



Traffic & Transportation Direction

Residential Subdivision

365 Marshall Mount Road, Marshall Mount

Traffic Assessment

5 November 2024

Reference: 186 rep 241105 final

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Prepared for: Maker ENG Pty Ltd

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1. Introduction

Amber Organisation has been engaged by Maker ENG Pty Ltd to advise on the traffic and parking matters of the proposed residential subdivision located at 365 Marshall Mount Road, Marshall Mount. The proposal involves the subdivision of land at Lot 8 in DP 626078 and Lot 5 in DP 24143, as well as construction of the associated internal road network.

The site is currently zoned C4 Environmental Living under the Wollongong Local Environmental Plan 2009 and is subject to a Minimum Lot Size of 4,999 square metres (sqm). By contrast the existing R2 Low Density Residential land to the west is subject to a Minimum Lot Size of 449 sqm.

This report has been prepared to accompany a Planning Proposal and associated Neighbourhood Plan for the land holding which will deliver a broader range of housing which is site responsive and responds to servicing capabilities.

Generally, the Planning Proposal seeks to adopt an implied lot size of 1,000 sqm (mapped as 999 sqm) over the western portion of the site and retain the current 4,999 sqm minimum lot size of the eastern portion of the land. This will deliver a transition in the lot size and housing arrangements.

The Neighbourhood Plan will address more detailed design outcomes as prescribed under the Wollongong Development Control Plan (DCP) consistent with the lot sizes sought under the Planning Proposal.

The development is expected to accommodate a total of 91 residential and rural lots with access proposed via a connection with a future Marshall Mount Town Centre Bypass Road at the north-western corner of the site. Based on Council's 80% design for the future bypass road, it is understood that a T-intersection will be provided to service the site on the southern side of the road. The future bypass road extends to connect with the broader road network via Marshall Mount Road to the west and Yallah Road to the north-east. The internal road network within the site provides an outer and inner loop road that allows access to the individual lots.

This report has been prepared to address the traffic and parking impacts of the proposed development. It is based on surveys and observations at the site and our experience of similar developments elsewhere.

2. Agency Advice

This report has considered the pre-lodgement advice received from Transport for New South Wales (TfNSW) dated 1 November 2023. An overview of the TfNSW comments and responses for each item are provided in Table 1.

Table 1: Response to TfNSW Comments

Comment	Response
1. Traffic Impact Study (TIS): TfNSW notes that the Scoping Report details that the PP will be supported by a 'Transport and Accessibility Impact Assessment' which will, in part, include an assessment of the cumulative traffic impacts at the key intersections. To enable an understanding of the impacts that this PP will have on its local road connections as well as the local road connections with the state classified roads and to understand how the PP will support public transport and active transport, the TIS provided with a future PP must: a) Be prepared by a suitably qualified consultant.	This assessment has been prepared by a suitably qualified consultant.
b) Address the applicable criteria/key issues in Table 2.1 of the RTA's Guide to Traffic Generating Developments.	This assessment considers the applicable criteria/issues listed in the RTA Guide.
c) Have regard for the Austroads publications, particularly the Austroads Guide to Traffic Management Part 12: Integrated Transport Assessments for Developments and Part 3: Traffic Studies and Analysis Methods.	This assessment has been prepared in accordance with the Austroads publications where relevant.
d) Base the trip generation rates for the new residential development on the maximum value of 0.85 and 0.90 for low density residential in regional areas for the AM and PM peak hours respectively (as detailed in NSW Technical Direction (TDT) 2013/04a).	The trip generation rates as outlined in Section 6.1 have utilised the maximum values from the Technical Direction.
e) Ensure that the estimated traffic generated by the future development of the land includes a component of the new development containing more than one dwelling per lot noting that the land zoning will enable other forms of residential development that will result in greater vehicle movements than a single dwelling house (i.e. secondary dwellings, bed and breakfast accommodation). Agreement should be reached with the Council about the proportion of lots that should be assumed to be developed with more than 1 dwelling per lot.	The lots are expected to be occupied by low density residential use which would generally be single dwellings noting that dual-occupancies are not permitted within the C4 zone. Trip rates for low density residential use have been utilised within the assessment.
f) Provide an assessment/explanation of assumed travel patterns (i.e. trip distributions) to access services.	An overview of the anticipated trip distributions is provided in Section 6.2.

Comment	Response
g) Consider future road infrastructure provision (e.g. as detailed in the West Dapto Development Contributions Plan (2020) – refer to Figures 10, 11 and 12).	Consideration of the future road environment is included within the report and discussed within Section 4.
h) Provide an assessment of the suitability of the local road connection to the state classified road network. Specifically, the Yallah Road connection with the Princes Highway for northbound traffic. This assessment should be based on current traffic counts during the AM and PM peaks and be calibrated with on-site observations while noting the comments in Points d), e), and g) above and include an assessment of the cumulative traffic impacts.	The Yallah Road connection with the Princes Highway (northbound) forms a priority controlled intersection with vehicles entering the highway from Yallah Road required to give way to northbound traffic. The traffic assessment as outlined in Section 6 indicates that the proposal is expected to generate up to 52 vehicles per hour in the northbound direction during the AM peak. This level of traffic (less than 1 vehicle per minute) is not anticipated to have a significant impact on the existing operation of the intersection. Furthermore, the road network has been modelled by Council in TRACKS to understand the demand and supply requirements to service the broader release area. Council's 80% design for the road network includes upgrade of the Princes Highway / Yallah Road intersection to 'Large signals' in line with the West Dapto Development Contributions Plan (2020).
i) Identify appropriate measures to mitigate any adverse impacts as a result of the PP and the future development it will facilitate on the state classified road network.	It is proposed to provide a priority-controlled T-intersection at the site access on the future Marshall Mount Town Centre Bypass to accommodate all vehicle movements entering and exiting the site. The intersection would require short Auxiliary Left Turn (AUL(s)) and Basic Right Turn (BAR) treatments irrespective of the proposed change in lot sizes (i.e. these treatments would be required to accommodate the current permissible development). Further discussion regarding the site access intersection is provided in Section 7.
j) Detail appropriate arrangements to support public transport (including school buses). The future subdivision of the land affected by the PP will need to demonstrate compliance with the TfNSW Guidelines for Public Transport Capable Infrastructure in Greenfield Sites and therefore ensure that the provided road network complies with the above guideline. These guidelines highlight the requirements for bus infrastructure in new development areas that should be included in the design/detailed in the TIS as it is important to ensure that future occupants will have access to bus infrastructure for their transportation needs.	Public transport has been considered within Section 10.1. It is noted that a bus service is required along the bypass road to service the lowna neighbourhood, and it is recommended that bus stops are provided near the site access to also cater for residents of the proposed subdivision.
k) Detail how sustainable modes of travel, such as cycling and walking will be incorporated into the design of any future development application that is lodged for subdivision. Refer to additional comments under Point 3 below.	Sustainable transport modes are discussed in Section 10 and includes consideration of public transport, walking and cycling.

Comment	Response
I) Provide a strategic design for any identified road upgrades that are required as a result of the PP. The design provided shall demonstrate compliance with the TfNSW Strategic design requirements for DAs fact sheet.	The proposed T-intersection at the site access is subject to future detailed design of the Marshall Mount Town Centre Bypass. It is noted that the intersection would require short Auxiliary Left Turn (AUL(s)) and Basic Right Turn (BAR) treatments irrespective of the proposed change in lot sizes (i.e. these treatments would be required to accommodate the current permissible development).
2. Iowna Neighbourhood Plan Precinct: Details are required on how the PP/ future development of the Timber Glades Neighbourhood Precinct will align with the exhibited Iowna Neighbourhood Plan that is currently being considered by the Council. This includes, but is not limited to, the timing of any future subdivision of the land affected by this PP (e.g. will this development occur after the completion of the subdivision/development in the Iowna Neighbourhood Precinct, impacts on the road network and intersections that are proposed within the Iowna Neighbourhood precinct, etc).	An overview of the Iowna neighbourhood is provided in Section 4.3.1. Based on Council's 80% design for the future bypass road, it is understood that a T-intersection will be provided to service the site on the southern side of the road. Should the bypass road not be constructed prior to the subject development, the site access would temporarily connect to Marshall Mount Road via the Iowna neighbourhood which has been considered within the design of the Iowna Neighbourhood Plan. Further discussion regarding the site access intersection is provided in Section 7.
3. Active Transport: The identification of appropriate pedestrian and cycling facilities will increase the attractiveness of walking and cycling, which in turn reduces traffic and congestion. TfNSW supports active transport connections to neighbourhood parks (i.e. identified as OS23 in the West Dapto Development Contributions Plan 2020), community facilities (i.e. identified as CF05 in the West Dapto Development Contributions Plan 2020) and connections that improve walking and cycling accessibility, especially to the commercial facilities that are proposed at the future Marshall Mount Town Centre. TfNSW also supports utilising riparian corridors and road corridors for walking and cycling paths that enable linkages with the wider area, including the links highlighted in the West Dapto Vision 2018 and ensuring the accessibility of and provision of footpath connections to higher-order roads where bus services may run in the future.	Noted. Sustainable transport modes including pedestrian and cycling facilities are discussed in Section 10.

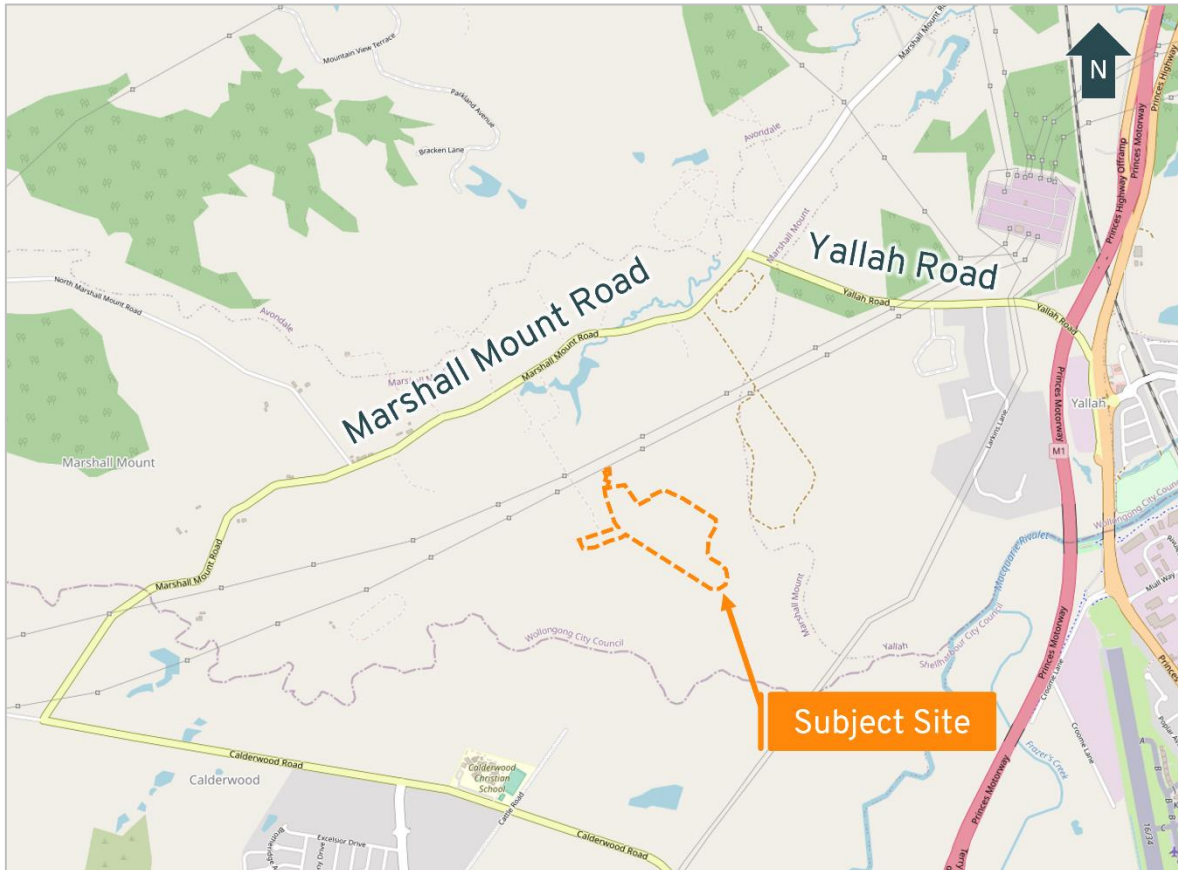
Comment	Response
4. Funding: The council needs to be satisfied that appropriate planning mechanisms are in place to ensure that any upgrades to local infrastructure required in both the Iowna Neighbourhood Plan (e.g. traffic signals) and Timber Glades Neighbourhood Plan are adequately funded and provided in a timely manner. TfNSW believes that appropriate contributions need to be made for required local and state infrastructure. The Council needs to be satisfied that arrangements are in place so that contributions for state infrastructure can be provided prior to the formal registration of any future subdivision of land. The number of additional dwellings proposed may bring forward the need for broader upgrades to both the local and the state road network.	Infrastructure funding arrangements are outside the scope of this assessment.
5. Other general comments: a) TfNSW has no current proposals which require any part of the subject site.	Noted.
b) TfNSW is aware of several potential new projects and upgrades that are being investigated in this area, by the Council and/or TfNSW, that could improve connectivity to the Iowna and Timber Glades Neighbourhoods. These projects include the West Lake Illawarra major road spine, Yallah Road upgrades (undertaken by Council and receiving funding in the West Dapto Development Contributions Plan 2020) and the Yallah Interchange.	This assessment has considered the broader West Dapto Urban Release Area and it is understood that a range of road upgrades are proposed in the area.
c) Approval/concurrence under Section 138 of the Roads Act 1993 will be required from TfNSW for any works that are identified as required within a classified road.	Noted.

