 4.5, RTA Guide to Traffic Generating Developments, version 2.2 dated October 2002.

2.4 Intersection Control and Operation

There are a number of intersections and driveways in the general vicinity of the site along the local residential roads. These driveways provide access to individual residential lots as well as larger rural residential lots.

All of the intersections are controlled by give way signs, due to the general low traffic flow in the vicinity of the site. The majority of these intersections are simple give ways, with limited road widening to cater for right turn movements.

The intersection of Fishery Point Road and Macquarie Street is currently a give way controlled intersection with a sheltered right turn lane together with a central right turn lane for traffic exiting the side road.

2.5 Road Network Improvements

It is understood there are no major road network improvements planned in the vicinity of the subject site, apart from normal road maintenance performed by Council and the RTA. It is noted however that Council has recently completed some upgrade works at the intersection of Fishery Point Road and Station Street to improve this intersection layout and capacity.

The intersection of Fishery Point Road and Macquarie Street has been identified for upgrade works, with the proposal to improve the intersection control by providing a set of traffic signals at this location. Macquarie Street is a classified main road and as such any works on this road require the consent of the RTA with Council being the road authority.

Traffic Analysis work completed on the proposed residential development on the corner of Fishery Point Road and Station Street (by Johnson Property Group) has shown that this intersection has limited future capacity and that there will be a need to upgrade this intersection to reduce the delays for the traffic exiting right from Station Street. The proposal currently before Council is to upgrade this intersection to a roundabout or signal control.

As part of this assessment, an assessment has been completed of future development in the general vicinity of the site along the Morisset Peninsula to determine future development that could impact upon the intersection of Fishery Point Road and Station Street. The Lake Macquarie City Urban Development Program for the locality has been reviewed and the future investigation zones noted. From this review, it is considered that there is the potential for some 195 lots to impact upon this intersection. The land from the Council UDP is identified as:

- Z37 (70 lots cnr Morisset Park Road & Chiefly Road)
- Z38 (10 lots off Asquith Avenue, Windermere Park))
- RZ1 (60 lots off Fishery Point Road, Brightwaters)
- Z31 (55 lots off Fishery Point Road, Mirrabooka).

2.6 Public Transport, Pedestrians and Cyclists

Public transport in the vicinity of the site is limited. School buses provide access for school children between this area and Morisset. Toronto buses also provide a regular connection along Fishery Point Road to connect Morisset and the peninsula. However, these services do not provide a high standard of service suitable for regular commuters.

Cyclists are able to use the public roads in the vicinity of the site. In addition, an off-road footway/cycleway is provided along the northern side of Fishery Point Road. During the survey there were limited cyclist and pedestrian movements observed.

2.7 Other Developments

A residential subdivision is currently being constructed on land immediately to the west of the subject site. The approval for this land allows for 194 residential lots and includes an approved public road system which will provide access to the subject site. The shopping centre at Bonnells Bay is currently being renovated and expanded. This shopping centre will provide a wide range of facilities and will provide a destination for shoppers as an alternative to the existing shops in Morisset.

3. Proposed Development

3.1 Development and Access Arrangements

The proposal for the subject site is a marina development with associated marina village. The development will provide a variety of facilities on the site, including up to 308 berth marina, gym, function centre, cafe, restaurant and facilities associated with a marina operation. There will also be a mixture of resort style accommodation for casual use and permanent residential occupancy. Parking will be provided on site for the above users together with access road connections, etc.

Access will be provided via the approved extension and upgrade to the existing access via Trinity Point Drive and Henry Road as part of the adjoining 194 lot subdivision.

The Concept Plan proposes a mix of land uses and a general scale of those. For purposes of traffic assessment at this Concept Plan level, a specific scale of use has been provided by the proponent and incorporated into this report. Traffic assessment associated with future project applications may need refinement as the parameters of specific uses are further refined.

3.2 Traffic Generation

The level of traffic generation from the development proposal has been assessed using the standard rates available from the RTA guidelines for Traffic Generating Developments. These Guidelines indicate a range of traffic generation rates depending on the type of land use activity.

The RTA guidelines indicate the critical movement periods for all developments are during the morning and afternoon peak periods, when the background traffic flows on the road network are at their highest. It can be seen however that the nature of the proposed development is in the main for a leisure type facility, which do not generate high traffic flows during the traditional peak periods during the week. The marina's peak use will be during the weekend and evenings in the week when there are twilight sailing events. There will be some peak usage associated with the permanent residential units, but these are a small component of the overall development.

The RTA Guide provides a value for daily traffic flows associated with marinas. It is reasonable to assume that the flows during the week would be much lower than the weekend, due to minimal use of boats during the week. For the traditional morning peak period in particular, the marina would generate very low flows, as the only vehicles would be those associated with the employees working on site and possibly a small number of sailors.

For the afternoon peak period, there may be a number of vehicles associated with twilight sailing, especially on Fridays. There are no specific details available at this stage as to the type and hours of sailing that could occur from the future marina. A review of similar marinas shows that traditionally, twilight sailing occurs on a Wednesday and Friday afternoon/evening. During the winter months, these generally commence at 2.30 or 3.00 PM, as the racing needs to finish by around 5.00 PM in the winter. During the summer months, the racing will start later on a Wednesday as it can then finish later due to the daylight lasting longer. The Friday racing generally commences later in the afternoon (around 5.00 PM) and continues until dusk. It is also considered that a significant number of the Friday sailors will stay in the mariner for social activities after the racing.

It can also be seen that the racing does not include all the boats located in the marina. Not all boat owners located at the marina will wish to participate in the racing at the marina. It should also be

noted that not all boats racing at this location will be associated with this marina- some of the boats will sail from other locations, such as nearby public launching ramps and swing moorings.

For the purposes of this assessment and based on reviews of other marinas, it is assumed that there will be a very low traffic flow associated with the marina berths in the AM peak. The afternoon flows could be higher, associated with twilight sailing. As a conservative approach, we have assumed an inbound flow of 25% of the sailing boats, giving some 75 vehicles per hour.

The resort apartments will again be busiest during the weekends, with some peak use during holiday periods when the units could be used for the full week. The cafes and restaurant together with the shops will have peak use at weekends when there are a high number of visitors to the site.

The function centre can be used for a wide range of uses, including conferences and special events such as parties or weddings. These events could occur 7 days a week, with peak events generally occurring over the weekend with large functions such as weddings.

The RTA Guide to Traffic Generating developments provides the following guide to potential traffic generation rates for the proposed development:

Table 3.1 – Potential Traffic Generation Rates

Feature	Rate		Area or number	Traffic flows	
	AM peak	PM peak		AM	PM
Marina	0.54 per berth	1.08 per berth	300 berths	20 (assumed)	75 (assumed)
Gym	2 per 100 m^2	2 per 100 m^2	50 m^2	2	2
Beauty Salon	2 (staff)	2 (staff)	64 m^2	2	2
Cafe	5 staff (assumed)	5 staff (assumed)	90 m^2	5	5
Bookshop/Newsagent	4 (staff)	4 (staff)	130 m^2	4	4
Function rooms	45 (assumed based on attendees and facilitators)	45	350 m^2	45	45
Restaurant	5 (staff)	5 per 100 m^2	160 m^2	10	20
Operations manager	2 (staff)	2 (staff)	40 m^2	2	2
Offices	2 per 100 m^2	2 per 100 m^2	100 m^2	2	2
Service area	5 (staff)	5 (staff)	450 m^2	5	5
Tourist units	1 per unit	1 per unit	75 (1/2/3/4 bedroom)	75	75
Residential	0.5 per unit	0.5 per unit	30 x 3-bedroom	15	15
	0.65 per unit	0.65 per unit	45 x 4-bedroom	29	29
TOTAL				**216**	**281**

The above table provides details on the AM and PM peak flows associated with the proposed development. The table provides a cumulative total of the traffic flows for each and every element of the proposed development.

An assumed rate of 1 vehicle movement per unit for the tourist units has been assumed as a worst case scenario. With the peak use at weekends, it can be seen that the flows during the week, when the background traffic flows on the road network are high, the impacts would be less.

These flow rates have been applied in the traffic analysis for these investigations, to ensure robustness of design. It is considered that these flows provide a worst case scenario for the future development.

3.3 Site Access

Vehicle access to the development will be via the approved extensions of Henry Road and Trinity Point Drive from the adjoining 194 lot subdivision. As a result of this proposal, a local roundabout will be required on the corner of the approved extension to Trinity Point Drive at the site access. Vehicles would use the existing road network and intersections linking with Fishery Point Road to connect to the greater road network.

Traffic will then enter the basement car parks for the residential units via private driveways off the public roads. Access to the marina element at the northern end of the site, together with the associated public facilities, will have access via a public roadway located off the roundabout on Trinity Point Drive.

3.4 Traffic Distribution

It can be seen that the majority of the traffic will have an origin / destination to the west of the site to Macquarie Street, as Macquarie Street provides the major access to all areas to the north and south of the locality. There will also be a significant portion of local traffic based on the peninsula that would use the marina and not impact upon the main road network. Allowing for local trips e.g. shops at Bonnells Bay, local schools, local attractions, it is assumed that 80% of the trips will have an origin/destination along Macquarie Street for centres to the north and south.

It is considered that the majority of the traffic would have an origin / destination to the south of Fishery Point Road at Macquarie Street i.e. towards Morisset. Whilst a reasonable volume of traffic could have an origin to the north of the site, it can be seen that by heading south, traffic can access the F3 Freeway some 3.5 kms south of this intersection. The F3 provides the quickest and most convenient route to Newcastle as well as areas such as Maitland, Cessnock, Port Stephens, etc.

For traffic heading south towards the Central Coast and Sydney, the most convenient route is via the F3 to the south of the intersection with Fishery Point Road.

For the purposes of this assessment, it has been assumed that 80% of the traffic using the intersection of Macquarie Street and Fishery Point Road would have an origin/destination to the south along Macquarie Street with the remainder heading north along Macquarie Street.

