



Proposed Service Station  
Lot 1 (No.1351) Wanneroo Road,  
Tapping  
Transport Impact Assessment

PREPARED FOR:  
BP Australia Pty Ltd

November 2019

## Document history and status

Author	Revision	Approved by	Date approved	Revision type
S Maharjan, M Rasouli	r01	B Bordbar	17/04/2019	Draft
S Maharjan	r01a	M Rasouli	18/11/2019	Final

**File name:** t19.016.sm.r01a

**Author:** S Maharjan, M Rasouli

**Project manager:** Mohammad Rasouli

**Client:** BP Australia Pty Ltd

**Project:** Lot 1 (No.1351) Wanneroo Road, Proposed Service Station

**Document revision:** r01a

**Project number:** t19.016

Copyright in all drawings, reports, specifications, calculations and other documents provided by the Consultant in connection with the Project shall remain the property of the Consultant.

The Client alone shall have a license to use the documents referred to above for the purpose of completing the Project, but the Client shall not use, or make copies of, such documents in connection with any work not included in the Project, unless written approval is obtained from the Consultant or otherwise agreed through a separate contract.

# TABLE OF CONTENTS

---

1.0	SUMMARY .....	1
2.0	INTRODUCTION .....	2
3.0	EXISTING SITUATION .....	4
3.1	EXISTING SITE USE, ACCESS AND PARKING.....	4
3.2	SURROUNDING ROAD NETWORK AND TRAFFIC MANAGEMENT ON FRONTAGE ROADS .....	4
3.3	EXISTING TRAFFIC VOLUMES ON ROADS AND MAJOR INTERSECTIONS .....	6
3.4	HEAVY VEHICLES.....	8
3.5	PUBLIC TRANSPORT ACCESS.....	9
3.6	PEDESTRIAN AND CYCLIST FACILITIES .....	10
3.7	PUBLIC TRANSPORT NETWORK PLANNING .....	10
3.8	CRASH DATA .....	11
4.0	DEVELOPMENT PROPOSAL.....	12
4.1	PROPOSED SITE USE.....	12
4.2	PROPOSED ACCESS FOR ALL MODES.....	12
5.0	CHANGES TO SURROUNDING TRANSPORT NETWORKS .....	13
6.0	INTEGRATION WITH SURROUNDING AREA .....	14
7.0	TRAFFIC ASSESSMENT .....	15
7.1	ASSESSMENT YEARS AND TIME PERIODS .....	15
7.2	DEVELOPMENT GENERATION AND DISTRIBUTION .....	15
7.2.1	<i>PROPOSED DEVELOPMENT TRAFFIC GENERATION.....</i>	<i>15</i>
7.3	TRAFFIC FLOWS.....	18
7.4	ANALYSIS OF INTERSECTIONS AND DEVELOPMENT ACCESSES.....	21
7.5	NETWORK OPERATION .....	22
7.6	IMPACT ON SURROUNDING ROADS.....	24
7.7	IMPACT ON NEIGHBOURING AREAS .....	25
7.8	TRAFFIC NOISE AND VIBRATION.....	25
8.0	PARKING .....	26
9.0	PROVISION FOR HEAVY VEHICLES .....	27
10.0	CONCLUSIONS.....	28

APPENDIX A: ENDORSED DETAILED PLAN

APPENDIX B: PROPOSED ORIGINAL SITE PLAN

APPENDIX C: DEVELOPMENT SITE PLAN

APPENDIX D: INTERSECTION ANALYSIS

APPENDIX E: TURN PATH ANALYSIS

# REPORT FIGURES

---

Figure 1: location of the subject site.....	3
Figure 2: Existing road hierarchy.....	4
Figure 3: Wanneroo Road Looking South, at the Intersection of Clarkson Avenue (source: Nearmap).....	5
Figure 4: Clarkson Avenue, Looking East (source: Nearmap).....	5
Figure 5: Existing traffic counts on Wanneroo Road.....	6
Figure 6: Existing traffic profile on Wanneroo Road (south of Joondalup Drive) .....	7
Figure 7: Existing traffic counts AM and PM hours .....	7
Figure 8: Restricted Access Vehicle Network.....	8
Figure 9: Examples of permitted prime mover – trailer combinations (Source: MRWA).....	8
Figure 10: Existing Bus Routes .....	9
Figure 11: Bike map.....	10
Figure 12: Transperth Service Development Plan Map .....	11
Figure 13: Regional Road Reservations in the Metropolitan Region Scheme (MRS) .....	13
Figure 14: Passing trade component - AM & PM peak hour traffic for the proposed development ...	17
Figure 15: Additional (non-passing trade) component - AM & PM peak hour traffic for the proposed development.....	17
Figure 16: Total peak hour traffic generated by the proposed development –AM and PM peak hours .....	18
Figure 17: Post-development traffic flows near the subject site –2019 AM and PM peak hours.....	19
Figure 18: Estimated 10-year total post-development traffic flows near the subject site – 2029 AM and PM peak hours .....	20
Figure 19: post development SIDRA Network Model.....	22
Figure 20: 10-year Post-development weekday AM peak hour network analysis – queue storage ratio .....	23
Figure 21: 10-year post-development weekday PM peak hour network analysis – queue storage ratio .....	24

# REPORT TABLES

---

Table 1: Composition of light and heavy vehicles on Wanneroo Road.....	9
Table 2: Crash history for the Wanneroo Road/ Clarkson Avenue intersection .....	11
Table 3: Estimated proposed development traffic generation .....	16

# 1.0 Summary

---

This Transport Impact Assessment (TIA) is prepared by Transcore with respect to the proposed service station and convenience store development to be located on Lot 1 (No. 1351) Wanneroo Road, Tapping, in the City of Wanneroo.

Access and egress to/from the proposed development would be indirectly from Wanneroo Road and the proposed signalised intersection of Wanneroo Road/ Clackson venue/Internal Road.

The development plan proposes a connection to the proposed internal road (the fourth leg of the signalised intersection on Wanneroo Road). This connection is almost opposite the proposed crossover for the development to the north of the internal road which created a 4-way intersection at this location. It is therefore suggested that a mini-roundabout should be implemented at this 4-way intersection to regulate traffic and improve traffic operations and circulation.

The proposed development layout and the mini-roundabout have been assessed with respect to the movements of fuel tankers and service vehicles. Swept path analysis confirms that the proposed entry and egress arrangements and the site layout facilitate safe and efficient vehicle circulation.

The SIDRA Network analysis undertaken as part of the Transport Impact Assessment confirms satisfactory operation of suggested mini-roundabout and the signalised intersection of Internal road/ Wanneroo Road/ Clarkson Avenue for the existing, post-development and 10 years post-development scenarios.

## 2.0 Introduction

---

This Transport Impact Assessment has been prepared by Transcore on behalf of BP Australia with regards to the proposed service station on Lot 1 (No 1351) Wanneroo Road, Tapping, in the City of Wanneroo.

The subject site is currently vacant and is located at the south-west corner of the future four-way signalised intersection of Wanneroo Road/ Clackson Avenue/ Internal Road. This intersection serves the endorsed Detailed Development Plan (DAP) for Drovers Place Central Precinct to the west of Wanneroo Road, which Lot 1 (No. 1351) is part of this precinct. A copy of the endorsed DAP is provided in **Appendix A**.

Access and egress to/from the proposed development would be indirectly from Wanneroo Road and the proposed signalised intersection of Wanneroo Road/ Clackson venue/Internal Road. The development plan allows for a connection to the proposed internal road (the fourth leg of the signalised intersection on Wanneroo Road). This connection will be located almost opposite of the proposed crossover for the development to the north of the internal road creating a 4-way intersection at this location. It is therefore suggested that a mini-roundabout be implemented at this location to improve traffic operation and circulation.

This TIA report will review the trip generation and distribution of the proposed development and will assess the impact of the proposed development traffic on the surrounding roads and in particular the proposed 4-way signalised intersection on Wanneroo Road and the suggested mini-roundabout. For the assessment of the proposed signalised intersection, the estimated traffic from the entire Central Precinct area and also from the previously undertaken TIA for another proposed mixed-used development located at Lots 1 & 132 Wanneroo Road, situated at the north side of the internal road will be considered.

Key issues that will be addressed in this report also include site crossover, access and egress system for fuel tanker and service vehicles movements.

**Figure 1** illustrates the location of the Central Precinct and the subject site



Figure 1: location of the subject site



## 3.0 Existing Situation

### 3.1 Existing Site Use, Access and Parking

Currently the site is vacant and does not generate any traffic. The land to the south of the site is also mainly vacant. There are existing retail and commercial land uses within the northern part of the Central Precinct. On the eastern side of Wanneroo Road, the existing land uses are predominantly residential dwellings.