3. Transport Environment

3.1 Site Location

The site is located on land at Lot 8 in DP 626078 and Lot 5 in DP 24143 in Marshall Mount, approximately 500 metres southeast of Marshall Mount Road. Figure 1 shows the location of the site in relation to the surrounding transport network.

Figure 1: Site Location



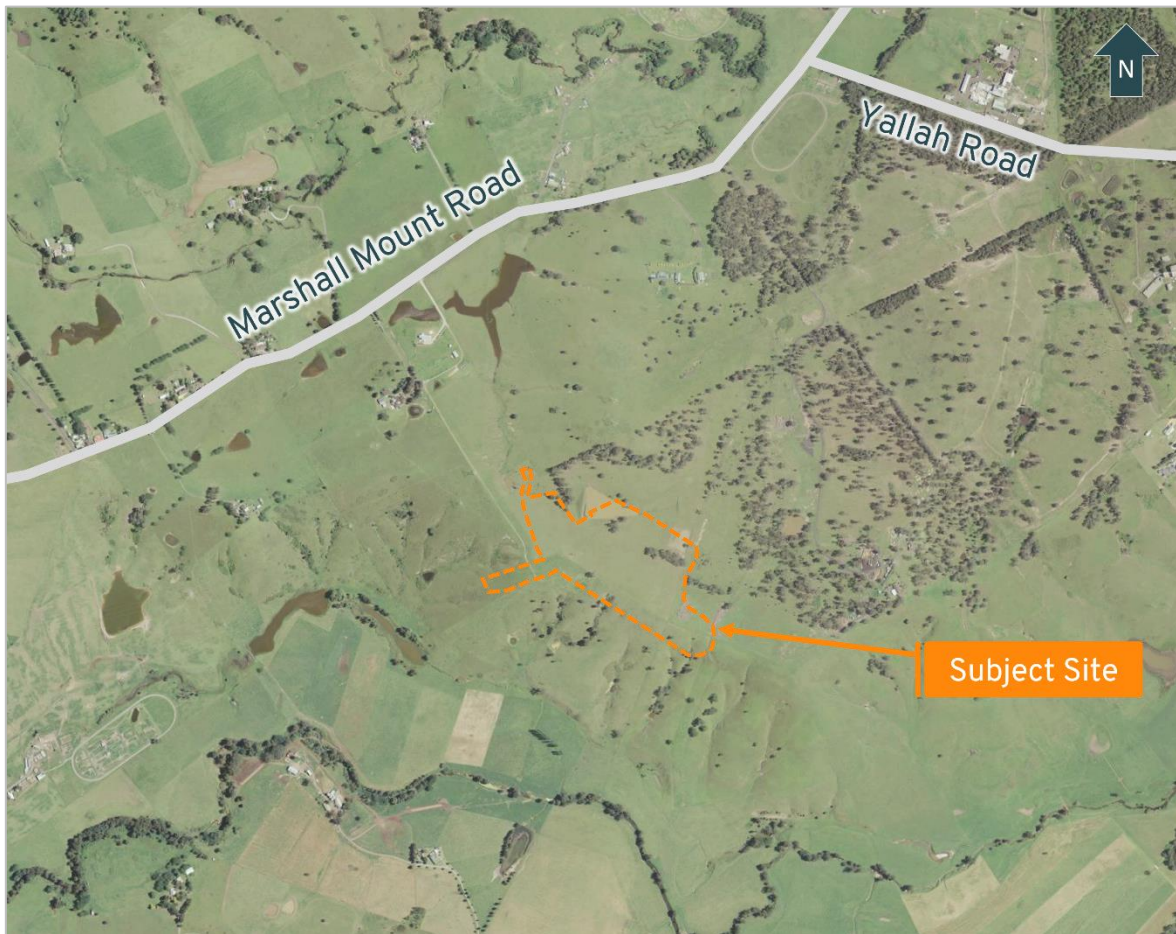
Source: OpenStreetMap

The site is currently zoned C4 – Environmental Living with land immediately surrounding the site zoned a mix of C2 – Environmental Conservation and C3 – Environmental Management. Land to the north and west in the vicinity of Marshall Mount Road is predominantly zoned for residential use.

The surrounding area is predominantly agricultural land, with several dwellings located on both sides of Marshall Mount Road. Notable land uses in the area include Calderwood Christian School and Calderwood Valley Golf Course located approximately 1.3 kilometres southwest and 3 kilometres west of the site, respectively.

Figure 2 shows an aerial photograph view of the site and the surrounding area. The site is currently occupied by open grassed fields with several established trees scattered throughout. A small pond is located near the north-western boundary of the site.

Figure 2: Aerial Photograph



Source: SixMaps

3.2 Road Network

Marshall Mount Road is a municipal local road that runs in a general northeast-southwest alignment extending between Huntley Road approximately 3.5 kilometres north of the site and Calderwood Drive approximately 2.5 kilometres southwest of the site. In the vicinity of the site Marshall Mount Road has a sealed carriageway width of approximately 7.5 metres which accommodates two-way vehicle movement. Grass berms are provided on both sides of the road, and it has a posted speed limit of 80km/hr.

Yallah Road extends east from Marshall Mount Road towards Princes Highway before running in a north-south alignment to its connection with Princes Motorway. It has a typical carriageway width of 10 metres and accommodates two-way vehicle movement and kerbside parallel parking on both sides of the road.

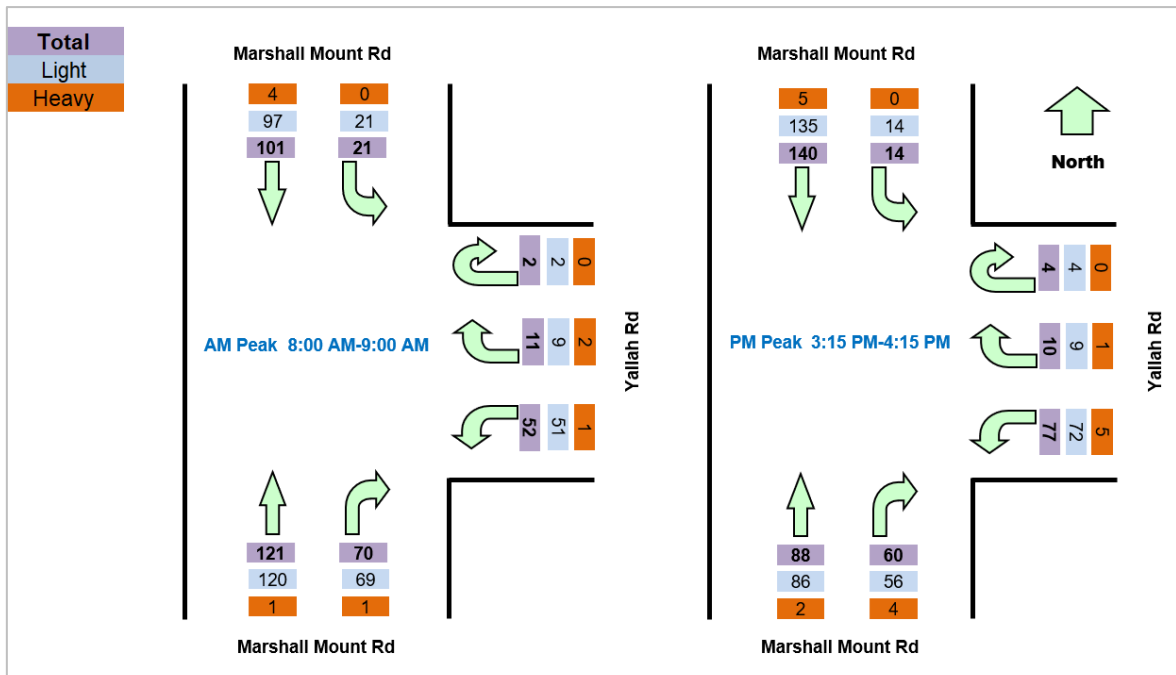
The intersection of Marshall Mount Road and Yallah Road is priority controlled with no signage or linemarking provided.

3.3 Traffic Conditions

Amber commissioned turning movement count surveys at the intersection of Marshall Mount Road and Yallah Road to determine the existing traffic conditions in the vicinity of the site.

The surveys were undertaken on Tuesday 2 May 2023 from 7:30am to 9:30am and from 2:30pm to 6:30pm. The results of the surveys are summarised below with the detailed survey results presented within Appendix A.

Figure 3: Turning Movement Count Survey Results - Marshall Mount Road / Yallah Road



The morning peak hour was recorded between 8:00am and 9:00am when a total of 378 vehicle movements were recorded at the intersection. The majority of vehicle movements during the morning peak were northbound vehicles on Marshall Mount Road with around one-third turning right into Yallah Road.

The evening peak hour was recorded between 3:15pm and 4:15pm when a total of 393 vehicle movements were recorded. In the evening peak the primary vehicle movement is southbound trips on Marshall Mount Road.

Overall, the survey results indicate the road network currently experiences a low to moderate level of traffic and is able to accommodate an increase in traffic volumes.

3.4 Public Transport

The site currently has no convenient access to the public transport network.

3.5 Pedestrians and Cyclists

No dedicated pedestrian or bicycle facilities are currently provided within the vicinity of the site given the rural nature of the surrounding area.

3.6 Crash History

Amber has conducted a review of the TfNSW Centre for Road Safety Crash and Casualty Statistics database for all casualty crashes along the entire lengths of Marshall Mount Road and Yallah Road including all respective intersections. The crash database provides the location and severity of all injury and fatal crashes for the five-year period from 2019 to 2023. The results of the crash search are outlined in Table 2.