The split in traffic between inbound and outbound for the morning and afternoon peaks is provided in Table 3.2 below.

Table 3.2 – Directional Split of Traffic Movements

Feature	AM flows	Inbound	Outbound	PM flows	Inbound	Outbound
Marina	20 (assumed)	20	0	75 (assumed)	70	5
Gym	2	2	0	2	0	2
Beauty Salon	2	2	0	2	0	2
Cafe	5	4	1	5	1	4
Bookshop/Newsagent	4	3	1	4	1	3
Function rooms	45	45	0	45	0	45
Restaurant	10	10	0	20	0	10
Operations manager	2	2	0	2	0	2
Offices	2	2	0	2	0	2
Service area	5	5	0	5	0	5
Tourist units	75	37	38	75	60	15
Residential	15	2	13	15	13	2
	29	4	25	29	25	4
TOTAL	**216**	138	78	**281**	170	111

These splits have been applied in the intersection analysis.

3.5 Pedestrian and Cycle Access

Pedestrian access to the site would be via existing facilities along the local road network. In addition, it is proposed to provide a network of walkways and cycleways around the site and on the approach from the west, to provide a good level of connectivity for pedestrians and cyclists. These paths will provide a mixture of off-road and on-road facilities for cyclists. There will also be a boardwalk provided along the eastern boundary of the site for use by pedestrians and cyclists.

3.6 Public Transport Facility

The development has the potential to increase public transport demand, for both regular bus routes and tourist services. The existing bus route (number 279 provided by Toronto buses) travels along Morisset Park Road then heads north along Lakeview Road towards Windermere Park. This bus route provides a regular service to connect with the train services to and from Sydney and Newcastle via the Main Northern railway line. It is considered that there is the potential for additional patronage for this bus route, with an extension via Henry Road to link through the site. A bus stop will be provided on the southern side of Trinity Point Drive (East-west link) suitable for use by this extension to the bus route.

In addition, it is considered that the development will attract tourist buses, requiring a set down and pick up area near the development. It is proposed that a single bus stop is provided near the roundabout entrance to the site on the main east-west access road, that can serve the possible regular service as well as tourist services. A footpath connection will be provided from this bus stop to link with the marina development and the boardwalk.

3.7 Site Operations and Access Arrangements

Overall access geometry will meet the requisite Council standards for new developments. The driveways and access road to the marina will be designed in accordance with Councils' Engineering requirements.

The design has also been prepared taking into account the swept path requirements for service vehicles. For the marina, the largest vehicle will be a fuel tanker making regular deliveries for the fuel storage facility. The tanker will be a large rigid vehicle, similar in size to a standard 12.5 metres truck, such as a Council garbage vehicle. All other service vehicles will be smaller, and include delivery vans for the various users within the marina.

The marina will not provide a facility for launching and retrieving large vessels (only a ship lift for maintenance activities), therefore there will not be a requirement to accommodate the swept path of a semi-trailer or larger vehicle.
An Autoturn simulation has been completed for the design of the development, to ensure the design can accommodate the requirements of the vehicles likely to use the site.

The technical analysis for the development of the site is discussed further in **Section 4.**

3.8 Parking Requirements

It can be seen that the new development will require parking for the marina and that it must be contained within the site. The parking provision for the site has been determined in consultation with the RTA Guide to Traffic Generating Developments, AS3962-2001 (Guidelines for design of marinas) as well as the Lake Macquarie DCP No1. A summary of the parking requirements is provided below.

Table 3.3 – Parking Requirements

Element	Notes	Size/number	Requirement	Source	Provision
Marina	Includes offices, boat storage, clubhouse	300 berths	0.3 per berth	AS3962-2001	90
Marina staff		4	0.5 per staff	RTA Guide	2
Gym & Fitness		50 m^2	1 per 10 m^2	LMCC	5
Beauty Salon		64 m^2	1 per 25 m^2	LMCC	3
Café / Bistro		90 m^2	1 per 10 m^2	LMCC	9
Chandlery		50 m^2	1 per 25 m^2	LMCC	2
Bookshop/Newsagent/ Internet/Chemist		130 m^2	1 per 25 m^2	LMCC	1
Function rooms		350 m^2	1 per 10 m^2	LMCC	35
Restaurant		160 m^2	1 per 10 m^2	LMCC	16
Operations/Management / Administration		40 m^2	1 per 40 m^2	LMCC	1
Offices/Strata		100 m^2	1 per 40 m^2	LMCC	3
Service area/Workshop	2 employees	450 m^2	-	-	2
Tourist units		67 x 1 or 2 bedroom	1 per unit	LMCC	67
		8 x 3 or 4 bedroom	1 per unit	LMCC	8
Residential units		75 x 3 or 4 bedroom	1.5 per unit	LMCC	113
TOTAL			357.5		357

It is considered that all future parking for the development can be contained on site and that there is no further requirement to review the impact of the parking for the development.

As part of the on-site parking provision, it is proposed to provide an element of valet parking for peak events within the marina area. To improve parking controls during peak events, a valet parking system will be used for guests utilising the function rooms. These peak functions could occur on a weekend, when demand associated with the marina could be high. The valet parking management will allow for vehicles to be parked within the residential parking area, to the immediate south of the marina. The residential units to be developed in this location will have a surplus parking provision that will serve as spill over area for the marina village.

3.9 Service Vehicles

As part of the development, there will be a requirement for service vehicles, for items such as refuse collection, fuel tanker deliveries, supply deliveries to the various users within the marina and village etc. These vehicles will access the site via Trinity Point Drive, which provides the most direct and appropriate access to the development.

The largest vehicle that will access the site is a large rigid vehicle, typically a fuel tanker or bus. The marina will not provide a service for launching large vessels so access for a low loader vehicle will not be required.

The design of the main access road to the site has been determined taking into account the swept path requirements of these larger vehicles.

4. Assessment of Transport Operations

4.1 Site Access Operations

The primary site access to the site will be via Trinity Point Drive with a secondary access via the extension of Henry Road.

4.2 Road Network Performance and Capacity

From **Table 2.1**, the current peak one-way hourly traffic flows along Fishery Point Road at its western end near Macquarie Street are in the order of up to 671 (eastbound in the PM peak) vehicles per hour one-way in a single lane. From Table 2.2 it can be seen that the level of service for the current flows is D. This table shows that the cut off point for this level of service is some 900 vehicles per hour one-way. The remaining peak flows are much lower, with flows of less than 150 vehicles per hour close to the subject site.

Upon completion of the full marina development on the subject site, there could be up to 216 vehicles per hour generated by the development during the critical afternoon peak period and 206 in the morning peak. With 70% of the traffic outbound in the AM peak and inbound in the PM peak, the peak directional flow along Fishery Point Road would increase by some 52 vehicles per hour eastbound in the PM peak (and allowing for 20% local traffic containment). This would increase the peak eastbound flow in the PM from 671 to 723 vehicles per hour. Thus the level of service would remain at D for existing road users.

Due to the cumulative impacts of the developments along the peninsula, it can be seen that the greatest impact will be at the western end of Fishery Point Road. The traffic flows on Fishery Point Road will decrease progressively further along the road towards the subject site (easterly direction).

4.3 Intersection Operation, Macquarie Street and Fishery Point Road

It can be seen that the critical intersection in the general locality of the subject site is the give way controlled intersection of Macquarie Street and Fishery Point Road. Previous studies at this intersection have shown that the intersection requires upgrading and Council together with the RTA have determined that the most appropriate upgrade is for signal control. This signal control will be able to cater for the high turning demand for traffic from Macquarie Street (south) to turn into Fishery Point Road.

The additional traffic associated with the proposed marina development has been assessed above to determine the impact of this traffic on the intersection of Macquarie Street and Fishery Point Road. As part of the assessment for this intersection, the following additional developments have also been allowed for:

- The proposed Johnson Property Group residential development (200 lots) on the corner of Station Street and Fishery Point Road.
- Balance of 300 residential lots identified by Council as part of the Transport Infrastructure Contribution Deed prepared by the RTA.
- Residential development to immediate west of Trinity Point Marina site (195 lots).

Based on Council's estimates of future development scenarios on the Morisset Peninsula area (including Trinity Point), the Trinity Point Marina Development's proportion of impact on this intersection is 17.5%.

The operation of this intersection has been assessed using Sidra, for both the AM and PM peaks. The analysis has used the traffic data collected for this project, together with the predicted flows for the development sites identified above.

The results of the analysis for the existing operation of Macquarie Street and Fishery Point Road are presented in **Table 4.1** below. This allows for the existing priority controlled intersection.

Table 4.1 – Existing Intersection Operation. 2007 AM/PM base flows

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in	0.151 / 0.515	9.9 / 11.5	A / A	7 / 41
Right turn out	0.138 / 0.314	14.6 / 30.4	B / C	4 / 10
Left turn out	0.760 / 0.385	17.6 / 11.6	B / A	76 / 19
Through n-bound	0.135 / 0.229	0.0 / 0.0	A / A	0 / 0
Through s-bound	0.184 / 0.176	0.0 / 0.0	A / A	0 / 0
Overall	0.697 / 0.515	8.0 / 7.3	A / A	76 / 41

The analysis was then completed for the future design year of 2017 with the results presented in table 4.2 below.

Table 4.2 – Existing Intersection Operation. 2017 AM/PM base flows

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in	0.163 / 0.552	10.3 / 12.4	A / A	7 / 45
Right turn out	0.163 / 0.407	16.3 / 39.9	B / C	5 / 13
Left turn out	0.760 / 0.417	17.6 / 12.5	B / A	76 / 21
Through n-bound	0.163 / 0.276	0.0 / 0.0	A / A	0 / 0
Through s-bound	0.222 / 0.211	0.0 / 0.0	A / A	0 / 0
Overall	0.760 / 0.552	8.4 / 7.4	A / A	76 / 45

The above analysis shows that whilst the majority of movements will operate acceptably, the delays for the critical right turns will become poor, although will remain within acceptable limits.

