

Traffic Impact Assessment

BlueScope Steel Neighbourhood
Plan, Kembla Grange

8201911101



Prepared for
BlueScope Steel (AIS) Pty Ltd

30 June 2020

Contact Information

Cardno (NSW/ACT) Pty Ltd

ABN 95 001 145 035

Level 9 - The Forum
203 Pacific Highway
St Leonards NSW 2065
Australia

www.cardno.com

Phone +61 2 9496 7700

Fax +61 2 9439 5170

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Traffic Engineering Team Lead

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1 Introduction

1.1 Overview

Cardno (NSW/ACT) Pty Ltd (Cardno) has been commissioned by BlueScope Steel (AIS) Pty Ltd to prepare a traffic impact assessment for the Neighbourhood Plan (NP) located in Kembla Grange within the West Dapto Urban Release Area. The full development of the NP is expected to comprise of low density residential development and a separated industrial estate. The site is located in Kembla Grange, approximately 14km from the Wollongong CBD.

1.2 Scope of Works

Cardno's scope of works for the traffic impact assessment is as follows:

- > Undertake a background review relevant to the site's locality
- > Undertake traffic modelling using Council's TRACKS 2036+ model to reflect the proposed neighbourhood plan layout and development yield
- > Critical analyse select intersections using SIDRA intersection modelling based on turning volumes from the updated TRACKS 2036+ model
- > Review and assess the public and active transport links relevant to the site
- > Document the traffic and transport findings for submission in support of the neighbourhood plan.

1.3 Reference Documents

In preparing this traffic impact assessment, Cardno has referred to the following documents:

- > Chapter D16: West Dapto Release Area, Wollongong Development Control Plan (2009).
- > Roads and Maritime Guide to Traffic Generating Developments TDT 2013/04a (Roads and Maritime Guide).
- > Premier Illawarra Routes and Timetables (available online).
- > Wollongong City Council indicative TRACKS 2036+ model geometry (equivalent to 2055 development year).

1.4 Report Structure

- > Section 1 – Introduction
- > Section 2 – Strategic Planning
- > Section 3 – Existing Conditions
- > Section 4 – Proposed Development
- > Section 5 – Traffic Assessment
- > Section 6 – Development Public and Active Travel
- > Section 7 –Conclusions

2 Strategic Planning

2.1 Regional NSW Services & Infrastructure Plan

The Regional NSW Services and Infrastructure Plan identifies the Illawarra – Shoalhaven region to include areas of Kiama, Shellharbour, Shoalhaven and Wollongong all of which covers the area of West Dapto and Kembla Grange.

The Plan identifies Wollongong as the capital for the region and further identified as a Satellite city of Greater Sydney. The need to improve efficiency of the transport to and from Wollongong and the broader Illawarra – Shoalhaven region is outlined below:

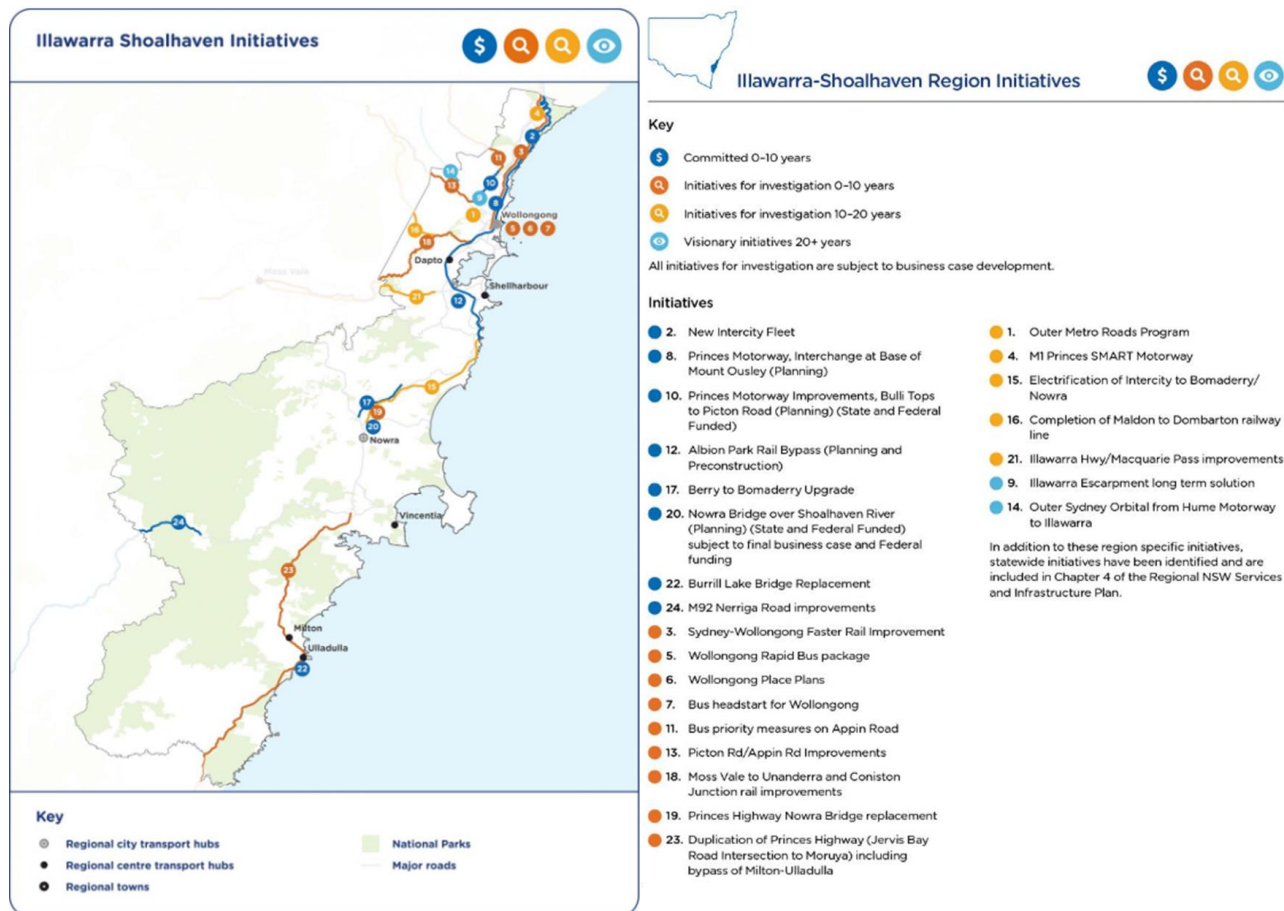
- > Development of an integrated public transport network hierarchy, including:
 - A single operator taking multi-modal responsibility across Wollongong
 - Improved integration and interchange between modes/services to enable seamless customer experience
 - Expanding 30 minute catchments for public transport
 - Improved time of day coverage and service frequency, reduced journey times, and the deployment of on-demand, flexible services
 - Facilitating car sharing services that are integrated with public transport.
- > Improving the accessibility of Wollongong to the three cities of Greater Sydney by public transport and private vehicle. We will work on improving rail travel times between Sydney and Wollongong as well as supporting connections between Campbelltown and the Illawarra. Additionally, road improvements on Appin (including potential bus priority measures) and Picton Roads and the proposed Outer Sydney Orbital will improve connections to Sydney.
- > Supporting urban renewal and increased accessibility and liveability of key centres through improved transport connections.
- > Improved access to Port Kembla, an emerging international trade gateway.
- > Development of active transport networks.
- > Addressing pinch points in the road network and informing the program of road network optimisation improvements to support the maintenance of 30 minute catchments for car journeys.
- > Undertaking a car parking review to evaluate and prioritise car parking availability and use within centres and at key interchanges.
- > Introducing travel demand management policies and transport optimisation programs to re-balance demand against service and infrastructure provision.

The Services and Infrastructure Plan is supported by the initiatives outlined in the following figures.

Figure 2-1 Illawarra – Shoalhaven Structure



Figure 2-2 Illawarra – Shoalhaven Transport Initiatives



The West Dapto Urban Release Area will look to integrate the forecast 19,000 new dwellings to the future transport strategy. Car based, public and active transport links to regional centres (i.e. Dapto) and the Satellite city of Wollongong will be achieved through Council's contributions plan which allocates road network improvements to support all transport modes.

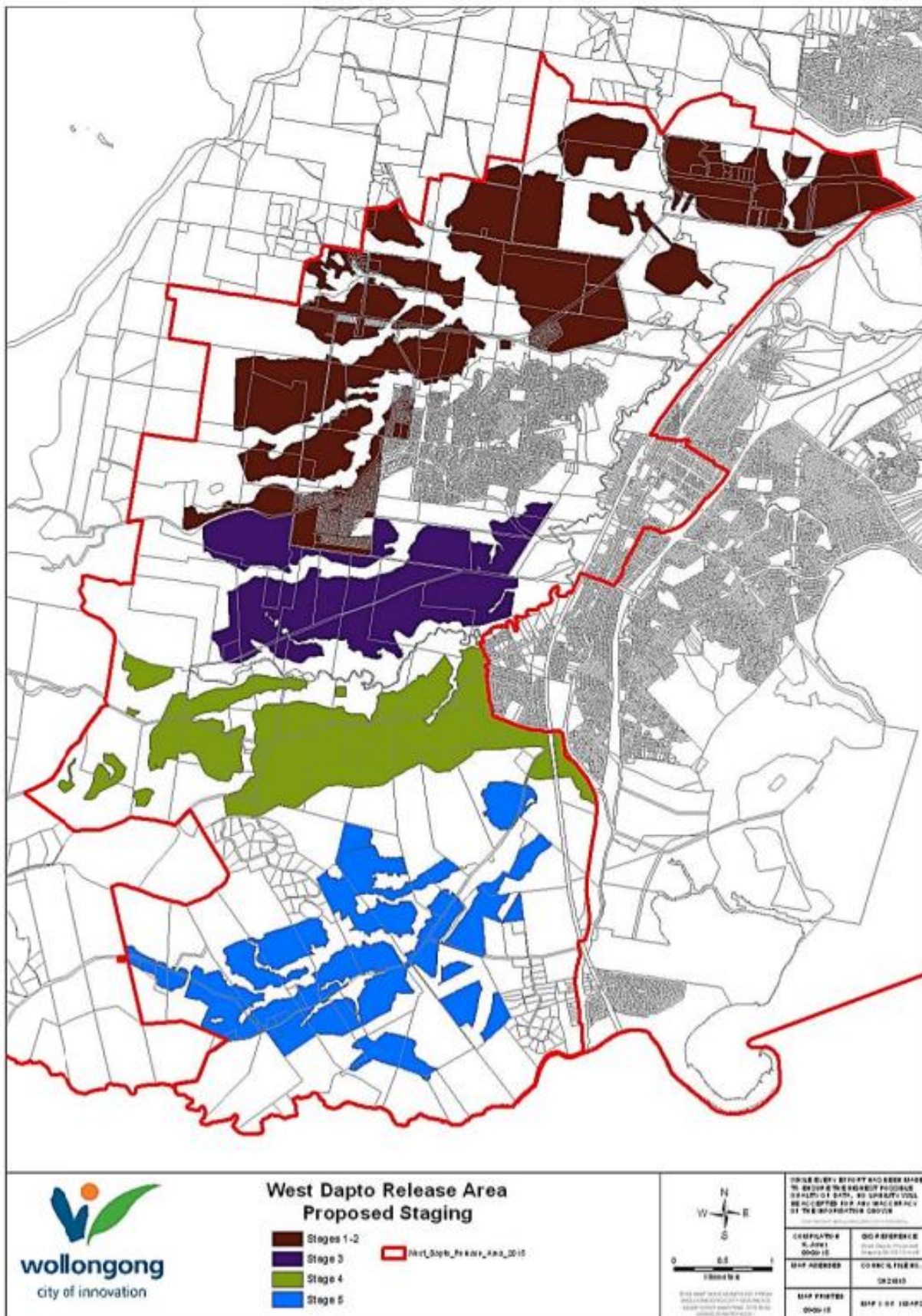
The proposed neighbourhood plan will be keeping with the development requirements set by Council to facilitate the strategic transport requirements.

