Traffic Impact Assessment

Chelsea Gardens, Stage 1

80220024

Prepared for
Aoyuan International

27 April 2021

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Abbreviations

Abbreviation	Description
Aoyuan	Aoyuan International Pty Ltd
Cardno	Cardno NSW/ACT Pty Ltd
Chelsea Gardens	Chelsea Gardens and Coomungie Lands
CML	Concessional mass limit
DA	Development application
DCP	Development control plan
GML	General mass limit
HML	Higher mass limit
LGA	Local government area
(N)	North approach
NSW	New South Wales
(S)	South approach
Stage 1	Chelsea Gardens Stage 1 32 Lovelle Street & 141 Yarrawa Road, Moss Vale
TfNSW	Transport for NSW
TIA	Traffic impact assessment
TRACKS	Strategic modelling software package
TSWA	Traffic signal warrant assessment
URA	Urban release area
WLEP	*Wingecarribee Local Environment Plan 2010*
WSC	Wingecarribee Shire Council

1 Introduction

1.1 Background

Cardno NSW/ACT Pty Ltd (Cardno) has been commissioned by Aoyuan International Pty Ltd (Aoyuan) to prepare a Traffic Impact Assessment (TIA) for Chelsea Gardens Stage 1 at 32 Lovelle Street & 141 Yarrawa Road (Stage 1) in Moss Vale, NSW. The site sits within the Wingecarribee Shire Council (WSC) Local Government Area (LGA).

Moss Vale is located in the Southern Highlands region of New South Wales (NSW), approximately 125 kilometres south-west of Sydney. The town currently has a population of 8579 and 3711 private dwellings with an average of 2.4 people per household and 1.8 motor vehicles per dwelling (Australian Bureau of Statistics, 2016).

The Chelsea Gardens and Coomungie Lands (Chelsea Gardens) development site is currently a large tract of rural land located within a naturally-formed amphitheatre which rises from Whites Creek to the hills surrounding the Moss Vale township. The site was identified as falling within an Urban Release Area (URA) under the *Wingecarribee Local Environment Plan 2010* (WLEP) and was rezoned in 2017. The land rezoning was supported by a planning proposal which aimed to yield up to 1200 residential lots over a number of stages. **Figure 1-1** shows the Chelsea Gardens Structure Plan which is considered to be the ultimate layout of the development.

Aoyuan and Cardno have been working on the Chelsea Gardens masterplan and, in conjunction with WSC and Transport for NSW (TfNSW), prepared extensive traffic modelling to assess and define the infrastructure requirements for Chelsea Gardens full development scenario.

The purpose of this TIA is to assess the traffic and transport implications of Chelsea Gardens Stage 1, which includes:

- 172 residential lots
- Two open space / drainage lots
- Four residue lots.

1.2 Objectives

The key objectives of this TIA are to:

- Undertake a detailed review of all provided documents associated with the development
- Determine the development site potential traffic generation by reviewing *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002) and using the WSC TRACKS model (consistent with the masterplan assessment)
- Assess the impacts of Stage 1 on the Yarrawa Road / Spencer Street / Darran Road intersection
- Review the proposed subdivision's internal road layout and comment on its adequacy
- Review the existing public transport services and provisions for walking and cycling in the vicinity of the development, and provide comment on their adequacy.

1.3 Technical References

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

- *Guide to Traffic Generating Developments* (Roads and Traffic Authority, 2002)
- *Guide to Traffic Generating Developments Updated Traffic Surveys* (Roads and Maritime Services, 2013)
- *Moss Vale Township Development Control Plan Section 22: Chelsea Gardens Coomungie Precinct* (Wingecarribee Shire Council, 2019)
- *Schedule of Classified and Unclassified Roads* (Roads and Maritime Services, 2014)
- *Section 94 Developer Contributions Plan for Roads and Traffic Facilities 2012 to 2031* (Wingecarribee Shire Council, 2012).

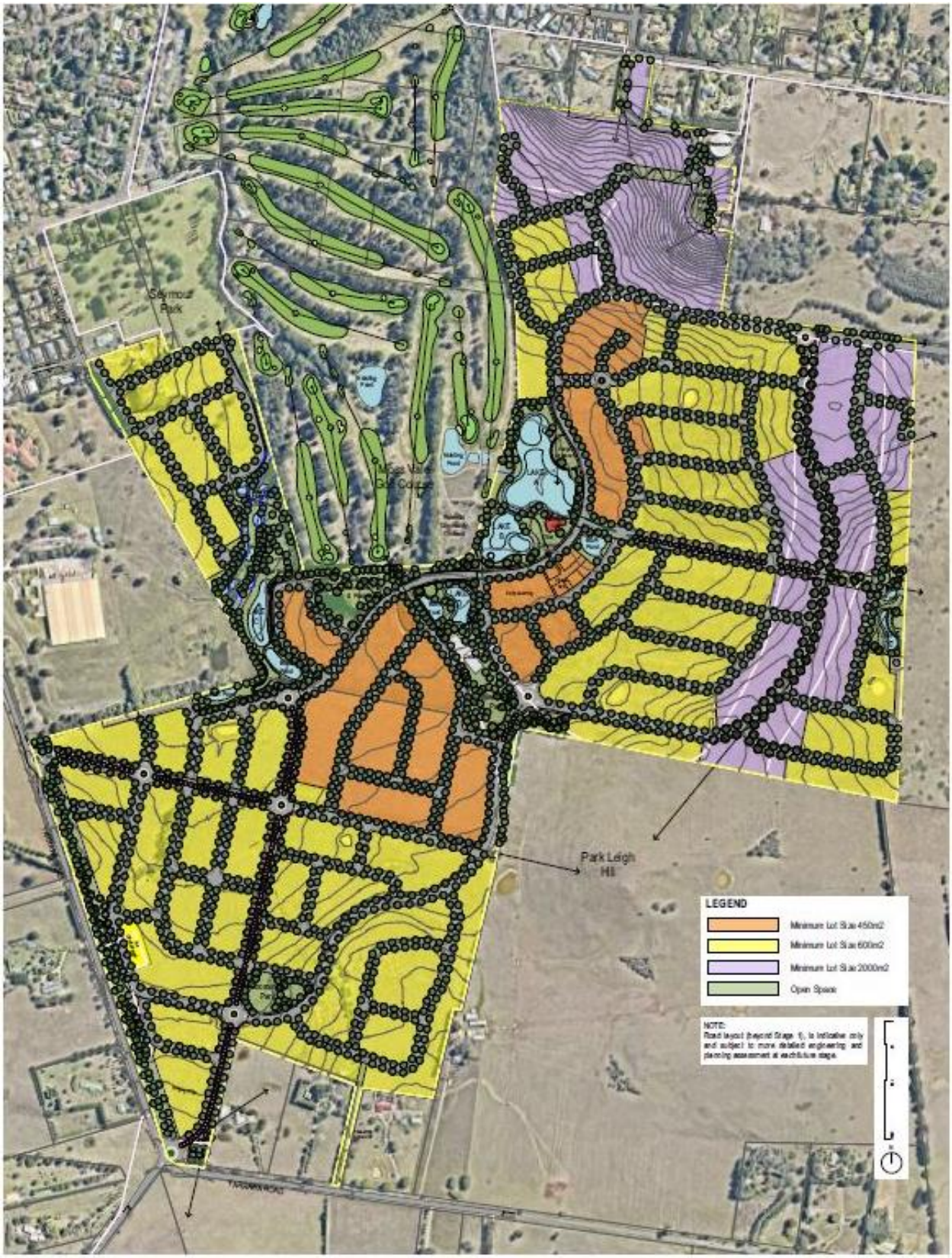


Figure 1-1 Chelsea Gardens Structure Plan

Source: Aoyuan (2020)
Background image source: Nearmap (2019)

2 Existing Conditions

This section outlines the existing conditions of the road network and public transport facilities within the area of the proposed development

2.1 Study Area

Stage 1 is proposed to be the first stage of Chelsea Gardens to be constructed. It borders Yarrawa Road to the west and occupies the south-western portion of the full development site.

The north-western boundary of the site borders Harper Entertainment Distribution Services and the north-eastern boundary of the site borders the Moss Vale Golf Course. All other boundaries are adjacent to later stages of Chelsea Gardens. Currently, the site is undeveloped, consisting of rural acreages and agriculture land.

Figure 2-1 shows the location of Stage 1 in the context of the full development site and southern Moss Vale.