However, with increased development along Fishery Point Road it can be seen that the intersection will not provide adequate capacity to cater for the increase in turning movements.

As indicated above, it has been identified that this intersection is to be upgraded in the future, to provide a 3-way signal controlled intersection. The RTA is currently in the preliminary planning stage of the intersection upgrade and no plans are available for the upgrade. The RTA are collecting money from a number of developments along the Peninsula under a Transport Infrastructure Contribution Deed.

A review of the intersection, together with normal requirements for signal controlled intersections provides the basic layout for the future upgrade of the intersection. It is also important to note that the right turn traffic volume into Fishery Point Road will be higher than the northbound through traffic movement on Morisset Road. Accordingly, an allowance has been made for a two dedicated right turn lanes into Fishery Point Road and two through lanes on Macquarie Road through the intersection.

The results of the future analysis of the upgraded intersection, taking into account the developments noted above as well as the subject site are presented in Table 4.3 below.

Table 4.3 – Intersection of Macquarie Street and Fishery Point Road, Signal control 2007 base traffic flows plus development flows

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in	0.382 / 0.629	16.9 / 21.7	B / B	30 / 158
Right turn out	0.358 / 0.588	39.8 / 55.6	C / D	41 / 42
Left turn out	0.729 / 0.418	20.5 / 24.2	B / B	162 / 105
Through n-bound	0.204 / 0.308	5.6 / 5.1	A / A	39 / 70
Through s-bound	0.737 / 0.511	32.2 / 31.6	C / C	108 / 116
Overall	0.737 / 0.629	21.2 / 21.7	B / B	162 / 158

N.B Results for AM / PM peaks

The above results show that the intersection will work to an acceptable level of service. The delays for the through traffic movements on all approaches are acceptable, with a level of service of A through to D.

This intersection has also been assessed for the future design year of 2017. Allowing for 10 year growth to the future design year of 2017, it has been assumed that there will be annual increases in through traffic flows of 2% giving an increase over 10 years of 20%. The results for the future design year 2017 are presented in **Table 4.4** below:

Table 4.4 - Intersection of Macquarie Street and Fishery Point Road, Signal control 2017 base traffic flows plus development flows

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in	0.398 / 0.674	17.5 / 25.2	B / B	29 / 160
Right turn out	0.384 / 0.568	40.8 / 55.6	C / D	42 / 42
Left turn out	0.777 / 0.418	24.1 / 24.2	B / B	181 / 105
Through n-bound	0.241 / 0.371	5.4 / 5.4	A / A	45 / 85
Through s-bound	0.771 / 0.612	31.3 / 33.1	C / C	127 / 141
Overall	0..777 / 0.674	22.6 / 23.0	B / B	181 / 160

N.B Results for AM / PM peaks

The above results confirm that the intersection overall will continue to operate satisfactorily, allowing for background growth to the future design year of 2017.

4.4 Intersection of Station Street and Fishery Point Road

The intersection of Fishery Point Road and Station Street is currently a priority controlled intersection. Previous work completed by Better Transport Futures for Johnson Property Group in relation to the residential development (DA 687/2007) on the eastern corner of this intersection has recommended that this intersection will need to be upgraded. The previous work indicated that a roundabout controlled intersection at this location provides the best operating solution for the upgrade of this intersection.

However, the road authorities have indicated a signal controlled intersection should be provided at this location. The works are being undertaken by that developer, with co-funding by Council of 36% of works or $97200 (whichever is lesser). The results of the analysis for the future signal controlled intersection at this location are shown in **Table 4.5** below:

Table 4.5 Intersection of Fishery Point Road and Station Street, signal controlled layout, 2007 traffic flows plus full development (AM/PM)

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in to Station Street	0.139 / 0.095	15.5 / 16.8	B / B	4 / 5
Right turn out Station Street	0.589 / 0.365	33.9 / 37.7	C / C	51 / 21
Through e-bound	0.213 / 0.541	5.4 / 4.7	A / A	32 / 86
Through w-bound	0.579 / 0.218	7.4 / 3.4	A / A	97 / 30

NB: Average delay, degree of saturation and level of service for the most delayed movement

The above results indicate that the signal controlled intersection at Fishery Point Road and Station Street will have adequate capacity and will operate at a good level of service, indicating acceptable delays for all road users.

The intersection has also been assessed for the future design year of 2017. The through traffic movements on Fishery Point Road have been increased to take into account the growth in through traffic movements at this location. The results of this analysis are presented in **Table 4.6** below.

Table 4.6 – Intersection of Fishery Point Road and Station Street, signal controlled layout, 2017 traffic flows plus full development (AM/PM)

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in to Station Street	0.140 / 0.101	15.5 / 19.3	B / B	4 / 6
Right turn out Station Street	0.648 / 0.365	35.6 / 37.7	C / C	53 / 21
Through e-bound	0.249 / 0.649	5.1 / 5.3	A / A	38 / 110
Through w-bound	0.675 / 0.262	7.6 / 3.5	A / A	120 / 37

NB: Average delay, degree of saturation and level of service for the most delayed movement

4.5 Intersection of Fishery Point Road and Morisset Park Road

From the result of the traffic survey completed in October 2007, it can be seen that there is a high demand for traffic turning right out of Fishery Point Road north into Fishery Point Road west. In the morning peak the right turn demand is 429 vehicles. This conflicts with the low through flow from east to west of 78 vehicles per hour in the morning peak. The analysis of the existing intersection flows shows that the delays for the right turning traffic from Fishery Point Road north (the minor road) in the AM peak acceptable, with a level of service of B. The Sidra analysis does however show that the queue length on this approach is 80 metres long, indicating delays for this movement.

The Sidra analysis was then completed with the balance of the approved development on the residential land to the immediate west of the subject site. For the balance of 195 residential lots, assuming a typical generation rate of 0.85 per lot would give additional traffic flows of 166 vehicles per hour. The results of this analysis are shown below in **Table 4.7.**

Table 4.7 – Intersection of Fishery Point Road and Morisset Park Road, 2007 existing control with approved development traffic flows (AM/PM)

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in to Fishery Point Rd	0.015 / 0.041	9.3 / 13.6	A / A	1 / 1
Right turn out of Fishery Pt Rd	0.940 / 0.590	43.8 / 25.4	D / B	159 / 31
Through e-bound	0.046 / 0.106	0.0 / 0.0	A / A	0 /0
Through w-bound	0.118 / 0.041	0.0 / 0.0	A / A	0 / 0

NB: Average delay, degree of saturation and level of service for the most delayed movement

The above results show that during the critical morning peak period the delay for traffic turning right out of Fishery Point Road will be high, with a level of service of D. The vehicle queue will be 159 metres long with delays in the order of 40 seconds or more.
Thus it can been, that the existing control at this intersection needs to be upgraded, regardless of the subject development. The right turn queue in the morning peak suffers from excessive delays

and congestion, as this is a key traffic movement from traffic on the Peninsula heading towards Morisset etc.

An initial analysis of the intersection, with the current controls and approved development together with the additional full development flows shows that the existing intersection does not have adequate capacity. The delays for the traffic turning right out of Fishery Point Road north that has to give way to traffic on Morisset Park Road in the AM peak would be unacceptable, with queues over 200 metres and a level of service of E.

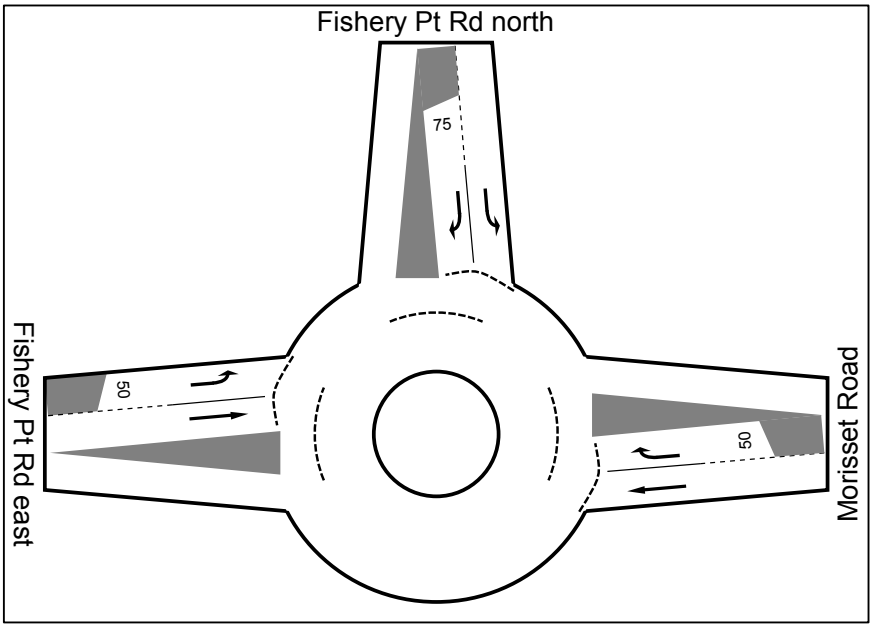
A review of the traffic flows and the existing intersection shows that a roundabout is a suitable intersection upgrade at this location. The results of the analysis for the intersection with roundabout control are provided below in **Table 4.8**.

Table 4.8 – Intersection of Fishery Point Road and Morisset Park Road, roundabout controlled layout, 2007 traffic flows plus full development (AM/PM)

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in to Fishery Point Rd	0.025 / 0.027	14.4 / 12.6	A / A	1 / 1
Right turn out Fishery Pt Rd	0.329 / 0.150	11.8 / 12.2	A / A	16 /7
Through e-bound	0.086 / 0.187	4.4 / 4.5	A / A	4 / 9
Through w-bound	0.230 / 0.087	6.5 / 5.1	A / A	12 /4

NB: Average delay, degree of saturation and level of service for the most delayed movement

The Sidra diagram for the proposed roundabout layout is shown below:



The modelling results above show that with the intersection upgrade to roundabout control, there is adequate capacity to cater for the proposed development.

