Nine Network Australia Pty Ltd
19 March 2013

Nine Network Australia (NNA) Willoughby site redevelopment

Transport and Accessibility Impact Assessment

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Prepared for

Nine Network Australia Pty Ltd

Prepared by

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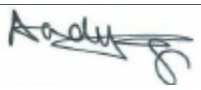
D	19-Mar-2013	Updated Final Report (with supplementary option)	Andy Yung Principal Transport Planner	

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1.0 Introduction

1.1 Background

AECOM has been commissioned by Nine Network Australia Pty Ltd (NNA) to prepare a Transport and Accessibility Impact Assessment in support of an Environment Assessment (EA) of the Concept Plan prepared for the redevelopment of the site at 6-30 Artarmon Road, Willoughby. The project site in relation to its regional context is shown in **Figure 1**.

Figure 1 Location of the project site

Source: AECOM 2012

The Concept Plan proposes a residential development with approximately 585 dwelling units consisting of 193 one-bedroom units, 374 two-bedroom units and 18 three-bedroom units with a small scale retail component serving a local catchment within walking distance.

This report addresses the relevant transport planning requirements in the Director-General's Requirements (DGRs) issued dated 9 February 2011 for the preparation of the EA for the project, which involved the following tasks:

- Identify any required road / intersection upgrades by estimating the trip generation by the proposed development.
- Review the access and loading dock design including service vehicle movements.
- Assess the car parking arrangements including car share schemes.
- Provide initiatives and measures to promote active and public transport usage by future residents.
- Demonstrate a minimal provision of on-site car parking for the proposed development having regard to the site's accessibility to public transport.

1.2 Report structure

The report is structured as follows:

- **Section 2** provides the strategic planning context in relation to the study, including State, Regional and Local Planning Policies.
- **Section 3** summarises the existing conditions in the area surrounding the site, including travel patterns and behaviour, public transport, cyclist and pedestrian facilities as well as the existing performance of the road network.
- **Section 4** gives details of the development proposal including vehicular access and parking arrangements.
- **Section 5** provides a traffic impact assessment of the site on the existing road network. This includes the trip generation exercise and intersection performance testing using the SIDRA modelling software.
- **Section 6** provides a summary and conclusions of the report.

2.0 Transport and Planning Policy

2.1 Regional and state planning policy

2.1.1 NSW Long Term Transport Master Plan (2012)

The Master Plan prepared by Transport for NSW sets the direction for transport planning for the next 20 years, providing a framework for transport policy and investment decisions that respond to key challenges

The plan sets out the transport challenges over the next 20 years:

- Integrating modes to meet customer needs.
- Getting Sydney moving again.
- Sustaining growth in Greater Sydney.
- Providing essential access for regional NSW
- Supporting efficient and productive freight.
- Addressing state wide challenges across the transport network.

The Master Plan also identifies solutions and actions that integrate, grow, modernise and manage the transport system in the short term (0-5 years), medium term (5-10 years) and longer term (10-20 years). This plan has superseded the “Metropolitan Transport Plan 2010” prepared by NSW Department of Transport and Infrastructure in 2010. Hence, the Metropolitan Transport Plan 2010 is no longer a relevant documentation for consideration in determining this Concept Plan application.

2.1.2 NSW 2021 – A Plan to make NSW Number One (2011)

The NSW 2021 plan is a10–year plan to guide the state government’s policy and budget decision making and, in conjunction with the NSW Budget, to deliver on community priorities. The plan will drive the agenda for change in NSW to:

- Restore economic growth.
- Return quality health, transport, education, police, justice and community services, putting customer service at the heart of service design.
- Build infrastructure that drives our economy and improves people’s lives.
- Strengthen our local environments, devolve decision making and return planning powers to the community.
- Restore accountability and transparency to government, and give the community a say in decisions affecting their lives.

Goal 5 of the NSW 2021 plan aims to increase the supply of land for housing and provide incentives to help make housing in NSW more affordable and housing stock more appropriate for people’s needs.

In order to facilitate housing affordability and availability, three specific targets are set in order to:

- Facilitate the delivery of 25,000 new dwellings in Sydney per year.
- Increase the available green field ‘zoned and trunk serviced’ lots to always be above 50,000.
- Increase uptake of ‘empty nester’ opportunities.

The NSW Government is committed to delivering an efficient and effective transport system that reduces the time it takes to travel around Sydney and across NSW in **Goal 7** of the plan.

Goal 8 of the plan aims to grow public transport usage in order to reduce traffic congestion, improve travel times and provide significant environmental benefits. Key targets to achieve this aim is to increase the proportion of total journeys to work by public transport in the Sydney Metropolitan Region to 28% by 2016 and to increase the amount of walking and cycling trips in the Greater Sydney region, at a local and district level.

2.1.3 Metropolitan Plan for Sydney 2036 (2010)

The Metropolitan Plan for Sydney prepared by the NSW Government is an integrated, long-term planning framework that will sustainably manage Sydney's growth and strengthen its economic development to 2036, providing improved accessibility, and a city capable of supporting more jobs, homes and lifestyle opportunities within the existing urban footprint.

The Metropolitan Plan refers to the provision of an additional 770,000 homes over the next 15 years, with a range of housing types, sizes and affordability levels. At least 70 per cent of these new homes will be located in existing suburbs and up to 30 per cent will be located in greenfield areas.

The plan sets out a long term framework to develop Sydney as a city of cities with radial public transport links feeding into each city, as well as cross regional transport connections linking more sub-regional areas to the Global Economic Corridor, stretching from Sydney Airport and Port Botany in the south through the city centre and North Sydney to Macquarie Park in the north. The Metropolitan Plan will develop a network of transport connections serving a range of different trips and strategic centres that support economic activity across more locations. The Metropolitan Plan also aims to focus the bulk of new housing development in or near centres with good public transport or where expanded public transport services are planned.

More specific strategies to the Willoughby area are recommended in the Draft Inner North Subregional Strategy

2.1.4 Draft Inner North Subregional Strategy (2007)

The Draft North East Sub-Regional Strategy is a key planning tool that is vital to the implantation of the Metropolitan Plan for Sydney 2036. It brings the broad objectives set by the plan for all of Sydney down to a local level, including the Hunters Hill, Lane Cove, Mosman, North Sydney, Ryde and Willoughby local government areas (LGAs).

The Draft Sub-Regional Strategy is part of an ongoing process to manage growth in the Inner North and will provide certainty for the community, local government, industry and business by identifying areas for future growth, conservation, items of infrastructure and key corridors.

The Strategy highlights the following transport improvements that would benefit the Willoughby area including the proposed development:

- Implementation of the Strategic Bus Corridors linking the Inner North Subregion to Strategic Centres such as Global Sydney, Parramatta, Brookvale – Dee Why, Hornsby and Burwood.
- Road network improvements on the Pacific Highway between North Sydney and Chatswood, Eastern Valley Way between Chatswood and Cammeray and Military Road between The Spit and Neutral Bay.
- Proposed Harbour Rail Link with potentially two new stations north of the harbour.
- Upgrade of North Sydney Station and Chatswood Station interchange (completed in 2008).
- Epping – Chatswood Rail Link, with three stations at Macquarie University, Macquarie Park and North Ryde (completed in 2009). This will provide direct rail access further to north western Sydney with the planned North West Rail Link.

2.1.5 The NSW Bike Plan (2010)

The NSW Bike Plan is a 10-year funded plan for bicycle infrastructure including:

- Cross-regional missing links in the Metro Sydney Bike Network.
- Sub-regional bike networks in the western Sydney River Cities of Parramatta, Liverpool and Penrith.
- Assistance for local councils across NSW to improve local cycleway networks.

The NSW Bike Plan includes a commitment for the NSW Government to fully fund construction of an average of 10 kilometres of new connections in the Metro Sydney Bike Network for each year of the ten year plan. The document includes a plan of the future Metro Sydney Bike Network, and sets out actions under the following key headings: to create connected cycling networks, to make bike-riding safe for all, to plan cycling-friendly neighbourhoods, to grow jobs in cycling, and to get organisations working together to support bike-riding.

2.1.6 NSW Planning Guidelines for Walking and Cycling (2004)

The NSW Planning Guidelines aim to assist land-use planners and related professionals to improve consideration of walking and cycling in their work. At the broadest level, they show how metropolitan strategies, master plans and Local Environmental Plans (LEPs) can help create urban form that is conducive to walking and cycling. At a more detailed level, they show how Development Control Plans, developer contributions plans and development assessment processes can reinforce these broader plans through funding mechanisms, provision of facilities and design outcomes that are supportive of walking and cycling.

The guidelines apply to major urban centres and are also relevant to regional cities and towns. They can be applied to redevelopment sites as well as release areas, and can be used to reshape or retrofit existing urban areas for walking and cycling.

2.1.7 Integrating Land Use and Transport Policy (2001)

The Integrating Land Use and Transport is a package of policy supporting the metropolitan planning strategy for the Greater Metropolitan Region. The aim of this document is to encourage development to:

- increase access to public transport , walking and cycling
- encourage people to travel shorter distances and make fewer trips
- reduce car dependency.

There are ten planning principles to accessible development to support the aims above, which are:

- Concentrate in centres
- Mix uses in centres
- Align centres within corridors
- Link public transport with land use strategies
- Connect streets
- Improve pedestrian access
- Improve cycle access
- Manage parking supply
- Improve road management
- Implement good urban design.