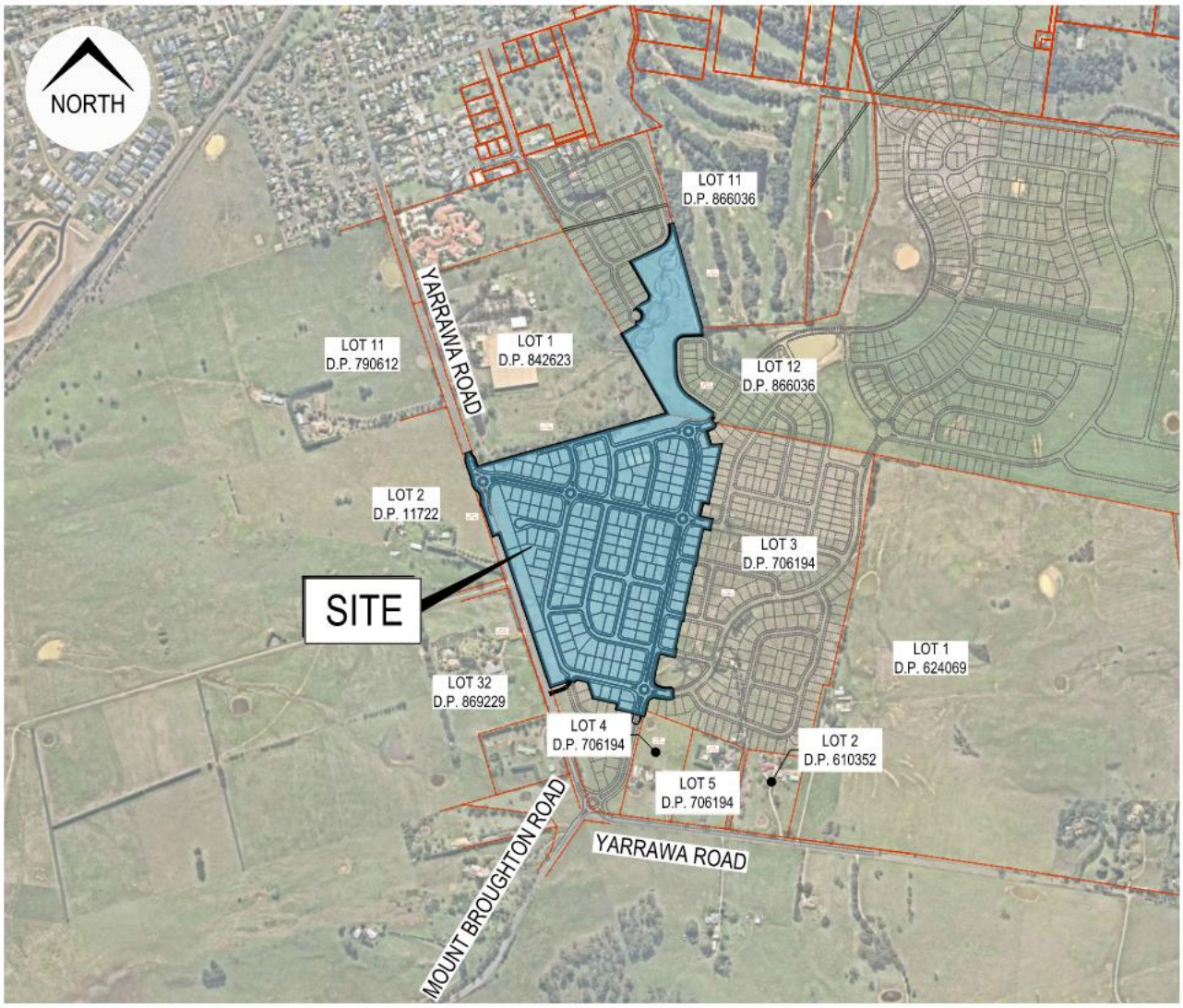


Figure 2-1 Stage 1 development site

Source: Orion Consulting (2021)
Background image source: Nearmap (2019)

2.2 Existing Road Network

TfNSW in partnership with local governments, established an administrative framework of State, Regional and Local Road categories to assist in managing the extensive network of roads.

State Roads are managed and financed by TfNSW and Local Roads are managed and financed by councils. Regional Roads perform an intermediate function between the main arterial network of State Roads and the council-controlled local road networks. They are managed and financed by councils but also receive financial assistance from TfNSW.

Figure 2-2 shows the key roads around Stage 1 which are summarised in the following sections.

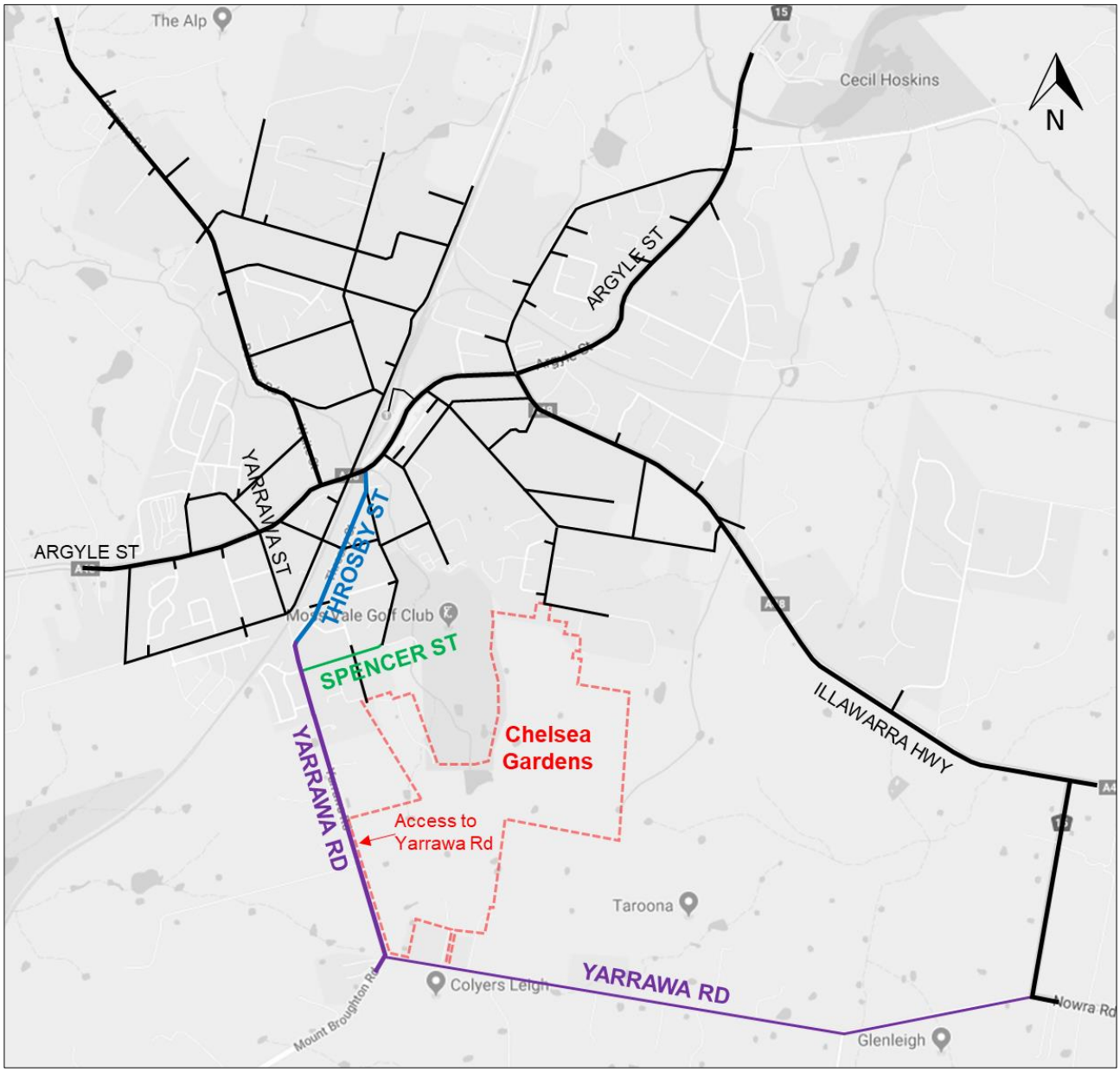


Figure 2-2 Key roads around the development

Background image source: Google Maps (2019)

2.2.2 Yarrawa Road

Yarrawa Road is a Local Road which runs from Throsby Street in southern Moss Vale to Nowra Road about 5km east of the town centre. Access to Stage 1 is proposed to be via a new intersection onto Yarrawa Road about 1km south of its northern extent. This is referred to as Yarrawa Road northern entry

Yarrawa Road begins at a bend in the road, north of which the route becomes Throsby Street. A pedestrian-only level rail crossing connects the northern extent of Yarrawa Road to Yarrawa Street on the other side of the railway. From here, the road runs approximately due south for about 500m through southern Moss Vale. The speed limit in this section is 50km/h.

South of this, the speed limit changes to 90km/h and the road continues on the same trajectory for about 1.2km to a priority T-intersection with Mount Broughton Road. From this intersection, Yarrawa Road continues due west for about 3.5km where it intersects at another priority T-intersection with Nowra Road.

Yarrawa Road is one lane in each direction for the entirety of its length.

2.2.3 Throsby Street

Throsby Street is a Local Road which runs through southern Moss Vale to the town centre and main street (Argyle Street). The southern end becomes Yarrawa Road at a bend and the northern end connects to Argyle Street. About halfway along its length is the Throsby Street / Spring Street roundabout which connects to a two-way single-lane railway underpass on its western side. The road is one lane in each direction and the posted speed limit is 50km/h.

Throsby Street will be the main access for vehicles from Stage 1 accessing the town centre and Argyle Street.

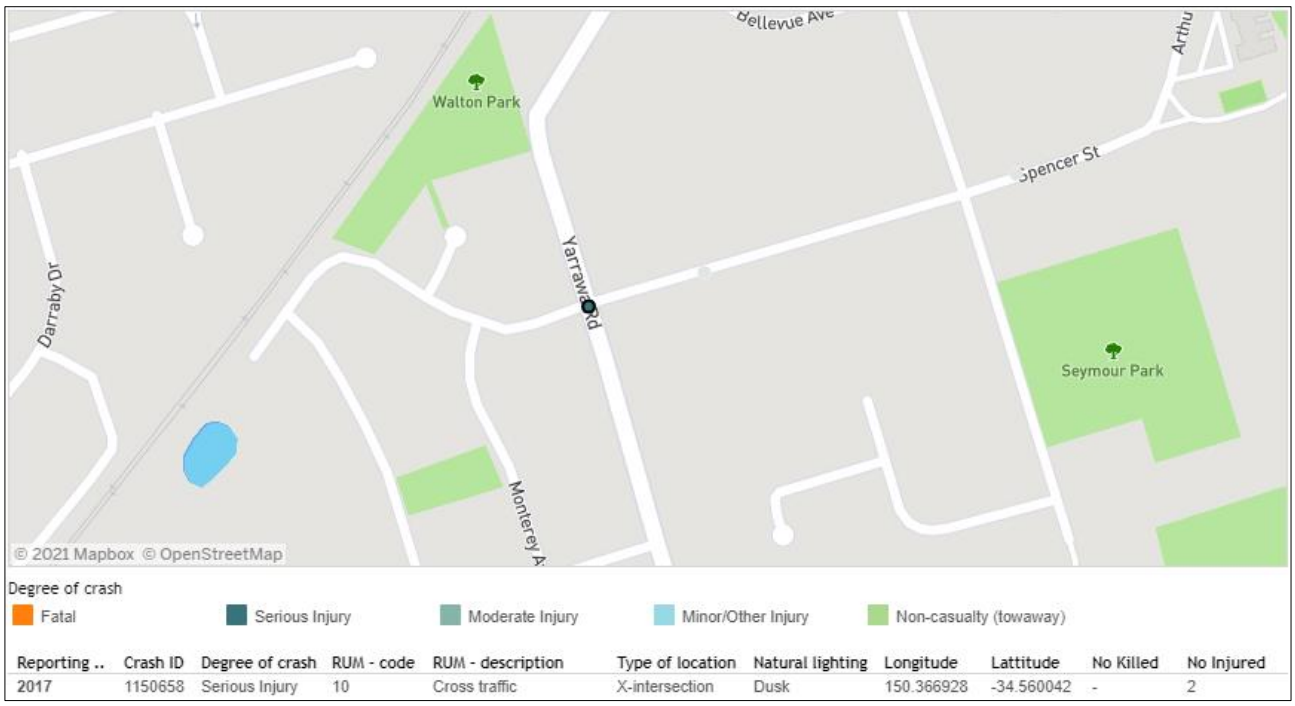
2.2.4 Spencer Street

Spencer Street is a Local Road which runs through southern Moss Vale. It provides an alternative access from Yarrawa Road to the town centre that avoids Argyle Street. It is approximately 500m long. It connects to Yarrawa Road at its western extent and changes name to Arthur Street at a bend in the road at its eastern extent. The speed limit is 50km/h.