### 3.2 Surrounding Road Network and Traffic Management on Frontage Roads

The existing road network and its classification in the Main Roads WA *Functional Road Hierarchy* is illustrated in **Figure 2**.

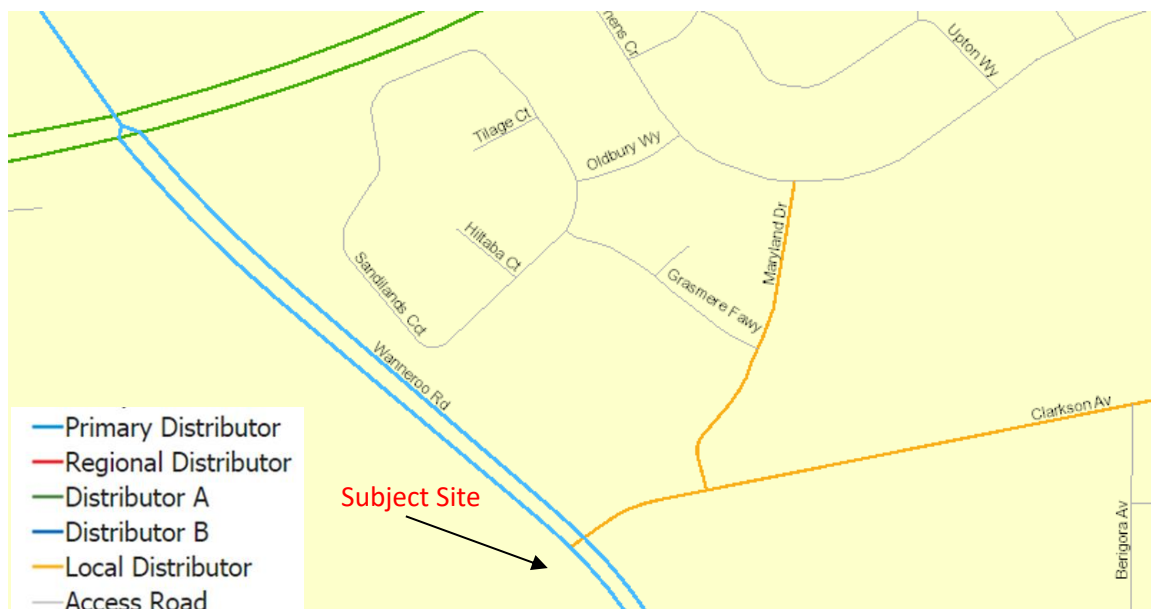


Figure 2: Existing road hierarchy

#### Wanneroo Road

**Wanneroo Road** is a dual divided carriageway with a speed limit of 70km/h in the vicinity of the subject site. It is reserved as a *Primary Regional Road* in the *Metropolitan Region Scheme* and is classified as a *Primary Distributor Road* in the Main Roads WA *Metropolitan Functional Road Hierarchy* document.

**Figure 3** shows Wanneroo Road at its intersection with Clarkson Avenue. The intersection of Clarkson Avenue and Wanneroo Road is an un-signalised T-intersection with left and right turn pockets on Wanneroo Road. Wanneroo Road and Joondalup Drive form a fully-channelized, four-way signalised intersection with turn facilities on all approaches of the intersection.

There is an existing intersection on Wanneroo Road serving the existing retail/commercial complex located at lots 810 and 811. This intersection is located approximately 250m south of Wanneroo Road/Joondalup Drive signalised intersection and operates as left-in/left-out/right-in, with a left-turn slip lane and right-turn pocket on Wanneroo Road.



Figure 3: Wanneroo Road Looking South, at the Intersection of Clarkson Avenue  
(source: Nearmap)

### Clarkson Avenue

Clarkson Avenue is a single undivided carriageway with a shared path along its northern side as shown in **Figure 4**. It is classified as a *Local Distributor* in Main Roads WA *Metropolitan Functional Road Hierarchy* document and operates under the speed limit of 50km/h in the vicinity of the subject site.



Figure 4: Clarkson Avenue, Looking East (source: Nearmap)

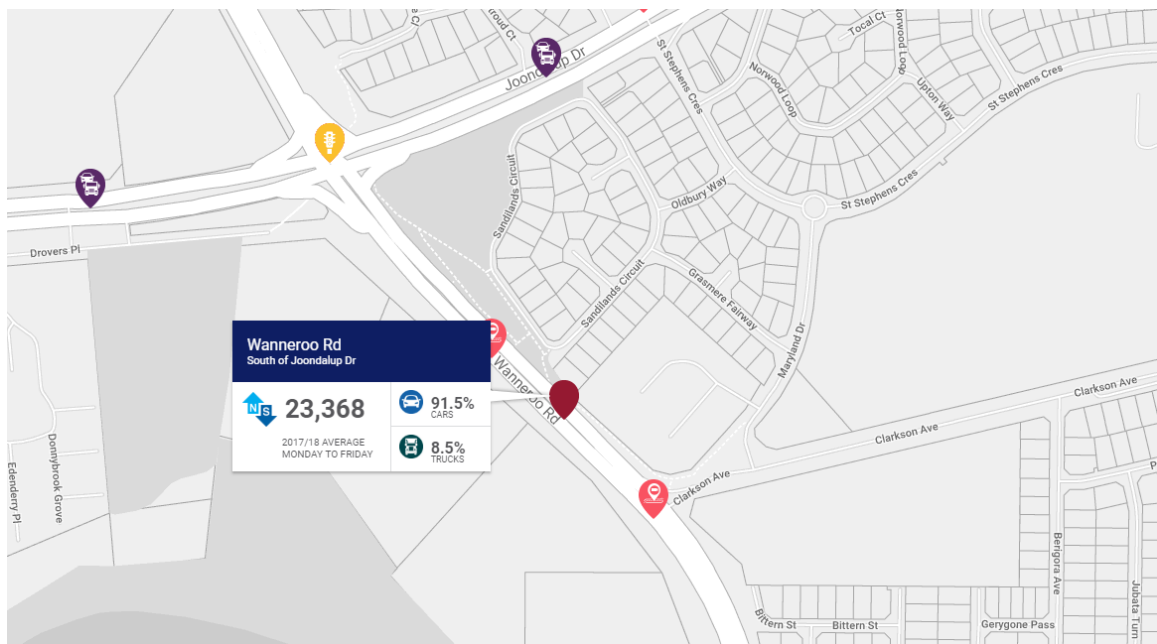
## Dover Place

**Drovers Place** provides access to properties along the northern frontage of the Drovers Place Precinct. It is constructed as a 6m-wide, kerbed single carriageway road and entails cul-de-sacs at both ends. Drovers Place is subject to the 50 km/h speed limit.

### *3.3 Existing Traffic Volumes on Roads and Major Intersections*

## Wanneroo Road

Existing average weekday traffic (AWT) volumes for Wanneroo Road have been obtained from Main Roads WA and are illustrated in **Figure 5**.



**Figure 5: Existing traffic counts on Wanneroo Road**

The latest traffic count information sourced from Main Roads WA indicates that Wanneroo Road (south of Joondalup Drive) carried approximately 23,368 vehicles per day (2017/2018) with 8.5% heavy vehicles.

**Figure 6** shows the existing traffic profile along Wanneroo Road.

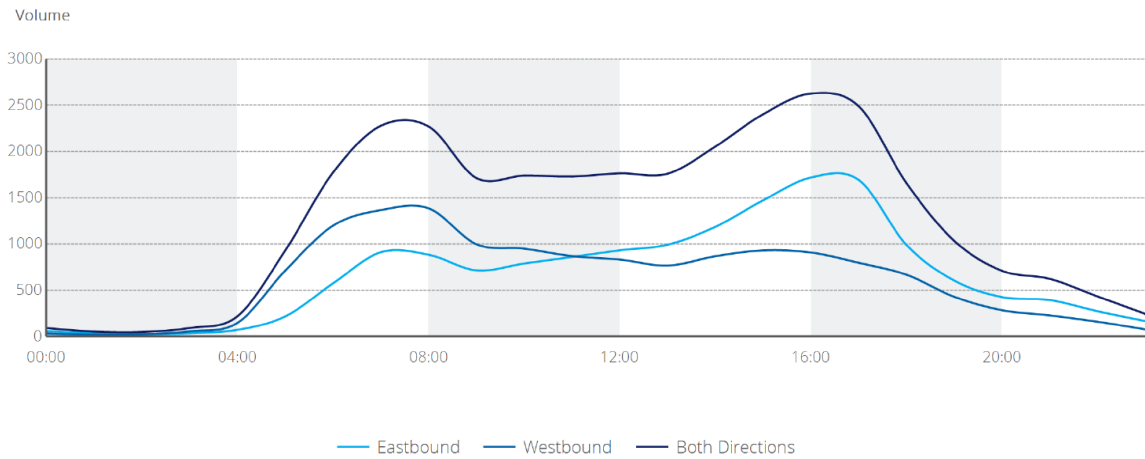


Figure 6: Existing traffic profile on Wanneroo Road (south of Joondalup Drive)

Clarkson Avenue

According to the traffic count information sourced from the City of Wanneroo, Clarkson Avenue (west of Berigora Avenue) carried approximately 3,000 vehicles per weekday (November, 2010). According to the manual traffic counts undertaken by Transcore in February 2019, Clarkson Avenue carried about 203 and 158 vehicles during AM and PM peak hours (refer Figure 7).