2.2 West Dapto Urban Release Area

West Dapto Urban Release Area (WDURA) has been identified as the priority new release area for the region in the Illawarra Regional Strategy (2007) by the NSW Department of Planning. The development of WDURA is closely linked to the growth and development of the town of Dapto, which has evolved to provide a range of local services and retailing opportunities to the area located between the larger centres of Wollongong in the north and Shellharbour to the south. At ultimate development, the entire WDURA will include approximately 19,000 new dwellings, over 50,000 people and create around 8,500 jobs. The scope of WDURA, proposed staging and indicative proposed development location is presented in **Figure 2-3**.

The proposed site is located in Wollongong Local Government Area (LGA) and is part of WDURA Stage 1.

Figure 2-3 Scope of West Dapto Release Area and Proposed Staging



2.3 Future Infrastructure

Reference is made to Council's draft West Dapto Contributions Plan (2020) which outlines a number of infrastructure provisions (transport based) that influence the development site. The planned infrastructure is shown in **Figure 2-4** and summarised in **Table 2-1**.

Figure 2-4 West Dapto Draft Contributions Plan Layout

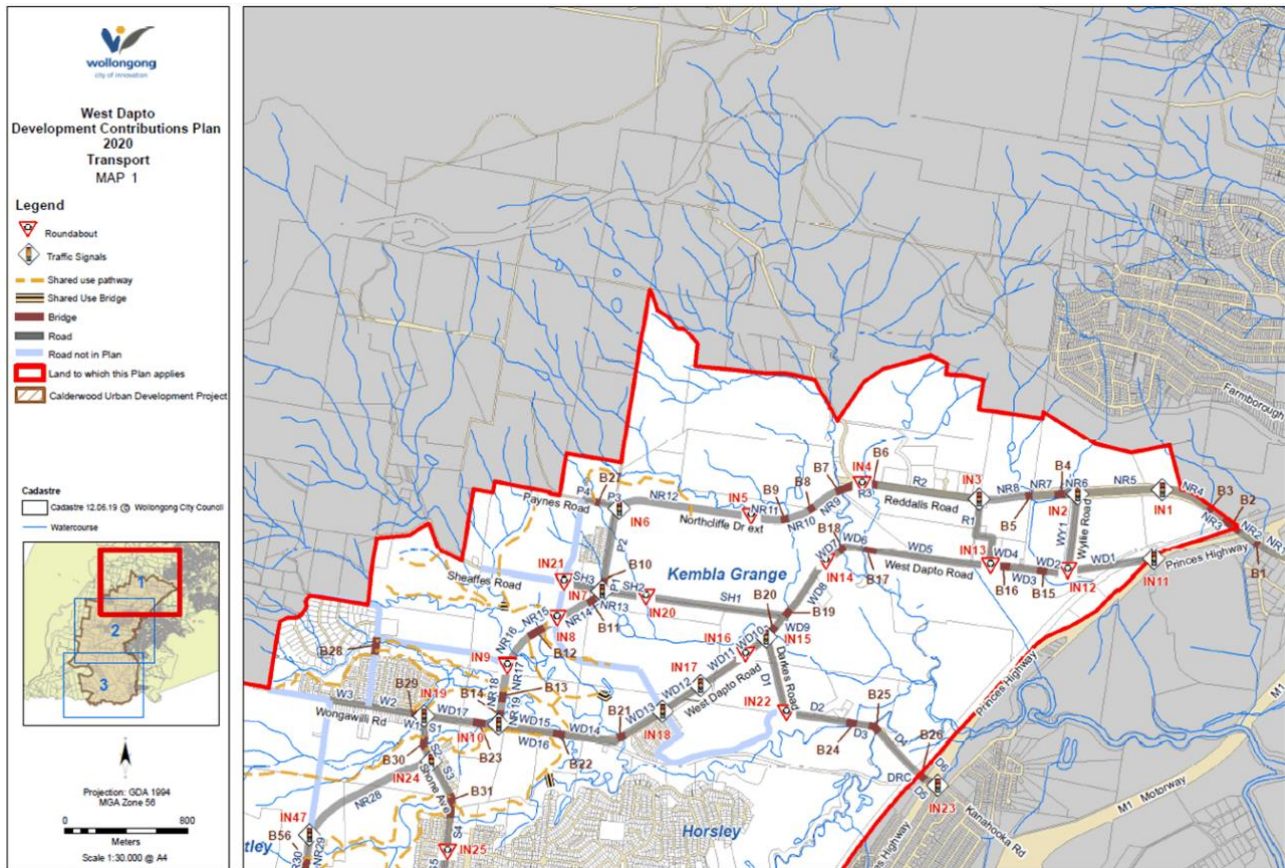
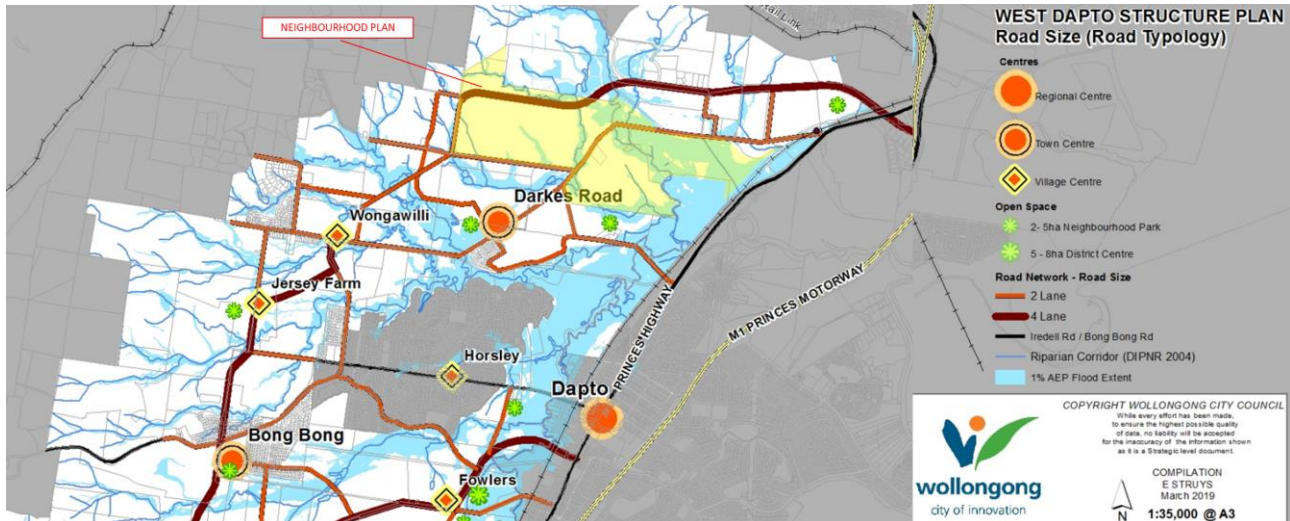


Table 2-1 West Dapto Draft Contributions Plan Infrastructure Description

Reference	Description
R2	Road upgrade of 4 lanes for approximately 4km
NR9	
NR10	
NR11	
NR12	
WD5	Road upgrade of 2 to 4 lanes for approximately 5km.
WD6	
WD7	
WD8	
IN5	Large roundabout for access to industrial lands off Northcliffe Drive Extension
IN6	Large signals for the intersection of Paynes Road and Northcliffe Drive Extension
IN14	Small roundabout for access to industrial lands off West Dapto Road

The exact nature of the road upgrade and intersection provisions is subject to further detailed design, however as an indication, the Wollongong DCP Chapter D16: West Dapto Release Area (Amendment 2019) provides the road structure plan.

Figure 2-5 Council DCP Chapter D16 Lane Configuration



3 Existing Conditions

3.1 Study Area

The overall BlueScope site is located approximately 14 kilometres (south-west), 13 kilometres (west) and 18km (north) from Wollongong CBD, Port Kembla and Albion Park respectively. It lies north of The Australian Motorlife Museum and south of Prixcar Services Kembla Grange.

At present, the subject site consists of predominantly grassed paddocks, small creeks and adjoining roads which form the boundary.

As illustrated in **Figure 3-1** there are two irregularly shaped areas that are bounded. The boundary runs along Payne Road / Farm Road, Sheaffes Road, West Dapto Road, Darkes Road with West Dapto Road abutting the eastern and western areas of the site.

The eastern proposed residential area is bounded by:

- > Payne Road to the west
- > Sheaffes Road to the south
- > West Dapto Road to the east
- > North and north-west are generally comprising of vacant land

The western proposed industrial area is bounded by:

- > West Dapto Road to the north and north-west
- > Darkes Road to the south-west
- > South and south-east are generally comprising of vacant land

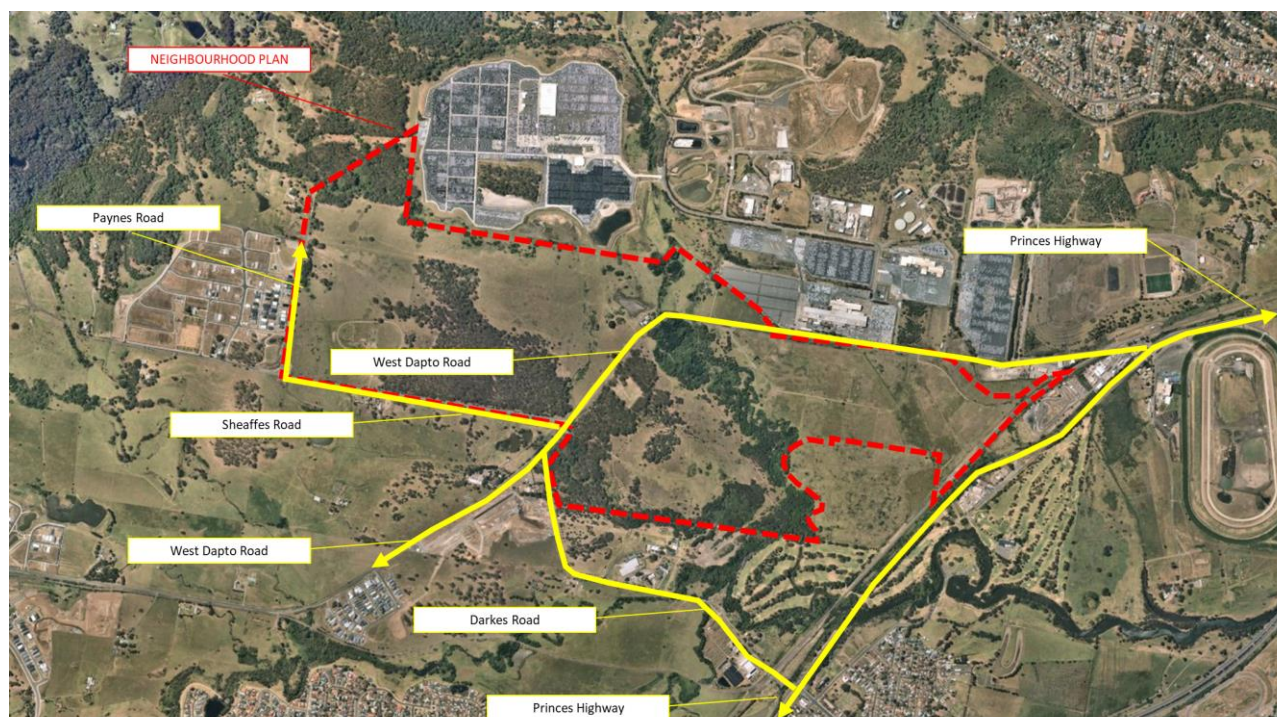


Figure 3-1 Site boundary and existing land usage at subject site

3.2 Existing Road Network

All roads in NSW are categorised by TfNSW based on their role in the road network and for road management responsibilities:

- > State Roads link urban and rural centres for the movement of people and freight across the state
- > Regional Roads are secondary roads that provide connectivity between towns or places of interest within a region
- > Local Roads are low-capacity roads that provide local access to residences and businesses within a town or locality.