2.3 Crash History

Crash history data was extracted from the TfNSW Centre for Road Safety[1] for the Yarrawa Road / Spencer Street intersection. The most recent data covers the five-year period from 2015 to 2019.

One crash was reported at the Yarrawa Road / Spencer Street intersection within the five-year period. This crash occurred when two vehicles passing straight through the intersection collided with one another at an angle of 90 degrees. It occurred at dusk and resulted in two serious injuries. **Figure 2-3** shows the location and details of the crash.



Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injured
2017	1150658	Serious Injury	10	Cross traffic	X-intersection	Dusk	150.366928	-34.560042	-	2

Figure 2-3 Crash history map

Source: Transport for NSW Centre for Road Safety (accessed 29 March 2021)

2.4 Public Transport

Stage 1 is approximately 2.5km south of Moss Vale train station. Moss Vale is serviced by Southern Highlands Line trains between Moss Vale and Campbelltown, with some services extending north to Central and/or south to Goulburn. Moss Vale is also serviced by NSW TrainLink Regional services between Sydney, Canberra and Melbourne.

The nearest existing bus stop to Stage 1 is HarbisonCare, Yarrawa Road (Stop ID 2577173). This bus stop is currently the southern extent of route 816 Moss Vale Courthouse to Willow Drive and Argyle Street (Loop Service). It is located approximately 500m north of the proposed access to the site. The route is a loop service and connects most of southern and western Moss Vale to the town centre and train station. **Figure 2-4** shows the 816 bus route.

On weekdays, the first bus service is at 9:24am, followed by services approximately every hour until 1:58pm and then three services between 4:54pm and 6:04pm. On Saturdays there are four buses between 8:55am and 1:53pm. There is no service on Sundays.

[1] TfNSW Centre for Road Safety Portal: https://roadsafety.transport.nsw.gov.au/statistics/interactivecrashstats/lga_stats.html?tablga=4

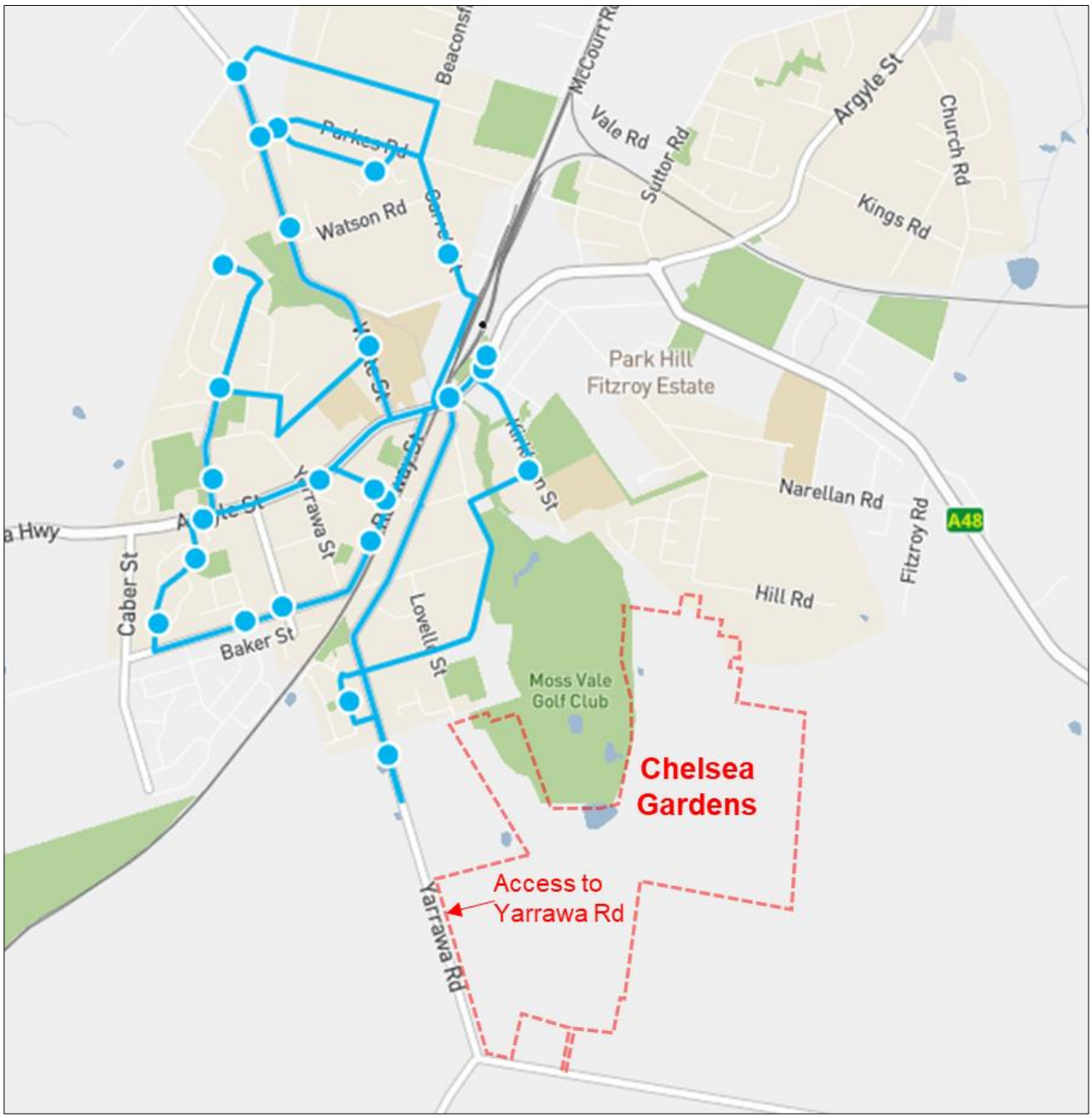


Figure 2-4 816 bus route map

Source: Transport for NSW (2021)

2.5 Walking and Cycling

Existing walking and cycling facilities around the Stage 1 site are limited. There are no footpaths or provision for pedestrians on Yarrawa Road. The posted speed limit on Yarrawa Road is 90km/h and there is no shoulder or cycle lane. **Figure 2-5** shows the existing streetscape approaching the site access.

Figure 2-5 Yarrawa Road looking south towards the Stage 1 site access location

Source: Google Streetview (accessed 30 March 2021)

Large, flat grassed verges are provided in front of residences around the Yarrawa Road / Spencer Street intersection. There is a footpath on one side of the road on the north approach only. **Figure 2-6** shows the existing streetscape on Yarrawa Road near the Yarrawa Road / Spencer Street intersection.

Figure 2-6 Yarrawa Road looking south from Yarrawa Road / Spencer Street intersection

2.6 Heavy Vehicles

Transport for NSW imposes limitations on heavy vehicle routes throughout the state. Three tiers of mass limits are defined based on vehicle mass and axle group category:

> General Mass Limits (GML): Heavy vehicles with unrestricted access to the road system

> Concessional Mass Limits (CML): Increased mass limits for eligible vehicles; requires accreditation

> Higher Mass Limits (HML): Highest level of mass except for vehicles requiring special permits; requires accreditation and GPS tracking to manage access and compliance.

Yarrawa Road is approved for use by heavy vehicles up to a 25/26m B-double (GML and CML) in the eastbound direction only. HML vehicles are not allowed in either direction. **Figure 2-7** shows the restricted access vehicle routes in and around Moss Vale.