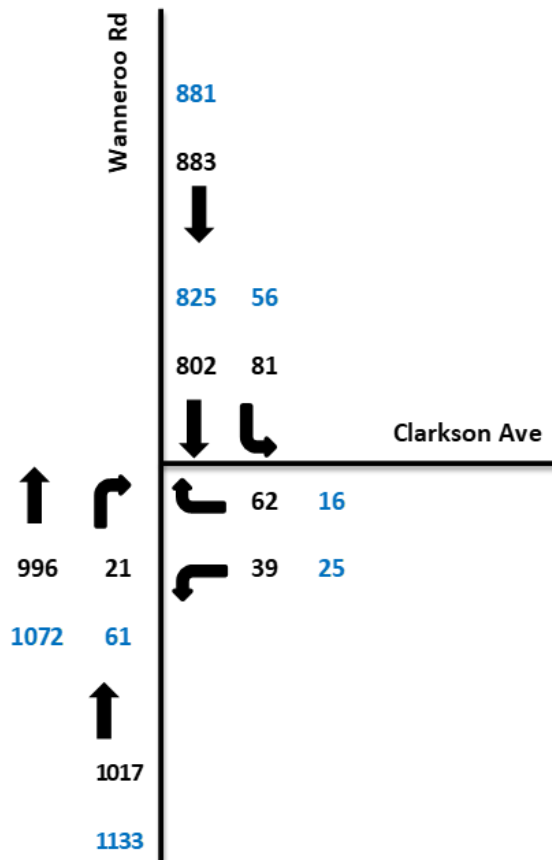


Figure 7: Existing traffic counts AM and PM hours

### 3.4 Heavy Vehicles

Restricted Access Vehicle (RAV) Network routes are designated for access by large heavy vehicle combinations, which is managed by Main Roads WA. Wanneroo Road adjacent to the subject site forms part of RAV Tandem Drive Network 4 as shown in **Figure 8**. The RAV 4 Network classification permits a variety of prime mover and trailer combinations, up to a maximum length of 27.5m as detailed in **Figure 9**.



**Figure 8: Restricted Access Vehicle Network**

Heavy Vehicle Services

VEHICLE DESCRIPTION AND CONFIGURATION CHART		(RAV) – PRIME MOVER, TRAILER COMBINATIONS EXAMPLES		Axle Group Table	Length (m)	Mass (T)	RAV Network
Category 1	(A) PRIME MOVER, SEMI TRAILER TOWING A PIG TRAILER (B) PRIME MOVER TOWING AN OVERHEIGHT SEMI TRAILER	(C) SHORT B-DOUBLE	(D) TWINSTEER PRIME MOVER TOWING SEMI TRAILER	(A)	≤20	50	Network 1
Category 2	(A) PRIME MOVER, SEMI TRAILER TOWING A PIG TRAILER (B) PRIME MOVER TOWING SEMI TRAILER	(C) B-DOUBLE	(D) SHORT B TRIPLE	(B) (C) (D)	≤10 ≤20 ≤19	42.5 50 47.5	Network 2
Category 3	(A) PRIME MOVER, SEMI TRAILER TOWING A DOG TRAILER	(B) SHORT B TRIPLE	(E) CAR CARRIER SEMI TRAILER	(A)	≤27.5	65.5	Network 3
Category 4	(A) PRIME MOVER, SEMI TRAILER TOWING 6 AXLE DOG TRAILER	Example of Axle Groups Example of Axle Group with An Optional Axle		(A)	≤27.5	87.5	Network 4

**Figure 9: Examples of permitted prime mover – trailer combinations (Source: MRWA)**

To establish the classified traffic profile of the Wanneroo Road, existing classified count data for this road was reviewed, which indicates around 8.5% heavy vehicles. The composition of heavy vehicle types is noted in **Table 1**.

Table 1: Composition of light and heavy vehicles on Wanneroo Road

Vehicle Type	Wanneroo Rd (South of Joondalup Dr)	
	NB	SB
Vehicle Type	% Composition	% Composition
Light Vehicles Class 1	90.30%	89.70%
Rigid Truck / Bus Class 2-5	8.20%	8.80%
Semi-trailer Class 6-9	1.10%	1.20%
B-doubles Class 10	0.10%	0.10%
Double road train Class 11	0.30%	0.20%
<b>Total</b>	<b>100%</b>	<b>100%</b>

### 3.5 Public Transport Access

The closest existing bus route to the development area is Bus Route No. 468 from Whitfords Station to Joondalup Station (refer **Figure 10**). The closest bus stops are on Wanneroo Road in close proximity of the proposed development.



Figure 10: Existing Bus Routes

### 3.6 Pedestrian and Cyclist Facilities

Currently a concrete shared path exists along Wanneroo Road fronting the subject site. This shared path continues north and connects with Drovers Place and the signalised intersection of Wanneroo Road/Joondalup Drive.

The Department of Transport's Perth Bike Map series (refer **Figure 11**) shows that Wanneroo Road also has a shared path on the eastern side which connects to the existing shared path on Clarkson Avenue and on the western side which connects the cul de sac of Drovers Place.

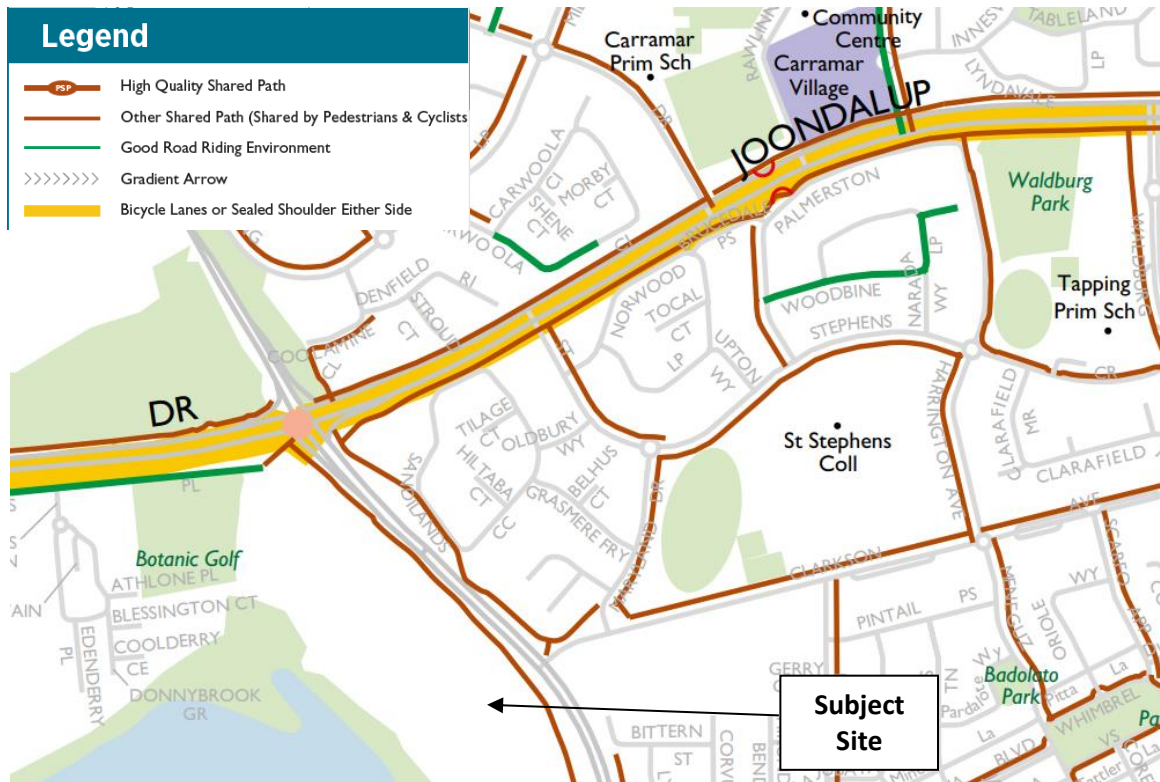


Figure 11: Bike map

### 3.7 Public Transport Network Planning

The Department of Transport plan, Public Transport for ultimate network for city of 3.5 million population, envisages a combination of a future light rail and bus rapid transit route from Perth to Joondalup providing a cross-suburban link between these two areas. However, this is a long-term plan beyond 2031 (refer **Figure 12**).