Table 2: Crash Search Results

Road	Location	Severity	Crash Type	Date and Time	Light and Weather Conditions
Marshall Mount Rd	800m South of Yallah Rd	Minor/Other Injury	Out of control on bend	May 2019 (10:00 - 11:59)	Daylight (Fine)
Marshall Mount Rd	350m South of Yallah Rd	Minor/Other Injury	Off road to the right on right bend, hitting object	September 2020 (12:00 - 13:59)	Daylight (Overcast)
Marshall Mount Rd	400m South of Yallah Rd	Moderate Injury	Off road to the left, hitting object	June 2020 (22:00 - Midnight)	Darkness (Fine)
Marshall Mount Rd	1100m North of North Marshall Mount Rd	Moderate Injury	Out of control on bend	November 2022 (10:00 - 11:59)	Daylight (Fine)
Marshall Mount Rd	1000m North of Calderwood Rd	Moderate Injury	Off road to the right on right bend, hitting object	July 2023 (00:01 - 01:59)	Darkness (Overcast)
Marshall Mount Rd	400m North of Calderwood Rd	Moderate Injury	Collision while overtaking turning vehicle	June 2022 (08:00 - 09:59)	Daylight (Fine)
Marshall Mount Rd	1000m East of Calderwood Rd	Serious Injury	Out of control on bend	September 2022 (12:00 - 13:59)	Daylight (Fine)
Yallah Rd	20m West of Princes Hwy	Minor/Other Injury	Vehicle hit while emerging from driveway	December 2021 (16:00 - 17:59)	Daylight (Fine)
Yallah Rd	200m West of Larkins Lane	Moderate Injury	Off road to the left, hitting object	June 2020 (08:00 - 09:59)	Daylight (Fine)
Yallah Rd	Intersection with Yallah Old Princes Hwy	Serious Injury	Collision between right turning vehicle and near vehicle	January 2020 (16:00 - 17:59)	Daylight (Fine)

The results of the crash search indicate 7 casualty crashes were recorded along Marshall Mount Road, of which 6 involved vehicles leaving the road. Given the observed crash trend, it is concluded that the safety of the road network could potentially be improved through suitable treatments to reduce the likelihood and severity of this type of crash. It is noted that future upgrades to the road network are proposed and would be likely to address these safety issues.

4. Future Road Environment

4.1 West Dapto Urban Release Area

The site is located within the West Dapto Urban Release Area which was previously identified as the priority release area for the region in the Illawarra Regional Strategy (and subsequently in the Illawarra Shoalhaven Regional Plan 2041) by the NSW Department of Planning. Wollongong City Council estimated the West Dapto Urban Release Area would provide 19,500 dwellings and an additional population of 56,500 people once fully developed. The release area will also provide local employment opportunities, community and recreational facilities and the conservation of sensitive sites and is estimated to create around 8,500 jobs.

The development of the West Dapto Urban Release Area is closely linked to the growth and development of the town centre of Dapto. Dapto is located between the larger centres of Wollongong to the north and Shellharbour to the south. Future urban development west of Dapto is proposed to strengthen the Dapto town centre as a regional township and centre for employment.

4.2 Stage 5: Yallah-Marshall Mount

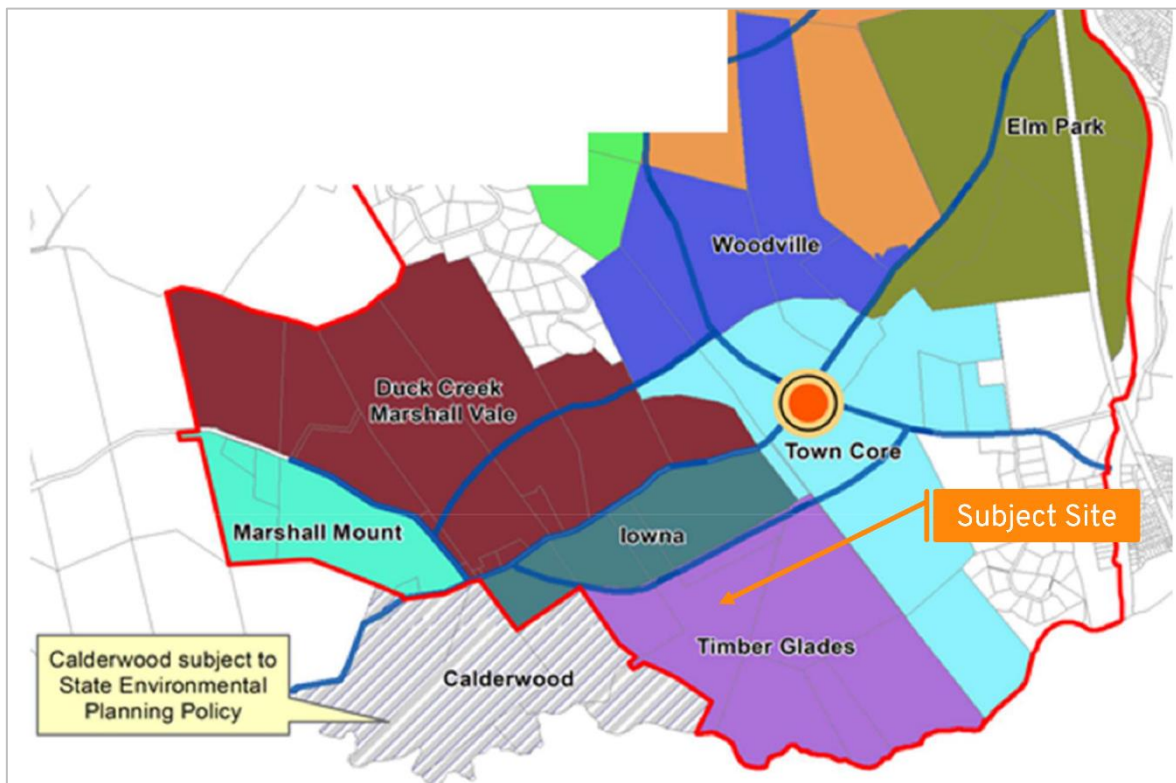
The West Dapto Urban Release Area is broken into a number of stages with the site located within the Stage 5 Yallah-Marshall Mount area. Yallah-Marshall Mount precinct is characterised by:

- Potential development of around 4,000 new dwellings.
- Marshall Mount Town Centre comprising approximately 3,500sqm of floor space in a traditional main street format to provide for retail shops, local convenience needs, local services, community facilities and similar uses.
- Connection of the precinct into Avondale and Cleveland, with access via an extension of Yallah Road as part of the overall West Dapto road network.
- Protection of significant vegetation and unique landscape features of the area.
- Utilisation of Duck Creek as a focal feature of the community.
- A primary school located near Marshall Mount Town Centre to meet the educational needs of the future residential families.

The Yallah-Marshall Mount precinct is proposed to utilise traditional urban design principles, with relatively high densities around the town centre and concentrated along the main access roads. The precinct is proposed to have a diverse range of housing types and densities.

The Precinct is made up of several neighbourhoods as shown in Figure 4, with the site located within the Timber Glades neighbourhood.

Figure 4: Yallah / Marshall Mount Precinct



Source: Wollongong DCP 2009 Chapter D16 – West Dapto Urban Release Area

4.3 Adjacent Neighbourhoods

4.3.1 iowna

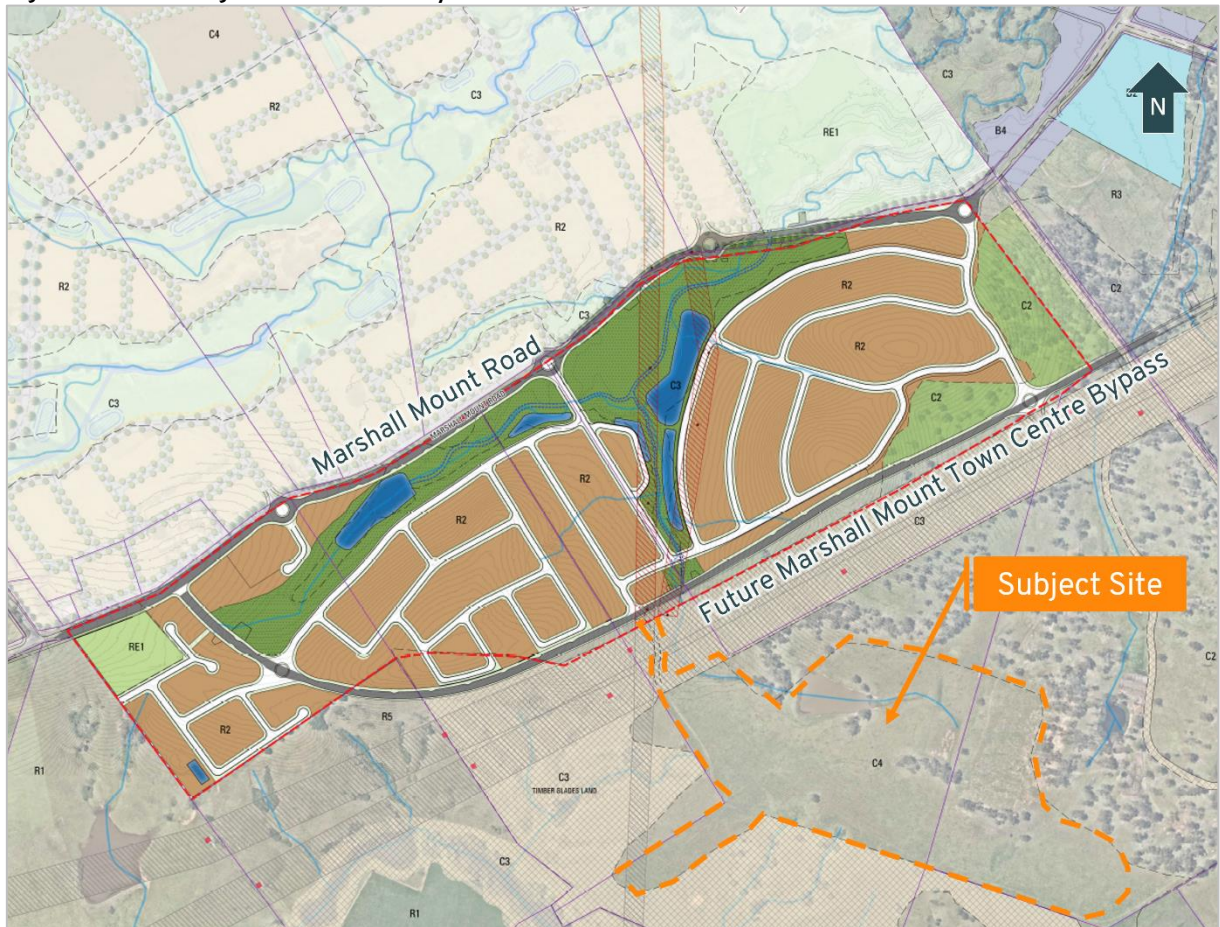
A draft Neighbourhood Plan has also been developed for the iowna subdivision to the northwest of the site. The proposed development is a residential subdivision which will deliver a total of approximately 600 low and medium-density dwellings.

A Traffic Impact Assessment was prepared by Cardno in December 2021 which found that:

- The proposal is expected to generate in the order of 353 vehicle trips in the morning peak hour and 435 trips in the evening peak hour;
- All intersections and mid-block road sections assessed were found to operate at a satisfactory level under future conditions beyond the year 2036; and
- The Neighbourhood Plan is supported based on traffic and transport grounds.

Figure 5 provides the current layout for the draft Neighbourhood Plan dated March 2024 which has been provided by Stantec. The figure shows that there is a new Marshall Mount Town Centre Bypass Road proposed along the southern boundary of the subdivision which splits the iowna subdivision and the subject site. The plan also shows that the road network within the iowna neighbourhood has been designed to facilitate a temporary connection between Marshall Mount Road and the subject site in the event that the bypass road is not constructed prior to the subdivision.

Figure 5: Iowna Neighbourhood Plan Layout



4.4 Future Road Network

The Wollongong Development Control Plan (DCP) notes that the future road network for West Dapto will be the ‘backbone’ of the community, providing for all types of access and movement through the release area. An integrated transport system is proposed that caters for the private car, freight, public transport, pedestrians and cyclists. Road types have been developed based on a functional hierarchy, where the road designs support the transport modes in various ways. The road network has been developed to cater for future urban land uses and aim to deliver a safe, connected and legible transport framework that compliments the natural environment and facilitates sustainable transport outcomes.