The intersection was tested to ensure there is adequate capacity for future growth allowing for other anticipated development on the peninsula that could impact upon this intersection. All traffic flows were increased by 20% to ensure robustness of design. The results of this analysis are present in **Table 4.9** below.

Table 4.9 – Intersection of Fishery Point Road and Morisset Park Road, roundabout controlled layout, 2007 traffic flows plus full development (AM/PM)

MOVEMENT	DEGREE OF SATURATION	AVERAGE DELAY (SEC/VEH)	LEVEL OF SERVICE	95th PERCENTILE BACK OF QUEUE
Right turn in to Fishery Point Rd	0.037 / 0.034	15.5 / 12.9	B / A	2 / 1
Right turn out Fishery Pt Rd	0.428 / 0.186	12.0 / 12.4	A / A	24 /9
Through e-bound	0.112 / 0.226	4.4 / 4.5	A / A	6 / 12
Through w-bound	0.336 / 0.107	7.6 / 5.2	A / A	20 / 5

NB: Average delay, degree of saturation and level of service for the most delayed movement

The above results confirm that the upgraded roundabout controlled intersection at this location has adequate capacity to cater for the traffic flows associated with the proposed development.

It should be noted however that the traffic associated with the subject development, whilst impacting on the performance of this intersection, does not by itself trigger the requirement to upgrade this intersection. The development should be liable for a portion of the cost of upgrading this intersection, with the balance provided by Council through contributions from other development along Fishery Point Road. It is considered that a contribution of 20% towards this upgrade from the proposed development is appropriate, based upon the percentage increase in traffic flows created by the subject development.

4.6 Amenity Impacts – Henry Road

The main access point to the development will be via Trinity Point Drive. The secondary access will be via an extension of Henry Road. There will be directional signage on Trinity Point Drive directing drivers to the development, thus the majority of traffic will use Trinity Point Drive.

Existing traffic flows on Henry Road are considered to be very low. Given the number of existing residential developments on this length of road, it is considered that the traffic flows would be in the order of 40-60 vehicles per hour two-way. This is backed up by observed flows on Morisset Park Road of 100 vehicles per hour or less one way.

With the additional development flows, the traffic flows on Henry Road could increase. Assuming that as a worst case scenario 10% of the future traffic associated with this development could use Henry Road, the traffic flows during the peak hours could increase by less than 25 vehicles per hour two-way. This would give total future traffic flows in the order of 65-85 vehicles per hour two-way.

From the RTA Guide to Traffic Generating Development, Henry Road will provide the function of a Collector Road. As such, the maximum desirable environmental flow should be 500 vehicles per hour. It can be seen that the minor increase in traffic flows created by the development will ensure that the future total flows along this road will remain well below this threshold.

4.7 Local Access Issues

The development will generate traffic that will wish to access some of the local amenities, including the local shopping centre at Bonnells Bay off Fishery Point Road and the Bonnells Bay Primary school, etc. These local attractions will reduce the amount of traffic wishing to access the major centre of Morisset.

It is noted that the intersection of Morisset Park Road and Charles Avenue is to be upgraded to roundabout control under the conditions of consent for the Stage 7 of the adjoining residential development (DA 2293/2006). The works are to be undertaken wholly by that developer. In addition, the same approval requires the provision of kerb and gutter on the southern side of Morisset Park Road from the new roundabout to the existing kerb.

For traffic accessing the shops at Bonnells Bay, the most direct local route will be via Chiefly Road / Victoria Street and Baldwin Boulevard.

The shops at Bonnells Bay will provide a range of services, but will not fully replace trips to the Morisset town centre for traffic from the marina development. Assuming that these shops could attract 50% of the shopping trips associated with the marina development, the flows between the Bonnells Bay shopping centre and the marina would be low. Typically, shopping trips account for some 25% of peak hour traffic movements associated with residential traffic movements. Using this assumption, with less than 50 vehicle movements per hour generated by the residential element of the development, there would be 15 vehicles or less two-way travelling between the marina development and the Bonnells Bay shopping village.

With an allowance for some of the tourist visitors using these shops, it can be seen that the volume of traffic from the development using the Bonnells Bay shopping centre would be low. Accordingly, it is considered that the impact upon the local road network i.e. Chiefly Road / Victoria Street and Baldwin Boulevard will be minimal and that the total flows on these roads will be well within acceptable environmental limits.

4.8 Road Safety

It is considered that the existing road network can safely accommodate the additional traffic flows associated with the development. The local roads generally provide a reasonably straight alignment offering good forward visibility for all road users.

The proposed intersection upgrades are at the following intersections:

- Macquarie Street and Fishery Point Road (traffic signals)
- Station Street and Fishery Point Road (signals)
- Fishery Point Road and Morisset Park Road (roundabout).

These intersection upgrades will improve road safety for all users whilst ensuring delays are acceptable for all users.

4.9 Pedestrian and Cyclist Facilities

It can be seen that the future pedestrian movements associated with the proposed development will be relatively low. The majority of pedestrian movements associated with the proposed development will be internal to the site. There will be pedestrian movements from the adjacent residential development in the general locality of the site, from the existing residential

development as well as the residential development currently being constructed to the immediate west of the site.

As part of the development, new pedestrian paths and linkages will be provided, with a mixture of on-road, off-road and foreshore paths. It is considered that the pedestrian and cyclist provision will be adequate to cater for the future demands.

Given the low overall traffic flows along Morisset Park Road it is not considered that a dedicated off-road cycleway is required.

4.10 Public Transport

It can be seen that the proposed development will have a minimal impact in terms of public transport demand. It is proposed to provide a bus stop within the development on the main north-south spine road for use by a regular bus service and tourist buses. Discussion will be required with the local bus provider (Morisset Bus Service) to determine suitable modifications to the existing bus route to provide access to the subject development.

The development will also cater for tourist buses, with a bus stop to be provided on the main east-west access road (Trinity Point Drive) and will be located close to the roundabout access, with a pedestrian link to the marina development.

4.11 Parking Management

As part of the development of the total site, a parking management strategy will be determined and implemented. The parking strategy could include:

- Valet control of parking within the marina for the function centre
- Members passes for entry to secure parking areas
- Controls for residents parking with automatic entry/exit barriers
- Security parking controls and monitoring
- Parking controls for tourist buses. A bus stop will be provided adjacent to the site on Trinity Point Drive, to allow for visitor drop off, but this bus will then leave the bus stop to park elsewhere waiting for the return trip.
- The parking on site will also be controlled to ensure general public car parking is provided in a safe and appropriate manner. This will include signage and pedestrian access to and from the parking.
- On-site parking for disabled use. The disabled parking for the marina will all be provided on the ground level, for ease of access for disabled users. The disabled parking will be located adjacent to the main pedestrian access routes.
- The approved Trinity Point Drive (north-south) verge should be modified to allow for indented parking bays between street tree scaping and driveways

5. Summary and Conclusions

5.1 Summary

The findings of the traffic investigations and assessment of the proposed marina and village development at Trinity Point, is provided below:

1. The proposed development is to provide a marina village development with associated facilities and tourist as well as residential units. This assessment has been completed for the full development of the marina and village. Parking for the development will be provided within the site.
2. The site is located to the east of Morisset on the peninsula. Access is provided via Fishery Point Road and Morisset Park Road. As part of this study, a traffic survey has been completed at the critical intersection and the current peak hour flows are relatively high at the western end of Fishery Point Road but within acceptable limits for these classifications of roads.
3. It has been assumed that the standard rates for residential developments from the RTA Guide to Traffic Generating Developments will apply resulting in an additional traffic volume of approximately 211 vehicles per hour two-way during the AM and PM peak hours.
4. It is considered that some 80% of the traffic from the development will access Macquarie Street, to gain access to all areas to the north and south of the site. Some 80% of the flows will head south along Macquarie Street.
5. It has previously been determined by RTA and LMCC that the intersection of Macquarie Street and Fishery Point Road is required to be upgraded from a priority control to a signal controlled intersection. It is understood that this upgrading work has been programmed to be implemented and for the purpose of this analysis it is assumed that this work has been carried out.
6. The analysis completed for the study shows that the proposed signal upgrade will have adequate capacity to cater for the flows associated with the development of the subject site. The analysis has allowed for the development of adjacent sites as well as other potential sites identified by Lake Macquarie City Council.
7. Previous work completed by Better Transport Futures for the intersection of Fishery Point Road and Station Street has shown that this intersection needs to be upgraded and the road authorities require a signal control intersection at this location. This upgrading will be implemented as works required for another development (but it is recognised that the upgrade is not fully attributable to that other development). For the purpose of this report it is assumed that this work has been carried out. The future signal controlled intersection has been analysed with Sidra and the future intersection control can accommodate the flows associated with the proposed development.
8. A review of the operation of the intersection of Fishery Point Road and Morisset Park Road shows that the current intersection suffers from delays, due to the high right turn demand from the side road in the morning peak. With the additional traffic associated with the subject development, the current intersection may not provide an acceptable level of service for road users.
9. It is considered that the intersection of Fishery Point Road and Morisset Park Road will need to be upgraded to provide a 3-way roundabout control. The Sidra analysis for a 3-way single lane roundabout indicates that the roundabout would have adequate capacity to cater for the additional flows associated with the development. A review of the traffic numbers indicates that the additional traffic associated with the subject development will increase the flows at this intersection by approximately 20%.

10. Existing pedestrian and cyclists facilities within the locality of the site are considered adequate. A network of on-road and off-road footway/cycleways will be provided to service the new development in addition to a public boardwalk through the subject site.
11. A bus stop will be provided to the immediate west of this development on Trinity Point Drive to allow for an extension of the existing bus route from Morisset to service the site. This bus stop can also be used by tourist buses associated with the proposed development.
12. The vehicle access to the site is proposed via the approved extension to Henry Road and Trinity Point Drive, as part of the 194 lot residential development adjacent to the site. The main site access will be via this approved extension at a new roundabout at the eastern end of Trinity Point Drive. Access to the residential basement parking will be via upto three driveway access points off the approved north-south extension of Trinity Point Drive.
13. Vehicle access from this development site to nearby attractions on the peninsula have been assessed and it is considered that the existing road network has capacity to accept these additional minor traffic flows.