State Roads are managed and financed by TfNSW. Regional and local roads are managed and financed by councils, however TfNSW may provide financial assistance to councils for the management of Regional Roads due to their network significance.

Roads can also be classified functionally by the traffic volume they are expected to convey and their typical characteristics:

- > Arterial Roads are major roads that connect one region to another
- > Sub-arterial Roads are secondary roads the connect different areas within a region
- > Collector Roads are minor roads that link local areas to sub-arterial and arterial roads
- > Local Roads are minor roads that provide access to houses and carry low traffic volumes.

Table 3 6 provides the expected daily and peak hour traffic volumes, vehicle operating speed, heavy vehicle restrictions and pedestrian crossing requirements for each functional road classification.

Table 3-1 Road Function Description

Road characteristic	Arterial	Sub-arterial	Collector	Local
Daily traffic volume	> 15,000	5000 – 20,000	2000 – 10,000	< 2000
Peak hour traffic volume	> 1500	500 – 2000	250 – 1000	< 250
Vehicle operating speed	70 – 100 km/hr	60 – 80 km/hr	40 – 60 km/hr	≤ 40 km/hr
Heavy vehicles restrictions	None	Preferably none	Yes	Yes
Pedestrian crossings	Grade-separated or signals	Signals or refuge	Marked crossing or refuge	Marked crossing or refuge

The following are the key roads in the vicinity of the overall BlueScope development site:

- > West Dapto Road
- > Darkes Road
- > Sheaffes Road
- > Paynes Road

3.2.2 West Dapto Road

West Dapto Road is located at the eastern boundary (east area) and north, north-west border (west area). It is a two-lane road (one in each direction) and is a road which connects Kembla Grange to Princes Highway. The posted speed limit is 80 km/h connecting to the Princes Highway. The current function of this corridor is a sub arterial road.

3.2.3 Sheaffes Road

Sheaffes Road is a local unclassified road under the care and maintenance of the local Council. Sheaffes Road is a key road connecting the subject site with Princes Highway via West Dapto Road and Darkes Road. The average carriageway width of Sheaffes Road is 5.7 metres. The current function of this corridor is a local road.

3.2.4 Darkes Road

Similar to Sheaffes Road, Darkes Road is also not directly connected with the proposed development however under the proposal it will provide future direct access to the site, travelling towards Albion Park and Shellharbour, to Princes Highway and Motorway. The current function of this corridor is a local road.

3.2.5 Paynes Road

Paynes Road is a local unclassified road under the care and maintenance of the local Council. Paynes Road is currently configured as two-way road providing access to Princes Highway by connecting proposed development to Sheaffes Road and West Dapto Road. Paynes Road has an approximate carriageway width of 6 metres. The current function of this corridor is a local road.

3.3 Existing Public Transport

It has been noted from a desktop review of the existing public transport network in the vicinity of the proposed development that there are existing local bus services operating within the proximity of the site in Kembla Grange, Brownsville and Farmborough Heights.

Kembla Grange has a very limited public transport network while neighbouring areas have a more established network.

The nearest bus stops to the subject site is located on Princes Highway opposite Kembla Grange Station and Princes Edward Drive before Kanahooka Road.

At present, the following bus routes operated in the vicinity of the proposed development site:

- > Route 31 – Wollongong to Horsley
- > Route 32 – Dapto to Brooks Reach
- > Route 33 – Wollongong to Dapto
- > Route 35 – Farmborough Heights to Wollongong
- > Route 37 – Wollongong anti-clockwise loop
- > Route 41 – Dapto to University of Wollongong
- > Route 43 – Port Kembla to Dapto District
- > Route 57 – Wollongong clockwise loop

The existing bus route network in the vicinity of the proposed development site is illustrated in **Figure 2-3**.

2011 Journey to Work data shows that mode share for the surrounding area of Horsley (*Original Travel Zone #5734*) is predominantly geared towards private vehicle use, with 79% using a car for commuting to work in comparison to a much lower percentage in public transport use; 3.4% trains and 1% using bus.



Figure 3-2 Existing Bus Route Network

4 Proposed Development

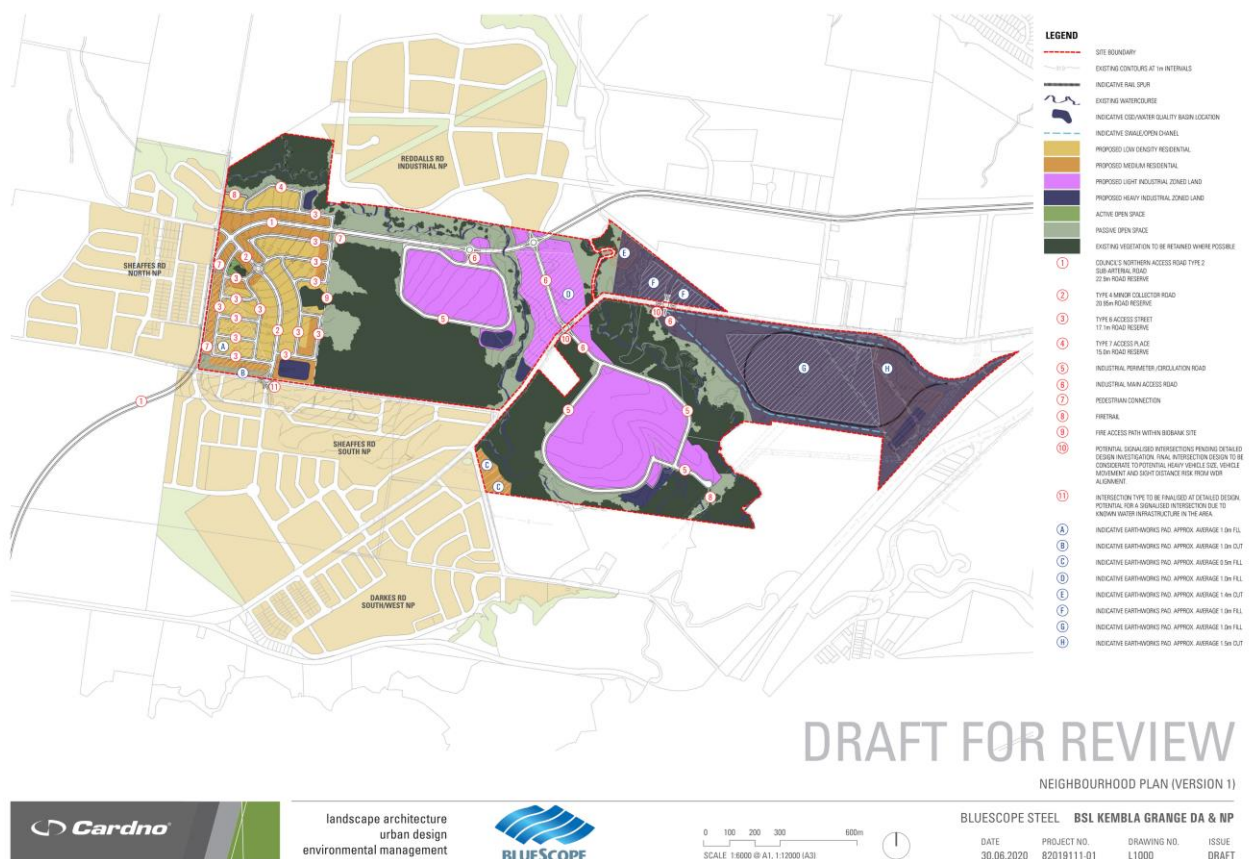
4.1 Development Scale

The neighbourhood plan as shown in **Figure 4-1** consists of residential and industrial development as well as open space and non-developable waterways.

The residential yield proposed is 422 low density single dwellings off Northcliffe Drive extension (traffic modelling has been based on 462 dwellings), low/medium density residential off West Dapto Road near Darkes Road (traffic modelling is based on 115 dwellings) whilst the industrial zoned land is a total of 897,730m² site area. Of the industrial site area, 893,749m² would access either Northcliffe Drive extension or West Dapto Road as their main travel route.

The proposed neighbourhood plan is shown in **Figure 4-1**.

Figure 4-1 Proposed Development



4.2 Internal Road Network

The proposed internal road work will be split between the residential zoned land and industrial zone land within the neighbourhood plan.

Residential streets will predominantly be local road access streets with parking permitted. The residential street types consist of the following cross section as per Wollongong DCP Part B Chapter B2: Residential Subdivision (2019 Amendment).

Figure 4-2 Residential Road Cross Section

Street Types		Carriageway			Verge			
		Kerb Lane (m)	Centre Lane (m)	Total (m)	Verge (m)	Total Reserve (m)	Footpath (m)	Shared Path (m)
Sub-Arterial Road	Type 1 (entry road with WSUD median strip (4.2m) & bus services)	3.6	3.4	18.2	10.5 (5.25 each side)	28.7	n/a	5m (2.5m each side)
	Type 2 (with bus services)	3.5	3.2	13.4	9.5 (4.75 each side)	22.9	n/a	5m (2.5m each side)
	Type 2A (with parking & bus services)	3.5	3.2	13.4	9.5 (4.75 each side)	22.9	n/a	5m (2.5m each side)
Major Collector Road	Type 3 (with parking & bus services)	3.0	3.2	12.4	9.5 (4.75 each side)	21.9	n/a	5m (2.5m each side)
Minor Collector Road	Type 4 (with parking & limited bus access)	2.6	3.0	11.2	9.75m (5.25m one side, 4.5m other side)	20.95	1.5	3m
Town & Village Centre Road	Type TC	(varies)	(varies)	(varies)	9m (4.5m each side) or 9.75m (5.25m residential side, 4.5m centre side)	(varies)	4.5m full width town centre side	3m provided on one side if residential
Local Road	Type 5 (with parking)	2.1	2.8	9.8	9m (4.5m each side)	18.8	3m (1.5m each side)	n/a
Access Street	Type 6 (with residential on both sides, and parking)	2.3	3.5	8.1	9m (4.5m each side)	17.1	3m (1.5m each side)	n/a
Access Place	Type 7 (with parking)	3.5	n/a	7.0	8m (4m each side)	15	n/a	n/a
	Type 7A (1-Way, adjacent open space on one side)	2.0 (parking lane) or 3.5 (travel lane)	n/a	5.5	6.45m (2.45m open space side, 4m other side)	11.95	n/a	n/a
	Type 7B (2-Way, adjacent open space on one side)	3.5	n/a	7.0	6.45m (2.45m open space side, 4m other side)	13.45	n/a	n/a
Laneway	Type 8 (no parking)	n/a	n/a	5.5	2.9m (1.45m each side to property boundary)	8.4	n/a	n/a

With regard to the industrial zoned land, the supporting street network will be as per **Figure 4-3**. This street profile consists of the follow cross section Wollongong DCP Part B Chapter B5: Industrial Development (2019 Amendment).

Figure 4-3 Industrial Road Cross Section

ROAD TYPE	MAXIMUM TRAFFIC VOLUME	DESIGN SPEED (Km/hr)	MINIMUM ROAD CARRIAGEWAY WIDTH (m)	MINIMUM VERGE WIDTH EACH SIDE (m)	MINIMUM TOTAL ROAD RESERVE WIDTH(m)
Other Industrial Roads	Up to 5,000 vehicles / day	50 /60	Min.12m	4m with upright kerbing	Min. 20 m
Cul-de-sacs	Up to 2,000 vehicles	50	Min. 12m	4m with upright kerbing	Min.20m Min. 28m diameter turning head

4.3 External Road Network

As per the neighbourhood plan, there is the provision of the Northcliffe Drive Extension (as per Council's current draft contributions plan) and a number of intersections.