The Structure Plan within the Wollongong Development Control Plan outlines the structural road network through the release area. The road network structure was modelled in TRACKS to understand the demand and supply requirements to service the release area. The modelling informed road typology requirements, road hierarchy, and cross sections. A summary of the future road network characteristics is provided within Table 3.

Table 3: West Dapto Urban Release Area Road Characteristics

Road	Road Typology	Road Sizes	Active Transport Network
Marshall Mount Town Centre Bypass	Road Type 3 (Major Collector)	2 lanes	2.5 metre wide shared paths on both sides
Marshall Mount Road	Road Type 2 (Sub-arterial)	4 lanes	
Yallah Road	Road Type 1/2 (Sub-arterial)	4 lanes	

At the time of preparing this document, the 80% Concept Design for the road network has been provided by Council and incorporated into the Civil package by Maker ENG.

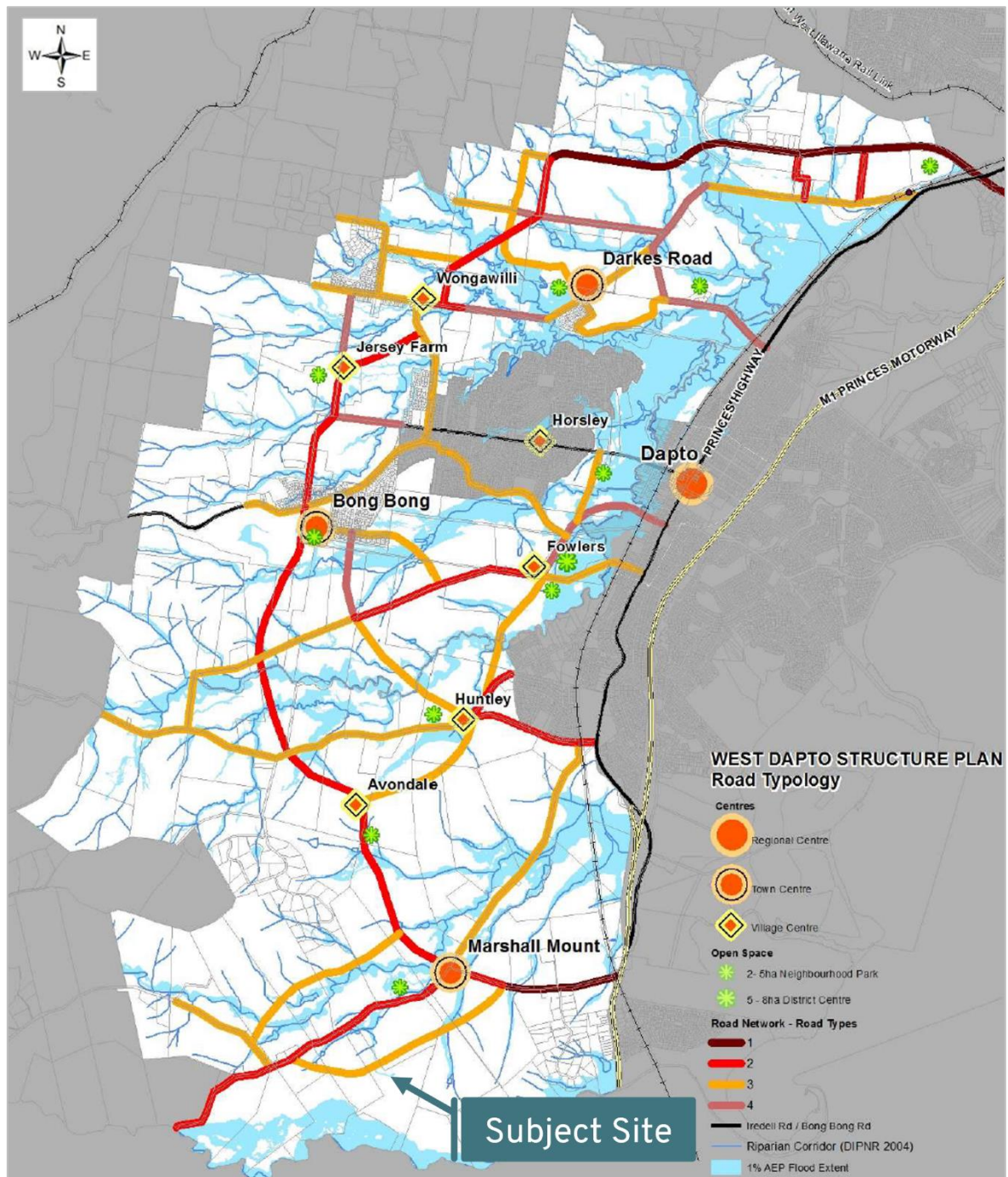
The West Dapto Development Contributions Plan indicates the proposed intersection upgrades for the West Dapto Urban Release Area which are summarised within Table 4.

Table 4: West Dapto Proposed Intersection Upgrades

Intersection	Intersection Treatment
Marshall Mount Road / Marshall Mount Town Centre Bypass	Small Signals
Yallah Road / Marshall Mount Town Centre Bypass	Large Signals
Marshall Mount Road / Yallah Road	Large Signals

The above indicates that the surrounding road network is expected to experience a significant increase in traffic associated with the development of the surrounding area. Wollongong City Council have prepared a strategic traffic model to determine the required road upgrades to ensure the road network is maintained at a suitable level to accommodate the expected traffic demands with road upgrades to be supported by developer contributions. An overview of the future road network is provided in Figure 6.

Figure 6: West Dapto Future Road Network



Source: Wollongong DCP 2009 Chapter D16 - West Dapto Urban Release Area

5. Development Proposal

The proposal will ultimately see the subdivision of land at Lot 8 in DP 626078, as well as construction of the associated internal road network. The layout has been designed with consideration to the broader Timber Glades Neighbourhood which is expected to accommodate a total of 91 residential and rural lots as outlined in Table 5.

Table 5: Site Overview

Site / Lot	Number of Lots	Minimum Lot Size	Status
365 Marshall Mount Road (Lot 8 in DP 626078)	72	999 sqm	Subject to Planning Proposal for reduction of lot sizes
297 Marshall Mount Road (Lot 5 in DP 24143)	10	4,999 sqm – 8.99 Ha	Part of Timber Glades Neighbourhood Plan (<i>Not subject to Planning Proposal. Lot count based on minimum lot sizes.</i>)
377 Marshall Mount Road	3		
142 Calderwood Road	1		
144 Calderwood Road	2		
1952 Illawarra Highway	3		

Access to the site is proposed via a connection with the future Marshall Mount Town Centre Bypass at the north-western corner of the site. Based on Council's 80% design for the future bypass road, it is understood that a T-intersection will be provided to service the site on the southern side of the road. The future bypass road extends to connect with the broader road network via Yallah Road to the northeast and Marshall Mount Road to the southwest. Should the bypass road not be constructed prior to the subject development, the site access would temporarily connect to Marshall Mount Road via the Iolna neighbourhood.

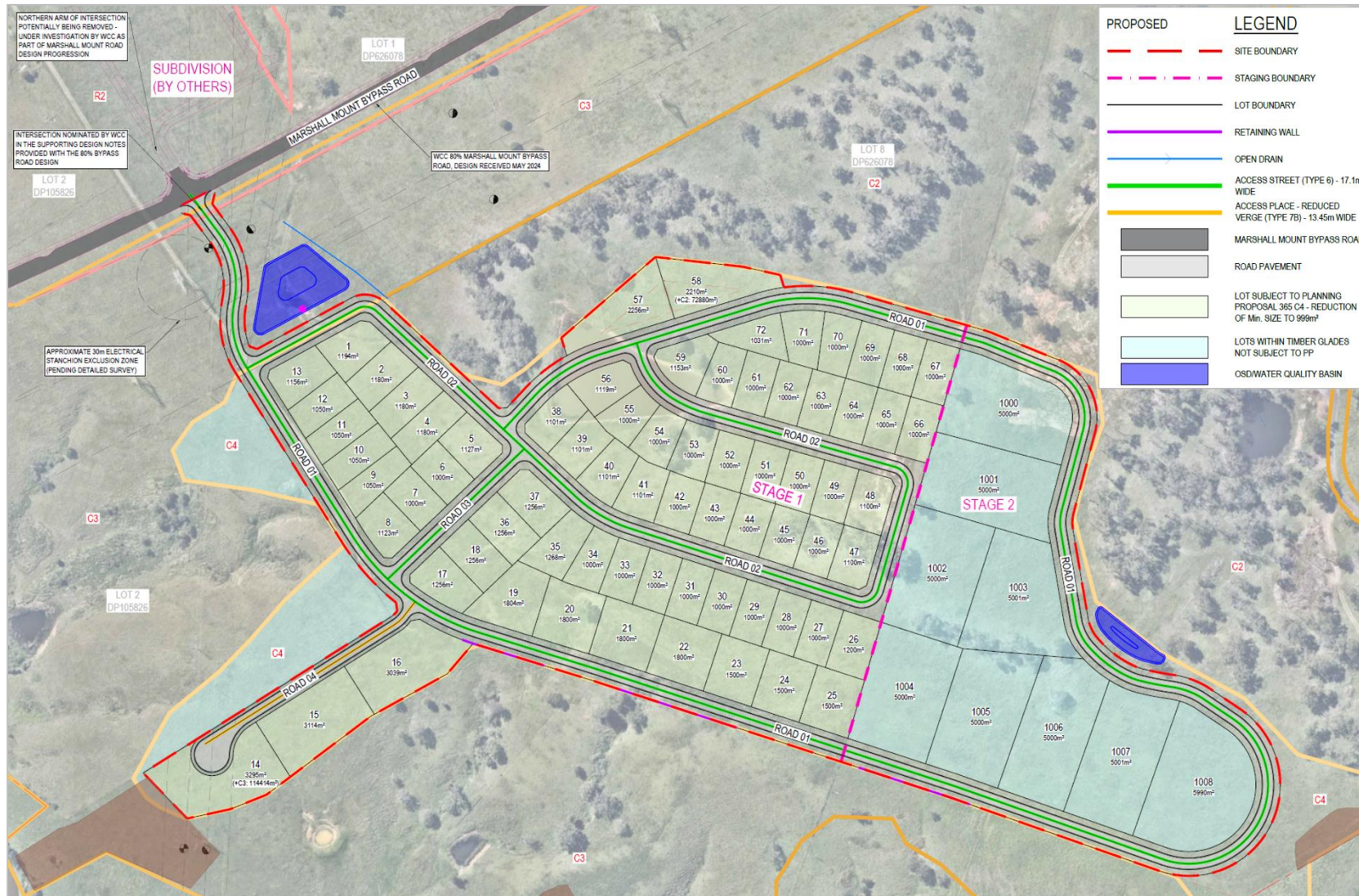
The internal road network within the site provides an outer and inner loop road that allows access to the individual lots. The proposed road network consists predominantly of Access Streets which are provided with a road reserve width of 17.1 metres, with a short section designated as an Access Place with a 13.45m road reserve servicing 3 lots in the south-western corner of the site.

It is understood that a future bus route would be required along the bypass road to service the Iolna neighbourhood which would subsequently pass the site frontage. It is recommended that bus stops are provided near the site access intersection to cater for residents of the proposed subdivision.

Footpaths are proposed on at least one side of all Access Streets within the site to provide pedestrian access to the individual lots and future bus stops. The footpaths would link with the proposed signalised intersection at the site access, providing a pedestrian connection with the broader surrounding area.

The proposed layout for the site is shown within Figure 7.

Figure 7: Site Layout



Source: Maker ENG

6. Traffic Assessment

6.1 Traffic Generation

Following discussions with Wollongong City Council it is proposed to utilise the traffic survey information provided within *Roads & Maritime Services Technical Direction 04a: Guide to Traffic Engineering Developments - Updated Traffic Surveys*, dated August 2013, to estimate the traffic generation of the site. The maximum traffic generation rates for low density residential land use within regional areas are as follows:

- Daily vehicle trips: 7.4 movements per dwelling
- Weekday average morning peak hour vehicle trips: 0.85 movements per dwelling
- Weekday average evening peak hour vehicle trips: 0.90 movements per dwelling.