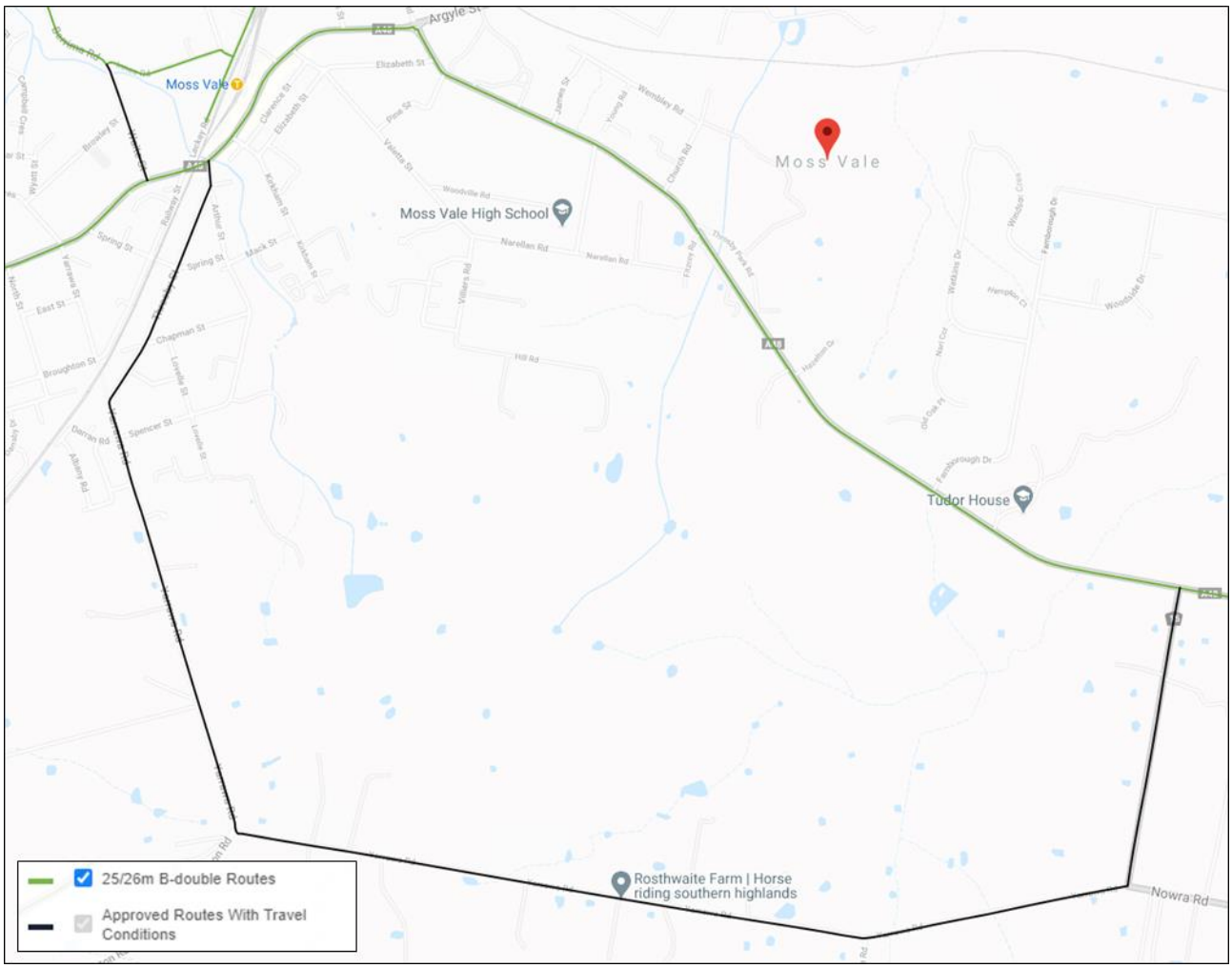


Figure 2-7 Restricted access vehicles map for 25/26m B-double (GML and CML)

Source: Roads and Maritime Services (accessed 30 March 2021)

2.7 Traffic Surveys

Traffic surveys were conducted at Yarrawa Road / Spencer Street as part of a wider data collection program across Moss Vale to inform traffic models developed for the full development stage. The data was collected on Thursday 30 August 2018 for 7:30am – 9:30am and 3:00pm – 6:00pm.

Figure 2-8 shows the AM and PM peak hour traffic volumes. The data indicates that:

- Traffic volumes are very low into and out of Darran Road (less than 20 vehicles) in both peaks
- The right turn from Yarrawa Street (S) to Spencer Street is the heaviest movement in both peaks
- Pedestrian movements are minimal, with a total of less than five pedestrians observed in either peak period.

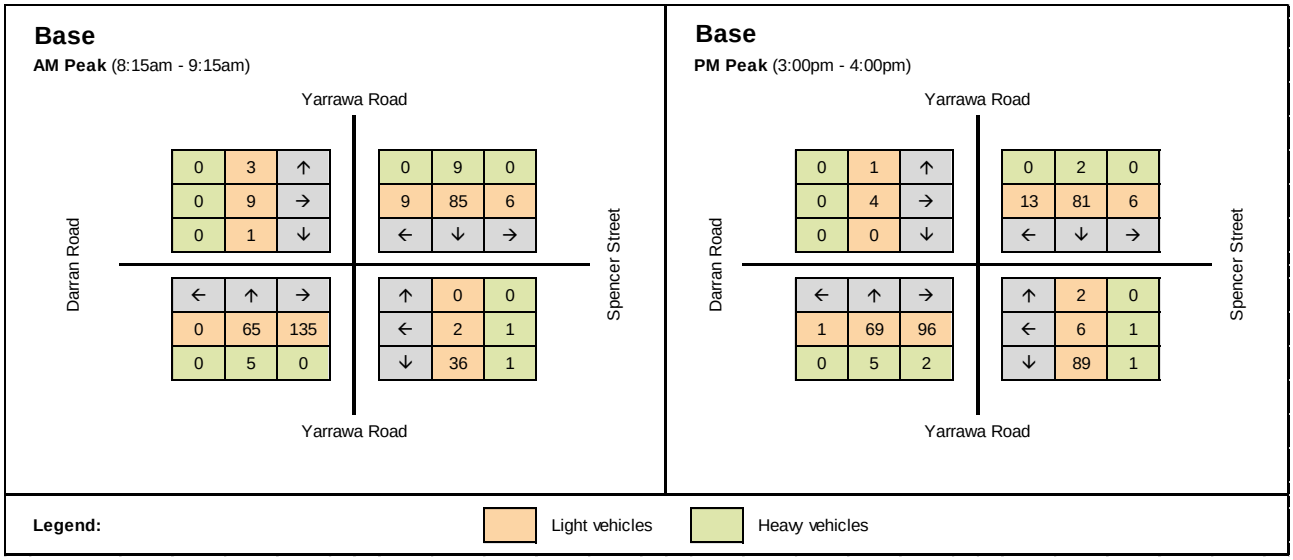


Figure 2-8 Yarrawa Road / Spencer Street intersection volumes

Appendix A contains the full traffic survey data for this intersection.

3 Proposed Development

3.1 Dwellings

Chelsea Gardens Stage 1 is proposed to include:

> 172 residential lots

> Two open space / drainage lots

> Four residue lots.

3.2 Site Access

The only site access to Stage 1 is via a new roundabout on Yarrawa Road which is referred to as the Yarrawa Road North access point in the *Moss Vale Township Development Control Plan* (Wingecarribee Shire Council, 2019). **Figure 3-1** shows the concept design of the proposed site access at Yarrawa Road / Road No. 01.

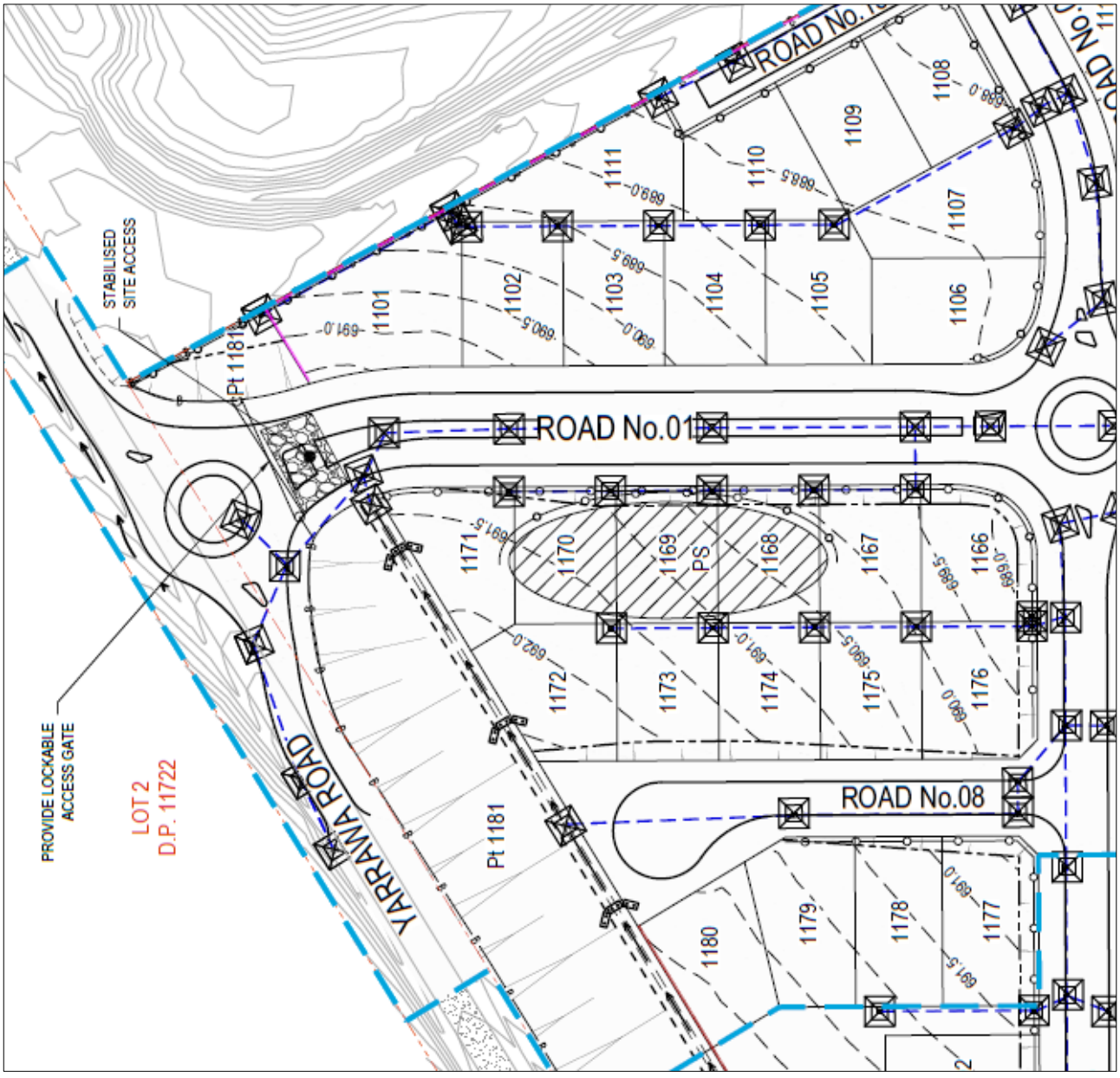


Figure 3-1 Proposed site access

Source: Orion Consulting (2021)

Individual dwellings and their respective driveway locations will be determined at each individual house development application / complying development certificate. It is expected that corner lots will achieve driveway access clear of the intersection tangent point and with sufficient sight lines to traffic.
On-site parking for dwellings will comply with the relevant development control plan in place at the time of lodgement.