Figure 12: Transperth Service Development Plan Map

### 3.8 Crash Data

Main Roads WA Intersection *Crash Ranking Report* provides detailed crash data for the Wanneroo Road/ Clarkson Avenue intersection over the 5-year period ending 31 December 2017. Crash report information for this intersection is presented in **Table 2**. The crash history data for the intersection indicates that the majority of the accidents were rear end accidents which happened during the day. No pedestrian was involved in the accidents. Upgrading the existing intersection to a signalised intersection would improve traffic operation and safety of the intersection.

Table 2: Crash history for the Wanneroo Road/ Clarkson Avenue intersection

Intersection				Total Crashes	Casualty
Wanneroo Road/ Clarkson Avenue				7	1
Right Angle	Rear End	Other	Pedestrian	Wet	Night
1	4	2	N	0	1



## 4.0 Development Proposal

---

### 4.1 Proposed Site Use

The proposed development is for a service station with convenience store comprising:

- ✚ Light vehicle canopy with 8 fuelling positions (4 bowsers) for light vehicles;
- ✚ 17 car parking bays including 1 ACROD bay;
- ✚ One Delivery bay; and,
- ✚ One Air & Water bay.

The layout of the proposed development is shown in the site plan included in Appendix C.

### 4.2 Proposed Access for all Modes

Access and egress to/from the proposed development will be indirectly from Wanneroo Road and the proposed signalised intersection of Wanneroo Road/Clackson venue.

The development plan allows for a connection to the proposed internal road (the fourth leg of the signalised intersection on Wanneroo Road) which is located almost opposite of the proposed crossover for the development to the north of the internal road. This situation creates a four-way intersection.

It is therefore suggested that a mini-roundabout with mountable centre dome be implemented at this 4-way intersection to improve traffic operation and circulation and to facilitate tanker movements.

The proposed service station and convenience store layout is designed to reduce the traffic conflict, traffic congestion and potential queues on the proposed mini-roundabout.

The pedestrian and cyclist movements are accommodated by the existing concrete shared path along Wanneroo Road fronting the subject site and the proposed shared path to the north side of the proposed internal road.

## 5.0 Changes to Surrounding Transport Networks

Proposed changes to the surrounding road network includes a signalised intersection at Wanneroo Road and Clarkson Avenue T-intersection converting this intersection to four-way with the western leg of the intersection providing a connection to the Central Precinct.

Structure Plan 80 (SP80) also proposes a signalised intersection for the connection from Drovers Place to Joondalup Drive within Drovers Place Western Precinct.

The intersection of Wanneroo Road and Joondalup Drive is planned to be grade separated and the project is currently undergoing detailed design. The four-way signalised intersection of Wanneroo Road/Clarkson Avenue/Internal Road is proposed to be implemented as part of the proposed interchange. It is Transcore's understanding that these projects will be implemented within the next couple of years.

The land affected by the future interchange is shown by the red Primary Regional Road reservation in the Metropolitan Region Scheme (MRS) map, in **Figure 13**.

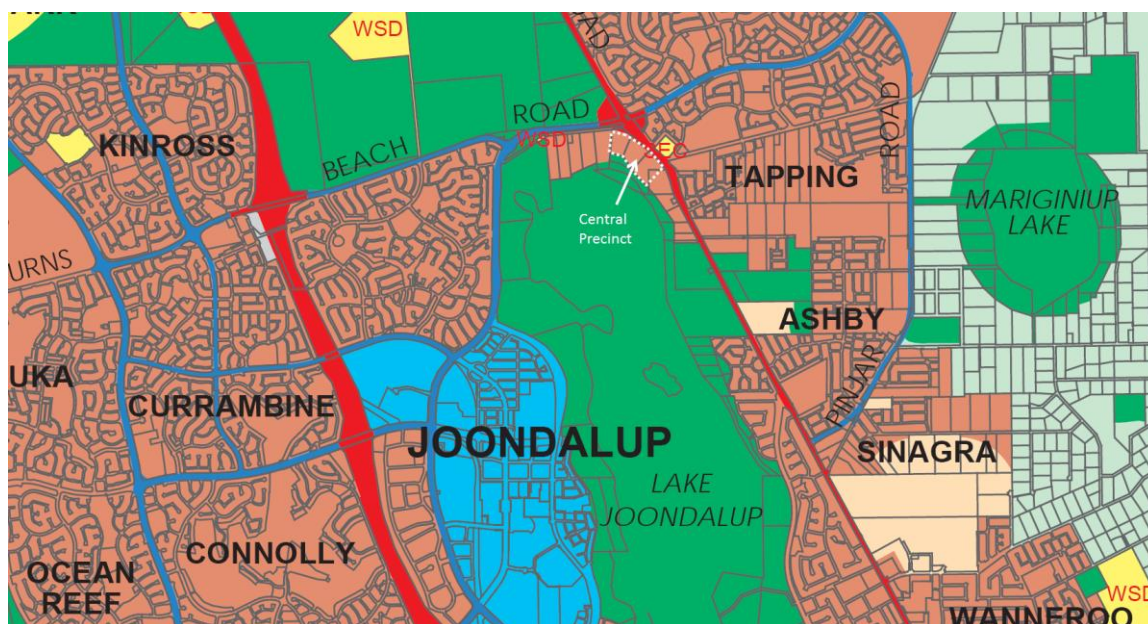


Figure 13: Regional Road Reservations in the Metropolitan Region Scheme (MRS)

## 6.0 Integration with Surrounding Area

---

The proposed development land use is in line with existing and planned land uses in the locality. The proposed development promotes internal connectivity with other planned uses in the Central Precinct area. Dover Place will connect with existing internal road and the proposed mini-roundabout intersection via the proposed development to the north of the internal road to promote permeability and improve accessibility.

## 7.0 Traffic Assessment

---

### 7.1 Assessment Years and Time Periods

The assessment years that have been adopted for this analysis are immediately post-development (2019) and 2029 for the 10-year post development scenarios.

### 7.2 Development Generation and Distribution

#### 7.2.1 Proposed Development Traffic Generation

The traffic volume that would be generated by the proposed development has been estimated using trip generation rates derived from:

- ✚ ITE Trip Generation Manual 10<sup>th</sup> Edition

The trip rates which were used to estimate the proposed development traffic generation are as following:

#### Gasoline/Service Station with Convenience Market (945) – Regular Fuelling Points

- ✚ AM Peak hour: 12.47 trips per fuelling point.
- ✚ PM Peak hour: 13.99 trips per fuelling point.
- ✚ Weekday: 206 trips per fuelling point.

As detailed in **Table 3**, it is estimated that the proposed development would generate approximately 1,314 trips per day (both inbound and outbound) with approximately 100 and 90 trips during AM and PM peak hours respectively.

For this development conservatively 60% passing trade is assumed. Therefore, the net addition of traffic when accounting for passing trade is **+525vpd (daily)**, **+40vph (AM peak hour)** and **+36vph (PM peak hour)** on the surrounding road.

The directional split of inbound and outbound trips for the proposed development is estimated to be about 50/50 for inbound/outbound trips during the peak hours.

Two traffic distributions have been modelled for the weekday AM and PM peak hours:

- ✚ Passing trade traffic as detailed in **Figure 14**.
- ✚ Non-passing trade (primary trips) traffic as detailed in **Figure 15**.

The total proposed development traffic is detailed in **Figure 16**. The development traffic distribution modelled in this report has been established by considering the catchment area of the proposed development, existing traffic patterns and the traffic routes.