Furthermore, the current alignment of West Dapto Road will be upgraded to suit the forecast 2036+ traffic volumes and road geometry requirements.

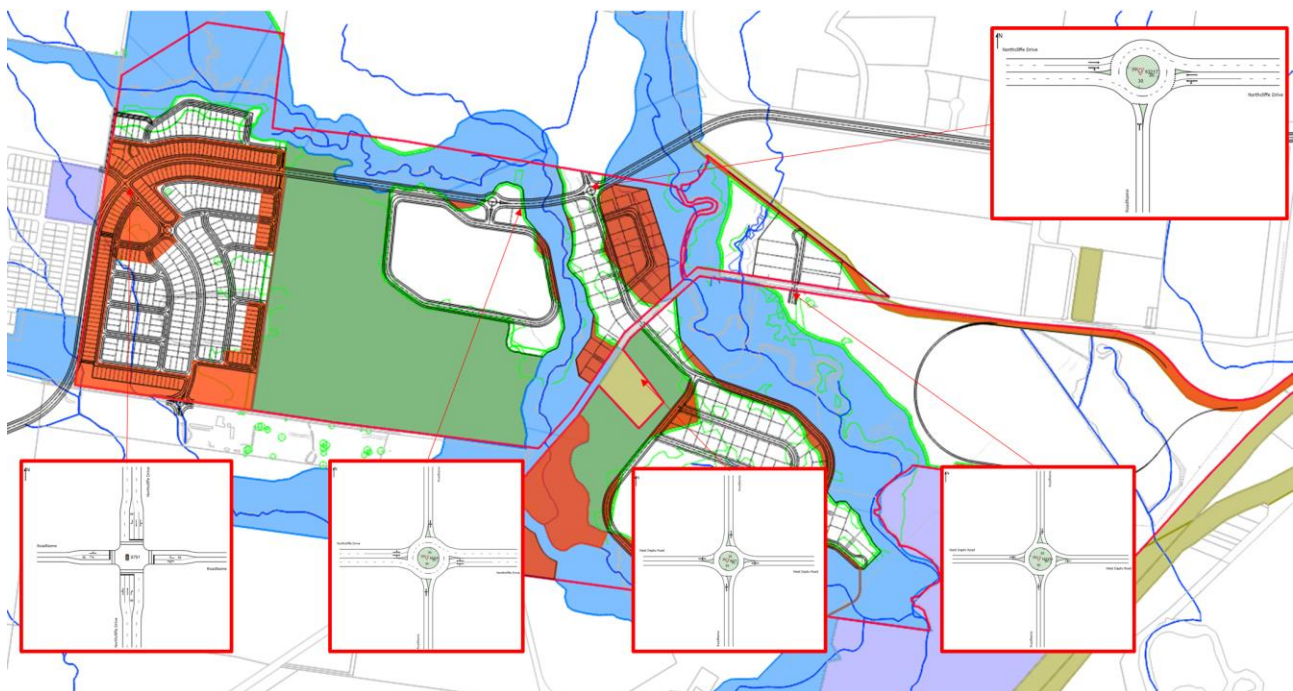
The lane arrangement for Northcliffe Drive Extension and West Dapto Road is shown in **Figure 2-5**.

4.4 Intersection Treatments

To facilitate the proposed development and connection to the broader road network, a number of intersections are proposed as part of the neighbourhood plan.

The intersection locations and types are shown in **Figure 4-4** below.

Figure 4-4 Critical Intersection Treatments



The proposed plan identifies three main intersections along Northcliffe Drive extension, consisting of two roundabouts and one signalised intersection, as well as a minor left in / left out intersection. Two roundabouts are proposed on West Dapto Road to provide access to the industrial parcels.

Figure 4-4 above shows the possible lane arrangement at the assessed intersections. However, the final lane arrangements will be subject to detailed design at the development application stage.

Intersection 8791 (traffic signals at Northcliffe Drive Extension / Paynes Road) will be subject to meeting TfNSW traffic signal warrants. This assessment has prepared an initial review of the warrant criteria and determined that the signalised intersection is most likely required based on pedestrian movements and road safety.

Intersection 9271 (West Dapto Road) is likely to be a roundabout which is generally consistent with the West Dapto Contributions Plan (2020). However, it is noted that the current road geometry to the north west has an acute horizontal alignment which may impact sight lines and the gap acceptance for heavy vehicles. Further detailed analysis is to be prepared at the development application stage and will determine if further intersection treatments, or possible signalisation, is required to address any prevailing road safety concerns.

5 Traffic Assessment

5.1 Methodology

For the purpose of this traffic impact assessment, the modelling methodology is based on adopting Council's latest TRACKS model (2036+, version M79). The TRACKS model, released by Council, is an important element of this assessment and allows integration of the proposed development scale with Council's future plan for the WURA.

Key steps in the traffic modelling methodology are:

- > Obtain and review the network geometry within Council's original TRACKS model.
- > Update the TRACKS model within the project site to reflect the proposed road network
- > Update the residential and employment forecast for the development site through the creation (or modification) of zones. The residential yield is based on the proposed 577 residential dwellings. The industrial traffic generation within the TRACKS model is based on the employment assumptions.
- > Extract link volumes and intersection volumes for the AM and PM peak hour
- > Assess intersection performance using SIDRA intersection analysis providing Degree of Saturation, Average Delay and Level of Service outputs.

The TRACKS model is a strategic model developed on forecast land use to simulate traffic conditions on the road network and used to capture land use and road network changes that may occur. The model is a three step model consisting of total vehicle trip generation, trip distribution and trip assignment. Route choice is captured within the TRACKS model through the application of a traffic equilibrium assignment.

5.2 Trip Generation

The TRACKS 2036+ model is used to develop the traffic demand based on assumptions developed by Council.

For the residential development, the proposed dwellings (577) have been coded within the TRACKS model with an associated occupancy rate to provide the trip persons (across all transport modes). The industrial trip generation is based on the employment density of industrial land within the neighbourhood plan.

5.2.1 Residential Trip Generation

The supplied TRACKS 2036+ model has been updated to reflect the residential land within the neighbourhood plan. The residential land has been split into three zones as shown in **Figure 5-1**.

Figure 5-1 Residential Zone System



The resulting number of dwellings, person density and assumed car ownership (which is built in to the model and unchanged by Cardno) is summarised below.

Table 5-1 Residential Traffic Generation

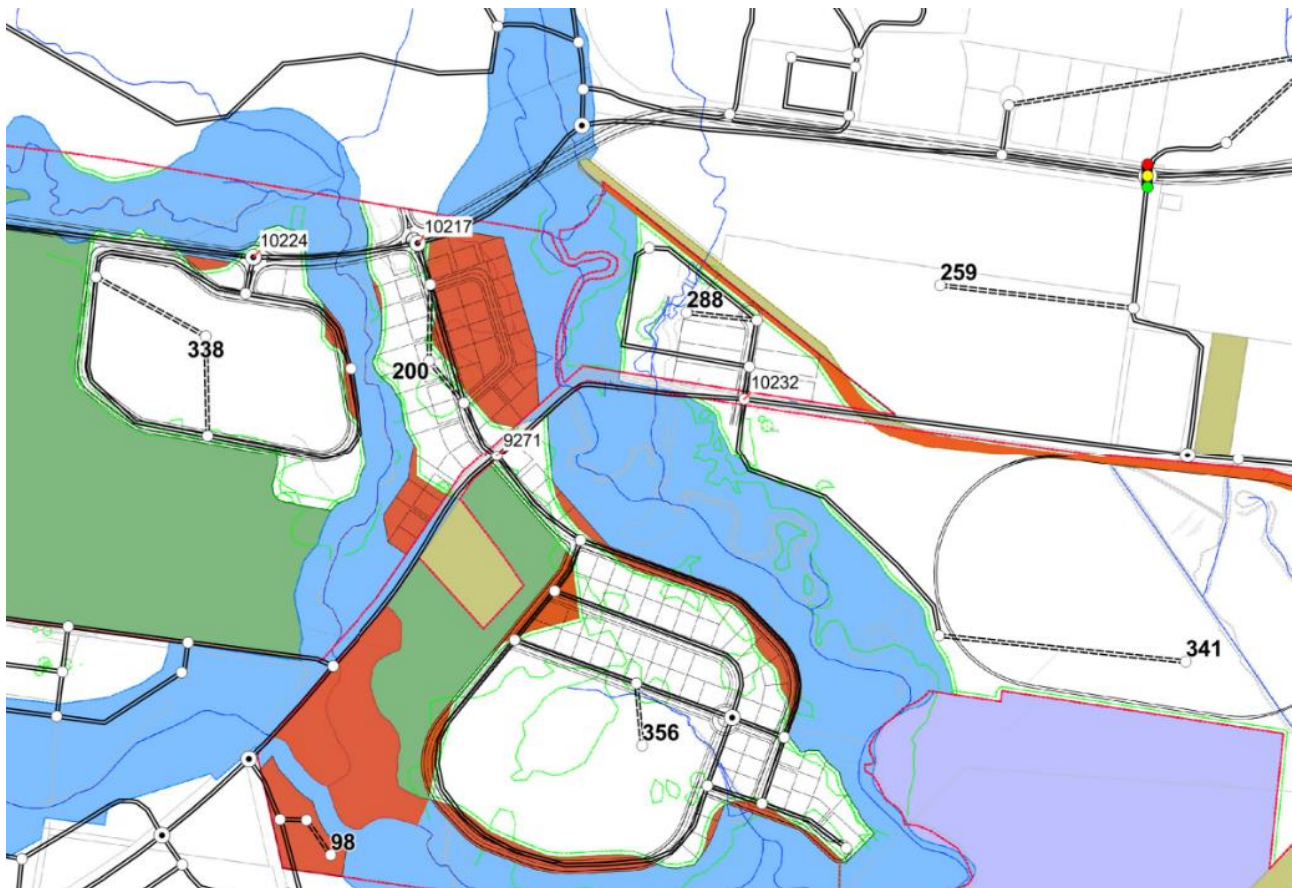
Zone	Dwellings	Persons per Dwelling	Undefined Jobs	Traffic Generation	
				AM	PM
Zone 98	115	2.75 = 316	6	84	95
Zone 264	72	2.75 = 198	4	52	59
Zone 563	185	2.75 = 509	9	134	150
Zone 566	205	2.75 = 563	10	149	167
Total	577	1,032	29	419	471

The number of trips generated by the updated TRACKS 2036+ model is some 419 vehicles in the AM and 471 in the PM peak hour. This equates to a vehicular trip rate of 0.726 and 0.816 trips per dwelling in the AM and PM respectively.

5.2.2 Industrial Trip Generation

With regard to the industrial lands, the main trip generation is associated with the employment density. The industrial zoned land has been separated into five centroids as shown in **Figure 5-2**.

Figure 5-2 Industrial Zone System



The West Dapto Housing and Employment Forecast Study (2018) does provide projected employment per travel zone, however the results / data is rather coarse and does not allow separation of the zone and area to be specific to the neighbourhood plan.

For the purpose of estimating employment across the five centroids, the following assumptions have been made:

- > Employment Type
 - 5% of the jobs are admin and,
 - 5% are transport jobs.
 - 90% are manufacturing jobs.
- > Employment Density
 - The provided TRACKS 2036+ Council model has a density of 17 to 22 jobs per hectare, resulting in an average of 19.6 jobs per hectare. The Council model has a job density of 4.51 per hectare for the land situated within the heavy industrial precinct.
 - Light industrial = 19.63 jobs per hectare
 - Heavy industrial = 4.51 jobs per hectare

Table 5-2 Industrial Traffic Generation

Zone	Jobs	Traffic Generation	
		AM	PM
200 – Light industrial	97	27	22
338 – Light industrial	256	72	59

356 – Light industrial	446	124	101
Sub-total	799	223	182
288 – Heavy industrial	24	7	5
341 – Heavy industrial	159	45	37
Sub-total	183	52	42
Overall Total	982	275	224

The number of trips generated by the updated TRACKS 2036+ model is some 275 vehicles in the AM and 224 in the PM peak hour. This equates to a trip rate of 0.228 to 0.279 trips per light industrial job and 0.223 to 0.284 trips per heavy industrial job.