3.3 Public Transport

The *Moss Vale Township DCP* (Wingecarribee Shire Council, 2019) lists the following objectives for Chelsea Gardens:

- Create a street network that encourages walking and cycling while still facilitating vehicle access
- Enable shuttle or other bus service on selected routes through the development.

These objectives will be met through the following development controls:

- Creating direct pedestrian and bicycle pathway connections to the Moss Vale town centre and local public transport nodes
- Designing a select set of streets to accommodate future bus service.

Provision for a future public transport service operating between the town centre and Chelsea Gardens is included in the DCP. **Figure 3-2** shows the indicative route through the site.

Moss Vale-Bowral-Mittagong is defined as a major town in *Public Transport Service Planning Guidelines – Rural and Regional NSW* (Transport for NSW, October 2015). For travel within major towns, the guidelines specify that service coverage should be based on a needs assessment to determine service coverage based on local demand and resource availability.

The public transport services during Stage 1 will ultimately be determined by TfNSW and the local bus operator (Berrima Buslines). This will be based on the demand generated by the proposed 172 lots.

The road hierarchy for Stage 1 includes a road type (Boulevard) as well as internal roundabouts which can accommodate bus access and turnaround within Stage 1 if necessary. The current loop service (route 816) may better service the community by utilising internal roundabouts in Stage 1 to route back to Moss Vale.

Figure 3-2 Indicative bus route plan

Source: Arterra Design (2019)

4 Internal Road Network

Figure 4-2 shows the proposed internal road hierarchy plan for Stage 1.

The internal road network has been designed in accordance with *Moss Vale Township DCP Section 22: Chelsea Gardens Coomungie Precinct* (Wingecarribee Shire Council, 2019).

Table 4-1 Minimum street design standards

Road classification	Detail typology	Road reserve width (m)	Carriageway width (m)	Street verge widths (pathway and grass verge) (m)
Boulevard	Central vegetated drainage boulevard	25	11	4.5 and 5.5
	Typical boulevard	22	11	3.5 and 5.5
	Special eastern ridge boulevard	22	11	4.5 and 6.5
	Village centre boulevard	20	11	4.5 both sides
Local roads	Typical primary access street	18	9	4 both sides
	Typical minor access street and cul-de-sacs	16	7	4.5 both sides
	Special steep land access street	15	7	4 both sides

Source: Wingecarribee Shire Council (2019)

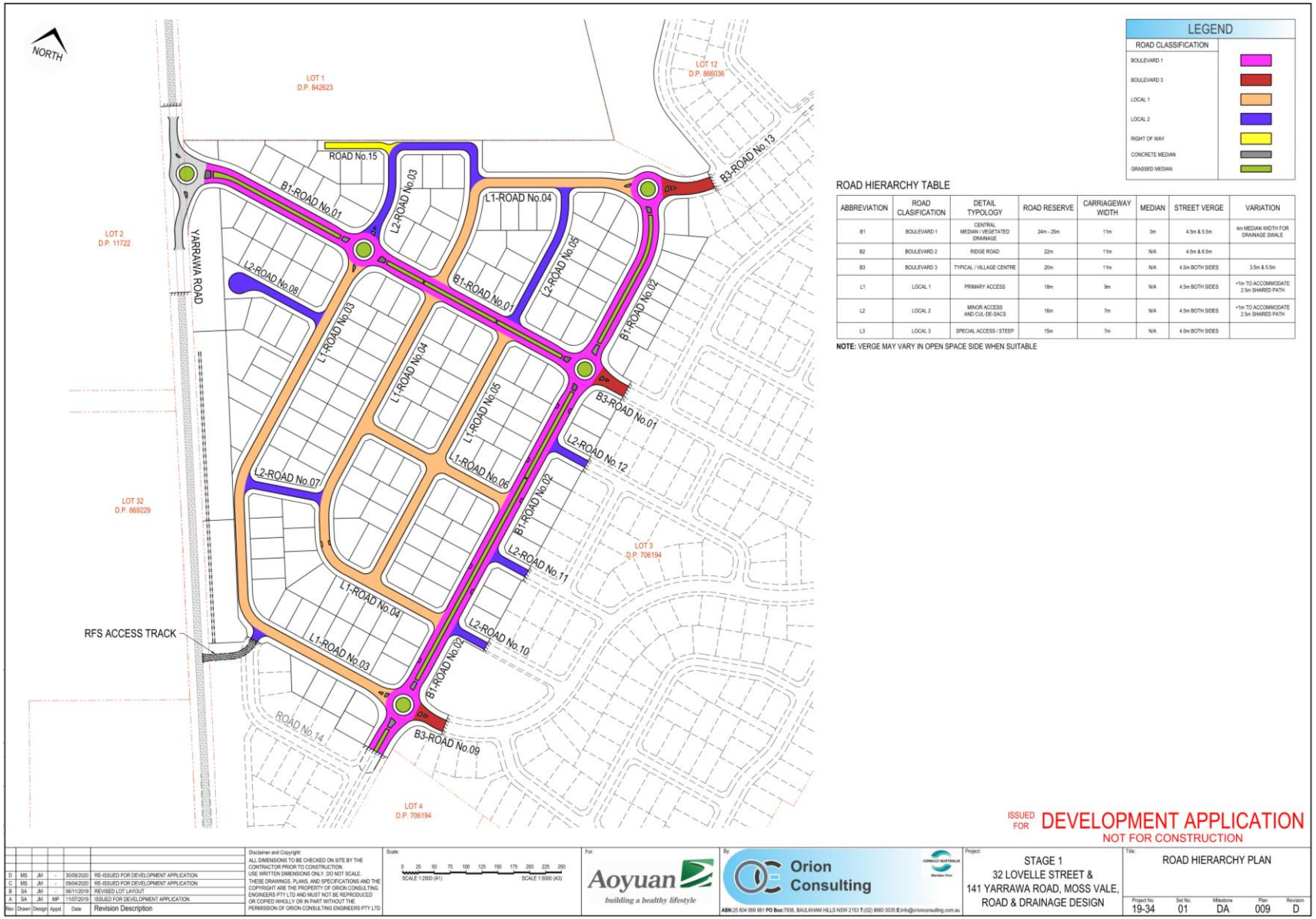


Figure 4-2 Internal road network hierarchy plan

Source: Orion Consulting (2021)

5 Traffic Assessment

5.1 Traffic Generation

Cardno understands that WSC previously developed a strategic model of the local government area (LGA) including the Moss Vale township using TRACKS. Outputs from this model were previously provided to Cardno. A summary of the outputs was provided in Chelsea Gardens, Moss Vale Traffic Study Report (Cardno, July 2019).

The TRACKS model was cordoned based on the study area and demands extracted for different scenarios covering 2016 up to 2036 in five-year intervals. The 2021 outputs were used in this TIA to estimate the trip generation rates and distribution for Stage 1.

The TRACKS model was developed based on a superseded layout for Chelsea Gardens. The 2021 model assumes 280 lots developed across the Lovelle Street access and Yarrawa Road access[2]. Stage 1 now corresponds to 172 lots developed off the Yarrawa Road access only[3]. As the trip generation rates are not expected to change, the trip rates per lot from the 2021 TRACKS model have been adopted for this TIA.

In the 2021 TRACKS model, the Chelsea Gardens demand (representing 280 lots) is 271 trips in the AM Peak and 216 trips in the PM Peak. This represents a trip generation rate of 0.97 for the AM Peak and 0.77 in the PM Peak. **Table 5-1** shows these trip generation rates applied to the 172 lots in Stage 1.

Table 5-1 Chelsea Gardens Stage 1 traffic generation

Stage 1 lots	**AM trip rate** (trips per lot)	**PM trip rate** (trips per lot)	**AM trips** (trips)	**PM trips** (trips)
172	0.97	0.77	167	132

5.2 Traffic Distribution

The trip distribution between zones from the TRACKS model was adopted. A divide was established across the cordon to represent the most likely route vehicles from Stage 1 would take to reach their destination. Trips heading “north” from Stage 1 to destinations including the town centre and Argyle Street were assumed to turn right from the site access onto Yarrawa Road. Trips heading “south” to Mount Broughton Road, Nowra Road and Illawarra Highway were assumed to turn left from the site access. **Figure 5-1** shows the location of this dividing line.

[2] Corresponding to zones 191 and 198 in the TRACKS model.
[3] This would correspond to zones 192 and 193 in the TRACKS model.