Table 3: Estimated proposed development traffic generation

Land use	Quantity	Daily Rate	AM Peak	PM Peak	Cross Trade	Daily Trips	AM Trips	PM Trips	AM		PM	
									IN	OUT	IN	OUT
Service Station + Convenience Store	8	205.36	12.47	13.99	0.20	1314	100	90	50	50	45	45
<b>TOTAL TRAFFIC</b>						<b>1314</b>	<b>100</b>	<b>90</b>	<b>50</b>	<b>50</b>	<b>45</b>	<b>45</b>

Passing Trade Component

Daily Trips	AM		PM	
	IN	OUT	IN	OUT
789	30	30	27	27
<b>789</b>	<b>30</b>	<b>30</b>	<b>27</b>	<b>27</b>

Non Passing Trade Component

Daily Trips	AM		PM	
	IN	OUT	IN	OUT
525	20	20	18	18
<b>525</b>	<b>20</b>	<b>20</b>	<b>18</b>	<b>18</b>

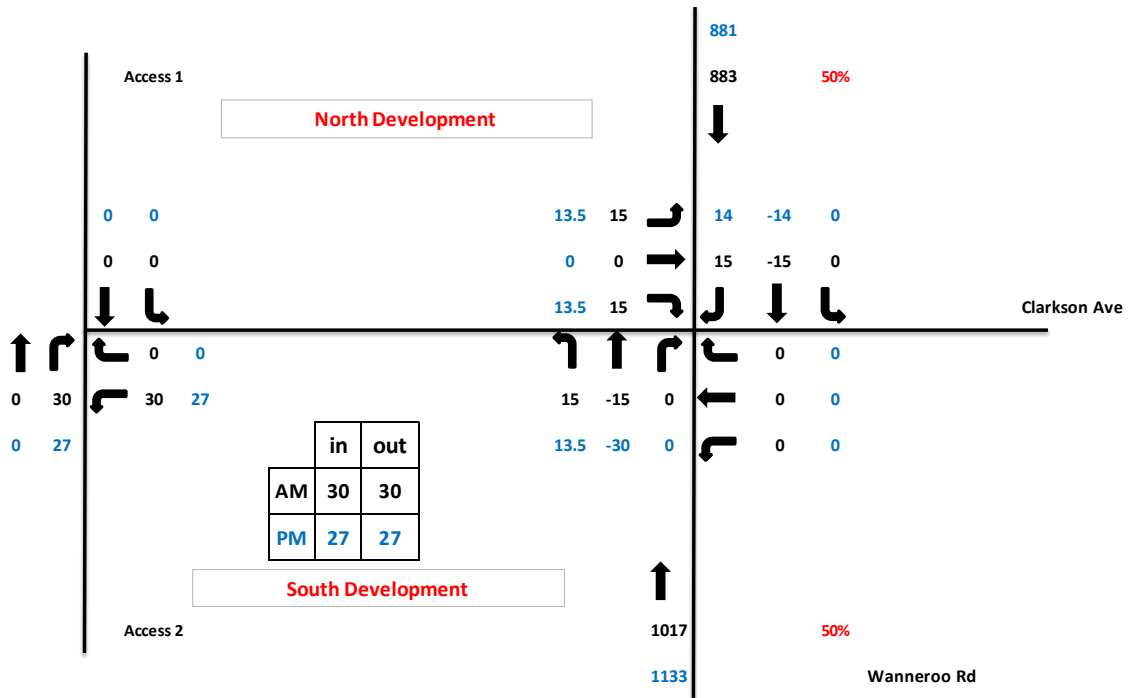


Figure 14: Passing trade component - AM & PM peak hour traffic for the proposed development

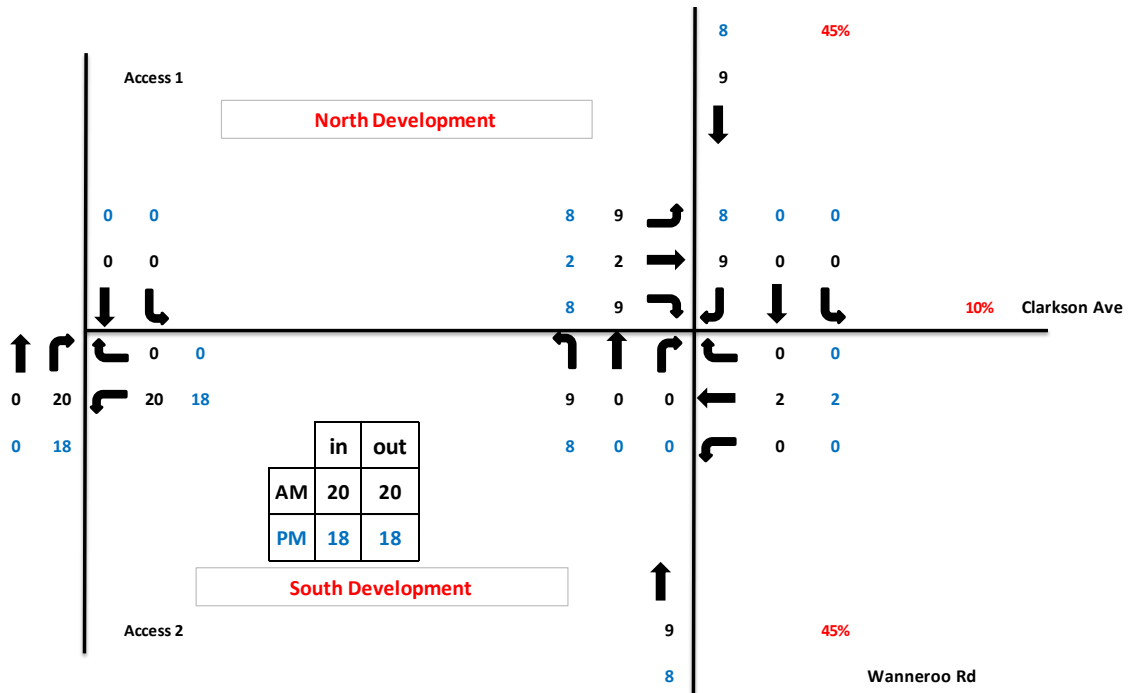


Figure 15: Additional (non-passing trade) component - AM & PM peak hour traffic for the proposed development

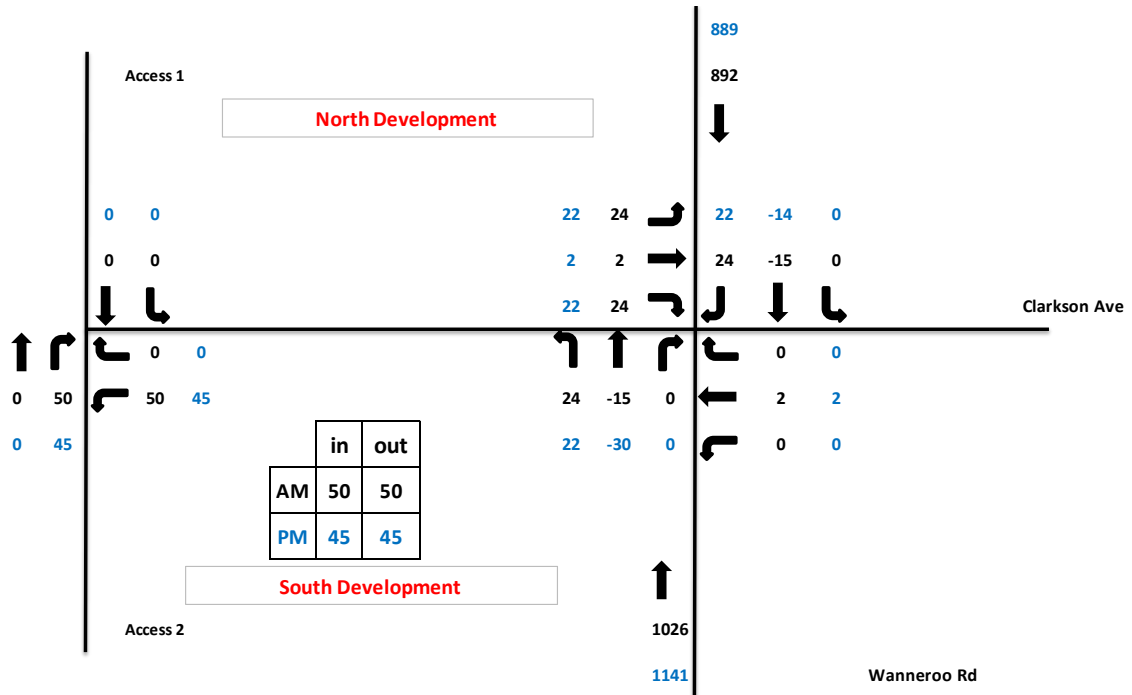


Figure 16: Total peak hour traffic generated by the proposed development –AM and PM peak hours

### 7.3 Traffic Flows

The existing traffic counts for Clarkson Avenue was established by manual traffic counts undertaken by Transcore in February 2019 (refer Figure 7). The total post development traffic for the assessment year of 2019 is detailed in Figure 17. This figure includes the traffic from the development on the northern side of the internal road to represent a robust assessment.

To approximate the 10-year post development traffic, a conservative traffic growth of 20% was applied to background traffic through the intersection of Wanneroo Road and Clarkson Avenue.

The total ten-year post-development traffic volumes are presented in Figure 18.