One of the methods to reduce car dependency is by limiting the supply and increasing the cost of parking to encourage people to choose other transport mode.

2.1.8 RMS (formerly RTA) Guide to Traffic Generating Developments (2002)

The Roads and Maritime Services of NSW (RMS, formerly RTA) Guide to Traffic Generating Developments outlines all aspects of traffic generation considerations relating to developments. The information provided gives background into the likely impacts of traffic from various types of development.

The guide provides a section on various land use traffic generation and a section on interpretation of traffic impacts. The impact on traffic efficiency at intersections is used in this study and intersection performance is based on the following level of service criteria for intersections, as shown in **Table 1**.

Table 1; Level of Service criteria for intersections

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

Source: RMS, 2002

The guide also sets out the following peak hour trip generation rates and parking requirements for residential use as shown in **Table 2** and **Table 3**.

Table 2: Peak hour trip generation rates

Land use	Peak hour trip rates
High density units – Metropolitan Regional (CBD) Centres	0.24 trips per dwelling

Source: RMS, 2002

Table 3: Parking requirements

Land use	Parking requirements
High density units – Metropolitan Regional (CBD) Centres	1 bedroom – 0.4 space 2 bedroom – 0.7 space 3 bedroom – 1.20 spaces Visitor spaces – 1 per 7 dwellings

Source: RMS, 2002

2.2 Local planning policy

2.2.1 Willoughby City Strategy 2010 - 2025 (2009)

The Willoughby City Strategy is a long term vision and plan that has been developed by Willoughby Council to help guide decision making and planning for up to 2025. The goal for transport in Willoughby is "To manage the transport needs of the community in a sustainable manner by reducing car dependence and increasing public transport use, walking and cycling."

The three key objectives to achieve this goal with the relevant strategies:

1) Increased use of active and alternative transport
    - Provide leadership in the promotion of active transport.
    - Provide regional and local bike paths, safe bicycle parking and storage facilities.
    - Promote sustainable transport and conduct education programs.
    - Provide new pedestrian and cyclist focused precincts within local centres.
    - Identify improvements for a city-wide network of accessible, local walking trails linking activity areas and public transport services.
    - Design best practice cycling and pedestrian pathways.
    - Enhance pedestrian safety.
2) Increased use of public transport
    - Improve integration between transport modes.
    - Improve local accessibility and options for local public transport between suburbs in Willoughby.
    - Improve physical mobility access to public transport.
    - Improve Chatswood Transport Interchange provision for rail, bus, and taxi transport, pedestrian and cyclists.
    - Advocate for improvement in the level of service of and connections between public transport (trains and buses).
    - Improve cross-city transport.
    - Work in partnership with government and the private sector for improved local public transport.
3) Transport management balances our necessary private vehicle trips with alternative, more sustainable transport
    - Plan and develop higher density land uses within and around existing centres, where infrastructure and services are located.
    - Manage car parking in developments in order to promote public transport use instead of private vehicle use.
    - Control parking in areas served by public transport through pricing and parking time.
    - Involve the business community in transport initiatives.
    - Identify and implement traffic mitigation strategies and alternative transport options for industrial areas.

2.2.2 The Willoughby City Section 94A, Development Contributions Plan 2011 (2011)

The plan is a framework for developer contributions to allow for the provision, extension or augmentation of public amenities and public services that are likely to be required as a consequence of development in the project site. Traffic and transport facilities proposed in the plan potentially affecting the site are set out below:

- Upgrade the bicycle path along the Route 20 (Artarmon to St Leonards via Herbert Street).
- Install bus shelters at various locations in residential streets as agreed with Council's bus shelter program.
- Provision of shuttle bus in Willoughby City wide area.

2.2.3 Willoughby Development Control Plan (DCP) (2006)

Off-street vehicle parking requirements within the Willoughby LGA are set out in the Willoughby DCP. The minimum numbers of vehicle parking spaces that are required to be provided for off-street parking in Residential flats are set out in **Table 4**. The intention of the control plan is to encourage the use of public transport by the general public. As such, Council will not issue Resident Parking Permits to residents of newer multi-unit developments.

Table 4: Off-street car parking requirements

Development Type	Parking requirements
Residential flats within Railway Precincts and located on Major Public Transport Corridors	Studio – 0.5 space 1 bedroom – 1 space 2 bedroom – 1 space 3+ bedroom – 1.25 spaces Visitor spaces – 1 per 4 dwellings

Source: Willoughby DCP 2006

In additional to car parking requirements, motorcycle parking must also be provided at a rate of 1 motorcycle space per 25 car spaces.

The Willoughby DCP also sets out the bicycle parking facilities requirements for residential and retail land uses as shown in **Table 5**.

Table 5 Bicycle parking requirements

Development Type	Bicycle lockers	Bicycle rail / racks
Residential	1 per 10 units	PLUS 1 per 12 units

Source: Willoughby DCP 2006

The Willoughby DCP indicates that off-street loading and unloading facilities must be provided for all retail and Council will determine the size and number of loading bays based on the development. Removalist vans loading spaces are required to be provided for all residential developments in excess of 12 units.

3.0 Existing Conditions

3.1 Site description

The project site is located in the Inner North Sub-Region of the Sydney Metropolitan area, as defined by the Metropolitan Strategy 2031 as the area between the northern harbour foreshore, Chatswood and Macquarie Park. Approximately 8km to the north of the Sydney CBD, the site is located in the centre of the Willoughby Local Government Area (LGA). At a local level, the site is located within close proximity to the Chatswood CBD (2km) and Artarmon train station (1km) on the North Shore line of the CityRail network. Services provide frequent connection to the CBD and Chatswood.

The site is bounded to the north by Artarmon Road and Richmond Avenue to the west with existing residential areas located to the east and south. Scott Street is currently owned by Council, but the parking areas on both side of Scott Street are owned by the Nine Network. The extent of the site is highlighted by the red dotted line in **Figure 2**.

Figure 2 Site boundary

Source: AECOM, 2012

The site is located within 15 minute walking distance to Artarmon train station and Willoughby Road is a key bus corridor providing frequent bus services between Chatswood, North Sydney and the CBD. The introduction of M40 bus service provides an express bus service for local residents along Willoughby Road to Chatswood and the CBD. 2006 census data showed that Willoughby has good public transport mode share, over 25 per cent of journey-to-work trips were made by public transport.

3.1.1 Site access

The main site access is through the security gate at Artarmon Road, at approximately 30m east of Edward Street. Another main access to the car park is located at Scott Street. An emergency access is located at Richmond Avenue, at approximately 90m south of Artarmon Road.

3.1.2 On-site parking provision

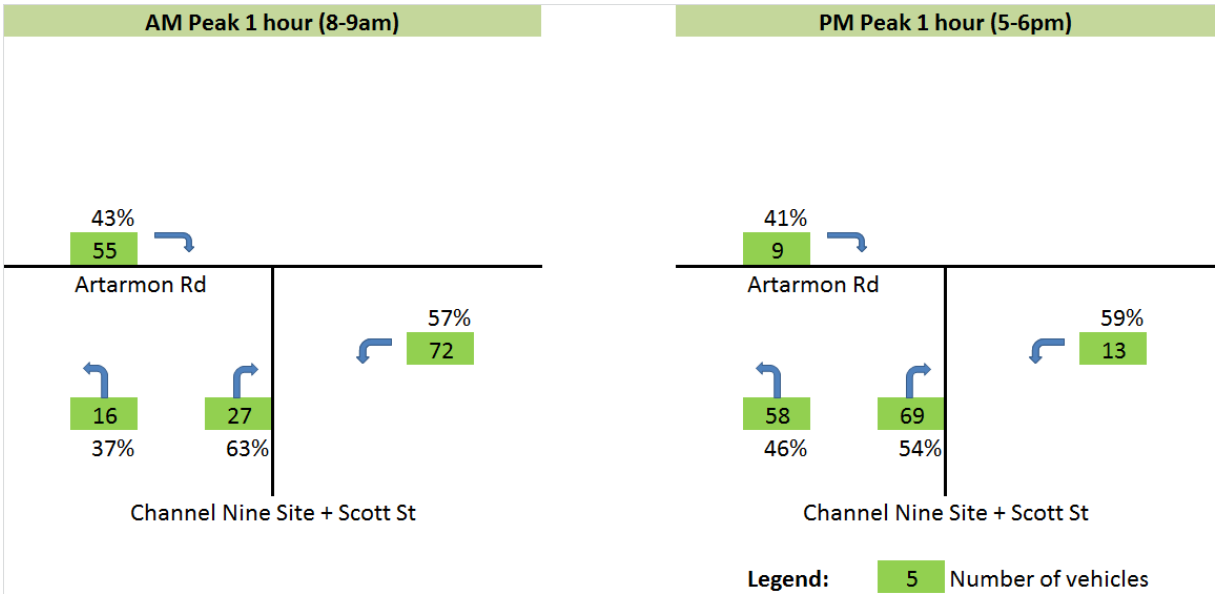
There are 356 parking spaces provided on site at present, including the 90 degree angled parking spaces on Scott Street. The on-street parking spaces on Scott Street are currently reserved by Nine Network Australia Pty Ltd and are not for general public parking.