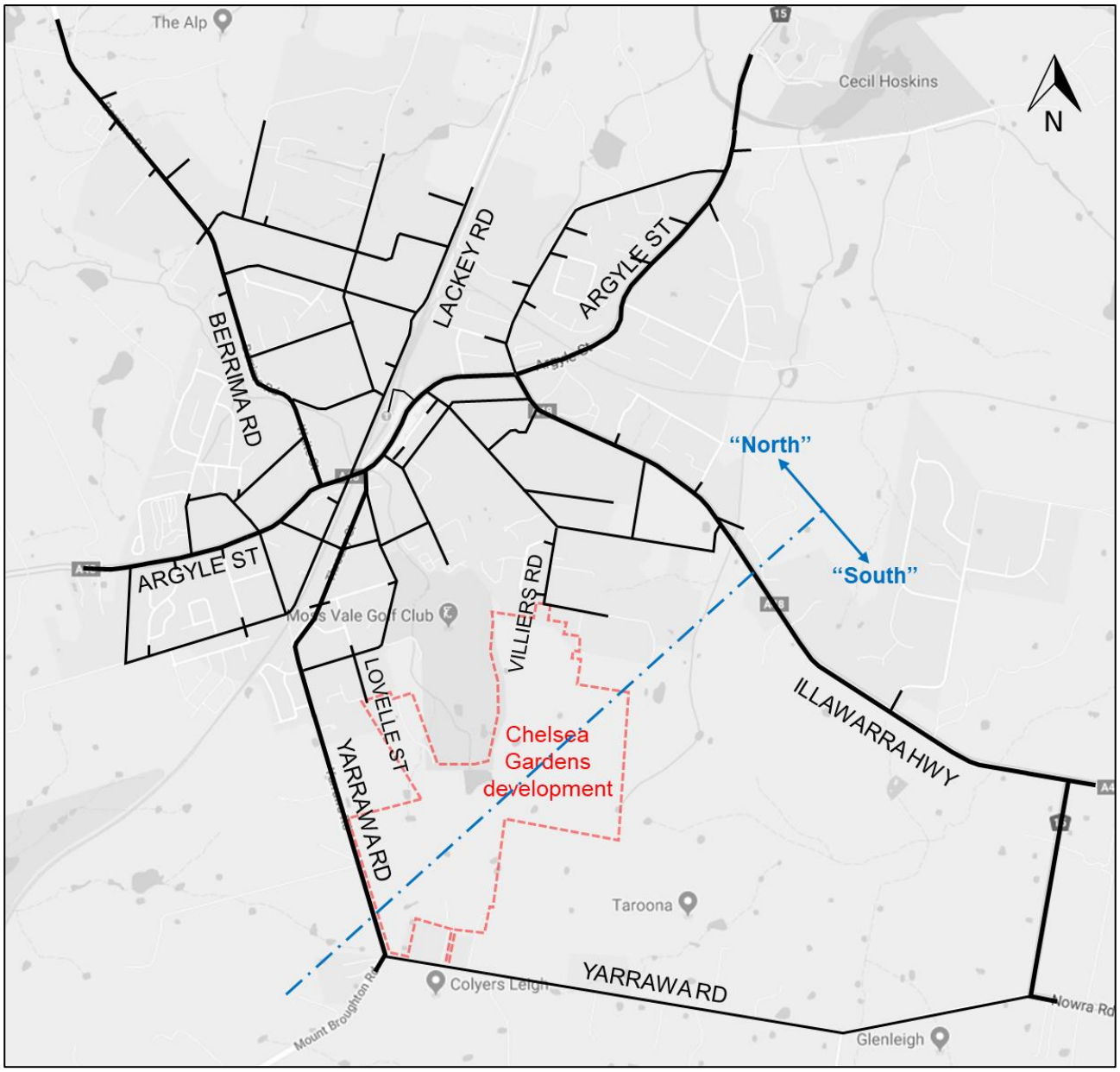


Figure 5-1 Stage 1 trip distribution

Background image source: Google Maps (2019)

Table 5-2 shows the trip distribution based on the above split. Inbound trips are trips with a destination within Stage 1. Outbound trips are trips with an origin within Stage 1.

Table 5-2 Chelsea Gardens Stage 1 traffic distribution

Peak	Trips to/from north (% of total trips)	Trips to/from south (% of total trips)	Inbound trips (% of total trips)	Outbound trips (% of total trips)
AM Peak	84%	16%	33%	67%
PM Peak	86%	14%	57%	43%

Trips to/from the north were all assumed to use the Yarrawa Road / Spencer Street intersection. **Figure 5-2** shows the traffic generated by the Stage 1 at the Yarrawa Road / Spencer Street intersection. The percentage splits for vehicles using Yarrawa Road and Spencer Street were derived from existing proportions.

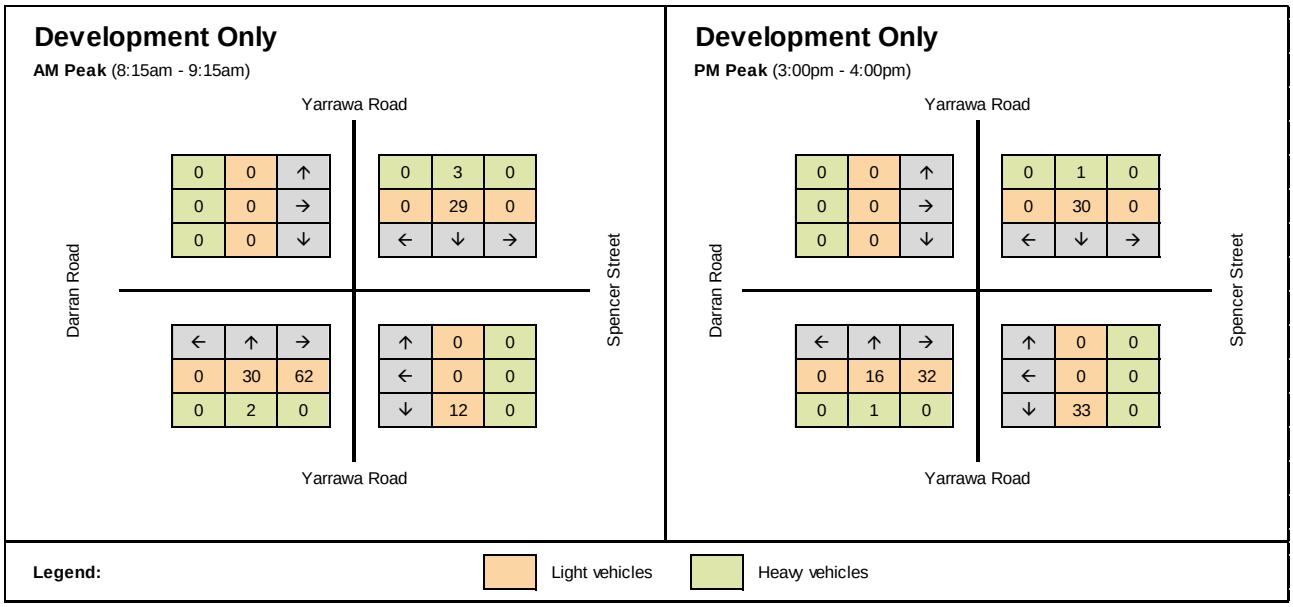


Figure 5-2 Stage 1 development traffic at Yarrawa Road / Spencer Street

The Stage 1 traffic volumes were applied to the base volumes from the 2018 at the Yarrawa Road / Spencer Street intersection. **Figure 5-3** shows the estimated future traffic volumes with Stage 1.

Background traffic volumes have not been applied as previously masterplan modelling considered the development traffic on top of existing volumes only, which was an agreement with TfNSW and Council.

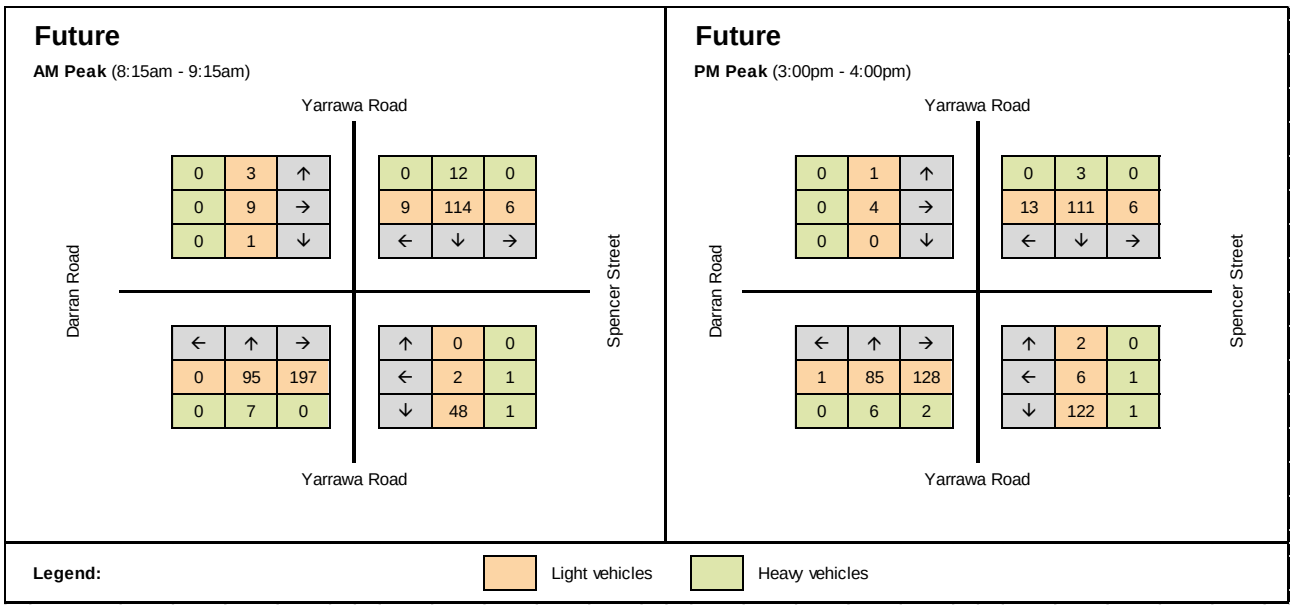


Figure 5-3 Future Yarrawa Road / Spencer Street intersection volumes

Cardno attended a teleconference with WSC representatives on 26 February 2021. The main outcomes from this meeting were:

> WSC's concerns about the future operation of the Yarrawa Road / Spencer Street intersection primarily arise from safety concerns

> Existing intersection capacity is satisfactory, and it is not anticipated that the additional traffic from Stage 1 will cause any operational deficiencies.

Future performance of this intersection was previously assessed as part of Chelsea Gardens, Moss Vale Traffic Study (Cardno, July 2019). At the 26 February 2021 meeting, it was agreed with WSC's representatives that no traffic modelling would be required specifically for the Stage 1 TIA given the ample capacity and relatively small increase in volumes anticipated. It was requested that the intersection safety be assessed and consideration be given to the options to upgrade this intersection to a safer configuration.

6 Traffic Signal Warrant Assessment

Cardno understands that WSC would like to consider signalising the Yarrawa Road / Spencer Street intersection to address operational and safety concerns. TfNSW typically requires a traffic signal warrant assessment (TSWA) to be completed for proposed signalised intersections. This section outlines the assessment criteria and results for the TSWA for this intersection.