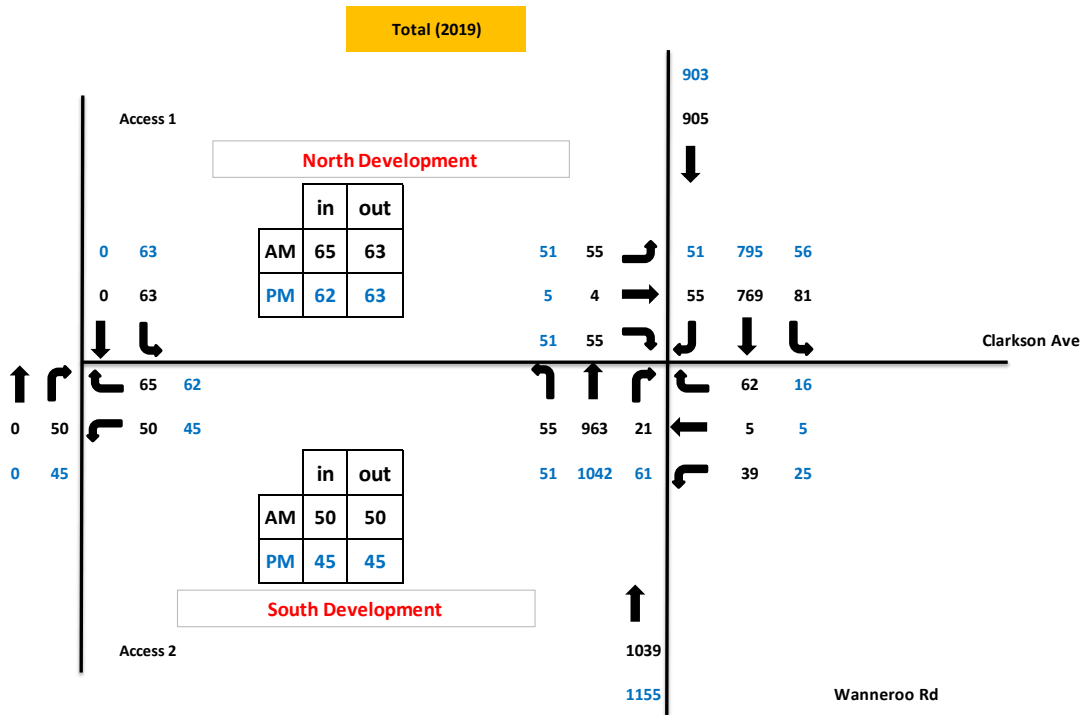


Figure 17: Post-development traffic flows near the subject site –2019 AM and PM peak hours



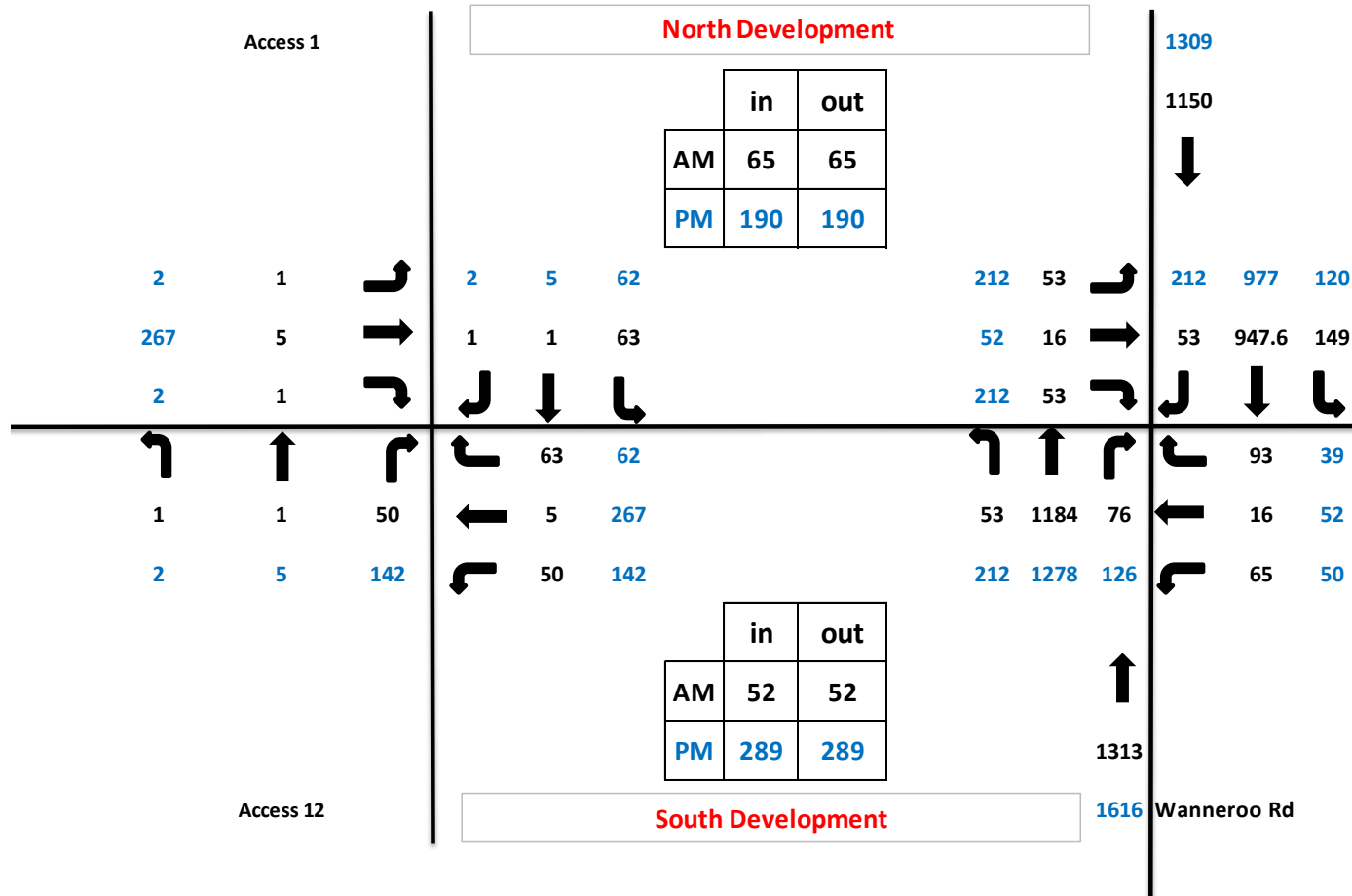


Figure 18: Estimated 10-year total post-development traffic flows near the subject site – 2029 AM and PM peak hours

## ***7.4 Analysis of Intersections and Development Accesses***

The operation of the four-way intersection of Wanneroo Road/ Clackson Avenue/internal road and the site crossover off the proposed mini-roundabout has been analysed for the post-development and 10-year post development scenarios for the weekday AM and PM peak hours.

Capacity analysis was undertaken using the SIDRA Network computer software package. SIDRA is an intersection modelling tool commonly used by traffic engineers for all types of intersections. SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics are defined as follows:

- **Degree of Saturation (DoS):** is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity.
- **Level of Service (LoS):** is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- **Average Delay:** is the average of all travel time delays for vehicles through the intersection.
- **95% Queue:** is the queue length below which 95% of all observed queue lengths fall.

The results of the SIDRA analysis are detailed in **Appendix D** and briefly explained in this section of the report.

A Network SIDRA model was prepared to assess the proposed development crossovers. A conceptual diagram of the SIDRA model developed for analysis is shown in **Figure 19**.

The SIDRA intersection model was coded with reference to the *Main Roads Operation Modelling Guidelines Version No. 1.1*. All relevant parameters such as heavy vehicle groups, PCU factors etc. were coded as per Main Roads Guidelines.