5.2 Conclusion

From the study, it is concluded that the existing road system is able to cater for the traffic demands of the proposed development subject to the intersection upgrades detailed above. The intersections identified above require upgrading to ensure delays for road users remain acceptable during the peak periods.

The parking provision for the development has been assessed using the requirements of Lake Macquarie City Council's DCP as well as AS 3962-2001 (Guidelines for the Design of Marinas). All parking can be accommodated on site, with no impact on the adjacent road network.

It is assumed that the following intersection upgrading works will be constructed in the medium term:

- Macquarie Street and Fishery Point Road (to signal control). The RTA are currently collecting contributions for this upgrade but have advised that there is currently no timetable for this work and;
- Fishery Point Road and Station Street (to signal control). This work is being completed as part of the approval process for the Scarborough Gardens development.

From analysis of existing traffic flows and the proposed traffic to be generated from the development, it is recommended that the proposed development be required to make contribution to upgrading works at the following intersection based on the additional traffic flows of approximately 20%:

- Morisset Park Road and Fishery Point Road (to roundabout control, single lane)

Appendix A Sidra results

Intersection Summary
Fishery Point Rd and Morisset Park Rd
AM peak 2007 plus dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	1056 veh/h	1584 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	0.999	
Effective Intersection Capacity	1057 veh/h	
95% Back of Queue (m)	200 m	
95% Back of Queue (veh)	28.6 veh	
Control Delay (Total)	8.85 veh-h/h	13.27 pers-h/h
Control Delay (Average)	30.2 s/veh	30.2 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS E	
Total Effective Stops	1181 veh/h	1772 pers/h
Effective Stop Rate	1.12 per veh	1.12 per pers
Proportion Queued	0.43	0.43
Travel Distance (Total)	638.2 veh-km/h	957.3 pers-km/h
Travel Distance (Average)	604 m	604 m
Travel Time (Total)	19.5 veh-h/h	29.2 pers-h/h
Travel Time (Average)	66.4 secs	66.4 secs
Travel Speed	32.7 km/h	32.7 km/h
Operating Cost (Total)	632 $/h	632 $/h
Fuel Consumption (Total)	75.2 L/h	
Carbon Dioxide (Total)	188.1 kg/h	
Hydrocarbons (Total)	0.333 kg/h	
Carbon Monoxide (Total)	12.77 kg/h	
NOX (Total)	0.399 kg/h	

Movement Summary
Fishery Point Rd and Morisset Park Rd
AM peak 2007 plus dev
Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Morisset Road										
5	T	251	0.0	0.129	0.0	LOS A	0	0.00	0.00	60.0
6	R	17	0.0	0.016	9.4	LOS A	1	0.36	0.64	47.3
Approach		**268**	**0.0**	**0.129**	**0.6**	**LOS A**	**1**	**0.02**	**0.04**	**59.0**
Fishery Pt Rd north										
7	L	43	0.0	0.063	9.2	LOS A	2	0.31	0.65	47.6
9	R	452	0.0	0.999#	68.5	LOS E	200	1.00	2.34	20.7
Approach		**495**	**0.0**	**1.000**	**61.2**	**LOS E**	**200**	**0.91**	**2.13**	**22.3**
Fishery Pt Rd east										
10	L	172	0.0	0.093	8.2	LOS A	0	0.00	0.67	49.0
11	T	121	0.0	0.062	0.0	LOS A	0	0.00	0.00	60.0
Approach		**293**	**0.0**	**0.093**	**4.8**	**LOS A**		**0.00**	**0.39**	**53.0**
All Vehicles		**1056**	**0.0**	**0.999**	**30.2**	**Not Applicable**	**200**	**0.43**	**1.12**	**32.7**

Intersection Summary
Fishery Point Rd and Morisset Park Rd
PM peak 2007 plus dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	1237 veh/h	1856 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	0.661	
Effective Intersection Capacity	1872 veh/h	
95% Back of Queue (m)	36 m	
95% Back of Queue (veh)	5.2 veh	
Control Delay (Total)	3.25 veh-h/h	4.87 pers-h/h
Control Delay (Average)	9.5 s/veh	9.5 s/pers
Level of Service	Not Applicable	
Level of Service (Worst Movement)	LOS C	
Total Effective Stops	698 veh/h	1047 pers/h
Effective Stop Rate	0.56 per veh	0.56 per pers
Proportion Queued	0.15	0.15
Travel Distance (Total)	747.9 veh-km/h	1121.9 pers-km/h
Travel Distance (Average)	605 m	605 m
Travel Time (Total)	15.7 veh-h/h	23.6 pers-h/h
Travel Time (Average)	45.7 secs	45.7 secs
Travel Speed	47.6 km/h	47.6 km/h
Operating Cost (Total)	534 $/h	534 $/h
Fuel Consumption (Total)	76.5 L/h	
Carbon Dioxide (Total)	191.1 kg/h	
Hydrocarbons (Total)	0.321 kg/h	
Carbon Monoxide (Total)	13.62 kg/h	
NOX (Total)	0.435 kg/h	

Movement Summary
Fishery Point Rd and Morisset Park Rd
PM peak 2007 plus dev
Give-way

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Morisset Road										
5	T	113	0.0	0.058	0.0	LOS A	0	0.00	0.00	60.0
6	R	22	0.0	0.042	13.9	LOS A	1	0.65	0.85	43.3
Approach		**135**	**0.0**	**0.058**	**2.3**	**LOS A**	**1**	**0.11**	**0.14**	**56.5**
Fishery Pt Rd north										
7	L	14	0.0	0.022	11.6	LOS A	1	0.51	0.73	45.5
9	R	193	0.0	0.661	30.1	LOS C	36	0.86	1.18	32.7
Approach		**207**	**0.0**	**0.660**	**28.8**	**LOS C**	**36**	**0.84**	**1.15**	**33.4**
Fishery Pt Rd east										
10	L	662	0.0	0.356	8.2	LOS A	0	0.00	0.67	49.0
11	T	233	0.0	0.119	0.0	LOS A	0	0.00	0.00	60.0
Approach		**895**	**0.0**	**0.356**	**6.1**	**LOS A**		**0.00**	**0.49**	**51.4**
All Vehicles		**1237**	**0.0**	**0.661**	**9.5**	**Not Applicable**	**36**	**0.15**	**0.56**	**47.6**

Intersection Summary
Fishery Point Rd and Morisset Park Rd
AM peak 2007 plus dev (Roundabout)

Performance Measure	Vehicles	Persons
Demand Flows - Total	1056 veh/h	1584 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	0.329	
Effective Intersection Capacity	3205 veh/h	
95% Back of Queue (m)	16 m	
95% Back of Queue (veh)	2.3 veh	
Control Delay (Total)	2.49 veh-h/h	3.73 pers-h/h
Control Delay (Average)	8.5 s/veh	8.5 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS A	
Total Effective Stops	594 veh/h	892 pers/h
Effective Stop Rate	0.56 per veh	0.56 per pers
Proportion Queued	0.32	0.32
Travel Distance (Total)	667.1 veh-km/h	1000.7 pers-km/h
Travel Distance (Average)	632 m	632 m
Travel Time (Total)	13.9 veh-h/h	20.9 pers-h/h
Travel Time (Average)	47.4 secs	47.4 secs
Travel Speed	48.0 km/h	48.0 km/h
Operating Cost (Total)	475 $/h	475 $/h
Fuel Consumption (Total)	69.2 L/h	
Carbon Dioxide (Total)	173.0 kg/h	
Hydrocarbons (Total)	0.288 kg/h	
Carbon Monoxide (Total)	12.88 kg/h	
NOX (Total)	0.403 kg/h	

Movement Summary
Fishery Point Rd and Morisset Park Rd
AM peak 2007 plus dev
Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Morisset Road										
5	T	251	0.0	0.230	6.5	LOS A	12	0.58	0.59	49.1
6	R	17	0.0	0.025	14.4	LOS A	1	0.55	0.70	44.0
Approach		**268**	**0.0**	**0.230**	**7.0**	**LOS A**	**12**	**0.58**	**0.60**	**48.7**
Fishery Pt Rd north										
7	L	43	0.0	0.048	6.4	LOS A	2	0.30	0.49	50.1
9	R	452	0.0	0.329	11.8	LOS A	16	0.30	0.64	45.4
Approach		**495**	**0.0**	**0.330**	**11.3**	**LOS A**	**16**	**0.30**	**0.63**	**45.8**
Fishery Pt Rd east										
10	L	172	0.0	0.133	5.6	LOS A	5	0.14	0.45	51.2
11	T	121	0.0	0.086	4.4	LOS A	4	0.10	0.38	52.8
Approach		**293**	**0.0**	**0.133**	**5.1**	**LOS A**	**5**	**0.12**	**0.42**	**51.9**
All Vehicles		**1056**	**0.0**	**0.329**	**8.5**	**LOS A**	**16**	**0.32**	**0.56**	**48.0**

Intersection Summary
Fishery Point Rd and Morisset Park Rd
PM peak 2007 plus dev (roundabout)