Application of the above rates to the 91 lots results in a future traffic generation of 673 vehicle movements per day, and 77 and 82 vehicle movements (two-way total) in the morning and evening peak hours respectively.

In comparison it is considered that a minimum lot size of 4,999 sqm would result in a total of approximately 40 lots within the neighbourhood, which would generate 296 vehicle movements per day, with 34 and 36 vehicle movements in the morning and evening peak hours. The proposal to reduce the minimum lot sizes to 999 sqm therefore results in an additional 377 vehicle movements per day, including 43 and 46 movements in the morning and evening peak hours respectively.

6.2 Trip Distribution

It is typical for traffic movements associated with residential activities to predominantly be outbound in the morning peak and inbound in the evening peak. The following traffic distribution has been used for the purposes of this assessment which are based on the survey data presented within the RMS Technical Direction:

- Morning Peak: 80% outbound and 20% inbound
- Evening Peak: 30% outbound and 70% inbound

As such, the site is expected to generate the following traffic volumes during the morning and evening peak periods, with a comparison provided against the traffic that would be generated if the larger minimum lot size of 4,999 sqm were adopted for all lots.

Table 6: Peak Hour Traffic Generation

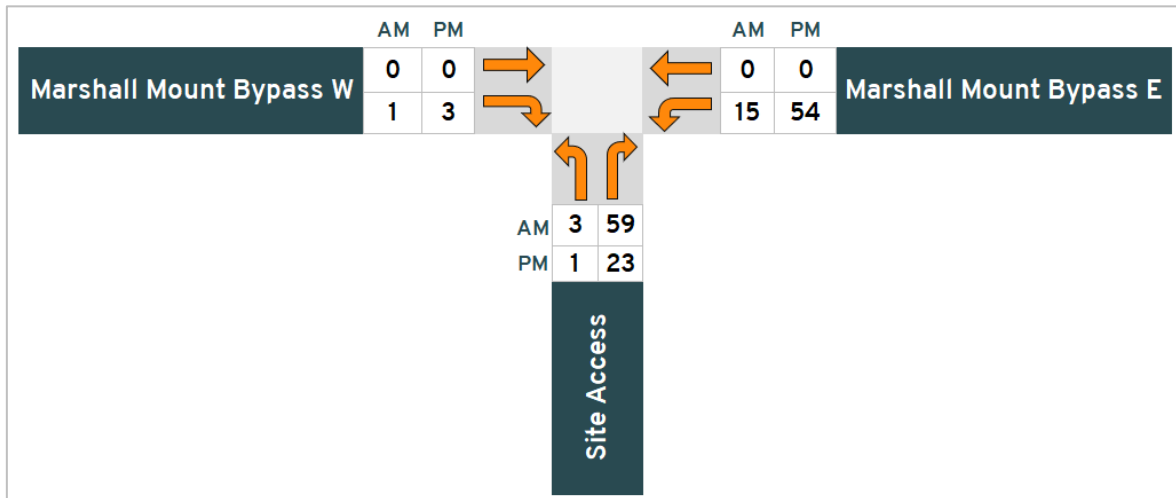
Traffic Generation	Proposal (min. 999 sqm lots) 91 lots		Comparison (min. 4,999 sqm lots) 40 lots	
	AM Peak (vph)	PM Peak (vph)	AM Peak (vph)	PM Peak (vph)
Arriving Trips	15	57	7	25
Departing Trips	62	25	27	11
Total	77	82	34	36

The traffic movements associated with the site are expected to be distributed from the internal road network to Marshall Mount Town Centre Bypass. Vehicles would then access the wider road network via Yallah Road or Marshall Mount Road.

It is estimated that 95% of site traffic will travel to/from the northeast to access the Princes Motorway or Dapto area, while the remaining 5% will travel to/from the southwest via Marshall Mount Road and Calderwood Road. The traffic distribution has been based on the layout of the future road network, the existing traffic distribution for vehicles presented in Section 2.3, and is broadly in line with journey to work census data.

Based on the traffic distribution the estimated traffic movements generated by the site during the morning and evening peak hour are shown within Figure 8.

Figure 8: Site Traffic Generation



6.3 Traffic Assessment

The future road network for the West Dapto Release Area has been designed based on the strategic model prepared by Wollongong City Council. The vehicle movements associated with the proposed reduced lot size represent a minor proportion of the overall traffic generated by the broader Precinct. The traffic associated with the site is understood to have been allowed for as part of the model and as such, the future road network has been designed to accommodate the traffic volumes of the site.

In order to determine the ability for the site access intersection on Marshall Mount Town Centre Bypass to accommodate the traffic expected to be generated by the site, a traffic modelling exercise has been undertaken using the SIDRA intersection modelling software. The SIDRA software is an advanced lane-based micro-analytical tool for design and evaluation of individual intersections and networks of intersections including modelling of separate movement classes.

The intersection performance criteria are based on the TfNSW Traffic Modelling Guidelines. A key indicator of intersection performance is Level of Service which is a qualitative measure used to describe the operating conditions of a section of road or an intersection. Levels of Service are designated from A to F from best (free flow conditions) to worst (forced flow with stop start operation, long queues and delays) and represent the perception of the road conditions by motorists including speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety.

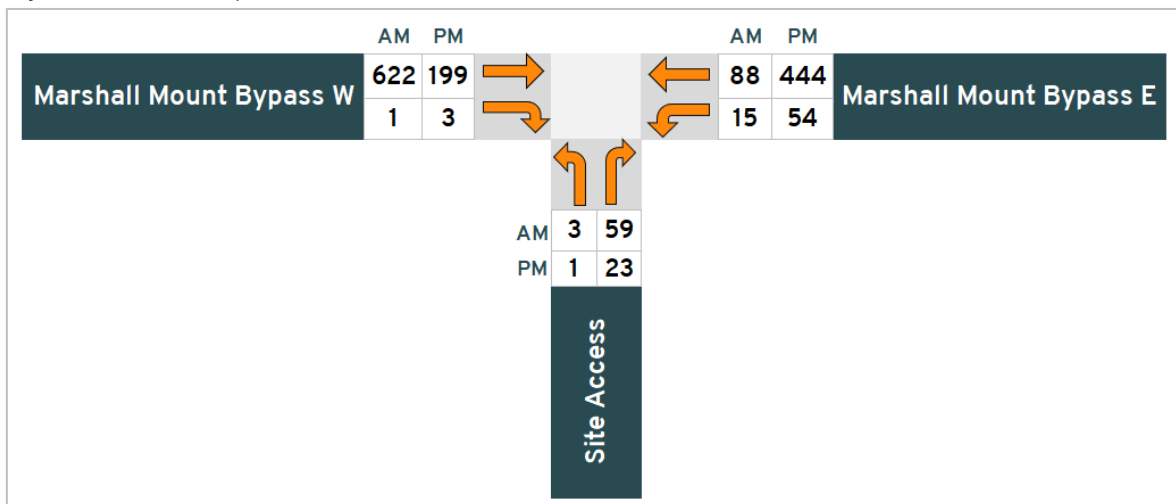
The best indicator of the level of service at an intersection is the average delay experienced by vehicles at that intersection. Table 7 sets out average delays for different levels of service.

Table 7: Level of Service Criteria for Intersections

Level of Service	Average Delay per Vehicle (sec/veh)	Summary
A	Less than 14	Good operation
B	15 – 28	Acceptable delays and spare capacity
C	29 – 42	Satisfactory, but accident study required
D	43 – 56	Near capacity and accident study required
E	57 - 70	At capacity, require other control mode

The SIDRA analysis has been undertaken based on the anticipated AM and PM peak traffic volumes beyond the year 2036 from the TRACKS model prepared by Wollongong City Council. The relevant data is provided in Appendix B with a summary of the resulting traffic volumes used for the assessment in Figure 9.

Figure 9: Total Anticipated Traffic (2036+)



The results of the SIDRA analysis for the intersection are summarised in Table 8 with the full results presented within Appendix C. It is noted that the default SIDRA settings have been adopted for the modelling analysis.

Table 8: SIDRA Analysis Results Summary – Site Access / Marshall Mount Bypass

Approach / Movement		AM Future Conditions (2036+)			PM Future Conditions (2036+)		
		Average Delay (sec)	95% Queue (m)	Level of Service	Average Delay (sec)	95% Queue (m)	Level of Service
Site Access (South)	Left	4.8	2.5	A	6.3	0.9	A
	Right	9.2	2.5	A	8.3	0.9	A
Marshall Mount Bypass (East)	Left	4.6	0.0	A	4.6	0.0	A
	Through	0.0	0.0	A	0.1	0.0	A
Marshall Mount Bypass (West)	Through	0.0	0.1	A	0.1	0.3	A
	Right	4.6	0.1	A	6.5	0.3	A

The SIDRA analysis for the AM and PM peaks indicates that the intersection is expected to operate with a good level of service (LOS A) and minimal delays for all movements following the development of the site and surrounding area. It is noted that the analysis has been conservatively undertaken without any turn treatments along the bypass road which would further improve the overall performance.

Accordingly, the future traffic volumes are expected to be readily accommodated at the site access intersection which is able to cater for all turning movements at the intersection.

It is also considered that the internal intersections within the site are able to accommodate the site traffic given they accommodate a lower number of vehicle movements than the intersections assessed. Therefore, the subdivision including the additional traffic resulting from the proposed reduction in lot sizes is not expected to create any adverse traffic impacts on the road network.

7. Site Access

7.1 Design

Access to the site is proposed via a connection with the future Marshall Mount Town Centre Bypass at the north-western corner of the site. Based on Council's 80% design for the future bypass road, it is understood that a T-intersection will be provided to service the site on the southern side of the road. The future bypass road extends to connect with the broader road network via Yallah Road to the northeast and Marshall Mount Road to the southwest. Should the bypass road not be constructed prior to the subject development, the site access would temporarily connect to Marshall Mount Road via the Iowana neighbourhood.

The 80% design for the bypass road indicates that a left-in left-out intersection treatment will be investigated for the site access intersection. It is considered that this treatment would be expected to result in detours and additional travel time for residents/visitors of the site, as those arriving from the south/west or departing to the north/east would be required to continue along the bypass road and perform a u-turn manoeuvre. Review of the 80% design indicates that the nearest adjacent intersections which would cater for the u-turn manoeuvres would be located approximately 600-700 metres from the site access which would result in a total detour of 1.2-1.4 kilometres for impacted vehicles. Based on the traffic distribution assumptions outlined in Section 6.2, it is estimated that the majority of site traffic will travel to/from the northeast to access the Princes Motorway or Dapto area and would be impacted by the turn movement restrictions when departing the site. This is considered undesirable, and it is instead suggested to allow all movements at the site access intersection with turn treatments to facilitate safe and efficient vehicle access.

7.2 Turn Treatments

An assessment has been carried out for the Planning Proposal to determine the turn treatments which would be required at the site access intersection to facilitate all turning movements. The assessment has been undertaken in accordance with *Austroads Guide to Traffic Management Part 6: Intersections, Interchanges, and Crossings* which specifies the turning treatments required at intersections. Figure 3.25 of the guide specifies the required turn treatments on the major road at unsignalised intersections. A design speed of up to 70km/h has been assumed for the bypass road based on the intended classification as a Road Type 3 (Major Collector), and the forecast 2036+ intersection volumes have been utilised for the assessment (Figure 9). The results of the assessment are provided in Figure 10 for the AM peak and Figure 11 for the PM peak.