The total traffic generated during the AM and PM peak hour is summarised in **Table 5-3** below.

Table 5-3 Total Traffic Generation

Land Use	AM	PM
Residential	419	471
Industrial	275	224
Total	694	695

The neighbourhood plan is forecast to generate up to 695 peak hour vehicles.

5.3 SIDRA Intersection Modelling

Turning Volumes

The intersection turning movements have been obtained from the 2036+ Tracks model inclusive of the development scale. The resulting AM and PM network traffic volumes at critical intersections are shown in **Figure 5-3** and **Figure 5-4** for the AM and PM peak hour respectively.

Figure 5-3 2036+ AM Peak Hour Turning Volumes

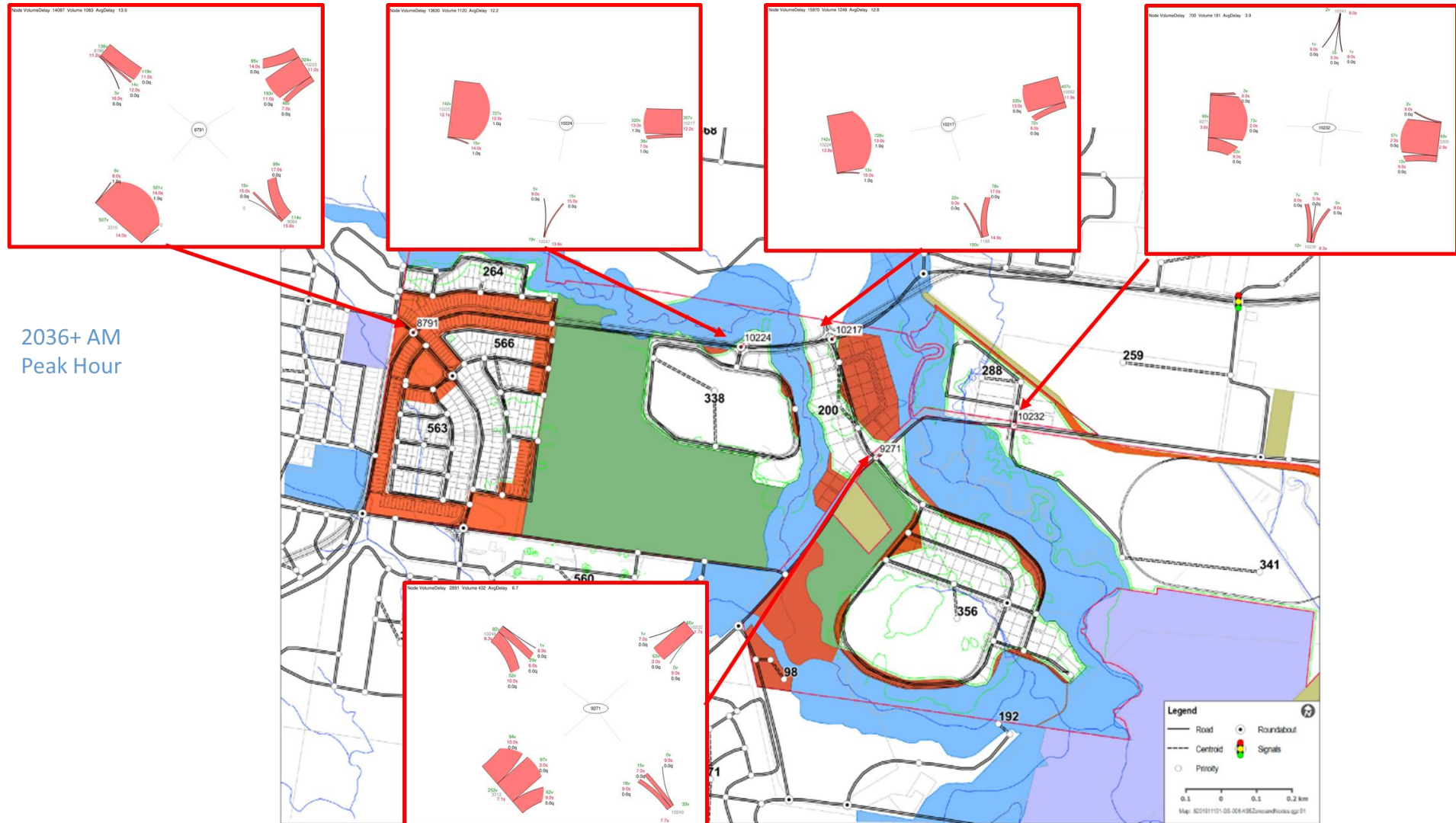
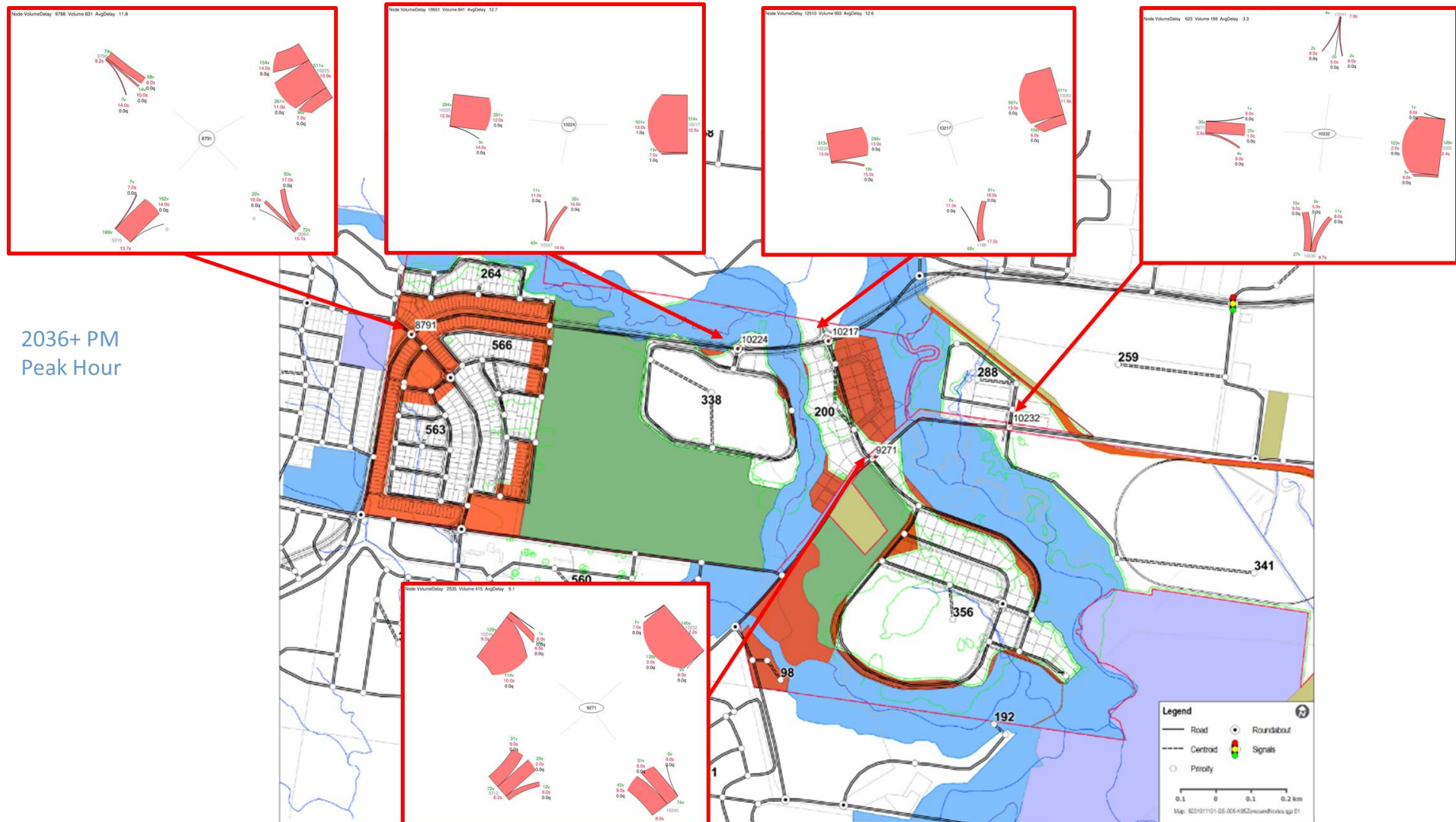


Figure 5-4 2036+ PM Peak Hour Turning Volumes



5.3.2 Intersection Performance Criteria

The intersection performance criteria are based on the Roads and Maritime Traffic Modelling Guidelines (2013). The capacity of a road network can be primarily determined by the capacity of the controlling intersections. The key indicator of intersection performance Level of Service (LOS) is delay, where results are placed on a continuum from 'A' to 'F' as shown in **Table 5-4**.

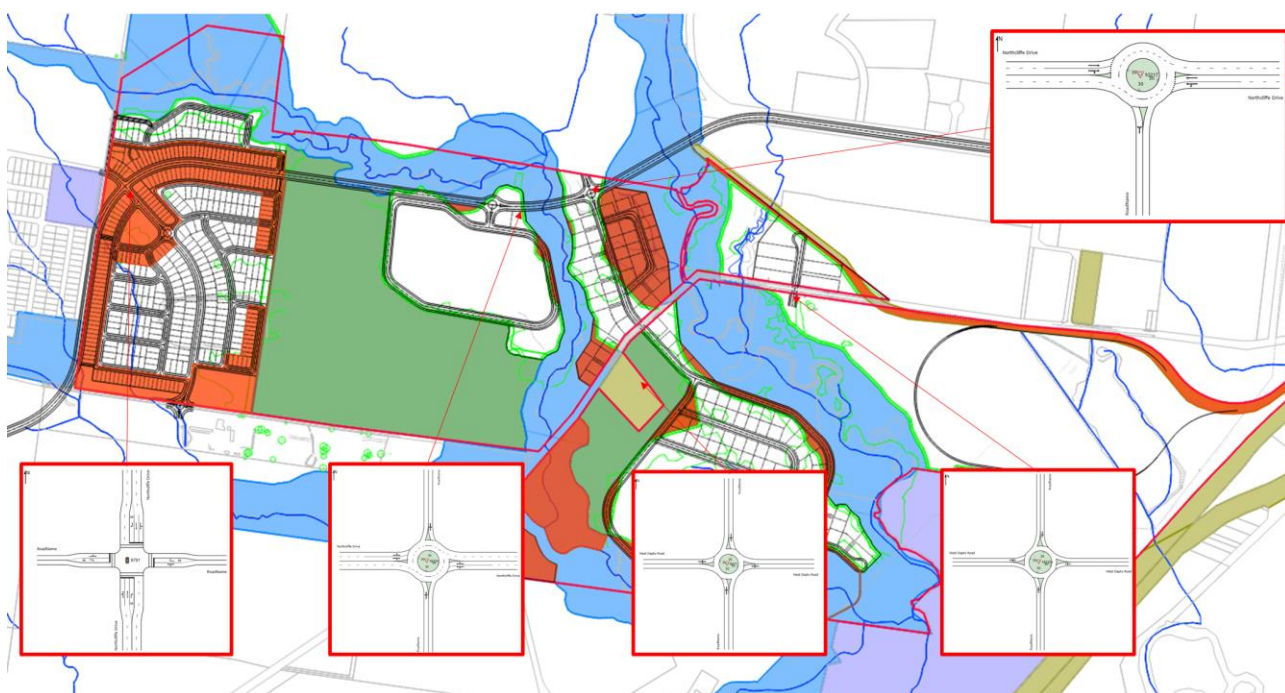
Table 5-4 Performance Criteria

Level of Service	Average Delay per Vehicle (seconds)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays	At capacity, requires another control mode
F	>70	Unsatisfactory and requires additional capacity	Unsatisfactory and requires additional capacity

Source: RMS Traffic Modelling Guidelines (2013)

Roads and Maritime guidelines state that for roundabouts and priority control intersections a LOS assessment should be reported based on the worst performing movement of the intersection. For traffic signals, the average movement delay and corresponding Level of Service overall movements should be determined and reported.