Performance Measure	Vehicles	Persons
Demand Flows - Total	1237 veh/h	1856 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	0.481	
Effective Intersection Capacity	2573 veh/h	
95% Back of Queue (m)	25 m	
95% Back of Queue (veh)	3.5 veh	
Control Delay (Total)	2.29 veh-h/h	3.44 pers-h/h
Control Delay (Average)	6.7 s/veh	6.7 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS A	
Total Effective Stops	526 veh/h	789 pers/h
Effective Stop Rate	0.43 per veh	0.43 per pers
Proportion Queued	0.44	0.44
Travel Distance (Total)	763.8 veh-km/h	1145.7 pers-km/h
Travel Distance (Average)	617 m	617 m
Travel Time (Total)	15.7 veh-h/h	23.6 pers-h/h
Travel Time (Average)	45.8 secs	45.8 secs
Travel Speed	48.6 km/h	48.6 km/h
Operating Cost (Total)	540 $/h	540 $/h
Fuel Consumption (Total)	79.6 L/h	
Carbon Dioxide (Total)	199.0 kg/h	
Hydrocarbons (Total)	0.331 kg/h	
Carbon Monoxide (Total)	14.91 kg/h	
NOX (Total)	0.468 kg/h	

Movement Summary
Fishery Point Rd and Morisset Park Rd
PM peak 2007 plus dev
Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Morisset Road										
5	T	113	0.0	0.087	5.1	LOS A	4	0.35	0.45	50.8
6	R	22	0.0	0.027	12.6	LOS A	1	0.38	0.64	45.1
Approach		**135**	**0.0**	**0.087**	**6.3**	**LOS A**	**4**	**0.35**	**0.48**	**49.7**
Fishery Pt Rd north										
7	L	14	0.0	0.017	7.1	LOS A	1	0.40	0.52	49.4
9	R	193	0.0	0.150	12.2	LOS A	7	0.38	0.66	45.1
Approach		**207**	**0.0**	**0.150**	**11.8**	**LOS A**	**7**	**0.38**	**0.65**	**45.3**
Fishery Pt Rd east										
10	L	662	0.0	0.481	5.9	LOS A	25	0.59	0.36	48.2
11	T	233	0.0	0.187	4.5	LOS A	9	0.13	0.38	52.6
Approach		**895**	**0.0**	**0.481**	**5.5**	**LOS A**	**25**	**0.47**	**0.36**	**49.3**
All Vehicles		**1237**	**0.0**	**0.481**	**6.7**	**LOS A**	**25**	**0.44**	**0.43**	**48.6**

Intersection Summary
Fishery Point Rd and Morisset Park Rd
AM peak 2017 plus dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	1371 veh/h	2057 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	0.428	
Effective Intersection Capacity	3204 veh/h	
95% Back of Queue (m)	24 m	
95% Back of Queue (veh)	3.5 veh	
Control Delay (Total)	3.39 veh-h/h	5.08 pers-h/h
Control Delay (Average)	8.9 s/veh	8.9 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS B	
Total Effective Stops	812 veh/h	1217 pers/h
Effective Stop Rate	0.59 per veh	0.59 per pers
Proportion Queued	0.40	0.40
Travel Distance (Total)	866.1 veh-km/h	1299.2 pers-km/h
Travel Distance (Average)	632 m	632 m
Travel Time (Total)	18.2 veh-h/h	27.3 pers-h/h
Travel Time (Average)	47.9 secs	47.9 secs
Travel Speed	47.5 km/h	47.5 km/h
Operating Cost (Total)	623 $/h	623 $/h
Fuel Consumption (Total)	90.8 L/h	
Carbon Dioxide (Total)	227.1 kg/h	
Hydrocarbons (Total)	0.380 kg/h	
Carbon Monoxide (Total)	17.09 kg/h	
NOX (Total)	0.531 kg/h	

Movement Summary
Fishery Point Rd and Morisset Park Rd
AM peak 2017 plus dev
Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Morisset Road										
5	T	326	0.0	0.336	7.6	LOS A	20	0.71	0.69	48.1
6	R	22	0.0	0.037	15.5	LOS B	2	0.63	0.74	43.1
Approach		**348**	**0.0**	**0.336**	**8.1**	**LOS A**	**20**	**0.71**	**0.69**	**47.7**
Fishery Pt Rd north										
7	L	56	0.0	0.065	6.7	LOS A	3	0.34	0.51	49.8
9	R	587	0.0	0.428	12.0	LOS A	24	0.39	0.65	45.0
Approach		**643**	**0.0**	**0.428**	**11.6**	**LOS A**	**24**	**0.39**	**0.64**	**45.4**
Fishery Pt Rd east										
10	L	223	0.0	0.173	5.6	LOS A	7	0.17	0.44	51.0
11	T	157	0.0	0.112	4.4	LOS A	6	0.12	0.38	52.7
Approach		**380**	**0.0**	**0.173**	**5.1**	**LOS A**	**7**	**0.15**	**0.42**	**51.7**
All Vehicles		**1371**	**0.0**	**0.428**	**8.9**	**LOS A**	**24**	**0.40**	**0.59**	**47.5**

Intersection Summary
Fishery Point Rd and Morisset Park Rd
PM peak 2017 plus dev

Performance Measure	Vehicles	Persons
Demand Flows - Total	1483 veh/h	2225 pers/h
Percent Heavy Vehicles	0.0 %	
Degree of Saturation	0.577	
Effective Intersection Capacity	2572 veh/h	
95% Back of Queue (m)	33 m	
95% Back of Queue (veh)	4.8 veh	
Control Delay (Total)	2.82 veh-h/h	4.22 pers-h/h
Control Delay (Average)	6.8 s/veh	6.8 s/pers
Level of Service	LOS A	
Level of Service (Worst Movement)	LOS A	
Total Effective Stops	628 veh/h	942 pers/h
Effective Stop Rate	0.42 per veh	0.42 per pers
Proportion Queued	0.54	0.54
Travel Distance (Total)	915.7 veh-km/h	1373.5 pers-km/h
Travel Distance (Average)	617 m	617 m
Travel Time (Total)	19.1 veh-h/h	28.6 pers-h/h
Travel Time (Average)	46.3 secs	46.3 secs
Travel Speed	48.0 km/h	48.0 km/h
Operating Cost (Total)	655 $/h	655 $/h
Fuel Consumption (Total)	96.8 L/h	
Carbon Dioxide (Total)	241.9 kg/h	
Hydrocarbons (Total)	0.404 kg/h	
Carbon Monoxide (Total)	18.37 kg/h	
NOX (Total)	0.572 kg/h	

Movement Summary
Fishery Point Rd and Morisset Park Rd
PM peak 2017 plus dev
Roundabout

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Morisset Road										
5	T	135	0.0	0.107	5.2	LOS A	5	0.39	0.47	50.5
6	R	27	0.0	0.034	12.9	LOS A	1	0.42	0.66	44.9
Approach		**162**	**0.0**	**0.107**	**6.5**	**LOS A**	**5**	**0.40**	**0.50**	**49.4**
Fishery Pt Rd north										
7	L	16	0.0	0.021	7.4	LOS A	1	0.44	0.54	49.2
9	R	231	0.0	0.186	12.4	LOS A	9	0.43	0.68	44.9
Approach		**247**	**0.0**	**0.186**	**12.1**	**LOS A**	**9**	**0.43**	**0.67**	**45.1**
Fishery Pt Rd east										
10	L	795	0.0	0.577	6.1	LOS A	33	0.74	0.34	47.2
11	T	279	0.0	0.226	4.5	LOS A	12	0.15	0.38	52.4
Approach		**1074**	**0.0**	**0.576**	**5.7**	**LOS A**	**33**	**0.59**	**0.36**	**48.5**
All Vehicles		**1483**	**0.0**	**0.577**	**6.8**	**LOS A**	**33**	**0.54**	**0.42**	**48.0**

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Intersection Summary
Macquarie Street and Fishery Point Road
2007 AM base + full Peninsula development

Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows - Total	1892 veh/h	106 ped/h	2944 pers/h
Percent Heavy Vehicles	4.5 %		
Degree of Saturation	0.737	0.050	
Effective Intersection Capacity	2566 veh/h		
95% Back of Queue (m)	162 m	0 m	
95% Back of Queue (veh)	22.5 veh	0.1 ped	
Control Delay (Total)	11.15 veh-h/h	0.92 ped-h/h	17.65 pers-h/h
Control Delay (Average)	21.2 s/veh	31.1 s/ped	21.6 s/pers
Level of Service	LOS B	LOS C	
Level of Service (Worst Movement)	LOS C	LOS D	
Total Effective Stops	1459 veh/h	93 ped/h	2282 pers/h
Effective Stop Rate	0.77 per veh	0.88 per ped	0.78 per pers
Proportion Queued	0.74	0.88	0.75
Travel Distance (Total)	1144.1 veh-km/h	3.5 ped-km/h	1719.6 pers-km/h
Travel Distance (Average)	605 m	33 m	584 m
Travel Time (Total)	30.2 veh-h/h	1.7 ped-h/h	46.9 pers-h/h
Travel Time (Average)	57.4 secs	56.6 secs	57.4 secs
Travel Speed	37.9 km/h	2.1 km/h	36.6 km/h
Operating Cost (Total)	1042 $/h	28 $/h	1070 $/h
Fuel Consumption (Total)	152.8 L/h		
Carbon Dioxide (Total)	382.7 kg/h		
Hydrocarbons (Total)	0.639 kg/h		
Carbon Monoxide (Total)	30.03 kg/h		
NOX (Total)	0.896 kg/h		

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Movement Summary
Macquarie Street and Fishery Point Road
2007 AM base + full Peninsula development
Signalised - Fixed time Cycle Time = 80 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Macqaurie Street south										
2	T	252	8.0	0.204	5.6	LOS A	39	0.42	0.35	52.0
3	R	314	2.9	0.382	16.9	LOS B	30	0.67	0.77	41.0
Approach		**564**	**5.1**	**0.382**	**11.8**	**LOS A**	**39**	**0.56**	**0.58**	**45.3**
Fishery Point Road										
4	L	795	3.0	0.729	20.5	LOS B	162	0.77	0.86	38.4
6	R	122	3.3	0.358	39.8	LOS C	41	0.91	0.79	28.7
Approach		**917**	**3.1**	**0.729**	**23.1**	**LOS B**	**162**	**0.79**	**0.85**	**36.7**
Macquarie Street north										
7	L	69	2.9	0.152	18.8	LOS B	15	0.53	0.72	39.6
8	T	342	7.9	0.737	32.2	LOS C	108	0.98	0.89	31.8
Approach		**411**	**7.1**	**0.738**	**29.9**	**LOS C**	**108**	**0.90**	**0.86**	**32.9**
All Vehicles		**1892**	**4.5**	**0.737**	**21.2**	**LOS B**	**162**	**0.74**	**0.77**	**37.9**