Figure 10: Planning Proposal (91 lots) – AM Peak Turn Treatment Assessment

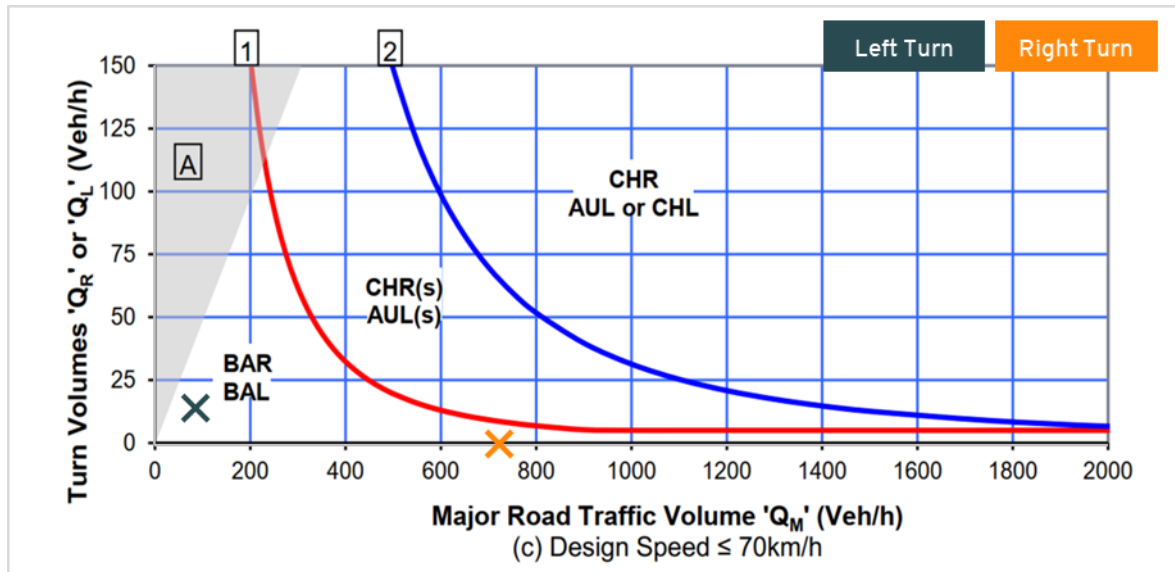
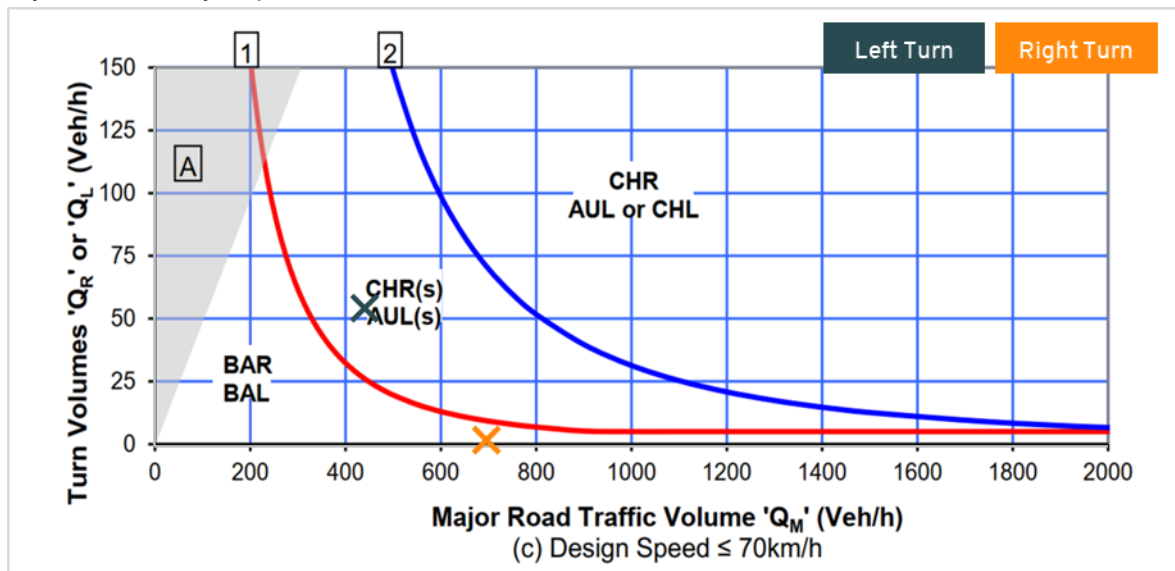


Figure 11: Planning Proposal (91 lots) – PM Peak Turn Treatment Assessment



The required turn facilities at the site access intersection on the bypass road are dictated by the PM peak hour which would require short Auxiliary Left Turn (AUL(s)) and Basic Right Turn (BAR) treatments, as outlined in Table 9.

Table 9: Planning Proposal (91 lots) - Turn Treatment Requirements

Turning Treatment	Traffic Volume (vph)		Requirement
	Turn Volume	Major Road	
Right Turn	3	697	BAR
Left Turn	54	444	AUL(s)

It is noted that AUL(s) and BAR turn treatments would also be required to accommodate the current permissible development, and accordingly the Planning Proposal which includes changes to the minimum lot sizes would not impact the required turn treatments at the intersection.

8. Internal Road Layout

8.1 Road Alignment

The internal road network within the site provides an outer and inner loop road that allows access to the individual lots. The layout does not allow for through traffic access which serves to eliminate the potential for any rat-running behaviour. The internal road network provides an orderly lot layout and suitable vehicle circulation with all internal intersections proposed to be provided in a 'T' arrangement.

One cul-de-sac is proposed within the site. The cul-de-sac is approximately 180 metres long which exceeds the maximum length of 80 metres specified within the DCP, however it serves only 3 large lots and provides a generous turning head radius of 12 metres. The design of the cul-de-sac is therefore considered to be acceptable, particularly considering the geometric constraints of the site.

Overall, the road layout is considered to meet the objectives of the *Wollongong Development Control Plan - Chapter B2: Residential Subdivision* by providing a legible and well-connected road network that establishes a clear hierarchy of different road types which cater for different types of traffic movement.

8.2 Road Design

The proposed road typologies have been allocated in accordance with the DCP controls as outlined in Table 10.

Table 10: Road Typology Characteristics

Road Typology	Road Reserve Width (m)	Carriageway Width (m)	Active Transport
Access Street (Type 6)	17.1	8.1	1.5 metre wide footpaths on both sides of the road
Access Place (Type 7B)	13.45	7.0	N/A

The proposed road network consists predominantly of Access Streets, with a short section designated as an Access Place servicing 3 lots in the south-western corner of the site.

The internal road cross sections are considered to be appropriate to accommodate suitable vehicle movement through the site and are reflective of the road classifications. Accordingly, it is concluded that the proposed road type and cross-sections have been designed in accordance with the DCP and are expected to provide suitable vehicle access for all road users whilst facilitating vehicle movements to/from the site and the adjacent the properties.

8.3 Traffic Management

The road network provides a straight section of approximately 400 metres which runs along the southern boundary of the site. To control traffic speeds, flat top speed humps are proposed to be installed for these straight road sections at approximately 100 metre intervals, as outlined in *Austroads Guide to Traffic Management Part 8 – Local Street Management*.

Whilst the remainder of the local road network provides some relatively straight sections, it is considered that the roads are relatively short ensuring safe operating speeds throughout the network.

8.4 Intersection Design

All internal intersections are proposed to be priority controlled in a 'T' arrangement. All intersections would be provided with appropriate signage and associated linemarking to control vehicle movements. A minimum spacing of 20 metres is provided between all staggered intersections in accordance with Section 13.2 of the DCP.

The intersections have been designed to meet the Safe Intersection Sight Distance specified within *Austroads Guide to Road Design – Part 4A: Unsignalised Intersections* to ensure the sight distance at each intersection allows the safe movement of vehicles on the road network.

The required sight distance within the Austroads Guideline is provided in Table 3.2 of the document. A typical design speed of 50km/hr has been assumed based on the residential area and geometric characteristics including relatively narrow carriageways, speed humps and curved roads. Assuming a reaction time of 1.5 seconds, which is applicable in a built-up area where drivers are more alert, the required sight distance at the internal intersections is 90 metres. It is noted that a design speed of 40 km/hr has been assumed for the road along the southern boundary of the site due to the proposed flat top speed humps, which requires a sight distance of 67 metres.

An assessment of the sight distance at the intersections concludes that the required sight distance is provided in all directions in accordance with the requirements of the Austroads Guideline. Accordingly, the intersections are expected to operate in a safe manner.

8.5 Lot Access

All lots are proposed to gain access via the internal road network with access locations for each lot yet to be determined. A review of the lot layout indicates that vehicle crossovers are able to be provided in locations that would allow the individual driveways to meet the sight distance requirement outlined within Figure 3.2 of AS/NZS 2890.1:2004.

Overall, the proposed road layout is expected to allow for suitable vehicle access to the individual lots.

9. Car Parking

The applicant has advised that all car parking is to be provided in accordance with the Wollongong Development Control Plan. The large lots are considered to be a sufficient size to accommodate the resident parking requirement on-site. In addition, the minimum carriageway width of the internal road network is 7.0 metres in accordance with the required cross-section for an Access Place. The road width allows for two-way traffic and on-street parallel parking once fully constructed, with the on-street spaces available to service the needs of visitors of future residents within the subdivision. Accordingly, the subdivision is not expected to generate any parking impacts and the parking demand can be readily accommodated internally within the site.

10. Alternative Transport Modes

10.1 Public Transport

It is understood that TfNSW are currently planning and developing strategies to services the West Dapto communities. The Wollongong DCP also outlines a range of principles relating to the establishment of efficient and attractive public transport options for West Dapto, including provision for a future bus network which is highly accessible and services the majority of residences. Suitable road types to cater for bus routes are identified within the West Dapto Development Contributions Plan as Major Collector Roads, Minor Collector Roads and Sub-Arterial Roads. The Neighbourhood Plan proposes that the Marshall Mount Town Centre Bypass is to be designed and constructed as a Major Collector Road which would suitably cater for future bus services in accordance with the DCP.

The DCP generally requires bus stops to be located within 400 metres walking distance for 90% of the lots. The Traffic Impact Assessment prepared by Cardno in December 2021 for the Iowna Neighbourhood Plan identified that a future bus route would be required along the bypass road (i.e. passing the site frontage) to service 90% of the lots within the Iowna neighbourhood. It is recommended that bus stops are provided near the site access intersection which would cater for approximately 50% of the lots within 400 metres and 90% of the lots within a 550 metre walking distance. It is noted that the 9 large lots along the eastern boundary of the subdivision would require longer walking distances to access the bus stop.

10.2 Alternative Transport Facilities

Footpaths are proposed on at least one side of all Access Streets which reflects the requirements of the DCP. The footpaths would connect with the proposed signalised intersection at the site access which would provide convenient crossing opportunities.

It is understood that the design for the bypass road also includes a shared path on the northern side of the road, which would link with the proposed signalised intersection and internal footpath network within the site to provide pedestrian and cycling access to the broader surrounding area. The signalised intersection would allow for controlled pedestrian crossing facilities which would promote walking as a travel mode within the local area.

Accordingly, the proposed alternative transport facilities are considered appropriate and link with the wider existing and future network.

11. Conclusions

Amber has reviewed the traffic and parking matters of the Planning Proposal and associated Neighbourhood Plan at 365 Marshall Mount Road, Marshall Mount. The neighbourhood is expected to accommodate a total of 91 residential and rural lots and includes the construction of the internal road network. Access to the site is proposed via a connection with the future Marshall Mount Town Centre Bypass at the north-western corner of the site. Based on Council's 80% design for the future bypass road, it is understood that a T-intersection will be provided to service the site on the southern side of the road.