3.1.3 Existing trip generation from site

At present, the staff levels at the existing Channel Nine TV station are around 650 people and up to 900 people for the large broadcasting events. Channel Nine currently operates a shuttle bus service between the site and Artarmon Station throughout the day, with approximately 150 staff using the shuttle service every day.

A traffic survey was undertaken on 11 October 2012 at the main Artarmon Road access and Scott Street to determine total traffic volumes being generated by the site during the (7am to 9am) and evening (4pm to 6pm) peak hours. As shown in **Figure 3**, the existing site currently generates 170 and 149 vehicle movements during the morning and evening peak hours respectively. Approximately 60 per cent of the traffic generated by the site use Willoughby Road to access the wider road network. The survey indicated that no heavy commercial vehicles visited the site during the peak periods.

Figure 3 Trip generated by the existing site



During the site visit undertaken in October 2012, some employees were observed to park their cars on Artarmon Road and Richmond Avenue. These vehicular movements were not captured in the traffic surveys at the main access points to determine the existing trip generation.

3.2 Road network

The site has good access to Sydney's motorway and arterial road network. Willoughby Road is classified as a sub-arterial road, while other surrounding streets such as Artarmon Road and Edward Street are classified as collector and local roads. The proposed site is also located close to the Warringah Freeway, which provides good connectivity to Sydney Central Business District (CBD).

3.2.1 Willoughby Road

Willoughby Road is an urban sub-arterial road providing a link between Willoughby and Crows Nest. It is connected to the Warringah Freeway near the Naremburn shops, providing direct access to Sydney CBD and areas to the south, east and west of the CBD. It is also used as a major road connecting North Sydney and Chatswood as an alternative route of Pacific Highway.

Willoughby Road between Mowbray Road and Warringah Freeway is a state road under the care and management of the RMS. The road has a posted speed limit of 60km/h through the section in Willoughby, and 50km/h in the areas through Crows Nest at the south of Warringah Freeway off ramp.

Willoughby Road is generally a four- lane road with on-street parking permitted on both sides of the road. Clearways operate in peak periods in the direction of peak traffic flow between Mowbray Road and Warringah Freeway. No parking is permitted on the section between Artarmon Road and Warringah Freeway.

3.2.2 Artarmon Road

Artarmon Road is generally a four-lane collector road with a 50km/h speed limit which runs from Willoughby Road in the east to Elizabeth Street in Artarmon to the west. It provides connectivity to Artarmon village and railway station. There is a three ton load limit restriction for the vehicles using this road. Unrestricted on-street parking is permitted on both sides of the road in the vicinity of the site. Artarmon Road is very steep between Willoughby Road and Edward Street and becomes relatively flat west of Edward Street. Footpaths are provided on both sides of Artarmon Road.

3.2.3 Edward Street

Edward Street is a local road with one travel lane and a parking lane in each direction with a speed limit of 50km/h. It provides a local connection between Artarmon Road and Willoughby Road with connectivity to other local residential streets. With right turn ban from Willoughby Road to Artarmon Road during the morning peak period, Edward Street provides an alternative route access to Artarmon Road from Willoughby Road. Short-term two hour limit on-street parking (local resident excepted) is permitted on both sides of the road.

3.2.4 Richmond Avenue

Richmond Avenue is a local cul-de-sac with one travel lane and a parking lane in each direction. It provides access to the existing residents in the area and also provides an emergency access to the existing site. Unrestricted on-street parking is permitted on the eastern side of the street and short-term two hour limit on-street parking is permitted on the western sides of the street.

3.2.5 Scott Street

Scott Street is also a local cul-de-sac road with two lanes and a speed limit of 50km/h. It runs along the eastside of the proposed site and connects to Artarmon Road. On-street parking is reserved for the Channel Nine employees.

3.2.6 Willoughby Road / Artarmon Road / Small Street intersection

The Willoughby Road / Artarmon Road / Small Street intersection is a signalised four-way intersection. Artarmon Road is the western approach which provides access to the project site as well as the local residential area in Willoughby. The eastern approach to the intersection is Small Street which links to Hallstrom Park, Bicentennial Reserve and Willoughby Leisure Centre.

This intersection has two lanes on each approach and does not have auxiliary turning bay facility on both Willoughby Road approaches. Short turning lanes are provided at Artarmon Road and Small Street approaches by restricting on-street parking on the approaches to the intersection. At present, there is no exclusive right turning phase provided on both Willoughby Road approaches. No right turn is permitted from Willoughby Road to Artarmon Road during the morning peak (6-10am) and from Willoughby Road to Small Street during the afternoon peak (3-7pm). Signalised pedestrian crossing facilities are provided at all approaches except the southern approach.

3.3 Traffic volumes

3.3.1 Daily traffic counts

Historic traffic data was obtained from RMS to establish background traffic growth in the vicinity of the site. The Average Annual Daily Traffic (AADT) data from selected RMS count survey location in the area surrounding the site are presented in **Table 6**, with the location of the traffic count stations shown in **Figure 4**.

Table 6 Daily traffic volume

Station	Location	2006 AADT	2007 AADT	2008 AADT	2009 ADT	2010 ADT
33.098	Willoughby Road – South of Artarmon Road	35,034	33,463	32,747	32,494	30,236

Note:

AADT (Annual Average Daily Traffic was calculated on 365 days of data)

ADT (Average Daily Traffic was calculated based on the number of days available for that year. 2009 (Average Available Days = 329) 2010 (Average Available Days = 142)

Source: RMS 2012

Figure 4 Traffic count location

Source: AECOM 2012

The data indicates that traffic on Willoughby Road in the vicinity of the site has gradually declined between 2006 and 2010. For the purpose of any future year analysis, traffic growth is assumed to be at zero per cent rather than a negative growth as a worst case.

3.3.2 Intersection traffic counts

Classified turning movement counts were undertaken by Austraffic Pty Ltd during the morning (7am to 9am) and evening (4pm to 6pm) peak periods on 11 October, 2012 at the following intersections:

- Willoughby Road / Artarmon Road (I-1)
- Willoughby Road / Garland Road (I-2)

These intersections are considered to be critical in the movement to and from the site, as they are the main intersections connecting to the arterial road (Willoughby Road and Warringah Freeway). The selection of the key intersections for this assessment is consistent with Willoughby City Council's traffic assessment of the development of Willoughby Leisure Centre Expansion, which is located near the site on Small Street.

The turning movement counts revealed that the AM and PM peak hours for the survey date were 8am to 9am and 5pm to 6pm respectively. There were 23 cars recorded making the illegal right turn from Willoughby Road (south approach) to Small Street (east approach) during the evening peak one hour. Intersection turning movements (split into light and heavy vehicles) for the morning and evening peak periods are contained in **Appendix A**.

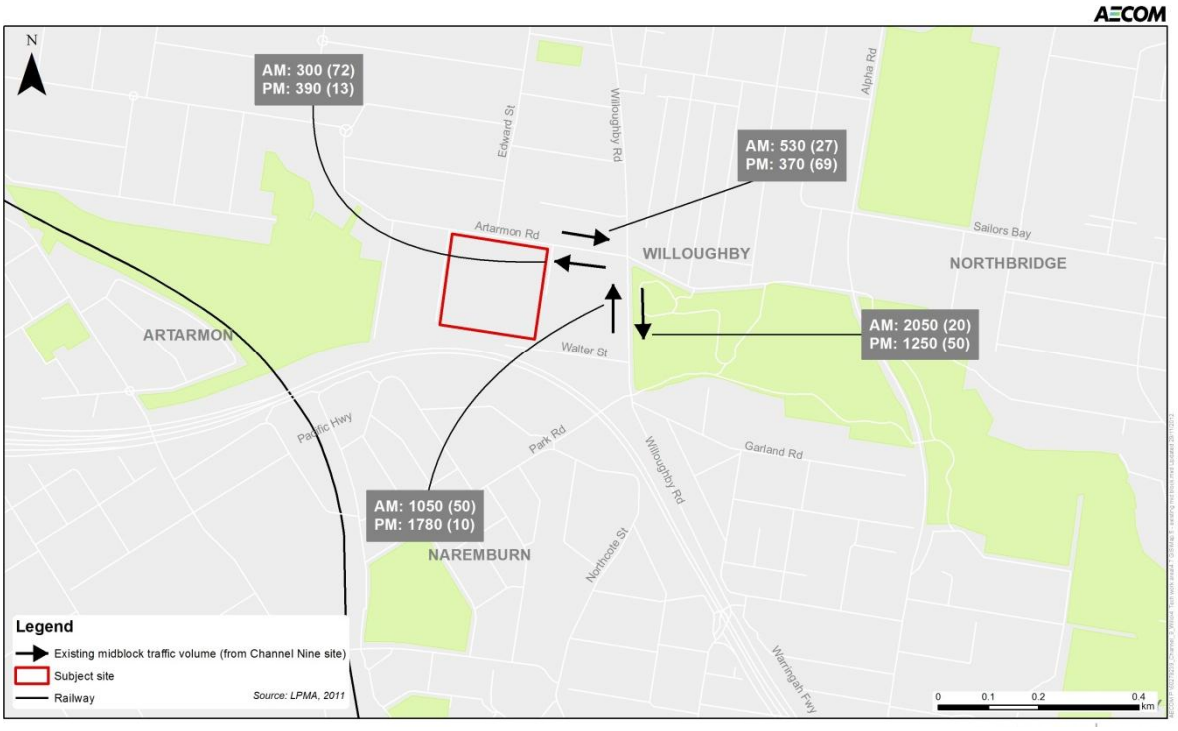
Based on the intersection surveys undertaken, a summary of peak hour midblock traffic counts on the local road network at locations surrounding the site is shown in **Table 7**. **Figure 5** shows the total peak hour traffic on the Artarmon Road and Willoughby Road approaches as well as the component of traffic generated by the existing operation of Channel Nine (as shown in brackets).