Figure 5-5 Modelled Intersections



5.3.3 Northcliffe Drive Extension / Eastern Roundabout (Intersection 10217)

The roundabout intersection 10217 as shown in **Table 5-5** show that it is forecast to operate at a satisfactory Level of Service "A" under the neighbourhood plan

Table 5-5 10217 Peak period movement summary

Peak Period	DoS	Delay (sec)	LoS
AM	0.283	10.6	A
PM	0.214	11.2	A

5.3.4 Northcliffe Drive Extension / Western Roundabout (Intersection 10224)

Intersection 10224 is forecast to operate at a satisfactory Level of Service "A" under the neighbourhood plan as shown **Table 5-6**.

Table 5-6 10224 Peak period movement summary

Peak Period	DoS	Delay (sec)	LoS
AM	0.258	11.2	A
PM	0.173	11.1	A

5.3.5 Northcliffe Drive Extension / Paynes Road (Intersection 8791)

As shown in Table 5-7, the SIDRA results determine that the intersection is forecast to operate satisfactory at Level of Service "B" with the neighbourhood plan.

Table 5-7 8791 Peak period movement summary

Peak Period	DoS	Delay (sec)	LoS
AM	0.404	23.8	B
PM	0.314	27.1	B

5.3.6 West Dapto Road / Western Roundabout (Intersection 9271)

Table 5-8 shows that the intersection is forecast to operate satisfactory at Level of Service "A" with the neighbourhood plan.

Table 5-8 9271 Peak period movement summary

Peak Period	DoS	Delay (sec)	LoS
AM	0.169	10.0	A
PM	0.117	10.5	A

5.3.7 West Dapto Road / Eastern Roundabout (Intersection 10232)

SIDRA assessment shows that the intersection is forecast to operate satisfactory at Level of Service "A" as shown in **Table 5-9** with the neighbourhood plan.

Table 5-9 10232 Peak period movement summary

Peak Period	DoS	Delay (sec)	LoS
AM	0.066	9.6	A

PM	0.085	10.0	A
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5.4 Intersection Performance Summary

The results of the 2036+ intersection modelling (SIDRA) is summarised in table below.

Table 5-10 Intersection Modelling Summary

Intersection	AM Peak			PM Peak		
	DoS	Delay (sec)	LoS	DoS	Delay (sec)	LoS
10217	0.283	10.6	A	0.214	11.2	A
10224	0.258	11.2	A	0.173	11.1	A
8791	0.404	23.8	B	0.314	27.1	B
9271	0.169	10.0	A	0.117	10.5	A
10232	0.066	9.6	A	0.085	10.0	A

The SIDRA results indicate that all of the intersections assessed are forecast to operate at a satisfactory level of service of LoS “B” or better, with minimal delays and queueing in both of the AM and PM peak periods. This indicates that these intersections have considerable spare capacity in each of the AM and PM peak periods.

5.5 Traffic Signal Warrants

The neighbourhood plan shows the provision of a signalised intersection with Road 01 and Northcliffe Drive Extension, which is also in accordance with Councils draft contributions plan. The traffic signal warrant assessment has been prepared based on the *Traffic Signal Design – Section 2: Warrants* which outlines the following criteria.

Figure 5-6 Traffic Signal Warrants Criteria

(a) Traffic demand:

For each of four one-hour periods of an average day:

- (i) the major road flow exceeds 600 vehicles/hour in each direction; and
- (ii) the minor road flow exceeds 200 vehicles/hour in one direction.

OR

(b) Continuous traffic:

For each of four one-hour periods of an average day:

- (i) the major road flow exceeds 900 vehicles/hour in each direction; and
- (ii) the minor road flow exceeds 100 vehicles/hour in one direction; and
- (iii) the speed of traffic on the major road or limited sight distance from the minor road causes undue delay or hazard to the minor road vehicles; and
- (iv) there is no other nearby traffic signal site easily accessible to the minor road vehicles.

OR

(c) Pedestrian safety:

For each of four one-hour periods of an average day:

- (i) the pedestrian flow crossing the major road exceeds 150 persons/hour; and
- (ii) the major road flow exceeds 600 vehicles/hour in each direction or, where there is a central median of at least 1.2 m wide, 1000 vehicles/hour in each direction.

OR

(d) Pedestrian safety – high speed road:

For each of four one-hour periods of an average day:

- (i) the pedestrian flow crossing the major road exceeds 150 persons/hour; and
- (ii) the major road flow exceeds 450 vehicles/hour in each direction or, where there is a central median of at least 1.2 m wide, 750 vehicles/hour in each direction; and
- (iii) the 85th percentile speed on the major road exceeds 75 km/h.

OR

(e) Crashes:

- (i) The intersection has been the site of an average of three or more reported tow-away or casualty traffic accidents per year over a three year period, where the traffic accidents could have been prevented by traffic signals; and
- (ii) the traffic flows are at least 80% of the appropriate flow warrants.

The traffic volumes extracted from the 2036+ TRACks model for the signalised intersection is summarised below.

Approach	AM	PM
Northcliffe Drive Extension (southern approach)	507	169
Northcliffe Drive Extension (northern approach)	324	511
Development Access (Road 01 – eastern approach)	114	72
Paynes Road (western approach)	138	79

Based on the traffic signal warrant assessment, the traffic volumes do not satisfy criteria (a) or (b) for the two peak periods. It is therefore likely that the required four, one hour periods would similarly be unsatisfied.

The signalised location is more likely to achieve the warrant criteria (c) or (d) based on pedestrian demand and road safety, particularly as this location will support the east – west movement either side of Northcliffe Drive Extension and further to the future Darkes Road town centre.

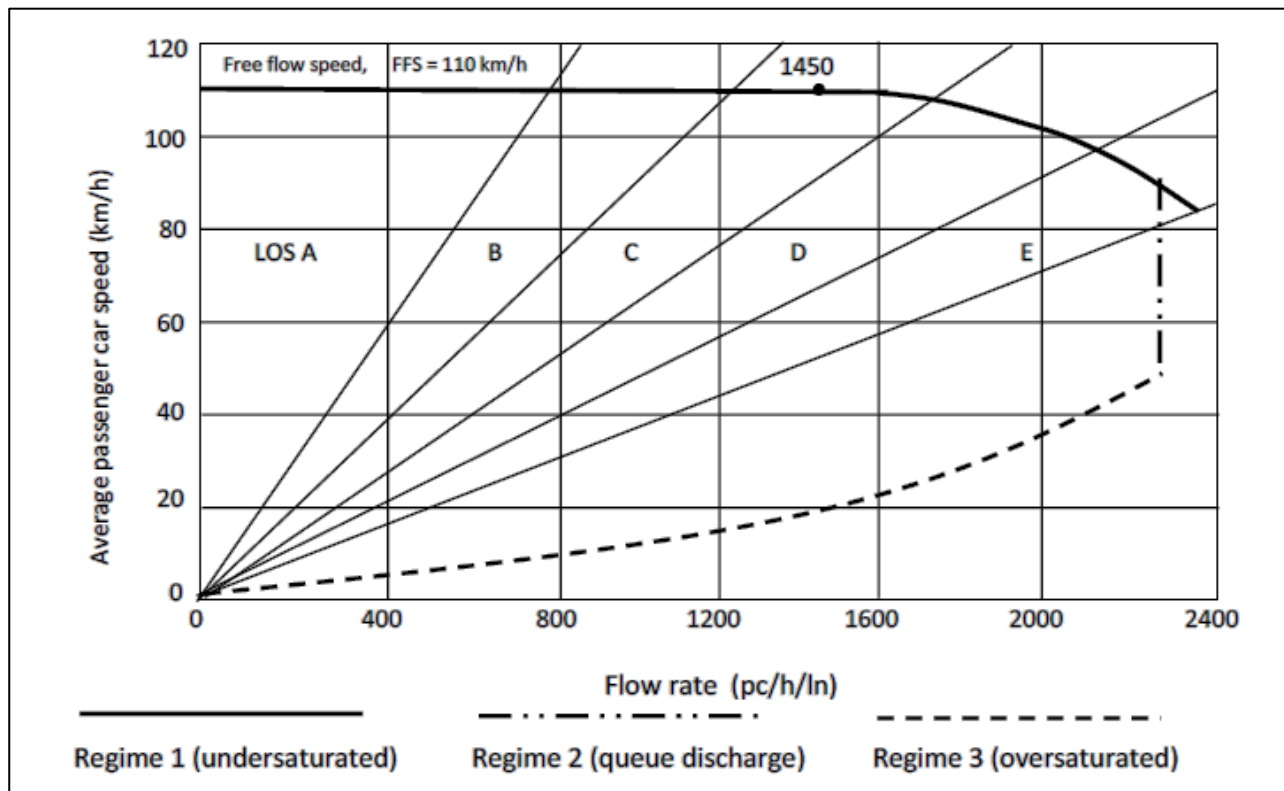
5.6 Midblock Capacity Assessment

For the purposes of determining mid-block road capacity, traffic performance was assessed using criteria contained within Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis. **Figure 5-7** illustrates theoretical road performance under different flow and speed conditions, also referred to as Service Flow Rates. Austroads describes Service Flow Rate as the maximum hourly rate at which vehicles can reasonably be expected to traverse a point under the prevailing roadway, traffic and control conditions while maintaining a designated level of service. They indicate the vehicle capacity for each level of service and are used to determine the level of service corresponding to actual traffic volumes.

For example, a traffic flow of 1,450 passenger cars per lane travelling at 110 km/h results in LoS C, however the same volume travelling at an average speed of 60km/h results in LoS E. These thresholds were used to assess level of service as part of the study.

At each level of service, the service flow rate is defined as the maximum for that level. Service flow rates are discrete values, whereas the level of service represents a range of conditions. Service flow rates therefore effectively define the flow boundaries between the levels of service.

Figure 5-7 Service Flow Rates Definition of the Flow Boundaries between Levels of Service



Source: Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis

Table 5-11 provides definitions for the Service Flow Rate and LoS classifications 'A' to 'F'.

Table 5-11 Level of Service and Service Flows Rates

LoS	Description	Speed and Flow Ranges *
A	A condition of free-flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.	60km/h - 0-400 veh/h/ln 90km/h - 0-600 veh/h/ln 110km/h - 0-800 veh/h/ln
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with level of service A.	60km/h - 400-650 veh/h/ln 90km/h - 600-900 veh/h/ln 110km/h - 800-1,200 veh/h/ln
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	60km/h - 650-850 veh/h/ln 90km/h - 900-1,400 veh/h/ln 110km/h - 1,200-1,650 veh/h/ln
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.	60km/h - 850 - 1,250 veh/h/ln 90km/h - 1,400 - 1,800 veh/h/ln 110km/h - 1,650 - 1,900 veh/h/ln
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.	60km/h - 1,250 - 1,650 veh/h/ln 90km/h - 1,800 - 2,000 veh/h/ln 110km/h - 1,900 - 2,100 veh/h/ln
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.	60km/h - above 1,650 veh/h/ln 90km/h - above 2,000 veh/h/ln 110km/h - above 2,100 veh/h/ln

Source: Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis

* Approximate range

The AM and PM outputs from the TRACKS model is provided in **Figure 5-8 & Figure 5-9** below. These outputs have been compared to the LoS criteria for midblock locations with results summarised in **Table 5-12**.