Based on the above assessment, it is concluded that:

- The site is expected to generate in the order of 673 vehicle movements per day, with 77 and 82 vehicle movements (two-way total) in the morning and evening peak hours respectively.
- The future road network for the West Dapto Release Area has been designed based on the strategic model prepared by Wollongong City Council. The proposed subdivision is understood to have been allowed for as part of the model and as such, the future road network has been designed to accommodate the traffic volumes of the site.
- The traffic modelling analysis indicates that the site access intersection is able to accommodate the anticipated future traffic volumes while catering for all turning movements at the intersection.
- The 80% design for the bypass road indicates that a left-in left-out intersection treatment will be investigated for the site access intersection. It is considered that this treatment would be expected to result in detours and additional travel time for residents/visitors of the site. This is considered undesirable, and it is instead suggested to allow all movements at the site access intersection with turn treatments to facilitate safe and efficient vehicle access.
- The required turn treatments at the site access intersection would be a short Auxiliary Left Turn (AUL(s)) and a Basic Right Turn (BAR) in accordance with the Austroads Guide. It is noted that these turn treatments would also be required to accommodate the current permissible development, and accordingly the Planning Proposal which includes changes to the minimum lot sizes would not impact the required turn treatments at the intersection.
- The proposed road layout is considered to meet the objectives of the DCP by providing a defined hierarchy of roads and an acceptable level of access, safety and convenience for all road users. The road reserve widths required by the Wollongong Development Control Plan has been provided for all internal roads.
- The internal intersections have been designed to provide suitable sight distance in accordance with Austroads Guidelines.
- Car parking for the individual lots is to be provided in accordance with the Wollongong Development Control Plan, with on-street parking provided for visitors.
- It is understood that a future bus route would be required along the bypass road to service the Iona neighbourhood which would subsequently pass the site frontage. It is recommended that bus stops are provided near the site access intersection to cater for residents of the proposed subdivision.
- Footpaths are proposed on at least one side of all Access Streets within the site to provide pedestrian access to the individual lots and any potential future bus stops.

Overall, it is concluded that the proposed subdivision is in a form that meets the objectives of the West Dapto Release Area, and the car parking and traffic demands generated by the site can be readily accommodated on the surrounding and internal road network.

Appendix A

Intersection Traffic Survey Data



TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

trafficsurvey.com.au



Intersection of Marshall Mount Rd and Yallah Rd, Marshall Mount

GPS -34.535910, 150.767750

Date:	Tue 02/05/23
Weather:	Overcast
Suburban:	Marshall Mount
Customer:	Amber

North:	Marshall Mount Rd
East:	Yallah Rd
South:	Marshall Mount Rd
West:	N/A

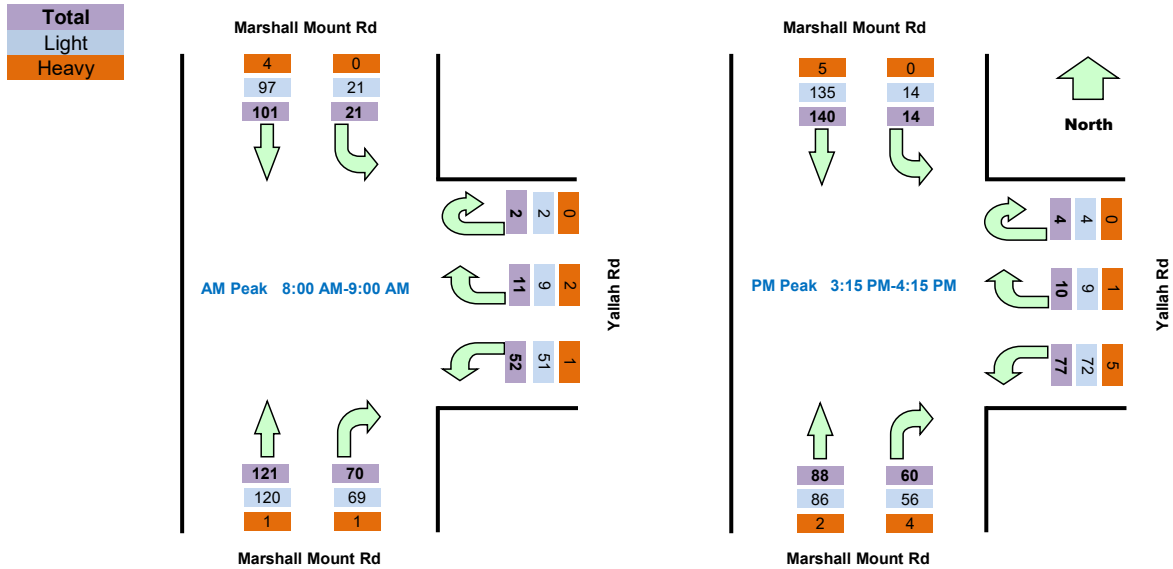
Survey	AM:	7:30 AM-9:30 AM
Period	PM:	2:30 PM-6:30 PM
Traffic	AM:	8:00 AM-9:00 AM
Peak	PM:	3:15 PM-4:15 PM

All Vehicles

Time		North Approach Marshall Mount Rd			East Approach Yallah Rd			South Approach Marshall Mount Rd			Hourly Total	
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	Hour	Peak
7:30	7:45	0	12	2	0	2	3	0	8	25	300	
7:45	8:00	0	21	1	0	2	2	0	12	30	352	
8:00	8:15	0	22	3	1	2	3	0	14	30	378	Peak
8:15	8:30	0	26	9	0	3	16	0	19	32	348	
8:30	8:45	0	26	6	1	3	15	0	21	32	305	
8:45	9:00	0	27	3	0	3	18	0	16	27		
9:00	9:15	0	19	1	1	1	4	0	9	10		
9:15	9:30	0	18	3	3	2	7	0	15	14		
14:30	14:45	0	18	5	1	2	14	0	9	14	304	
14:45	15:00	0	23	3	0	3	18	0	6	11	346	
15:00	15:15	0	28	9	0	0	15	0	5	16	373	
15:15	15:30	0	36	5	1	1	22	0	18	21	393	Peak
15:30	15:45	0	33	2	0	3	15	0	27	25	366	
15:45	16:00	0	25	3	3	3	21	0	9	27	360	
16:00	16:15	0	46	4	0	3	19	0	6	15	363	
16:15	16:30	0	26	6	0	4	16	0	10	15	358	
16:30	16:45	0	41	2	0	1	26	0	15	14	354	
16:45	17:00	0	45	2	0	5	15	0	9	18	312	
17:00	17:15	0	30	7	0	6	24	0	9	12	261	
17:15	17:30	0	29	9	0	1	18	0	5	11	216	
17:30	17:45	0	30	3	0	1	15	0	2	6	170	
17:45	18:00	0	14	3	0	1	9	0	7	9		
18:00	18:15	0	15	0	0	1	18	0	3	6		
18:15	18:30	0	10	0	0	1	4	0	5	7		

Peak Time		North Approach Marshall Mount Rd			East Approach Yallah Rd			South Approach Marshall Mount Rd			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
8:00	9:00	0	101	21	2	11	52	0	70	121	378
15:15	16:15	0	140	14	4	10	77	0	60	88	393

Note: Site sketch is for illustrating traffic flows. Direction is indicative only, drawing is not to scale and not an exact streets configuration.



Light Vehicles

Time		North Approach Marshall Mount Rd			East Approach Yallah Rd			South Approach Marshall Mount Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:30	7:45	0	12	2	0	2	3	0	8	24
7:45	8:00	0	21	1	0	2	2	0	12	29
8:00	8:15	0	20	3	1	1	3	0	14	30
8:15	8:30	0	26	9	0	3	15	0	18	32
8:30	8:45	0	25	6	1	2	15	0	21	32
8:45	9:00	0	26	3	0	3	18	0	16	26
9:00	9:15	0	17	1	1	1	4	0	9	10
9:15	9:30	0	18	3	3	1	7	0	14	14
14:30	14:45	0	18	4	1	2	14	0	9	14
14:45	15:00	0	23	3	0	3	18	0	6	11
15:00	15:15	0	28	9	0	0	15	0	5	16
15:15	15:30	0	35	5	1	0	21	0	17	21
15:30	15:45	0	31	2	0	3	14	0	25	25
15:45	16:00	0	25	3	3	3	20	0	9	25
16:00	16:15	0	44	4	0	3	17	0	5	15
16:15	16:30	0	26	6	0	4	16	0	10	15
16:30	16:45	0	41	2	0	1	26	0	14	14
16:45	17:00	0	45	2	0	5	15	0	9	15
17:00	17:15	0	30	6	0	6	24	0	8	12
17:15	17:30	0	29	9	0	1	18	0	5	10
17:30	17:45	0	30	3	0	1	15	0	2	6
17:45	18:00	0	14	3	0	1	9	0	7	9
18:00	18:15	0	15	0	0	1	18	0	3	6
18:15	18:30	0	10	0	0	1	3	0	5	7

Peak Time		North Approach Marshall Mount Rd			East Approach Yallah Rd			South Approach Marshall Mount Rd			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
8:00	9:00	0	97	21	2	9	51	0	69	120	369
15:15	16:15	0	135	14	4	9	72	0	56	86	376

Heavy Vehicles

Time		North Approach Marshall Mount Rd			East Approach Yallah Rd			South Approach Marshall Mount Rd		
Period Start	Period End	U	SB	L	U	R	L	U	R	NB
7:30	7:45	0	0	0	0	0	0	0	0	1
7:45	8:00	0	0	0	0	0	0	0	0	1
8:00	8:15	0	2	0	0	1	0	0	0	0
8:15	8:30	0	0	0	0	0	1	0	1	0
8:30	8:45	0	1	0	0	1	0	0	0	0
8:45	9:00	0	1	0	0	0	0	0	0	1
9:00	9:15	0	2	0	0	0	0	0	0	0
9:15	9:30	0	0	0	0	1	0	0	1	0
14:30	14:45	0	0	1	0	0	0	0	0	0
14:45	15:00	0	0	0	0	0	0	0	0	0
15:00	15:15	0	0	0	0	0	0	0	0	0
15:15	15:30	0	1	0	0	1	1	0	1	0
15:30	15:45	0	2	0	0	0	1	0	2	0
15:45	16:00	0	0	0	0	0	1	0	0	2
16:00	16:15	0	2	0	0	0	2	0	1	0
16:15	16:30	0	0	0	0	0	0	0	0	0
16:30	16:45	0	0	0	0	0	0	0	1	0
16:45	17:00	0	0	0	0	0	0	0	0	3
17:00	17:15	0	0	1	0	0	0	0	1	0
17:15	17:30	0	0	0	0	0	0	0	0	1
17:30	17:45	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	0	0	0
18:00	18:15	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	1	0	0	0

Peak Time		North Approach Marshall Mount Rd			East Approach Yallah Rd			South Approach Marshall Mount Rd			Peak total
Period Start	Period End	U	SB	L	U	R	L	U	R	NB	
8:00	9:00	0	4	0	0	2	1	0	1	1	9
15:15	16:15	0	5	0	0	1	5	0	4	2	17