Table 7 Peak hour traffic volume

Midblock location	Direction	AM peak hour (veh/hr)	PM peak hour (veh/hr)
Willoughby Road, South of Artarmon Road	NB	1,050	1,780
	SB	2,050	1,250
	Total Peak Hour Traffic	**3,100**	**3,030**
Artarmon Road, West of Willoughby Road	EB	530	370
	WB	300	390
	Total Peak Hour Traffic	**830**	**760**

Source: AECOM 2012

Figure 5 Midblock traffic volumes in the vicinity of the site



Source: AECOM 2012

3.4 Existing intersection performance

Intersection performances have been evaluated using *SIDRA Intersection 5.1*, a computer based modelling package designed for calculating isolated intersection performance.

The main performance indicators for SIDRA 5.1 include:

- Degree of Saturations (DoS) – a measure of the ratio between traffic volumes and capacity of the intersection is used to measure the performance of isolated intersections. As DoS approaches 1.0, both queue length and delays increase. Satisfactory operations usually occur with a DoS range between 0.7-0.8 or below.
- Average Delay – duration, in seconds, of the average vehicle waiting at an intersection.
- Level of Service (LoS) – a measure of the overall performance of the intersection (this is explained further in **Table 8**.

Table 8 Level of Service criteria for intersections

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

Source: RMS, 2002

The existing performance of the key intersections has been assessed and the results are presented in **Table 9** for the AM and PM peak hours. The table summarises intersection performance based on the 2012 traffic flows for the morning and evening peak hours.

Table 9 Intersection performance – existing 2012

Location	Demand Flow (veh/h)	Level of Service	Degree of Saturation	Ave Delay (sec)	95% Back of Queue (m)
AM Peak					
Willoughby Road / Artarmon Road / Small Street	3,271	B	0.86	23	191
Willoughby Road / Garland Road	3,195	A	0.68	3.8	62
PM Peak					
Willoughby Road / Artarmon Road / Small Street	3,278	B	0.80	19.5	209
Willoughby Road / Garland Road	3,104	A	0.74	2.9	73

Source: AECOM 2012

The results indicate that in the existing AM and PM peak hour, both intersections in the vicinity of the proposed site operate satisfactorily at LoS B or better. However, the movements from Artarmon Road (west approach) and Small Street (east approach) perform at LoS E during the peak periods. The delays in these approaches are most likely due to the majority of signal timing allocated to the major movements at Willoughby Road. The model results show that the queues on Willoughby Road would not queue back to the previous intersections.

3.5 Travel behaviour

3.5.1 Journey to work data

Travel characteristics for NSW residents travelling to work are gathered from the journey-to-work data extracted from the Australian Bureau of Statistics (ABS) 2006 census data. Journey to work data (JTW) includes details of the origin and destination of trips, together with characteristics of the journey such as mode of travel. The project site is located within the Willoughby LGA and Travel Zone (TZ) 2401. JTW data from and to the project site travel zone has been analysed and is summarised in the tables below.

Table 10 shows the mode share of trips travelling to and from the project site travel zone and **Table 11** shows the origins and destinations of trips to and from the project site travel zone.

Table 10 Journey to work mode split

Mode	Site area as origin (TZ 2401)	Site area as destination (TZ 2401)
Total JTW Trips	1,128	1,332
Vehicle Driver	47%	69%
Vehicle Passenger	4%	3%
Bus	24%	4%
Train	5%	4%
Other Modes	7%	6%
Worked at Home or Did not go to Work	13%	12%
Not Stated	1%	2%

Source: ABS Census Data 2006

The journey to work data shows that the majority of trips to and from the site area travel zone are made by private car. This indicates that 72 per cent of people working on site travel by cars and a much lower proportion (51%) of people living around the site go to work by car. The census data also shows that a high proportion of trips from the travel zone are made by bus (24%), reflected that the site's proximity to the major bus corridor along Willoughby Road, with high frequency bus services to the City and major town centre such as Chatswood, has a significant influence in encouraging use of public transport in the study area.

Table 11 Journey to work origins / destinations

Site Area Travel Zone (TZ 2401)			
Destination (LGA)	Proportion	Origins (LGA)	Proportion
Willoughby	31%	Willoughby	17%
Sydney	31%	Warringah	9%
North Sydney	15%	North Sydney	8%
Ryde	5%	Ku-ring-gai	6%
Ku-ring-gai	3%	Sydney	6%
Lane Cove	2%	Hornsby	5%
Warringah	2%	Ryde	4%
Botany Bay	2%	Mosman	3%
Canada Bay	1%	Woollahra	3%
Manly	1%	Blacktown	3%
Others	37%	Others	8%

Source: ABS Census Data 2006

The JTW data shows that the majority of trips leaving the site area travel zone are self-contained within the Willoughby LGA (31%), or travelling to Sydney (31%). A high proportion of trips to Willoughby LGA were either made by walking, cycling (15%) or public transport (17%).

A high proportion of trips coming to the site area travel zone to work also originate within the Willoughby LGA (17%) and a high proportion of trips originate from Warringah (9%) and North Sydney (8%).

3.5.2 Car ownership

The car ownership data is extracted from the Australian Bureau of Statistics (ABS) 2011 census data. Such data has been analysed to estimate the car ownership for the proposed development. **Table 12** shows the car ownership for the suburb Willoughby, the whole Willoughby LGA and the Greater Sydney.

Table 12 Car ownership in 2011

Car ownership per household	2011		
	Willoughby (%)	Willoughby LGA (%)	Greater Sydney (%)
No motor vehicles	8.6	13.7	11.8
1 motor vehicle	45.6	43.7	36.8
2 motor vehicles	32.2	29.2	31.4
3 or more motor vehicles	8.4	7.9	13.0
Not stated	5.2	5.5	7.1
Total	100	100	100

Source: ABS Census Data 2011

The table shows that approximately nine per cent of household in the suburb of Willoughby do not own a car. Of all the surveyed households, approximately 77 per cent own two or fewer cars. There was only smaller proportion of households having three or more cars.

The analysis also shows that the car ownership in Willoughby was slightly higher than for the whole LGA.

3.6 Public transport network

3.6.1 Bus services

A number of frequent bus services operate along Willoughby Road, which is within 350m from the western end of the site near Richmond Avenue and within 150m from the eastern end of the site near Scott Street. These bus services provide direct connection to the CBD, Chatswood and also Bondi Junction. Two bus stops are located in the just north of Artarmon Road on Willoughby Road. The bus routes which operate on this corridor are illustrated in **Figure 6**, and include:

- Route 257 Chatswood – Balmoral Beach via Crows Nest and Neutral Bay
- Route 272 North Willoughby – City
- Route 273 Chatswood – City via North Sydney
- Route M40 Chatswood – Bondi Junction via City.

Figure 6 Bus services in the vicinity of the site

Source: Sydney Buses, 2012

The number and frequency of bus services in the area are shown in **Table 13**.

Table 13 Frequency of bus services on Willoughby Road corridor

Bus Service	Route	Weekdays			Weekend
		AM Peak (0700-0900)	Off Peak	PM Peak (1600-1800)	
257	Chatswood - Balmoral Beach via Crows Nest and Neutral Bay	20 minutes 6 services	30 minutes	20 minutes 7 services	30 minutes 4 services
272	North Willoughby - City	5 minutes 27 services	No service	10 minutes 10 services	No service
273	Chatswood - City via North Sydney	9 minutes 14 services	10 minutes	7 minutes 17 services	15-60 minutes 2-8 services
M40	Chatswood - Bondi Junction via City	10 minutes 12 services	15 minutes	10 minutes 12 services	20 minutes 6 services

Source: Sydneybuses.info, 2012

During the site visit in October 2012, it was observed that most bus seats were occupied during the AM peak period.

3.6.2 Shuttle bus services

Willoughby Council currently operates a number of community shuttle bus services in the local area providing free transport options to local residents to key destinations such as Chatswood. One of the shuttle services operates between Northbridge and Chatswood via Artarmon Station and the existing site along Artarmon Road. This service only operates on Wednesdays and Fridays at every 45 minutes from 10:15am to 2:45pm.

3.6.3 Rail services

The project site is approximately 1.2 km to both Artarmon and St Leonards Stations, which takes approximately 15 minutes walking time.

Figure 7 shows that both stations are serviced by the North Shore and Northern lines which provide extensive services to the City and other major areas such as Hornsby, Macquarie Park, Epping and Chatswood, encouraging commuters to use public transport as a viable alternative to private motor vehicle transport. The number and frequency of railway services operating during peak hours is high and is shown in **Table 14**.