SIDRA INTERSECTION

Intersection Summary
Macquarie Street and Fishery Point Road
2007 PM base + full Peninsula development

Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows - Total	2332 veh/h	106 ped/h	3604 pers/h
Percent Heavy Vehicles	4.6 %		
Degree of Saturation	0.629	0.055	
Effective Intersection Capacity	3709 veh/h		
95% Back of Queue (m)	158 m	0 m	
95% Back of Queue (veh)	22.1 veh	0.2 ped	
Control Delay (Total)	14.09 veh-h/h	1.14 ped-h/h	22.27 pers-h/h
Control Delay (Average)	21.7 s/veh	38.8 s/ped	22.2 s/pers
Level of Service	LOS B	LOS C	
Level of Service (Worst Movement)	LOS D	LOS E	
Total Effective Stops	1661 veh/h	87 ped/h	2579 pers/h
Effective Stop Rate	0.71 per veh	0.82 per ped	0.72 per pers
Proportion Queued	0.62	0.82	0.63
Travel Distance (Total)	1409.2 veh-km/h	3.5 ped-km/h	2117.4 pers-km/h
Travel Distance (Average)	604 m	33 m	588 m
Travel Time (Total)	37.5 veh-h/h	1.9 ped-h/h	58.2 pers-h/h
Travel Time (Average)	58.0 secs	64.3 secs	58.2 secs
Travel Speed	37.5 km/h	1.9 km/h	36.4 km/h
Operating Cost (Total)	1285 $/h	32 $/h	1317 $/h
Fuel Consumption (Total)	184.3 L/h		
Carbon Dioxide (Total)	461.7 kg/h		
Hydrocarbons (Total)	0.766 kg/h		
Carbon Monoxide (Total)	34.87 kg/h		
NOX (Total)	1.056 kg/h		

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Movement Summary
Macquarie Street and Fishery Point Road
2007 PM base + full Peninsula development
Signalised - Fixed time Cycle Time = 113 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Macqaurie Street south										
2	T	425	8.0	0.308	5.1	LOS A	70	0.36	0.32	52.6
3	R	938	3.0	0.629	21.7	LOS B	158	0.65	0.83	37.5
Approach		**1363**	**4.5**	**0.629**	**16.5**	**LOS B**	**158**	**0.56**	**0.67**	**41.2**
Fishery Point Road										
4	L	417	3.1	0.418	24.2	LOS B	105	0.63	0.80	36.1
6	R	85	3.5	0.568	55.6	LOS D	42	0.93	0.77	23.7
Approach		**503**	**3.2**	**0.567**	**29.5**	**LOS C**	**105**	**0.68**	**0.80**	**33.1**
Macquarie Street north										
7	L	139	2.9	0.374	21.4	LOS B	36	0.52	0.74	37.8
8	T	327	8.0	0.511	31.6	LOS C	116	0.85	0.73	32.1
Approach		**466**	**6.4**	**0.511**	**28.6**	**LOS C**	**116**	**0.75**	**0.73**	**33.6**
All Vehicles		**2332**	**4.6**	**0.629**	**21.7**	**LOS B**	**158**	**0.62**	**0.71**	**37.5**

SIDRA INTERSECTION

Intersection Summary
Macquarie Street and Fishery Point Road
2017 AM base + full Peninsula development

Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows - Total	2012 veh/h	106 ped/h	3124 pers/h
Percent Heavy Vehicles	4.8 %		
Degree of Saturation	0.777	0.059	
Effective Intersection Capacity	2588 veh/h		
95% Back of Queue (m)	181 m	0 m	
95% Back of Queue (veh)	25.3 veh	0.1 ped	
Control Delay (Total)	12.60 veh-h/h	0.89 ped-h/h	19.80 pers-h/h
Control Delay (Average)	22.6 s/veh	30.3 s/ped	22.8 s/pers
Level of Service	LOS B	LOS C	
Level of Service (Worst Movement)	LOS C	LOS D	
Total Effective Stops	1582 veh/h	92 ped/h	2465 pers/h
Effective Stop Rate	0.79 per veh	0.87 per ped	0.79 per pers
Proportion Queued	0.78	0.87	0.78
Travel Distance (Total)	1216.9 veh-km/h	3.5 ped-km/h	1828.8 pers-km/h
Travel Distance (Average)	605 m	33 m	585 m
Travel Time (Total)	32.8 veh-h/h	1.6 ped-h/h	50.9 pers-h/h
Travel Time (Average)	58.8 secs	55.9 secs	58.7 secs
Travel Speed	37.0 km/h	2.1 km/h	35.9 km/h
Operating Cost (Total)	1132 $/h	28 $/h	1159 $/h
Fuel Consumption (Total)	164.5 L/h		
Carbon Dioxide (Total)	412.2 kg/h		
Hydrocarbons (Total)	0.688 kg/h		
Carbon Monoxide (Total)	32.22 kg/h		
NOX (Total)	0.961 kg/h		

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Movement Summary
Macquarie Street and Fishery Point Road
2017 AM base + full Peninsula development
Signalised - Fixed time Cycle Time = 80 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Macqaurie Street south										
2	T	302	7.9	0.241	5.4	LOS A	45	0.41	0.36	52.3
3	R	314	2.9	0.398	17.5	LOS B	29	0.70	0.77	40.5
Approach		**615**	**5.4**	**0.398**	**11.5**	**LOS A**	**45**	**0.56**	**0.57**	**45.6**
Fishery Point Road										
4	L	795	3.0	0.777	24.1	LOS B	181	0.84	0.89	36.1
6	R	122	3.3	0.384	40.8	LOS C	42	0.93	0.79	28.3
Approach		**917**	**3.1**	**0.777**	**26.4**	**LOS B**	**181**	**0.85**	**0.88**	**34.8**
Macquarie Street north										
7	L	69	2.9	0.146	17.7	LOS B	14	0.50	0.72	40.4
8	T	411	8.0	0.771	31.3	LOS C	127	0.98	0.91	32.2
Approach		**480**	**7.3**	**0.771**	**29.4**	**LOS C**	**127**	**0.91**	**0.89**	**33.2**
All Vehicles		**2012**	**4.8**	**0.777**	**22.6**	**LOS B**	**181**	**0.78**	**0.79**	**37.0**

SIDRA INTERSECTION

Intersection Summary
Macquarie Street and Fishery Point Road
2017 PM base + full Peninsula development

Performance Measure	Vehicles	Pedestrians	Persons
Demand Flows - Total	2483 veh/h	106 ped/h	3831 pers/h
Percent Heavy Vehicles	4.8 %		
Degree of Saturation	0.674	0.055	
Effective Intersection Capacity	3682 veh/h		
95% Back of Queue (m)	160 m	0 m	
95% Back of Queue (veh)	22.3 veh	0.2 ped	
Control Delay (Total)	15.88 veh-h/h	1.14 ped-h/h	24.96 pers-h/h
Control Delay (Average)	23.0 s/veh	38.8 s/ped	23.5 s/pers
Level of Service	LOS B	LOS C	
Level of Service (Worst Movement)	LOS D	LOS E	
Total Effective Stops	1813 veh/h	87 ped/h	2807 pers/h
Effective Stop Rate	0.73 per veh	0.82 per ped	0.73 per pers
Proportion Queued	0.65	0.82	0.66
Travel Distance (Total)	1500.8 veh-km/h	3.5 ped-km/h	2254.7 pers-km/h
Travel Distance (Average)	604 m	33 m	589 m
Travel Time (Total)	40.8 veh-h/h	1.9 ped-h/h	63.2 pers-h/h
Travel Time (Average)	59.2 secs	64.3 secs	59.4 secs
Travel Speed	36.7 km/h	1.9 km/h	35.7 km/h
Operating Cost (Total)	1396 $/h	32 $/h	1428 $/h
Fuel Consumption (Total)	198.7 L/h		
Carbon Dioxide (Total)	497.8 kg/h		
Hydrocarbons (Total)	0.826 kg/h		
Carbon Monoxide (Total)	37.48 kg/h		
NOX (Total)	1.134 kg/h		

SIDRA SOLUTIONS

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Movement Summary
Macquarie Street and Fishery Point Road
2017 PM base + full Peninsula development
Signalised - Fixed time Cycle Time = 113 seconds

Vehicle Movements

Mov ID	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Macqaurie Street south										
2	T	511	8.0	0.371	5.4	LOS A	85	0.38	0.34	52.2
3	R	938	3.0	0.674	25.2	LOS B	160	0.71	0.88	35.4
Approach		**1449**	**4.8**	**0.674**	**18.2**	**LOS B**	**160**	**0.59**	**0.69**	**40.0**
Fishery Point Road										
4	L	417	3.1	0.418	24.2	LOS B	105	0.63	0.80	36.1
6	R	85	3.5	0.568	55.6	LOS D	42	0.93	0.77	23.7
Approach		**503**	**3.2**	**0.567**	**29.5**	**LOS C**	**105**	**0.68**	**0.80**	**33.1**
Macquarie Street north										
7	L	139	2.9	0.374	21.4	LOS B	36	0.52	0.74	37.8
8	T	393	7.9	0.612	33.1	LOS C	141	0.89	0.77	31.4
Approach		**531**	**6.6**	**0.612**	**30.0**	**LOS C**	**141**	**0.79**	**0.76**	**32.9**
All Vehicles		**2483**	**4.8**	**0.674**	**23.0**	**LOS B**	**160**	**0.65**	**0.73**	**36.7**

Appendix B Criteria for interpreting results of Sidra

1-Level of Service (LoS)

LoS	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Good	Good
B	Good, with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	Satisfactory	Satisfactory, but requires accident study
D	Operating near capacity	Near capacity and requires accident study
E	At capacity, excessive delay: roundabout requires other control method	At capacity, requires other control mode
F	Unsatisfactory, requires other control mode or additional capacity	Unsatisfactory, requires other control mode

2-Average Vehicle Delay (AVD)

The AVD is a measure of operational performance of an intersection relating to its LoS. The average delay should be taken as a guide only for an average intersection. Longer delays may be tolerated at some intersections where delays are expected by motorists (e.g. those in inner city areas or major arterial roads).