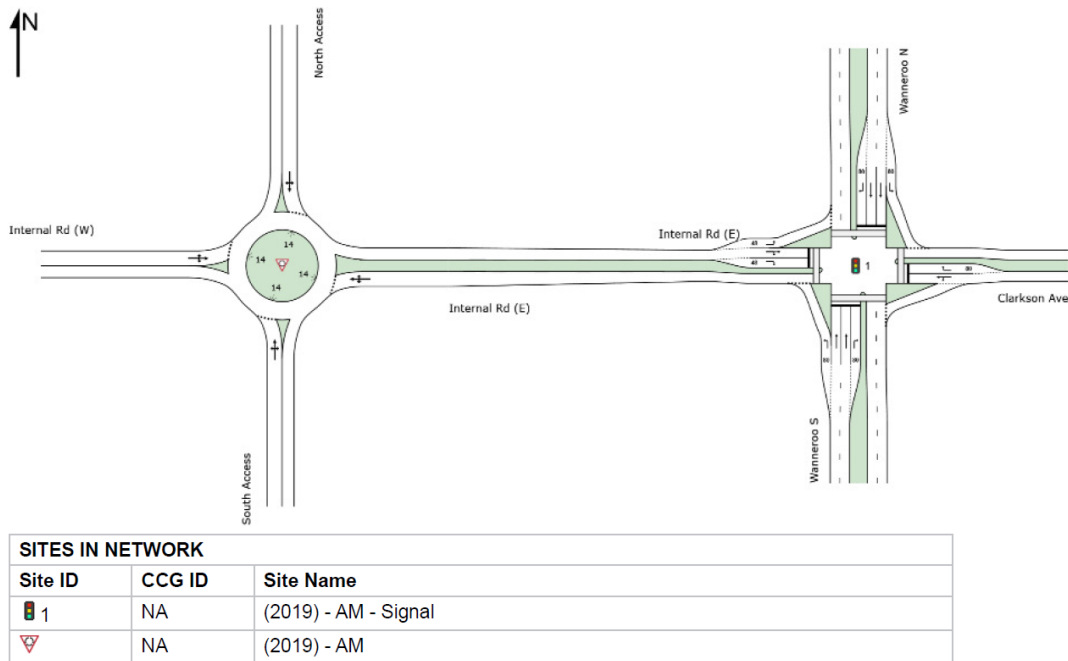


Figure 19: post development SIDRA Network Model

### Wanneroo Road traffic lights

SIDRA analysis indicates that this intersection will operate satisfactorily with overall level of service C during the post development (2019) AM and PM scenarios. The 95% queue back at the traffic lights on the internal road is approximately 15m for both AM and PM peak hours and would not block the internal crossover.

The 10-year post development analysis reported overall level of D and E for AM and PM peak hours respectively. Increased delays and queues are anticipated for the through traffic on Wanneroo Road. However, the anticipated delays will not result in excessive queuing and are within the range of what can reasonably be expected during the peak hours in 10 years time. The reported 95% internal queue on the internal road is about 18m and 80m during AM and PM peak hours respectively.

### Internal mini-roundabout

SIDRA analysis indicates that the internal roundabout will operate satisfactorily in the post development and 10 year after post development scenarios during both the AM and PM peak hours. All movements operate well with minimal delays and queuing.

## *7.5 Network Operation*

Relevant SIDRA network outputs were reviewed for both AM and PM peak hours to assess the operation of the proposed internal mini-roundabout and the signalised intersection at Wanneroo Road.

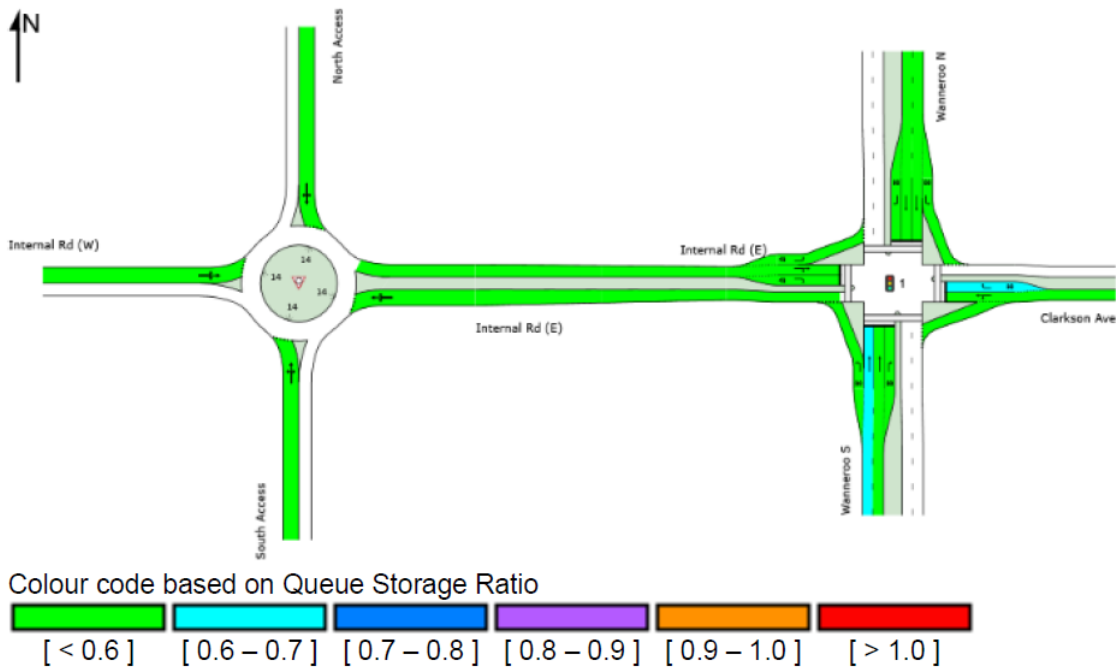
As detailed in **Figure 20** and **Figure 21**, no queuing back from the proposed traffic lights to the internal roundabout is anticipated during the 2029 AM peak hour. During the 2029 PM peak hour 95% queue back would extend to the internal roundabout however due to the relatively low level of turn movements at this mini-roundabout, no internal queues (back to the shared access easement) are expected. The reported 80m queue back on the internal road is occurring occasionally and on average the reported queue is about 40m which would not pass the mini-roundabout. The reported good level of service for all movements at the mini-roundabout confirms satisfactory traffic operations during the 2029 AM and PM peak hours.

**95% Back of Queue Distance per lane (metres)**

**Network: N101 [Ultimate - 2029 - AM]**

New Network

Network Category: (None)



**Figure 20: 10-year Post-development weekday AM peak hour network analysis – queue storage ratio**

# QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Network: N101 [Ultimate - 2029 - PM]

New Network

Network Category: (None)

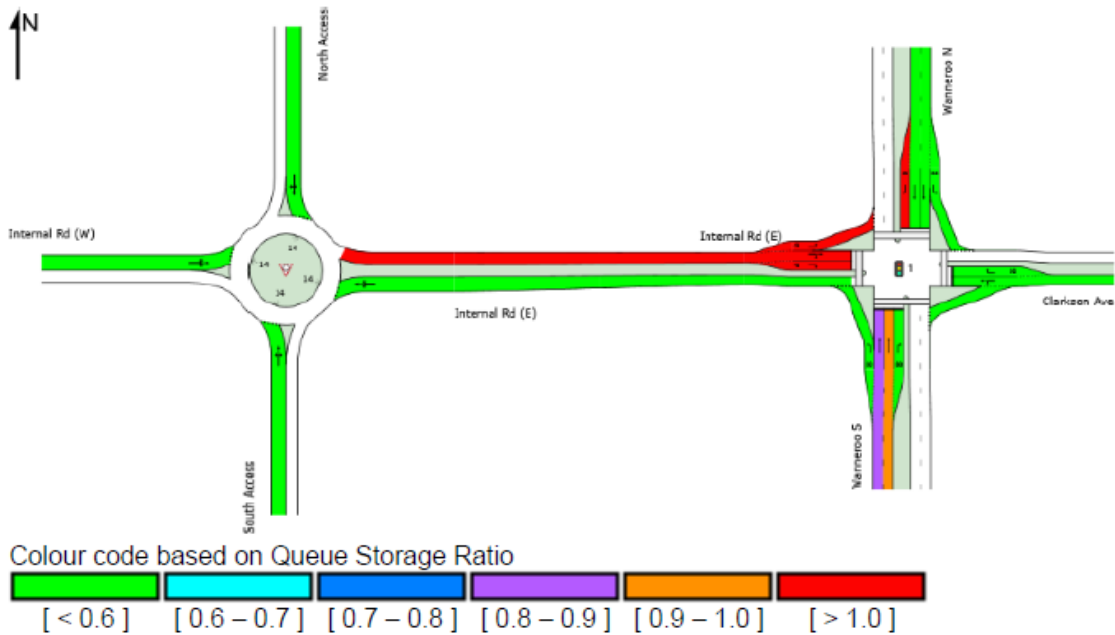


Figure 21: 10-year post-development weekday PM peak hour network analysis – queue storage ratio

## 7.6 Impact on Surrounding Roads

The WAPC Transport Impact Assessment Guidelines (2016) provides guidance on the assessment of traffic impacts:

*“As a general guide, an increase in traffic of less than 10 per cent of capacity would not normally be likely to have a material impact on any particular section of road, but increases over 10 per cent may. All sections of road with an increase greater than 10 per cent of capacity should therefore be included in the analysis. For ease of assessment, an increase of 100 vehicles per hour for any lane can be considered as equating to around 10 per cent of capacity. Therefore, any section of road where the structure plan traffic would increase flows by more than 100 vehicles per hour for any lane should be included in the analysis.”*

The proposed development will not increase traffic flows anywhere near the quoted WAPC threshold to warrant further detailed analysis. Accordingly, the impact on the surrounding road network will be insignificant.