Figure 7 Existing rail network

Source: Cityrail, October 2012

Table 14 Rail services at Artarmon / St Leonards station

Key Destination	AM Peak (0700-0900)	PM Peak (1600-1800)
To City	3-7 minutes 30 services	3-9 minutes 30 services
From City	3-6 minutes 30 services	3-7 minutes 26 services
To Hornsby via Macquarie Park	15 minutes 7 services	15 minutes 8 services
From Hornsby via Macquarie Park	15 minutes 7 services	15 minutes 8 services
To Hornsby via Gordon	3-9 minutes 23 services	3-12 minutes 22 services
From Hornsby via Gordon	3-9 minutes 23 services	3-9 minutes 22 services

Source: Cityrail, October 2012

With the site being less than 2.5km away from the station, it is within a reasonable cycling distance for commuters. A total of 12 bike lockers and a number of bike racks are available at Artarmon and St Leonards Station. Kiss and ride facilities are also provided at both stations.

Figure 8 Bicycle parking facilities at Artarmon Station

Source: AECOM, 2012

3.7 Pedestrian routes and facilities

Footpaths are provided on both side of Artarmon Road and Richmond Avenue. There is also an extensive footpath network in the surrounding area, which allows easy and safe access for pedestrian to nearby shopping areas on Willoughby Road, parks, bus stops and train stations. Pedestrian crossing points are located at Willoughby Road / Artarmon Road signalised intersection.

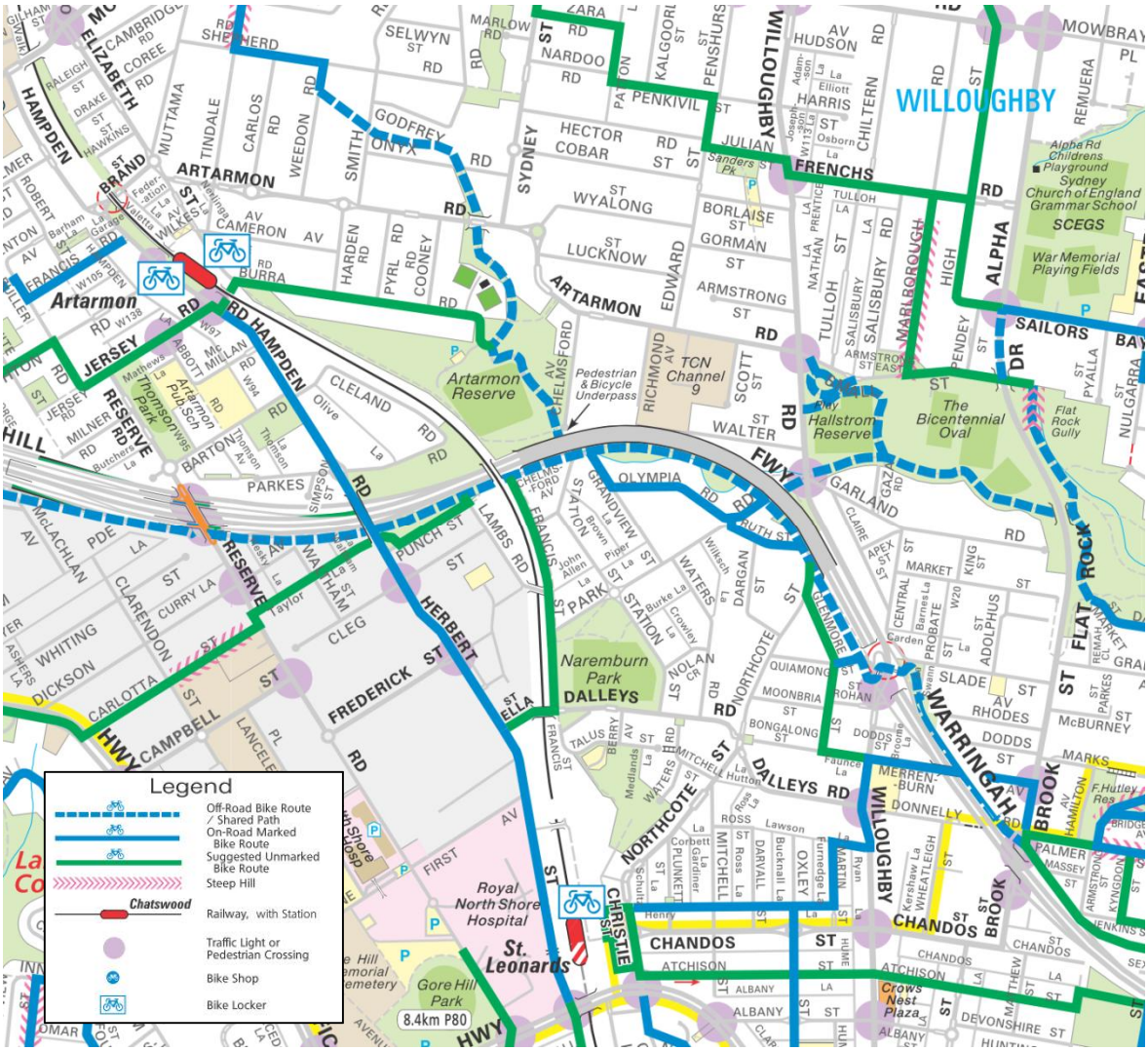
A pedestrian refuge is provided on Artarmon Road at the east of Richmond Avenue.

3.8 Cycling routes and facilities

There are no dedicated cycle facilities along Artarmon Road and Willoughby Road. However, there are a number of on- road and off-road cycle routes in the surrounding area providing connections between key destinations including schools, parks and reserves, train stations, etc.

Off-road cycle routes are available on the Gore Hill Freeway and part of the Warringah Freeway, as well as in the nearby Artarmon Reserve and Hallstrom Park which link with a wider network of cycling routes. On road cycling options include Herbert Street connecting to St Leonards Station, although traffic is heavier on these routes. An extract of Willoughby and Artarmon bicycle route map is shown in **Figure 9**.

Figure 9 Willoughby and Artarmon cycle route map



Source: Willoughby City Council

3.9 Crash analysis

A crash analysis has been undertaken using historical crash data provided by the RMS for a five year period from 2007 to 2011. The crash data was provided along Artarmon Road between Willoughby Road and Richmond Avenue.

Between 2007 and 2011, a total of 15 crashes have been recorded along this section of Artarmon Road, including six crashes involving injury-related crashes and nine tow away crashes. No fatality crash has been recorded during this period. **Table 15** shows the crash statistics for this period and **Table 16** summarises annual crash incidents by casualty from 2007 to 2011.

Table 15 Crash statistics for Artarmon Road between Willoughby Road and Richmond Avenue, 2007-2011

Location	Total crashes	Fatal crashes	Injury crashes	Non-casualty crashes
Artarmon Road, between Willoughby Road and Richmond Avenue	15	0	6	9

Source: AECOM, based on RMS Crash Report 2007-2011

Table 16 Historical trend of crashes by casualty 2007-2011

	2007	2008	2009	2010	2011	Total
Crashes	5	2	2	2	4	15
Casualties	6	1	3	2	0	12

Source: AECOM, based on RMS Crash Report 2007-2011

There has been less than five crashes occurred each year over the last five years, with only two crashes recorded each year between 2008 and 2010. A total of 12 injuries were reported from 2007 to 2011, with no injuries recorded in 2011. Of these 15 recorded crashes, there were:

- Twelve reported crashes at or within 10m approach to the Willoughby Road / Artarmon Road / Small Street intersection.
- One reported crash at Artarmon Road / Scott Street intersection. This crash involved a pedestrian.
- One reported crash at Artarmon Road / Edward Street. There was no casualty for this crash.
- One reported crash at Artarmon Road / Richmond Avenue. There was no casualty for this crash.

4.0 Proposed Development

4.1 Introduction

Nine Network Australia Pty Ltd is preparing an Environment Assessment (EA) of a Concept Plan for the redevelopment of the site at 6-30 Artarmon Road, Willoughby. The Concept Plan proposes a residential development with approximately 585 dwelling units consisting of 193 one-bedroom units, 374 two-bedroom units and 18 three-bedroom units with a small scale retail component serving a local catchment within walking distance.