LoS	Average Delay / Vehicle (secs)	Traffic Signals and Roundabouts	Give Way and Stop Signs
A	Less than 15	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	28 to 42	Satisfactory	Satisfactory but accident study required
D	42 to 56	Operating near capacity	Near capacity, accident study required
E	56 to 70	At capacity, excessive delays: roundabout requires other control mode	At capacity; requires other control mode
F	Exceeding 70	Unsatisfactory, requires additional capacity	Unsatisfactory, requires other control mode

3-Degree of Saturation (D/S)

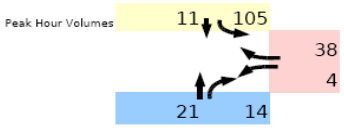
The D/S of an intersection is usually taken as the highest ratio of traffic volumes on an approach to an intersection compared with the theoretical capacity, and is a measure of the utilisation of available green time. For intersections controlled by traffic signals, both queues and delays increase rapidly as DS approaches 1.0. An intersection operates satisfactorily when its D/S is kept below 0.75. When D/S exceeds 0.9, queues are expected.

Appendix C Traffic Survey Data

Curtis Traffic Surveys

Turning movement count

Job: 071001BT
Day, date: Tue, 30 Oct 07
Location: Silky Oaks Dr & Morisset Pk Rd
Weather: Fine
Client: Better Transport



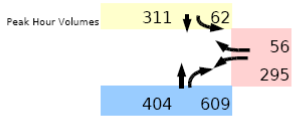
Time Period	From Silky Oaks Dr Through	From Silky Oaks Dr Right	From Morisset Pk Rd east Left	From Morisset Pk Rd east Right	From Morisset Pk Rd north Left	From Morisset Pk Rd north Through	Total vehicle movements	
15:30 to 15:45	6	4	2	10	45	8	75	Peak
15:45 to 16:00	4	5	2	18	31	2	62	
16:00 to 16:15	5	4	0	3	14	0	26	
16:15 to 16:30	6	1	0	7	15	1	30	
16:30 to 16:45	7	2	0	6	18	2	35	
16:45 to 17:00	6	1	1	9	14	1	32	
17:00 to 17:15	4	0	1	5	25	0	35	
17:15 to 17:30	3	3	1	9	15	0	31	
17:30 to 17:45	0	1	1	5	12	1	20	
17:45 to 18:00	1	2	0	7	18	0	28	
18:00 to 18:15	4	0	1	11	17	2	35	
18:15 to 18:30	3	3	3	8	12	2	31	
Totals	49	26	12	98	236	19	75	
15:30 to 16:30	21	14	4	38	105	11	193	Peak Hour
15:45 to 16:45	22	12	2	34	78	5	153	
16:00 to 17:00	24	8	1	25	61	4	123	
16:15 to 17:15	23	4	2	27	72	4	132	
16:30 to 17:30	20	6	3	29	72	3	133	
16:45 to 17:45	13	5	4	28	66	2	118	
17:00 to 18:00	8	6	3	26	70	1	114	
17:15 to 18:15	8	6	3	32	62	3	114	
17:30 to 18:30	8	6	5	31	59	5	114	
17:00 to 18:00	30	12	9	213	562	85	911	
17:15 to 18:15	30	13	10	215	592	87	947	
17:30 to 18:30	34	8	10	205	483	82	822	

Curtis Traffic Surveys

Turning movement count

Job: 071001BT
Day, date Tue, 30 Oct 07
Location: Macquarie St & Fishery Pt Rd
Weather: Fine
Client: Better Transport

Peak Hour Volumes



Time Period	From Macquarie St south Through	Right	From Fishery Pt Rd Left	Right	From Macquarie St north Left	Through	Total vehicle movements	
15:30 to 15:45	79	151	101	12	19	85	447	
15:45 to 16:00	89	134	72	17	8	81	401	
16:00 to 16:15	90	155	84	15	15	81	440	
16:15 to 16:30	110	157	67	9	21	84	448	Peak
16:30 to 16:45	115	163	72	15	18	65	448	Peak
16:45 to 17:00	53	69	39	3	12	27	203	
17:00 to 17:15	95	209	52	2	16	64	438	
17:15 to 17:30	58	115	31	6	22	40	272	
17:30 to 17:45	74	123	72	10	24	46	349	
17:45 to 18:00	75	115	58	1	19	56	324	
18:00 to 18:15	67	122	40	12	23	39	303	
18:15 to 18:30	54	83	49	12	11	40	249	
Totals	959	1596	737	114	208	708	448	
15:30 to 16:30	368	597	324	53	63	331	1736	
15:45 to 16:45	404	609	295	56	62	311	1737	Peak Hour
16:00 to 17:00	368	544	262	42	66	257	1539	
16:15 to 17:15	373	598	230	29	67	240	1537	
16:30 to 17:30	321	556	194	26	68	196	1361	
16:45 to 17:45	280	516	194	21	74	177	1262	
17:00 to 18:00	302	562	213	19	81	206	1383	
17:15 to 18:15	274	475	201	29	88	181	1248	
17:30 to 18:30	270	443	219	35	77	181	1225	

Curtis Traffic Surveys

Turning movement count

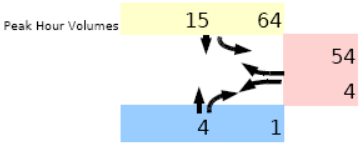
Job: 071001BT

Day, date: Tue, 30 Oct 07

Location: Silky Oak Dr & Morisset Pk Rd

Weather: Fine

Client: Better Transport



Time Period	From Silky Oaks Dr Through	From Silky Oaks Dr Right	From Morisset Pk Rd east Left	From Morisset Pk Rd east Right	From Morisset Pk Rd north Left	From Morisset Pk Rd north Through	Total vehicle movements	
07:30 to 07:45	1	0	3	14	4	4	26	
07:45 to 08:00	3	0	0	18	5	5	31	
08:00 to 08:15	2	0	1	20	12	6	41	
08:15 to 08:30	2	0	0	16	11	5	34	
08:30 to 08:45	1	0	1	15	6	4	27	
08:45 to 09:00	0	0	1	13	5	3	22	
09:00 to 09:15	2	1	0	14	32	5	54	Peak
09:15 to 09:30	1	0	2	12	21	3	39	
Totals	12	1	8	122	96	35	54	
07:30 to 08:30	8	0	4	68	32	20	132	
07:45 to 08:45	8	0	2	69	34	20	133	
08:00 to 09:00	5	0	3	64	34	18	124	
08:15 to 09:15	5	1	2	58	54	17	137	
08:30 to 09:30	4	1	4	54	64	15	142	Peak Hour

295

Curtis Traffic Surveys

Turning movement count

Job: 071001BT

Day, date Tue, 30 Oct 07

Location: Morisset Park Rd & Fishery Pt Rd

Weather: Fine

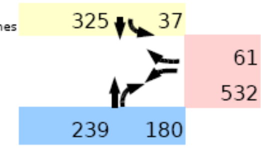
Client: Better Transport

Peak Hour Volumes 429 41 / 163 16 / 52 90

	From Morisset Pk Rd		From Fishery Pt Rd north		From Fishery Pt Rd west		
Time Period	Through	Right	Left	Right	Left	Through	Total vehicle movements
07:30 to 07:45	15	2	2	98	29	9	155
07:45 to 08:00	22	5	6	110	41	10	194
08:00 to 08:15	19	3	3	103	32	13	173
08:15 to 08:30	15	1	2	112	41	15	186
08:30 to 08:45	32	4	18	107	45	12	218
08:45 to 09:00	24	8	18	107	45	12	214
09:00 to 09:15	24	8	17	56	32	15	152
09:15 to 09:30	18	12	15	35	28	14	122
Totals	169	43	81	728	293	100	1414
07:30 to 08:30	71	11	13	423	143	47	708
07:45 to 08:45	88	13	29	432	159	50	771
08:00 to 09:00	90	16	41	429	163	52	791 Peak Hour
08:15 to 09:15	95	21	55	382	163	54	770
08:30 to 09:30	98	32	68	305	150	53	706

Curtis Traffic Surveys

Peak Hour Volumes



Turning movement count

Job: 071001BT

Day, date: Tue, 30 Oct 07

Location: Macquarie St & Fishery Pt Rd

Weather: Fine

Client: Better Transport

Time Period	From Macquarie St south – Through	From Macquarie St south – Right	From Fishery Pt Rd – Left	From Fishery Pt Rd – Right	From Macquarie St north – Left	From Macquarie St north – Through	Total vehicle movements
07:30 to 07:45	64	36	141	20	10	74	345
07:45 to 08:00	71	42	142	21	6	78	360
08:00 to 08:15	54	42	138	16	10	84	344
08:15 to 08:30	55	37	123	12	11	83	321
08:30 to 08:45	59	59	129	12	10	80	349
08:45 to 09:00	60	49	133	8	7	85	342
09:00 to 09:15	44	64	111	17	14	63	313
09:15 to 09:30	54	69	95	13	8	55	294
Totals	461	398	1012	119	76	602	2668
07:30 to 08:30	244	157	544	69	37	319	1370
07:45 to 08:45	239	180	532	61	37	325	1374 Peak Hour
08:00 to 09:00	228	187	523	48	38	332	1356
08:15 to 09:15	218	209	496	49	42	311	1325
08:30 to 09:30	217	241	468	50	39	283	1298