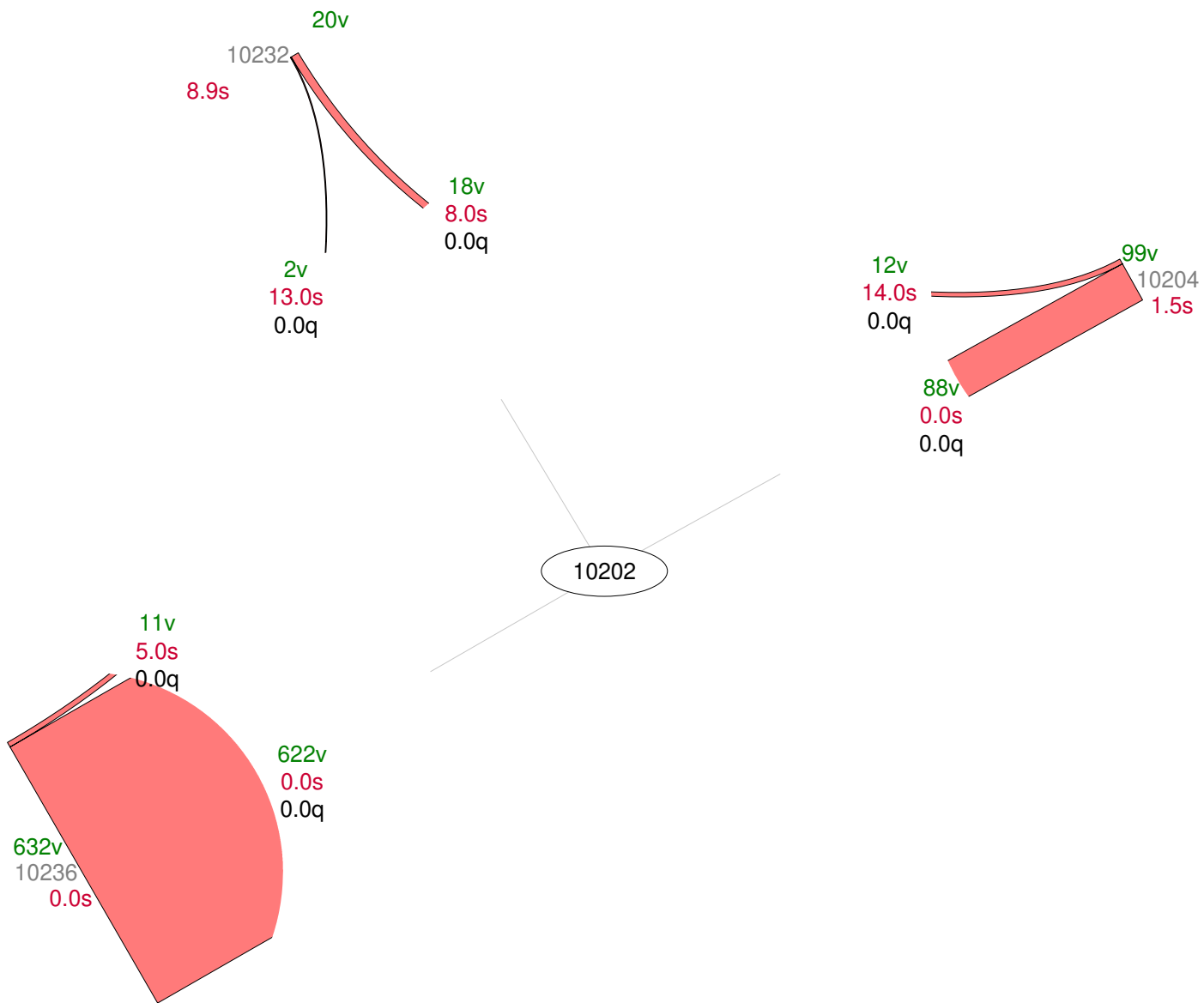
Appendix B

TRACKS Future Traffic Volumes (2036+)



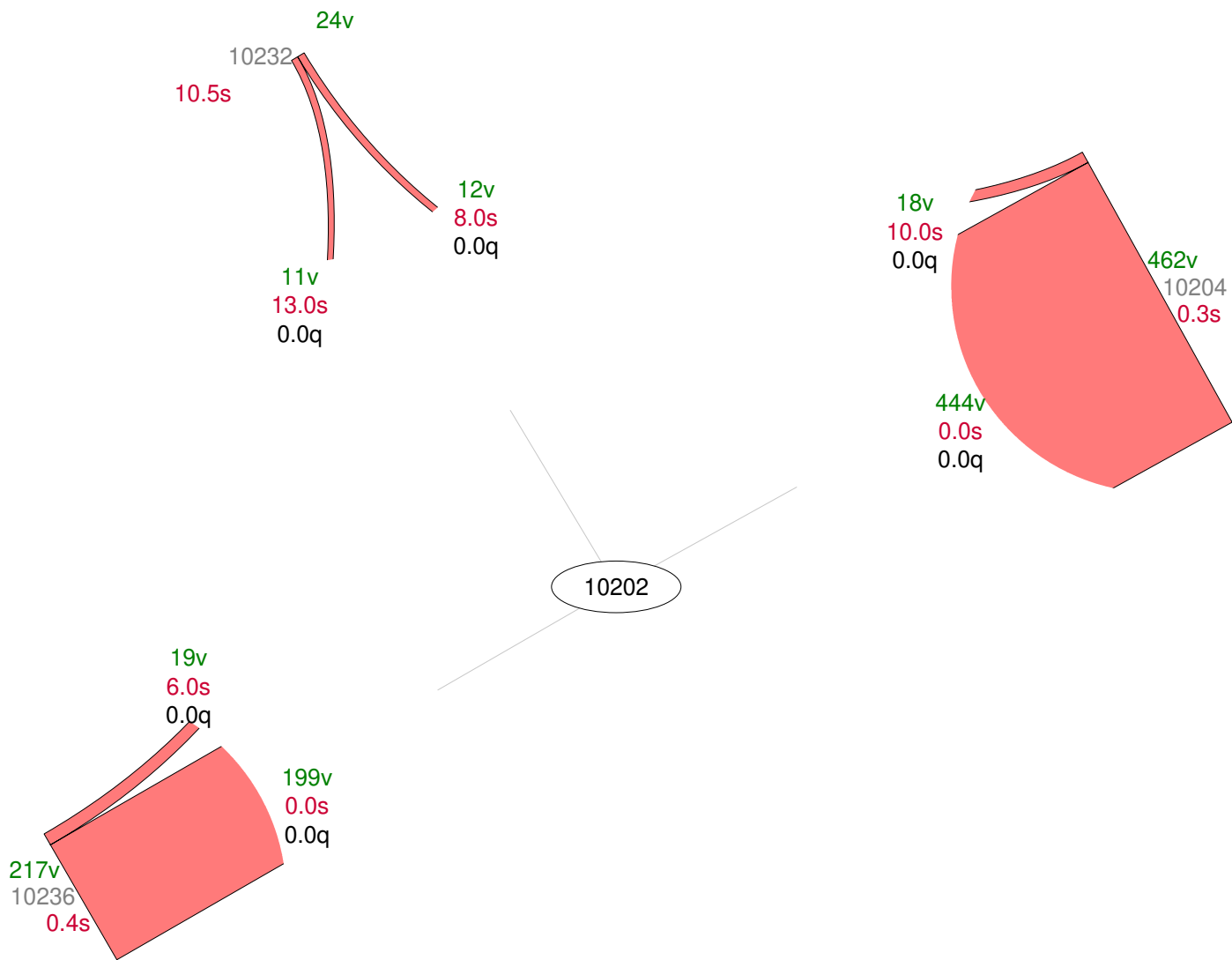
Node VolumeDelay 393 Volume 753 AvgDelay 0.5

AM PEAK



Node VolumeDelay 533 Volume 703 AvgDelay 0.8

PM PEAK



Appendix C

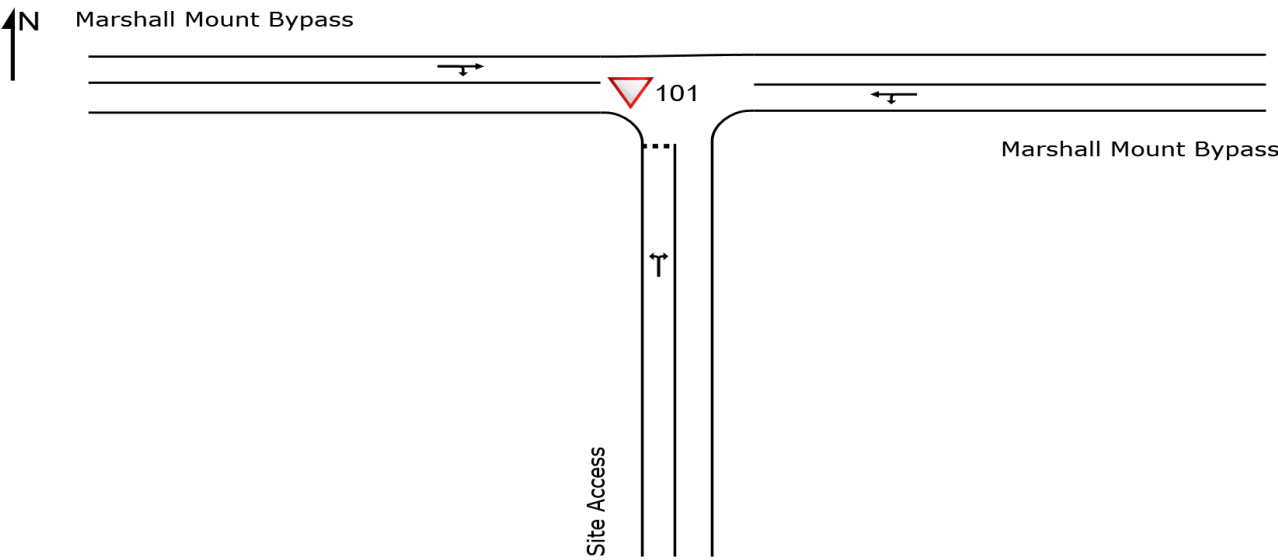
SIDRA Results

SITE LAYOUT

▽ Site: 101 [AM - Site Access / Marshall Mount Bypass (Site
Folder: Site Access / Marshall Mount Bypass / Iowna Access)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

▼ Site: 101 [AM - Site Access / Marshall Mount Bypass (Site Folder: Site Access / Marshall Mount Bypass / Iowna Access)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Site Access															
1	L2	All MCs	3	0.0	3	0.0	0.114	4.8	LOS A	0.4	2.5	0.55	0.76	0.55	43.5
3	R2	All MCs	62	0.0	62	0.0	0.114	9.2	LOS A	0.4	2.5	0.55	0.76	0.55	43.4
Approach			65	0.0	65	0.0	0.114	9.0	LOS A	0.4	2.5	0.55	0.76	0.55	43.4
East: Marshall Mount Bypass															
4	L2	All MCs	16	0.0	16	0.0	0.057	4.6	LOS A	0.0	0.0	0.00	0.08	0.00	48.3
5	T1	All MCs	93	5.0	93	5.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	49.5
Approach			108	4.3	108	4.3	0.057	0.7	NA	0.0	0.0	0.00	0.08	0.00	49.3
West: Marshall Mount Bypass															
11	T1	All MCs	655	5.0	655	5.0	0.344	0.0	LOS A	0.0	0.1	0.00	0.00	0.00	50.0
12	R2	All MCs	1	0.0	1	0.0	0.344	4.6	LOS A	0.0	0.1	0.00	0.00	0.00	48.6
Approach			656	5.0	656	5.0	0.344	0.0	NA	0.0	0.1	0.00	0.00	0.00	50.0
All Vehicles			829	4.5	829	4.5	0.344	0.8	NA	0.4	2.5	0.04	0.07	0.04	49.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [PM - Site Access / Marshall Mount Bypass (Site Folder: Site Access / Marshall Mount Bypass / Iowna Access)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Site Access															
1	L2	All MCs	1	0.0	1	0.0	0.041	6.3	LOS A	0.1	0.9	0.53	0.74	0.53	43.9
3	R2	All MCs	24	0.0	24	0.0	0.041	8.3	LOS A	0.1	0.9	0.53	0.74	0.53	43.8
Approach			25	0.0	25	0.0	0.041	8.2	LOS A	0.1	0.9	0.53	0.74	0.53	43.8
East: Marshall Mount Bypass															
4	L2	All MCs	57	0.0	57	0.0	0.275	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	48.3
5	T1	All MCs	467	5.0	467	5.0	0.275	0.1	LOS A	0.0	0.0	0.00	0.06	0.00	49.5
Approach			524	4.5	524	4.5	0.275	0.6	NA	0.0	0.0	0.00	0.06	0.00	49.4
West: Marshall Mount Bypass															
11	T1	All MCs	209	5.0	209	5.0	0.113	0.1	LOS A	0.0	0.3	0.02	0.03	0.02	49.9
12	R2	All MCs	3	0.0	3	0.0	0.113	6.5	LOS A	0.0	0.3	0.02	0.03	0.02	48.5
Approach			213	4.9	213	4.9	0.113	0.1	NA	0.0	0.3	0.02	0.03	0.02	49.9
All Vehicles			762	4.4	762	4.4	0.275	0.7	NA	0.1	0.9	0.02	0.07	0.02	49.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

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Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.