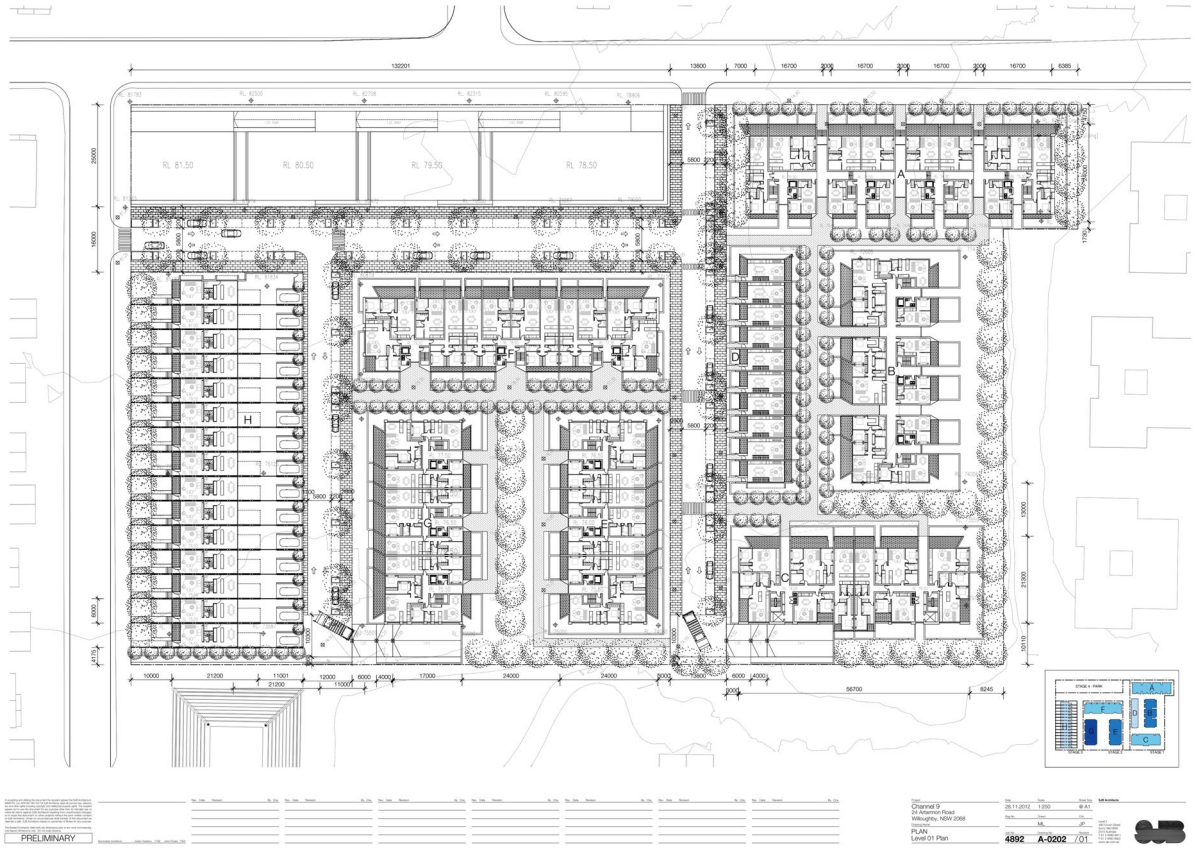
4.2 Design process

Based on a robust analysis of the site, the immediate and wider regional context, a series of design parameters were prepared by SJB Australia that addressed the key issues raised in the DGRs and established a framework for the design and testing of the Concept Plan options. A number of design principles and parameters were used during the consultation stages to articulate the breadth and range of opportunities and constraints that needed to be addressed throughout this project. They also provided a useful reference from the team to revisit the plans and test whether they satisfied the brief. The key design principles established are:

- Open space
- Movement
- Scale
- Transition
- Sustainability.

A number of options were prepared during the past three months that explored the site's capacity and ability to accommodate development without impact on the neighbouring properties and neighbourhoods, and where possible, making a positive contribution through new open spaces, improved site permeability, connections to surrounding routes and spaces, and the mitigation of traffic impacts. These options have been developed based on feedback from stakeholder and community consultation sessions and have then been discussed with Department of Planning & Infrastructure and Council. The preferred concept plan is shown in **Figure 10**.

Figure 10 Preferred concept plan



Source: SJB, 2012

4.3 Proposed land uses

The proposal for the redevelopment is a residential development with approximately 585 dwelling units with a small scale retail component serving a local catchment within walking distance. The development will comprise a mixture of low, medium and high-rise buildings across the site, with a total Gross Floor Area (GFA) of approximately 59,100 m^2 which equivalent to a floor space ratio (FSR) of 1.98:1.

4.4 Vehicular access

Two accesses to the site are proposed at Artarmon Road and Richmond Avenue. The number of access to the proposed site along Artarmon Road has been kept to a minimum to reduce conflicts with traffic on the main road. This includes the removal of Scott Street and its intersection with Artarmon Road.

The proposed access at Artarmon Road is located at approximately 20m east of the existing Nine Network main site access which provides better sight distance than the existing access. Based on the forecast traffic turning volumes, a priority controlled intersection is proposed for the site access at Artarmon Road.

The proposed access at Richmond Avenue is located at approximately 40m south of Artarmon Road. Due to the lower approach speed for the vehicles turning from Artarmon Road, this access provides reasonable sight lines between conflicting traffic streams on approach to the intersection.

An internal road network will connect the proposed accesses at Richmond Avenue and Artarmon Road, providing direct access to underground car parks of individual buildings. On-street parking will also be provided along the internal road network to provide parking opportunities for visitors in addition to those provided in the off-street car parks. The width and turning path of the internal road will be designed to allow access by refuse collection vehicles.

4.5 Parking provision

Off-street parking will be provided in a multi-level basement car parking areas, in accordance with Willoughby Council DCP. Based on the Willoughby DCP rates mentioned in **Section 2.2.3** for residential flats within railway precincts and located on major public transport corridors, in this case Willoughby Road, the overall proposed development will require approximately 589 resident parking spaces and 146 visitor spaces, a total of 735 parking spaces. Given the proximity to Willoughby Road as a major bus corridor, this level of parking to be provided on site can be supported to reduce the dependent on private car use.

Comparing to Willoughby Council DCP, the RMS Guide to Traffic Generating Developments (2002) mentioned in **Section 2.1.8** suggests a lower parking rates for the high density development which requires 360 parking spaces for residents and 83 spaces for visitors, a total of 443 parking spaces. Opportunities also exist with consultation with Willoughby Council to count the on-street parking spaces created along the internal road network as part of the requirements for visitor parking space.

However during the community consultation, local residents have expressed their concerns that there is a general shortage of on-street car parking spaces surrounding the site at present. To minimise the potential impact to local residents, Willoughby Council DCP parking rates are currently used to reflect the specific parking situation on the subject site, which have been reduced given the site's proximity to a major bus corridor.

A small proportion of these off-street parking spaces can also be converted to car share spaces to provide further incentives to residents of not owning a car, but has the flexibility of using a car when required if the destinations are not accessible by public transport.

Loading areas for removalist van and waste collection vehicles are required to be provided for all residential developments in excess of 12 units. The concept plan provides loading docks to cater for 10m vehicles in the basement car park. This is considered to be adequate as the maximum length of the waste collection vehicle operating in Willoughby LGA is 9.9m.

The service vehicles and general light vehicles are proposed to use the same access to the basement car park which is considered to be acceptable because the frequency of service vehicle access to the site is expected to be low for residential development. Such arrangements have been found in other existing high density residential developments in Willoughby LGA. The concept plan also proposes to use a turntable in the loading dock thus all vehicles are to enter and leave the site in a forward direction as required in Part 2 of Australian Standard (AS2890), and will minimise the conflicts with other general light vehicles accessing the car park.

4.6 Pedestrian and Cyclist Facilities

The design of the internal road network and internal footpaths will provide good connectivity to surrounding pedestrian and cyclist networks. In order to encourage sustainable transport choices, the proposed development will include end-of-trip cycle facilities on site in accordance with the Willoughby Council DCP. Applying the DCP rate mentioned in **Section 2.2.3**, 59 bicycle lockers and 49 bicycle rail / racks will be provided as part of the proposed development.

The close proximity to shops, parks and recreational facilities and bus stops will encourage walking and cycling as an alternative to private car transport, which will in turn serve to reduce trip generation from the proposal and traffic impacts on the surrounding area.

4.7 Public Transport Facilities

The site has very good accessibility to existing public transport services and facilities. Bus services and stops at Willoughby Road can be easily accessed within walking distance in less than a five-minute walk. Bus stops at Willoughby Road provide frequent services to Chatswood, Sydney CBD and Mosman, with services up to every 5 minutes during peak times. These services could be further improved in future, if justified by future population increase along this corridor.

Artarmon Station is a 15-minute walk and St Leonards Station is within cycling distance to the proposed development. These stations provide regular and frequent services on the North Shore Line and the Northern Line to major employment areas in Chatswood, Macquarie Park, Hornsby, Epping and Sydney.

4.8 Supplementary Option

A supplementary concept plan option has been considered by the project team that retains Scott Street with vehicular access to Artarmon Road. The layout of the supplementary option is shown in **Figure 11**.

Figure 11 Supplementary option concept plan layout

Source: SJB, 2013

There are some minor differences between the preferred concept plan and the supplementary option and the key differences are listed in **Table 17**.

Table 17 Comparison of preferred and supplementary option

	Preferred option	Supplementary option	Difference
Number of units	193 one-bedroom units 374 two-bedroom units 18 three-bedroom units A total of 585 units	188 one-bedroom units 377 two-bedroom units 18 three-bedroom units A total of 583 units	-2 units
Gross Floor Area (GFA)	59,100 m^2	59,195 m^2	+95 m^2
Floor Space Ratio (FSR)	1:1.98	1:2.043	-
Vehicular access	Two – one at Artarmon Road and one at Richmond Avenue	Three – one at Artarmon Road, one at Richmond Avenue and Scott Street	Additional Scott Street access
Car parking provision	DCP requirement: 735 parking spaces RMS requirement: 443 parking spaces	DCP requirement: 732 parking spaces RMS requirement: 443 parking spaces	Both meets DCP requirement with proposal of 736 parking spaces

	Preferred option	Supplementary option	Difference
Cyclist parking facilities	Council DCP requirement: 59 bicycle lockers and 49 bicycle racks	Council DCP requirement: 59 bicycle lockers and 49 bicycle racks	No differences. Both meets DCP requirement with proposal of 59 bicycle lockers and 49 bicycle racks
Traffic generation	140 trips during peak hour	140 trips during peak hour	No change

In general, there are negligible differences between the preferred option and the supplementary option. The only key difference is the additional access point at Scott Street. The access at Scott Street is an existing access which provides reasonable sight distance to both east and west traffic approaches from Artarmon Road. However, the additional access point along Artarmon Road in the supplementary option will increase conflict points and increase safety risks along Artarmon Road.