6.1 Assessment Criteria

Traffic Signal Design Section 2 – Warrants (Roads and Traffic Authority, 2008) provides guidelines for conditions that warrant the upgrade of an existing non-signalised intersection to traffic signals. The guideline states that a signalised intersection may be considered if one of the following warrants is met:

(a) Traffic demand:

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

(i) The major road flow exceeds 600 vehicles per hour in each direction, and

(ii) The minor road flow exceeds 200 vehicles per 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 per hour in each direction, and

(ii) The minor road flow exceeds 100 vehicles per 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 per hour, and

(ii) The major road flow exceeds 600 vehicles per hour in each direction, or where there is a central median of at least 1.2 metres wide, 1000 vehicles per 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 per hour, and

(ii) The major road flow exceeds 450 vehicles per hour in each direction, or where there is a central median of at least 1.2 metres wide, 750 vehicles per hour in each direction, and

(iii) The 85th percentile speed on the major road exceeds 75 kilometres per hour.

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 per cent of the appropriate flow warrants.

Source: Traffic Signal Design Section 2 – Warrants, Section 2.3 (Roads and Traffic Authority, 2008)

6.2 Traffic Volumes

This section outlines the base and future traffic volumes that were used in the TSWA.

6.2.1 Base traffic volumes

Traffic volumes for the intersection of Yarrawa Road / Spencer Street were collected for five hours across two peaks on Thursday 30 August 2018 (refer to **Section 2.7**). The traffic survey periods do not cover a continuous four-hour period, however as they capture both peaks, they can be used to provide an indication of whether an upgrade to traffic signals would be warranted.

6.2.2 Future traffic volumes

The estimated future traffic volumes and trip distribution were used to assess whether the conditions at this intersection with Stage 1 (refer to **Section 5.2**).

6.3 Results

6.3.1 Traffic Demand and Continuous Traffic

Table 6-1 shows the base traffic volumes on each approach during the peak hours. The results indicate that the criteria for (a) Traffic Demand and (b) Continuous Traffic are not met in either hour. As these represent the hours with the highest traffic volumes for each peak, the warrant is assumed to not be met in any of the other hours surveyed.

Table 6-1 Base-year TSWA results for peak hours

Interval	**Traffic volume** (veh)				Warrant satisfied (Y/N)
	Yarrawa Road (N) – major	**Spencer Street** (E) – minor	**Yarrawa Road** (S) – major	**Darran Road** (W) - minor	
8:15am – 9:15am	109	40	205	13	No
3:00pm – 4:00pm	102	99	173	5	No

Table 6-2 shows the future traffic volumes on each approach during the peak hours. The results indicate that the criteria for (a) Traffic Demand and (b) Continuous Traffic are not met in either hour. As these represent the hours with the highest traffic volumes for each peak, the warrant also is assumed to not be met in any of the other hours surveyed.

Table 6-2 Future-year TSWA results for peak hours

Interval	**Traffic volume** (veh)				Warrant satisfied (Y/N)
	Yarrawa Road (N) – major	**Spencer Street** (E) – minor	**Yarrawa Road** (S) – major	**Darran Road** (W) - minor	
8:15am – 9:15am	141	52	299	12	No
3:00pm – 4:00pm	133	132	222	5	No

6.3.2 Pedestrian Safety

The major road flow does not exceed 600 vehicles per hour in either peak so the criteria for (c) Pedestrian Safety is not met. Further, the number of pedestrians crossing the major road in any of the surveyed hours did not exceed four, whilst under Stage 1 development it is anticipated that pedestrian movements in this location will remain low given the active transport infrastructure context surrounding the site.

The speed limit is 50km/h. The criteria for (d) Pedestrian Safety – High Speed Road is also not met.

6.3.3 Crashes

There has only been one traffic accident at the site in the five-year period from 2014 to 2019. The criteria for (e) Crashes is not met.

6.3.4 Summary

Yarrawa Street / Spencer Street does not meet the warrant criteria for signalisation with Stage 1.

7 Sight Distance

Cardno understands that WSC's primary concerns about the existing and future performance of this intersection arise from the restricted sight distance. The intersection is situated on the crest of a hill. Visibility distance on some approaches is less than 50m. This section summarises the available sight distance, implications for road safety and possible mitigation measures.

7.1 Site Visit Observations

Cardno undertook a site visit of this location on Friday 26 March 2021. The purpose of the site visit was to observe driver behaviour and quantify sight distances on all approaches.

Figure 7-1 shows the visibility of oncoming traffic from about 70m south of the intersection on Yarrawa Road. The vehicle just visible behind the crest is about 30-40m from the intersection on the north approach.

Figure 7-1 Visibility from Yarrawa Road (south approach) approximately 70m from intersection

Figure 7-2 shows the visibility of oncoming traffic on the north approach at the intersection. This is the approximate visibility of vehicles turning right from Yarrawa Road (S) to Spencer Street. The vehicle just visible behind the crest is about 70-80m from the intersection on the north approach.

Figure 7-2 Visibility from Yarrawa Road (south approach) at intersection

Figure 7-3 shows the visibility for southbound vehicles on Yarrawa Road from about 70m north of the intersection. From this location, northbound vehicles can only be seen when they are about 10-20m from the intersection.

Figure 7-3 Visibility from Yarrawa Road (north approach) approximately 70m from the intersection

Visibility of southbound vehicles on Yarrawa Road is low for vehicles emerging from Darran Road and Spencer Street. **Figure 7-4** shows the visibility from the stop line for vehicles looking left (north) from Darran Road and **Figure 7-5** shows the visibility form the stop line for vehicles looking right (north) from Spencer Street. Visibility is less than 100m in both cases.

Figure 7-4 Sight distance on Darran Road looking left (north)

Figure 7-5 Sight distance on Spencer Street looking right (north)

Existing intersection volumes (refer to **Section 2.7**) indicate that the heaviest movements at this intersection are the right turn from Yarrawa Road (S) to Spencer Street, and the left turn in the opposite direction from Spencer Street to Yarrawa Road (S). These movements both conflict with through traffic from the north approach which has restricted sight distance.

While the crash history (refer to **Section 2.3**) does not indicate frequent crashes at this location, the risk of collision may increase as the volume of traffic passing through the intersection increases. Stage 1 is expected to increase the total traffic volume at this intersection by 138 vehicles in the AM Peak (38 per cent increase) and 112 vehicles in the PM Peak (29 per cent increase).

7.2 Intersection Upgrade Options

While a possible upgrade to traffic signals has been suggested by Council as a treatment to be considered, the warrant assessment documented in **Section 6.2** demonstrates that the intersection does not meet the warrants for intersection signalisation. However, different intersection treatments can still be considered to help mitigate this issue. Council has previously identified the existing safety deficiencies at this location and planned an upgrade to a roundabout configuration at this location. This confirms that the safety deficiencies precede the proposed Chelsea Gardens Stage 1 development.

More specifically, *Section 94 Developer Contributions Plan for Roads and Traffic Facilities 2012 to 2031* (Wingecarribee Shire Council, 2012) lists rehabilitation of Yarrawa Road / Spencer Street as part of Table 10 – Works Schedule for Local and District Roads and Traffic Facilities for the Wingecarribee Shire 2006 to 2031. The nominated rehabilitation is installation of a roundabout. The timing year for these works is 2025, with 45 per cent of the works cost attributed to future development and 55 per cent attributed to Council as the works are primarily for the benefit of the wider public.

Installation of a roundabout at this location would improve safety for right-turning vehicles from Yarrawa Road and left-turning vehicles from Spencer Street. It would reduce risks associated with the reduced sight distances at the intersection by slowing down approaching vehicles.

The timings for Stage 1 to fully materialise are dependent on a range of factors and are therefore difficult to predict. However, it is important to note that Stage 1 is still under a pre-DA phase and that it will take some time before all approvals are obtained and construction can commence. Assuming a best case scenario, it is reasonable to expect that most lots would start getting occupied around the time the intersection upgrade is planned (that is, circa 2025). On that basis, the upgrade shown in Council's contributions plan is deemed adequate to address existing safety deficiencies at this intersection and convert it to a configuration suitable to accommodate the relatively small increase in traffic volumes generated by Chelsea Gardens Stage 1.

Given how the traffic signal warrant criteria not being met, a meeting with Council and TfNSW is proposed to discuss the options available to improve safety at this intersection, namely the proposed upgrade to a roundabout configuration and respective delivery mechanism and timing.

8 Conclusions

This report presents the results of a TIA for Stage 1 of the Chelsea Gardens development. The key findings are as follows:

- Stage 1 is proposed to be the first stage of Chelsea Gardens to be constructed. It incorporates 172 residential lots
- The assessment considered the traffic impacts on the nearby road network with a focus on the Yarrawa Road / Spencer Street / Darran Road intersection. Crash history for this intersection showed only one crash within the five-year period from 2014 to 2019.
- Public transport servicing in the vicinity of the site is currently limited to bus route 816 which has limited frequency. The closest bus stop is located approximately 500m north of the proposed site access. The proposed Stage 1 and future stages of the Chelsea Gardens development will present opportunities to extend current bus routes or implement new services. The internal roads were design so that they can cater for bus movements
- Existing walking and cycling facilities around the site are limited and the overall network is not conducive to active transport trips. It is expected that Stage 1 will be predominantly reliant on vehicle access. As future stages of the Chelsea Gardens development materialise, improved walking and cycling conditions will be delivered, together with local connections to the north of the site
- Stage 1 is expected to generate approximately 167 trips in the AM peak and 132 trips in the PM peak. These include inbound and outbound trips and the respective origin destination patterns were assumed to be generally aligned with the 2021 TRACKS models' assignment provided by Council
- The surrounding traffic network has sufficient capacity to cater for the increase in traffic volumes associated with Stage 1
- There is limited sight distance at the Yarrawa Road / Spencer Street / Darran Road intersection (currently priority controlled). A traffic signal warrant assessment was undertaken with the results indicating that the criteria to upgrade this intersection to traffic signals is not met
- *Section 94 Developer Contributions Plan for Roads and Traffic Facilities 2012 to 2031* (Wingecarribee Shire Council, 2012) lists rehabilitation of Yarrawa Road / Spencer Street as part of Table 10 – Works Schedule for Local and District Roads and Traffic Facilities for the Wingecarribee Shire 2006 to 2031. The nominated rehabilitation is installation of a roundabout
- The upgrade shown in Council's contributions plan is deemed adequate to address existing safety deficiencies at this intersection (which precede Chelsea Gardens Stage 1) and convert it to a configuration suitable to accommodate the relatively small increase in traffic volumes generated by Chelsea Gardens Stage 1
- Given how the traffic signal warrant criteria not being met, a meeting with Council and TfNSW is proposed to discuss the options available to improve safety at this intersection, namely the proposed upgrade to a roundabout configuration and respective delivery mechanism and timing.