Figure 5-8 2036+ AM Midblock Flows

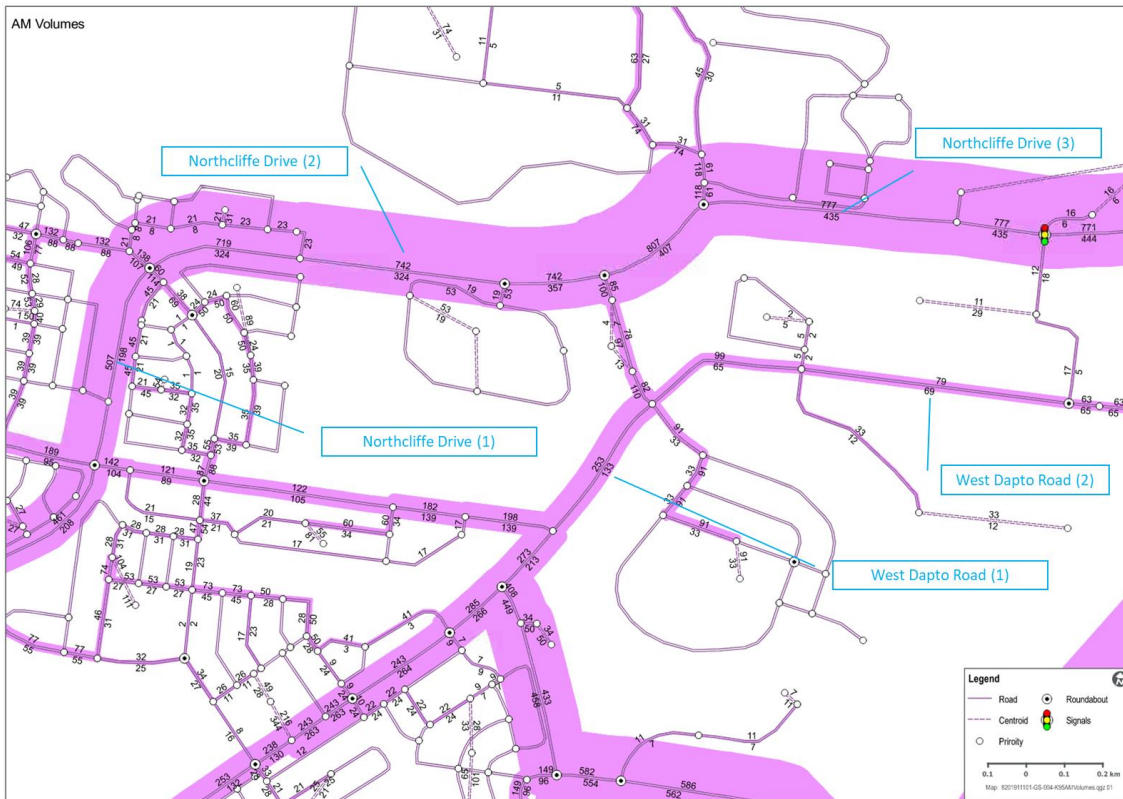


Figure 5-9 2036+ PM Midblock Flows

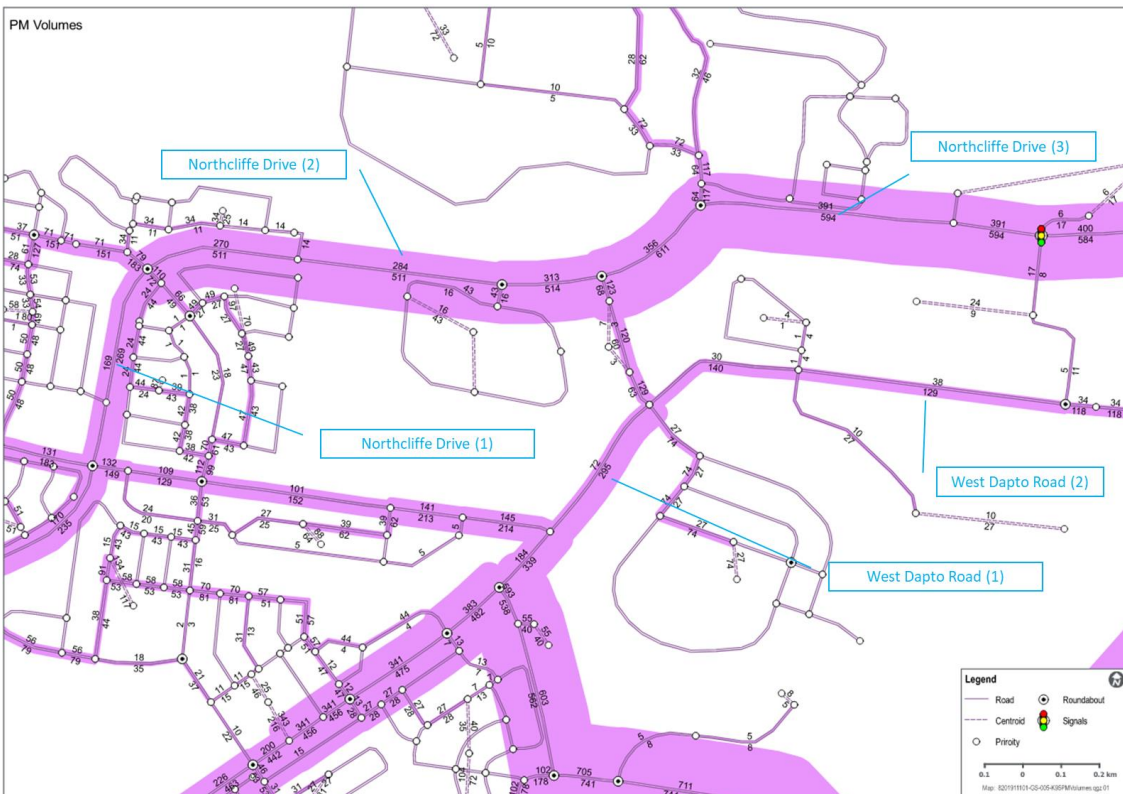


Table 5-12 AM Peak Hour Midblock Capacity

Location	Direction	Vehicles per Hour	Lanes	LoS
Northcliffe Drive (Location 1)	Northbound	507	1	B
	Southbound	198	1	A
Northcliffe Drive (Location 2)	Eastbound	742	2	A
	Westbound	324	2	A
Northcliffe Drive (Location 3)	Eastbound	777	2	A
	Westbound	435	2	A
West Dapto Road (Location 1)	Northbound	253	1	A
	Southbound	133	1	A
West Dapto Road (Location 2)	Eastbound	77	1	A
	Westbound	69	1	A

Table 5-13 PM Peak Hour Midblock Capacity

Location	Direction	Vehicles per Hour	Lanes	LoS
Northcliffe Drive (Location 1)	Northbound	169	1	A
	Southbound	269	1	A
Northcliffe Drive (Location 2)	Eastbound	284	2	A
	Westbound	511	2	A
Northcliffe Drive (Location 3)	Eastbound	391	2	A
	Westbound	594	2	A
West Dapto Road (Location 1)	Northbound	72	1	A
	Southbound	295	1	A
West Dapto Road (Location 2)	Eastbound	38	1	A
	Westbound	129	1	A

The traffic modelling results show that the morning and evening peak hour traffic volumes results in LoS “B” or better at midblock locations along the Northcliffe Drive extension and West Dapto Road. This result demonstrates that traffic conditions will be, in most cases, free flow with minimal friction along the two corridors allowing speed choice similar to the expect posted limit.

5.7 Road Hierarchy Considerations

The TRACKS traffic modelling for the 2036+ scenario provides 24 hour volumes, which can be adopted as Average Daily Traffic. The 24 hour plot is provided in **Figure 5-10** and summarised in **Table 5-14**.

Figure 5-10 Daily Traffic Volume

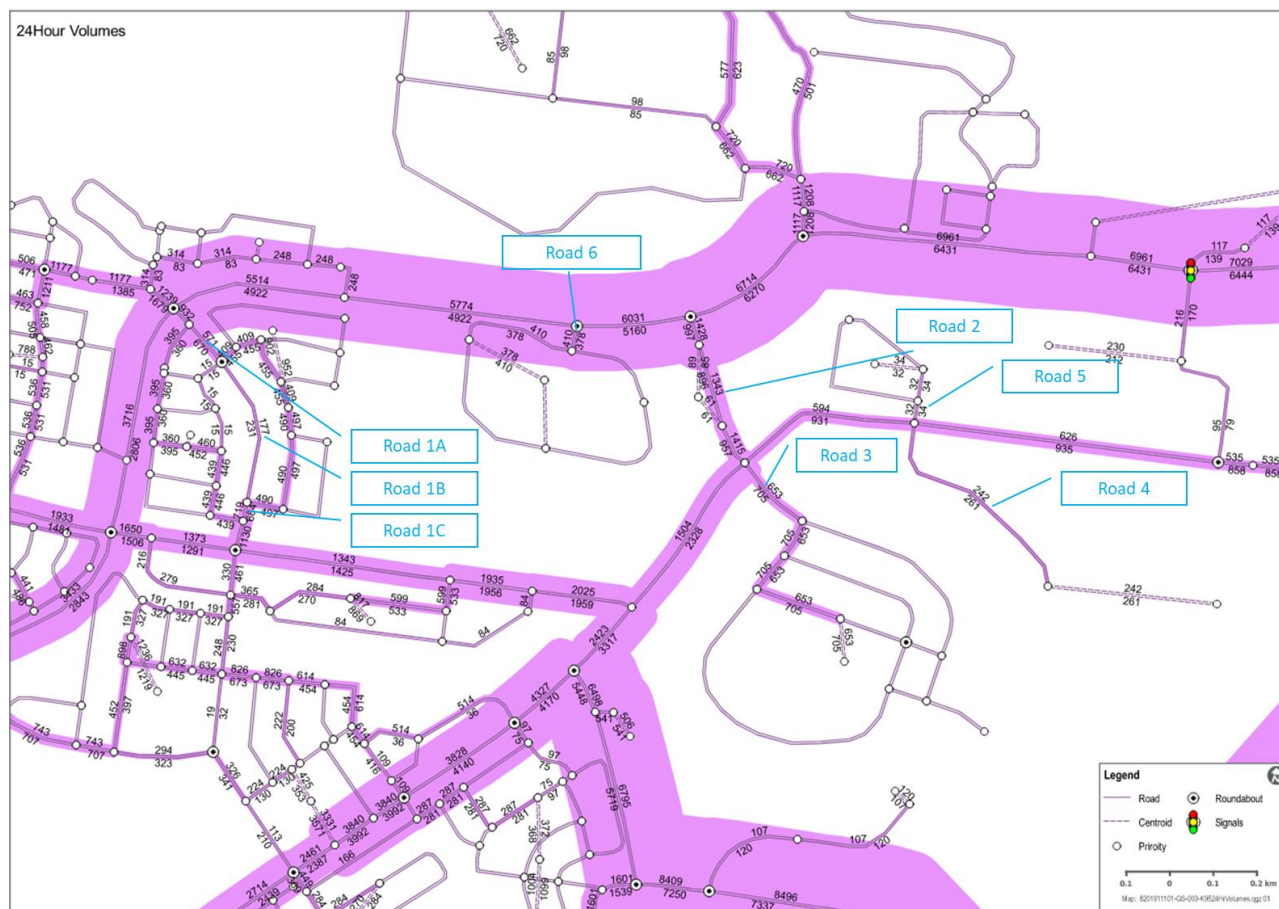


Table 5-14 Internal Road Network Hierarchy Suitability

Location	Vehicles (daily)	Location	Vehicles (daily)
Road 1a	1,241	Road 3	1,358
Road 1b	408	Road 4	503
Road 1c	1,403	Road 5	66
Road 2	2,239	Road 6	788

5.8 Other Considerations

5.8.1 IN2 Access to Northcliffe Drive Extension

Access to the IN2 land off Northcliffe Drive extension is proposed via two separate proposed roundabouts, approximately 250m apart. Facilitating two access on Northcliffe Drive extension, particularly in order to achieve access to the western IN2 land removes the need for an internal bridge crossing over the riparian corridor south of Northcliffe Drive. Given the Northcliffe Drive extension will already pass through the riparian corridor, minimising further impacts on this corridor is considered beneficial to the neighbourhood plan.