It is expected both options will generate the same number of trips, therefore the traffic impact assessment has been undertaken using the preferred option in **Section 5**.

5.0 Traffic Impact Assessment

This section of the report assesses the likely traffic impacts of the proposed redevelopment on the local road network and recommends mitigation measures to alleviate any impacts if required.

5.1 Trip generation

The RMS Guide to Traffic Generating Developments (2002) has been used to determine the number of vehicle trips the development will generate. The intent of the small retail component of the proposed development is to serve the future local residents on-site and passing trade of existing residents living in the local area on the way to / from work. Therefore, it is assumed that this component of the development will not generate any traffic.

Given the location of the proposed development with high accessibility to public and active transport alternatives, the trip rates as shown in **Table 18** were used to determine the number of trips generated by the development in the AM and PM peak hour.

Table 18 Trip generation rates

Land Use	AM peak hour trip rate	PM peak hour trip rate
Residential	0.24 trips / unit	0.24 trips / unit

Source: RMS Guide to Trip Generating Developments, 2002

A traffic survey was undertaken on the same day as the other intersection surveys to determine the number of vehicle movements generated by the existing high-rise residential building development at Castle Vale in order to verify the RMS trip generation rate. This residential development also has a child care centre which sharing the same vehicular access.

The survey results indicate that a total of 62 and 73 vehicle trips were generated during the AM Peak and PM Peak periods respectively. By using the RMS trip rates, it is estimated that there could be up to 20 vehicular movements generated by the child care centre during each of the peak hours. After excluding these vehicular trips, the residential land use would generate approximately 42 trips in the morning peak and 53 trips in the evening peak. For the 160 residential units on site, the trip generation rates would range between 0.26 and 0.33 trips per unit. With the requirements of lower car park provision rates recommended by Council's DCP, given proximity of the proposed development to Willoughby Road as a major bus corridor, it is expected that the proposed development would generate less trips than the Castle Vale development. Therefore, the proposed RMS rate of 0.24 trips per unit is considered appropriate to be used for this assessment.

Using a trip rate of 0.24 trips per unit, 585 dwellings are expected to generate a total of 140 trips during each of the morning and evening peak hours. It is also assumed that 10 per cent of residential trips will enter the site in the AM peak and 90 per cent will leave the site, with the reverse occurring in the PM peak.

As shown in **Figure 3**, the existing site currently generates 170 and 149 vehicle movements during the morning and evening peak hours respectively. Therefore, traffic generation of the proposed developments will be fewer than the existing traffic flows generated by the current operation of Nine Network. However, it is acknowledged that the direction of travel of the existing trips will be different to the future trips because of the change in land use type. This will be future explained in the following section of the report.

5.2 Trip distribution

Since the trip distribution patterns (travel direction of peak hour trips) are different between the existing use of the site (employment) and the proposed use of the site (residential). In order to determine the net increase in trips in each travel direction, trip distribution for the vehicular movements for the current and future uses of the site have been determined using existing (2006) JTW patterns to and from the site area travel zone and the traffic turning volume survey undertaken for the existing project site respectively.

As stated in the existing trip generation survey, approximately 60 per cent of the traffic generated by the site use Willoughby Road to access the wider road network, whereas 40 per cent would use Artarmon Road to and from the north and west of the site.

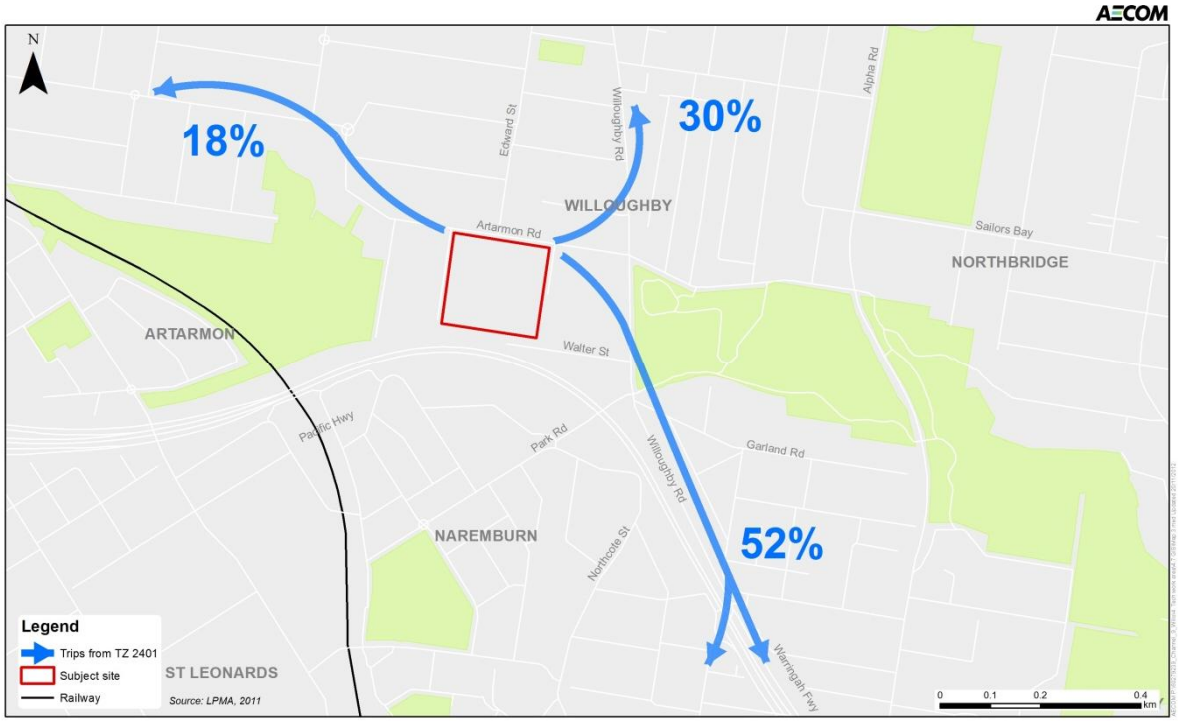
Table 19 and **Figure 12** show the expected travel directions of future residential trips for the AM peak hour. It has been assumed that the reverse travel pattern will occur for the PM peak hour.

Table 19 Distribution of proposed trips – AM peak hour

Direction	Strategic road link	In	Out
South, South East	Via Willoughby Road / Warringah Freeway	44%	52%
North, West	Via Artarmon Road	38%	18%
North East	Via Willoughby Road	18%	30%

Source: Journey to Work, 2006

Figure 12 Distribution of proposed outgoing trips – AM peak hour



Source: Journey to Work, 2006

5.3 Forecast Traffic Flow

Typically, a traffic impact assessment is undertaken for a future design year of 10year post opening / completion of the development. In this case, the development could be completed in 2016 and therefore the assessment should be undertaken for 2026.

However, as historical traffic data on Willoughby Road corridor shows a negative average annual growth rate in **Section 3.3.1**, as a worst case, the assessment has assumed there will be zero growth on Willoughby Road. Therefore forecast traffic flow along Artarmon Road and Willoughby Road has been estimated by using the

existing 2012 traffic flows as background traffic, with the removal of existing traffic generated by the existing operations of Channel Nine before the additional of the proposed residential development traffic.

Trips have also been distributed on to the road network according to the existing road network restrictions, i.e. right turn movement banned from Willoughby Road into Artarmon Road during AM Peak.

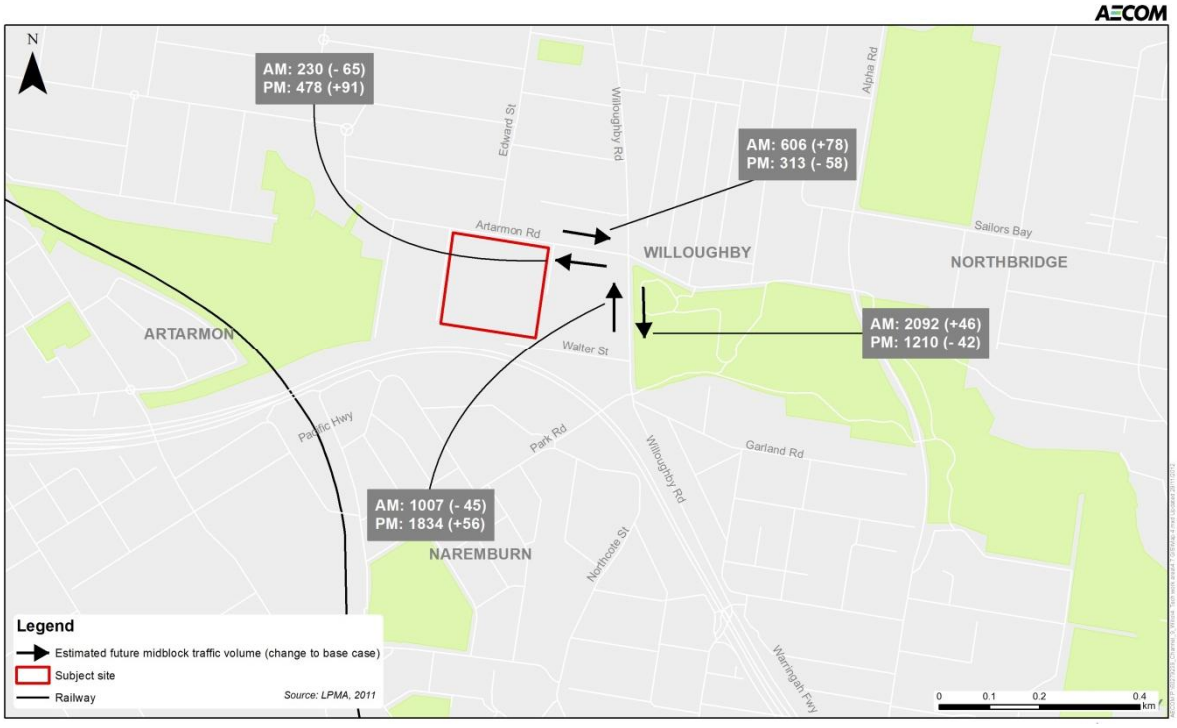
Table 20 and **Figure 13** show the midblock traffic volumes at locations in the vicinity of the subject site, with the residential development generated traffic present on the local road network (and the removal of existing operations traffic). It is evident that the total net increase of traffic as a result of the change of use of the proposed development is negligible across the network.