APPENDIX

A

TRAFFIC SURVEY

Traffic Information Specialist

Location	Yarrawa Road	Duration	0730 - 0930
	Spencer Street		1500 - 1800
	Yarrawa Road		-
	Darran Road	Day/Date	Thursday, 30 August 2018
Suburb	MOSS VALE	Weather	-

All Vehicles Time Per 15 Mins		NORTH *Yarrawa Road*											EAST *Spencer Street*												
		L			T			R					L			T			R					TOTAL		TOTAL
		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	PEDS	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	PEDS	LIGHT	HEAVY	
7:30 - 7:45		0	0	**0**	13	4	**17**	0	0	**0**	**17**	2	2	0	**2**	0	0	**0**	0	0	**0**	**2**	0	44	6	**50**
7:45 - 8:00		0	0	**0**	16	3	**19**	0	0	**0**	**19**	0	4	0	**4**	0	0	**0**	0	0	**0**	**4**	0	66	7	**73**
8:00 - 8:15		0	0	**0**	14	0	**14**	3	0	**3**	**17**	0	8	1	**9**	0	0	**0**	0	1	**1**	**10**	0	68	4	**72**
8:15 - 8:30		1	0	**1**	17	3	**20**	2	0	**2**	**23**	0	5	0	**5**	0	0	**0**	0	0	**0**	**5**	0	75	4	**79**
8:30 - 8:45		1	0	**1**	17	1	**18**	1	0	**1**	**20**	0	9	0	**9**	1	1	**2**	0	0	**0**	**11**	0	86	4	**90**
8:45 - 9:00		2	0	**2**	31	2	**33**	4	0	**4**	**39**	0	8	1	**9**	1	0	**1**	0	0	**0**	**10**	0	101	5	**106**
9:00 - 9:15		2	0	**2**	20	3	**23**	2	0	**2**	**27**	1	14	0	**14**	0	0	**0**	0	0	**0**	**14**	1	89	3	**92**
9:15 - 9:30		0	0	**0**	10	2	**12**	4	1	**5**	**17**	0	12	0	**12**	1	0	**1**	0	0	**0**	**13**	0	66	6	**72**
Period End		**6**	**0**	**6**	**138**	**18**	**156**	**16**	**1**	**17**	**179**	**3**	**62**	**2**	**64**	**3**	**1**	**4**	**0**	**1**	**1**	**69**	**1**	**595**	**39**	**634**
15:00 - 15:15		0	0	**0**	24	1	**25**	4	0	**4**	**29**	0	15	0	**15**	1	0	**1**	1	0	**1**	**17**	0	96	4	**100**
15:15 - 15:30		1	0	**1**	21	0	**21**	4	0	**4**	**26**	0	25	0	**25**	0	1	**1**	0	0	**0**	**26**	0	97	2	**99**
15:30 - 15:45		2	0	**2**	14	1	**15**	4	0	**4**	**21**	0	23	1	**24**	3	0	**3**	1	0	**1**	**28**	1	89	3	**92**
15:45 - 16:00		3	0	**3**	22	0	**22**	1	0	**1**	**26**	1	26	0	**26**	2	0	**2**	0	0	**0**	**28**	0	86	2	**88**
16:00 - 16:15		1	0	**1**	25	1	**26**	2	0	**2**	**29**	0	15	1	**16**	7	0	**7**	4	0	**4**	**27**	0	92	2	**94**
16:15 - 16:30		3	0	**3**	19	2	**21**	5	0	**5**	**29**	0	23	0	**23**	1	0	**1**	1	0	**1**	**25**	0	94	3	**97**
16:30 - 16:45		2	0	**2**	15	0	**15**	2	0	**2**	**19**	0	25	0	**25**	7	0	**7**	2	0	**2**	**34**	1	77	2	**79**
16:45 - 17:00		1	0	**1**	22	0	**22**	2	1	**3**	**26**	0	19	0	**19**	3	0	**3**	1	0	**1**	**23**	0	84	3	**87**
17:00 - 17:15		2	0	**2**	27	0	**27**	1	0	**1**	**30**	0	22	0	**22**	1	0	**1**	0	0	**0**	**23**	0	82	0	**82**
17:15 - 17:30		0	0	**0**	19	1	**20**	4	0	**4**	**24**	0	17	0	**17**	2	0	**2**	0	0	**0**	**19**	0	77	5	**82**
17:30 - 17:45		2	0	**2**	20	0	**20**	5	0	**5**	**27**	0	17	0	**17**	2	0	**2**	1	0	**1**	**20**	1	63	0	**63**
17:45 - 18:00		1	0	**1**	20	0	**20**	4	0	**4**	**25**	1	11	0	**11**	2	0	**2**	2	0	**2**	**15**	0	68	1	**69**
Period End		**18**	**0**	**18**	**248**	**6**	**254**	**38**	**1**	**39**	**311**	**2**	**238**	**2**	**240**	**31**	**1**	**32**	**13**	**0**	**13**	**285**	**3**	**723**	**18**	**1032**

All Vehicles Time Per 15 Mins		SOUTH *Yarrawa Road*											WEST *Darran Road*												
		L			T			R					L			T			R					TOTAL		TOTAL
		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	PEDS	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	TOTAL	PEDS	LIGHT	HEAVY	
7:30 - 7:45		0	0	**0**	13	2	**15**	13	0	**13**	**28**	0	2	0	**2**	1	0	**1**	0	0	**0**	**3**	0	44	6	**50**
7:45 - 8:00		0	0	**0**	16	3	**19**	25	1	**26**	**45**	2	1	0	**1**	4	0	**4**	0	0	**0**	**5**	0	66	7	**73**
8:00 - 8:15		0	0	**0**	18	1	**19**	21	1	**22**	**41**	0	1	0	**1**	3	0	**3**	0	0	**0**	**4**	0	68	4	**72**
8:15 - 8:30		0	0	**0**	10	1	**11**	36	0	**36**	**47**	0	0	0	**0**	3	0	**3**	1	0	**1**	**4**	0	75	4	**79**
8:30 - 8:45		0	0	**0**	20	2	**22**	33	0	**33**	**55**	0	2	0	**2**	2	0	**2**	0	0	**0**	**4**	2	86	4	**90**
8:45 - 9:00		0	0	**0**	18	2	**20**	32	0	**32**	**52**	0	1	0	**1**	4	0	**4**	0	0	**0**	**5**	0	101	5	**106**
9:00 - 9:15		0	0	**0**	17	0	**17**	34	0	**34**	**51**	0	0	0	**0**	0	0	**0**	0	0	**0**	**0**	0	89	3	**92**
9:15 - 9:30		0	0	**0**	16	2	**18**	21	1	**22**	**40**	0	0	0	**0**	2	0	**2**	0	0	**0**	**2**	0	66	6	**72**
Period End		**0**	**0**	**0**	**128**	**13**	**141**	**215**	**3**	**218**	**359**	**2**	**7**	**0**	**7**	**19**	**0**	**19**	**1**	**0**	**1**	**27**	**2**	**595**	**39**	**634**
15:00 - 15:15		0	0	**0**	16	3	**19**	34	0	**34**	**53**	0	0	0	**0**	1	0	**1**	0	0	**0**	**1**	0	96	4	**100**
15:15 - 15:30		0	0	**0**	20	0	**20**	25	1	**26**	**46**	0	0	0	**0**	1	0	**1**	0	0	**0**	**1**	0	97	2	**99**
15:30 - 15:45		0	0	**0**	18	1	**19**	23	0	**23**	**42**	0	0	0	**0**	1	0	**1**	0	0	**0**	**1**	0	89	3	**92**
15:45 - 16:00		1	0	**1**	15	1	**16**	14	1	**15**	**32**	0	1	0	**1**	1	0	**1**	0	0	**0**	**2**	0	86	2	**88**
16:00 - 16:15		0	0	**0**	15	0	**15**	19	0	**19**	**34**	3	3	0	**3**	1	0	**1**	0	0	**0**	**4**	0	92	2	**94**
16:15 - 16:30		0	0	**0**	17	0	**17**	18	1	**19**	**36**	0	3	0	**3**	4	0	**4**	0	0	**0**	**7**	0	94	3	**97**
16:30 - 16:45		0	0	**0**	9	1	**10**	12	1	**13**	**23**	0	2	0	**2**	1	0	**1**	0	0	**0**	**3**	0	77	2	**79**
16:45 - 17:00		0	0	**0**	8	1	**9**	26	1	**27**	**36**	0	2	0	**2**	0	0	**0**	0	0	**0**	**2**	0	84	3	**87**
17:00 - 17:15		0	0	**0**	17	0	**17**	10	0	**10**	**27**	0	1	0	**1**	1	0	**1**	0	0	**0**	**2**	0	82	0	**82**
17:15 - 17:30		0	0	**0**	10	2	**12**	22	2	**24**	**36**	0	1	0	**1**	2	0	**2**	0	0	**0**	**3**	0	77	5	**82**
17:30 - 17:45		0	0	**0**	7	0	**7**	7	0	**7**	**14**	0	0	0	**0**	2	0	**2**	0	0	**0**	**2**	0	63	0	**63**
17:45 - 18:00		0	0	**0**	10	0	**10**	16	1	**17**	**27**	0	0	0	**0**	2	0	**2**	0	0	**0**	**2**	0	68	1	**69**
Period End		**1**	**0**	**1**	**162**	**9**	**171**	**226**	**8**	**234**	**406**	**3**	**13**	**0**	**13**	**17**	**0**	**17**	**0**	**0**	**0**	**30**	**0**	**723**	**18**	**1032**