The separation of 250m between the two roundabouts does not result in traffic congestion, with both intersections shown to operate satisfactorily at LoS A with queues highly unlikely to extend to upstream / downstream intersections.

6 Development Public and Active Travel

6.1 Public Transport Planning

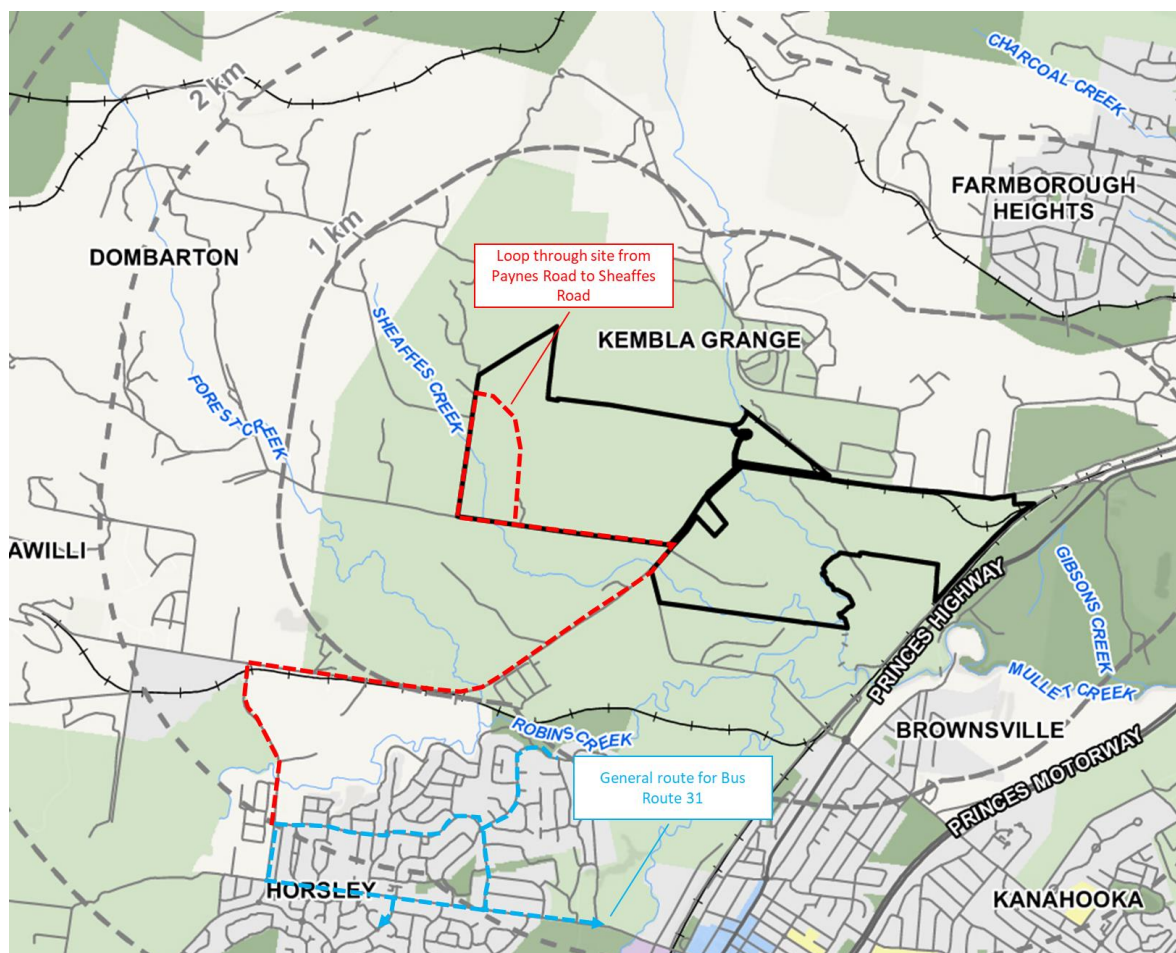
The current public transport network for Kembla Grange is very limited. There is a train station located near the T-Junction of West Dapto Road and bus stops along Princes Highway are within the station vicinity. The remaining area of Kembla Grange have no bus stops available. This is largely due to the lack of residential density in the area.

Future residential and industrial developments in West Dapto / Kembla Grange will need to integrate with the existing public and active transport network before functioning with the full public and active transport network envisaged within the WURA.

For the interim (i.e. without the Northcliffe Drive Extension), connectivity to bus routes 31 and / or 32 to service the residential and employment lands is favoured. To facilitate interim connection to the existing bus network, it is likely that bus stops on West Dapto Road and Sheaffes Road will be required to provide safe access to residential and employment land.

Route 31 could be extended up Shone Avenue to capture development on Smiths Lane, Darkes Forest and Paynes Road. An indicative route is shown below (not this does not include routing to favour other development areas listed).

Figure 6-1 Bus Route Through the Site



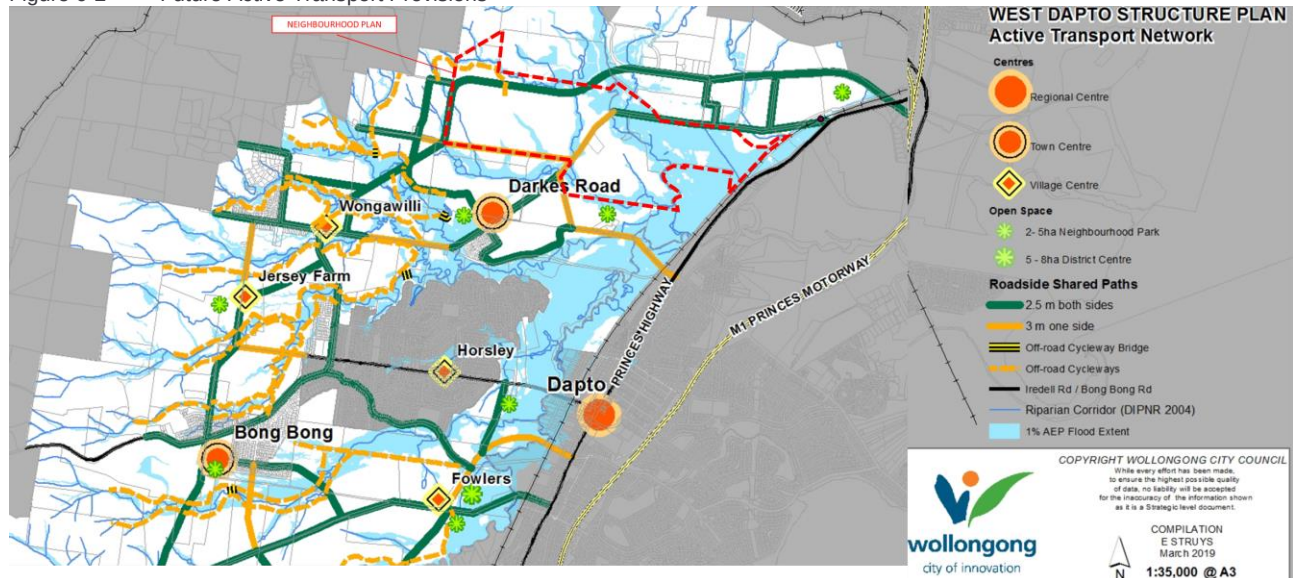
Under the ultimate neighbourhood plan, the bus corridor is most likely going to favour the Northcliffe Drive Extension with additional routes via Road 1 a potential consideration (subject to the road cross section supporting bus movements through the residential precinct as detailed in the proposal). A bus route along Road 01 also achieves a catchment of 400m for all allotments (whereby the distance either side of Road 01 to the most western and eastern lots is 200-300m, well within the 400m distance and achieved walking distance).

6.2 Pedestrian and Cycle Networks

The pedestrian and cycle network are limited within the vicinity of the subject site. Until such time as the bus network is brought forward to service the site, any pedestrian and cycle network is likely to facilitate recreational use only (as opposed to commuter based).

Referring to the Wollongong DCP Chapter D16: West Dapto Release Area (Amendment 2019), the active transport network is shown in **Figure 6-2**.

Figure 6-2 Future Active Transport Provisions



The key active transport network shows the following:

- > Northcliffe Drive to provide 2.5m shared path on both sides of the carriageway
- > West Dapto Drive to provide 2.5m shared path on both sides and in some locations a 3.0m shared path only on one side of the carriageway.

The intersection of Northcliffe Drive Extension / Road 01 will be signalised allowing movement for pedestrians and cyclists between developments either side of Northcliffe Dive Extension. In addition to this, the intersection of Sheaffes Road / Payne Road is to be signalised (as per the contributions plan) which will support the east-west movements between development either side of Northcliffe Drive Extension. The neighbourhood plan enhances this linkage on Sheaffes Road via the provision of passive open space on the eastern side of Northcliffe Drive extension. This will improve the amenity for pedestrians and cyclists in this location.

7 Conclusions

This report details the traffic impact assessment for the BlueScope Steel Neighbourhood Plan in Kembla Grange, NSW within the West Dapto Urban Release Area. The full development of the NP is expected to comprise of low density residential development and a separated industrial estate. The main findings of the traffic impact assessment are as follows:

- > The West Dapto Urban Release Area will look to integrate the forecast 19,000 new dwellings to the future transport strategy. Car based, public and active transport links to regional centres (i.e. Dapto) and the Satellite city of Wollongong will be achieved through Council's contributions plan which allocates road network improvements to support all transport modes. The proposed neighbourhood plan will be keeping with the development requirements set by Council to facilitate the strategic transport requirements.
- > Kembla Grange currently has a very limited public transport network while neighbouring areas have a more established network in line with the increased residential density.
- > The neighbourhood plan is forecast to generate between up to 695 peak hour vehicles.
- > The SIDRA results indicate that all of the intersections assessed are forecast to operate at a satisfactory level of service of LoS "B" or better, with minimal delays and queueing in both of the AM and PM peak periods. This indicates that these intersections have considerable spare capacity in each of the AM and PM peak periods. This result demonstrates that traffic conditions will be, in most cases, free flow with minimal friction along the two corridors allowing speed choice similar to the expect posted limit.
- > The final intersection configuration will be subject to detailed design as part of future development applications. The assessment shows the future signalised intersection on Northcliffe Drive Extension (node 8791) will perform adequately and most likely be warranted on pedestrian movements and road safety rather than traffic volumes. The roundabout intersection on West Dapto Road (node 9271) is proposed as a roundabout as per the contributions plan. However there may be a need to consider further upgrades (possibly signals) to address any prevailing road safety concerns in proximity to this location (i.e. potential poor sight distance on the north-eastern approach).
- > Under the ultimate neighbourhood plan, the bus corridor is most likely going to favour the Northcliffe Drive Extension with additional routes via Road 1 a potential consideration (subject to the road cross section supporting bus movements through the residential precinct as proposed).
- > Improvements to the active transport network will be facilitated via shared paths along Northcliffe Drive extension and West Dapto Road. The internal subdivision roads will be developed in accordance with Councils typical cross sections and supporting pedestrian movements along key routes.

In summary, the proposed neighbourhood plan has been shown to have minimal impact on the future road network within the West Dapto Urban Release Area.