Table 20: Midblock traffic volumes with development traffic

Midblock location	Direction	AM peak hour			PM peak hour		
		Base	With Dev	Diff	Base	With Dev	Diff
Willoughby Road, South of Artarmon Road	NB	1,052	1,007	-45	1,778	1,834	56
	SB	2,046	2,092	46	1,252	1,210	-42
	Total	**3,098**	**3,099**	**1**	**3,030**	**3,044**	**14**
Artarmon Road, West of Willoughby Road	EB	528	606	78	371	313	-58
	WB	295	230	-65	387	478	91
	Total	**823**	**836**	**13**	**758**	**791**	**33**

Source: AECOM, 2012

Figure 13 Midblock traffic volumes with development traffic



Source: AECOM, 2012

During the peak hours, the increase of traffic on the Willoughby Road (main arterial roads) is generally less than five per cent of existing traffic volumes in one direction. It should also be noted that there is a decrease in traffic in the opposite direction due to the change of the current employment land use to the proposed residential land use. The highest increase in traffic is expected at Artarmon Road, on the approach to Willoughby Road. An increase of

just under 100 veh/hr is expected in the eastbound direction during the AM peak and in the westbound direction during the PM peak. However, the total volume at Artarmon is still within the capacity of a collector road.

5.4 Intersection assessment

The key intersections in the vicinity of the proposed development have been remodelled in SIDRA 5.1 in the AM and PM peak hour. The intersection performance results for the AM and PM peak hour are shown in **Table 21** .

Table 21: Intersection performance – with development

Location	Demand Flow (veh/h)	Level of Service*	Deg of Satn (v/c)	Ave Delay (sec)	95% Back of Queue (m)
AM Peak					
Willoughby Road / Artarmon Road / Small Street	3,283	B	0.85	26.8	262
Willoughby Road / Garland Road	3,197	A	0.69	3.8	66
PM Peak					
Willoughby Road / Artarmon Road / Small Street	3,311	B	0.84	23.0	240
Willoughby Road / Garland Road	3,118	A	0.74	2.9	74

Source: AECOM 2012

The SIDRA model outputs from **Table 21** were compared to determine the likely changes in traffic performance in the key intersections after the proposed development in place. There is no substantial change in the modelled overall intersection performance. This is reflected in minor changes to the average delays and maximum queue lengths. The small net increased volume of traffic generated by the proposed development is not likely to have a significant impact on traffic performance. The intersections all continue to perform within capacity.

5.5 Cumulative impacts

Willoughby City Council is planning to expand the existing Willoughby Leisure Centre located at Small Street, Willoughby. A traffic and parking study has been prepared by GTA Consultants for Council in May 2012 to consider the impacts and mitigation measures as a result of the expansion during the peak time on a Saturday at the intersection of Willoughby Road / Small Street. A package of measures and infrastructure upgrades have been recommended including the construction of a left turn slip lane from Small Street into Willoughby Road in the short-term and an addition of a northbound right turn bay from Willoughby Road into Small Street in the longer-term.

The cumulative impacts of the proposed residential development with the existing operations and future expansion of the leisure centre should be minimal. Channel Nine currently operates seven days a week at the Willoughby site, therefore the relocation of the site will remove traffic through the road network during the weekend. The weekend peak hour trip generation for a residential development is typically lower than that of a weekday peak hour and the weekend peak hours are more dispersed throughout the day. The weekend trip destination is also more dispersed throughout the rest of Sydney. All of the above suggested that the impacts of the proposed development will not exacerbate the impacts of the surrounding road network on the weekend.

5.6 Impacts to on-street parking

Some of the existing Nine Network employees were observed to park their vehicles on Artarmon Road and Richmond Avenue. With the relocation of the Nine Network operations, it is anticipated that the on-street parking spaces that are currently occupied by existing employees would become available.

The proposed development will also provide sufficient on-site car park according to Council's DCP. The Willoughby Council's DCP also indicates that they will not issue Resident Parking Permits to residents of the new multi-unit developments. Therefore, future residents and visitors are expected to park on-site and not the local streets in the surrounding area. Willoughby City Council may review the on-street parking scheme in the area after the development is in place.

6.0 Travel Demand Management

6.1 Introduction

Travel Demand Management (TDM) strategies involve the application of policies, objectives, measures and targets to influence travel behaviour, to encourage uptake of sustainable forms of transport, i.e. non-car modes, wherever possible and to reduce the need to travel and hence reduce overall transport and travel demand and the impacts of new development.

6.2 Proposed sustainable travel measures

The measures include a range of different types of initiatives which together reinforce the principles and objectives of the sustainable travel strategy.

The measures support delivery of the high level transport and travel demand management objectives and support the wider principles discussed. This is how the precinct planning process will deliver a sustainable precinct, in which travel by car is not the only option for residents and visitors to make the journeys they wish to make.

6.2.1 Household Information Packs (HIPs) for each household

Each household in the proposed development would be provided with a household information pack (HIP) which would be a sustainable travel kit. This would incorporate public transport leaflets, route maps and timetables (including direction to the 131500 travel information line and website and bus, train and fare information), pedestrian and cycle network maps including leisure maps, and information on sustainable community initiatives, such as Bicycle User Groups, Car Sharing Schemes, and other local community projects to reduce travel or encourage uptake of sustainable modes.

6.2.2 Car sharing scheme

At present, car sharing scheme (GoGet) has a network connecting to Chatswood Interchange, Artarmon Station, Royal North Shore Hospital and Crows Nest. The extension of providing car share parking spaces on site using an established provider (such as GoGet) for the proposed residential development should be considered. This would reduce residents need to own and operate their own vehicle, safe in the knowledge that there can get access to a vehicle if they require one.

6.2.3 Public transport measures

The public transport service improvements could encourage more people to reduce the car usage. It includes the improvements of:

- Bus network coverage
- Frequency of bus services
- Quality of bus stops.

6.2.4 Bicycle measures

The following measures could encourage bicycle use and promote bicycle rides and initiatives.

- Dedicated, high quality cycle routes
- Bicycle facilities such bicycle parking
- Encourage local Bicycle User Group (BUG)
- Promotion of bicycle initiatives – NSW bicycle week, cycle to work day

6.2.5 Pedestrian Measures

A highly permeable and safe pedestrian network throughout the development will encourage and facilitate pedestrian accessibility.

7.0 Summary and Conclusions

This report has been prepared to assess the traffic and transport impacts associated with the proposed residential development at the Nine Network Australia site at 6-30 Artarmon Road, Willoughby.

The site has very good accessibility to existing public transport services and facilities. Bus services and stops at Willoughby Road can be easily accessed within walking distance in less than a five-minute walk. Bus stops at Willoughby Road provide frequent services to Chatswood, Sydney CBD and Mosman, with services up to every 5 minutes during peak times. These services could be further improved in future, if justified by future population increase along this corridor.

Artarmon Station is a 15-minute walk and St Leonards Station is within cycling distance to the proposed development. These stations provide regular and frequent services on the North Shore Line and the Northern Line to major employment areas in Chatswood, Macquarie Park, Hornsby, Epping and Sydney.

The Concept Plan proposes a residential development with approximately 585 dwelling units with a small scale retail component serving a local catchment within walking distance. The vehicular accesses to the development will be via Artarmon Road and Richmond Avenue, connected by an internal road network providing direct access to underground parking areas.

Based on the Willoughby City Council's DCP, a total of 735 parking spaces will be provided on-site, including 589 resident parking spaces and 146 visitor spaces. 59 bicycle lockers and 49 bicycle rail / racks will also be provided on-site to encourage non-private car use by future residents and visitors.

With the relocation of the existing operations of the Nine Network at the Willoughby site and the proposed development of the preferred Concept Plan, it is anticipated that there is a net reduction in vehicular trips during the weekday peak hours, based on the RMS trip generation rate for high density dwellings. Even considering the different peak hour travel direction between the existing and future uses, the net vehicular impacts of the proposed development will be considered quite minimal. The traffic modelling suggests that there is no requirement for road network upgrades to cater for the traffic generated by the proposed residential development.

Appendix A

Existing Intersection Traffic Counts

2012 Thursday Observed Traffic Flows