### ***7.7 Impact on Neighbouring Areas***

The traffic generated by the proposed development is not expected to significantly affect surrounding areas and the road network has been designed to accommodate this type of development traffic.

### ***7.8 Traffic Noise and Vibration***

It generally requires a doubling of traffic volumes on a road to produce a perceptible 3dB (A) increase in road noise. The proposed development will not increase traffic volumes on surrounding roads anywhere near this level.

## 8.0 Parking

---

The proposed development will provide 18 car parking spaces including 1 ACROD bay and 1 Air & Water bay plus at least 8 stacking space under canopy.

It is therefore considered that the proposed parking provision is sufficient to accommodate the needs of the proposed development.

## 9.0 Provision for Heavy Vehicles

---

The fuel delivery trucks are expected to enter and exit the proposed service station from the signalised intersection on Wanneroo Road and the proposed mini-roundabout on the internal road. The proposed mountable dome of the mini-roundabout is designed to accommodate the 19.0m fuel tankers.

Turn path analysis was undertaken to ensure satisfactory operation of the fuel tankers entering and exiting the service station. **Appendix E** shows the turn path analysis undertaken for the 19.0m fuel tanker which indicates satisfactory movements.



## 10.0 Conclusions

---

This Transport Impact Assessment has been prepared by Transcore on behalf of BP Australia Pty Ltd with regards to the proposed service station and convenience store development on Lot 1 (No.1351) Wanneroo Road, Tapping, in the City of Wanneroo.

The endorsed Detailed Area Plan (DAP) for Drovers Place Central Precinct contemplated installation of traffic signals at the intersection of Wanneroo Road and Clarkson Avenue converting this existing T-intersection to four-way intersection with the western leg of the intersection providing a connection to the Central Precinct. The installation of this traffic signal is supported by Main Roads WA and is expected to be implemented as part of the Wanneroo Road/Joondalup Drive interchange project.

Access and egress to/from the proposed development will be indirectly from Wanneroo Road and the proposed signalised intersection of Wanneroo Road/Clarkson Avenue/Internal Road. The development plan allows for a connection to the proposed internal road (the fourth leg of the signalised intersection on Wanneroo Road) which will be located almost opposite of the proposed crossover for the development to the north of the internal road. This situation creates a 4-way intersection.

It is therefore suggested that a mini-roundabout with mountable centre dome be implemented at the proposed 4-way intersection to improve traffic operation and circulation. The proposed mini-roundabout has been designed to accommodate the 19.0m fuel tankers.

Traffic modelling and analysis undertaken demonstrates that the proposed signalised intersection on Wanneroo Road and the proposed mini-roundabout on the internal road would operate satisfactorily.

The proposed service station and convenience store layouts are designed to reduce the traffic conflict, potential queues and avoid the risk of congestion at the mini-roundabout. Turn path analysis undertaken for the 19.0m fuel tanker indicates satisfactory movements in and out of the proposed station.

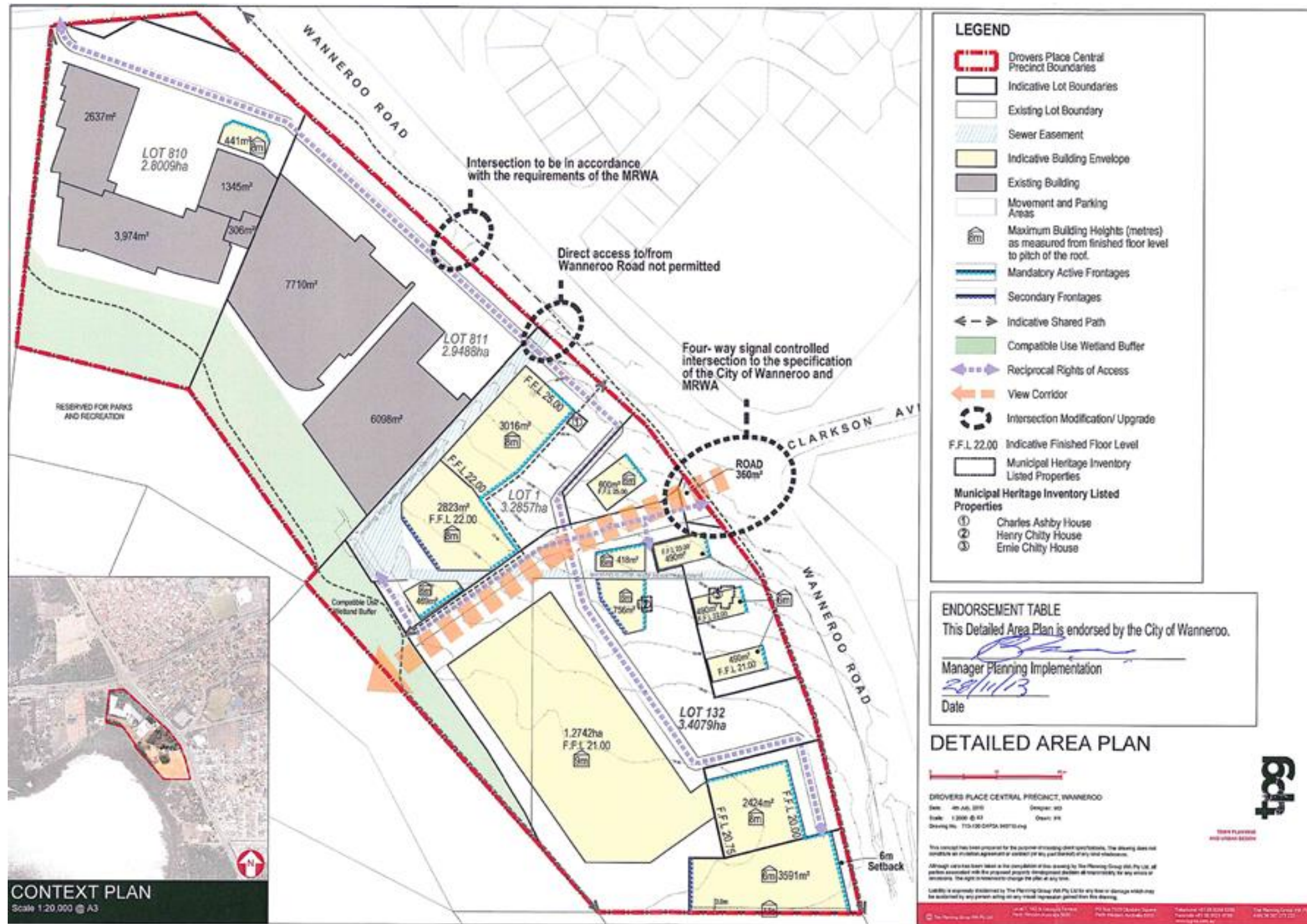
The proposed car parking is considered to satisfactorily meet the needs of the proposed development.

In conclusion, the findings of this Transport Impact Assessment are supportive of the proposed development.

# Appendix A

---

## ENDORSE DETAIL AREA PLAN



**LEGEND**

- Drovers Place Central Precinct Boundaries
- Indicative Lot Boundaries
- Existing Lot Boundary
- Sewer Easement
- Indicative Building Envelope
- Existing Building
- Movement and Parking Areas
- Maximum Building Heights (metres) as measured from finished floor level to pitch of the roof.
- Mandatory Active Frontages
- Secondary Frontages
- Indicative Shared Path
- Compatible Use Wetland Buffer
- Reciprocal Rights of Access
- View Corridor
- Intersection Modification/ Upgrade
- F.F.L. 22.00 Indicative Finished Floor Level
- Municipal Heritage Inventory Listed Properties

**Municipal Heritage Inventory Listed Properties**

- ① Charles Ashby House
- ② Henry Chilly House
- ③ Ernie Chilly House

**ENDORSEMENT TABLE**  
 This Detailed Area Plan is endorsed by the City of Wanneroo.

*[Signature]*  
 Manager Planning Implementation  
 28/11/13  
 Date

**DETAILED AREA PLAN**

**DROVERS PLACE CENTRAL PRECINCT, WANNEROO**  
 Date: 28 Aug 2013 Designer: JG  
 Scale: 1:2000 @ A3 Drawn: JG  
 Drawing No: 715-120-CAPSA-MS13-01-01

**tpg**  
 Town Planning Group  
 115-120-CAPSA-MS13-01-01

This concept plan has been prepared for the customer in response to their requirements. The drawing does not constitute an intention agreement or contract of any kind between the parties.  
 Although care has been taken in the preparation of this drawing by the Planning Group tpg Pty Ltd, all parties associated with the proposed project development shall be responsible for any errors or omissions. The sign is intended to be used as a guide only.  
 Liability is accepted by the Planning Group tpg Pty Ltd in all cases where damage or loss may be sustained by any person acting on any visual representation prepared from this drawing.

# Appendix B

---

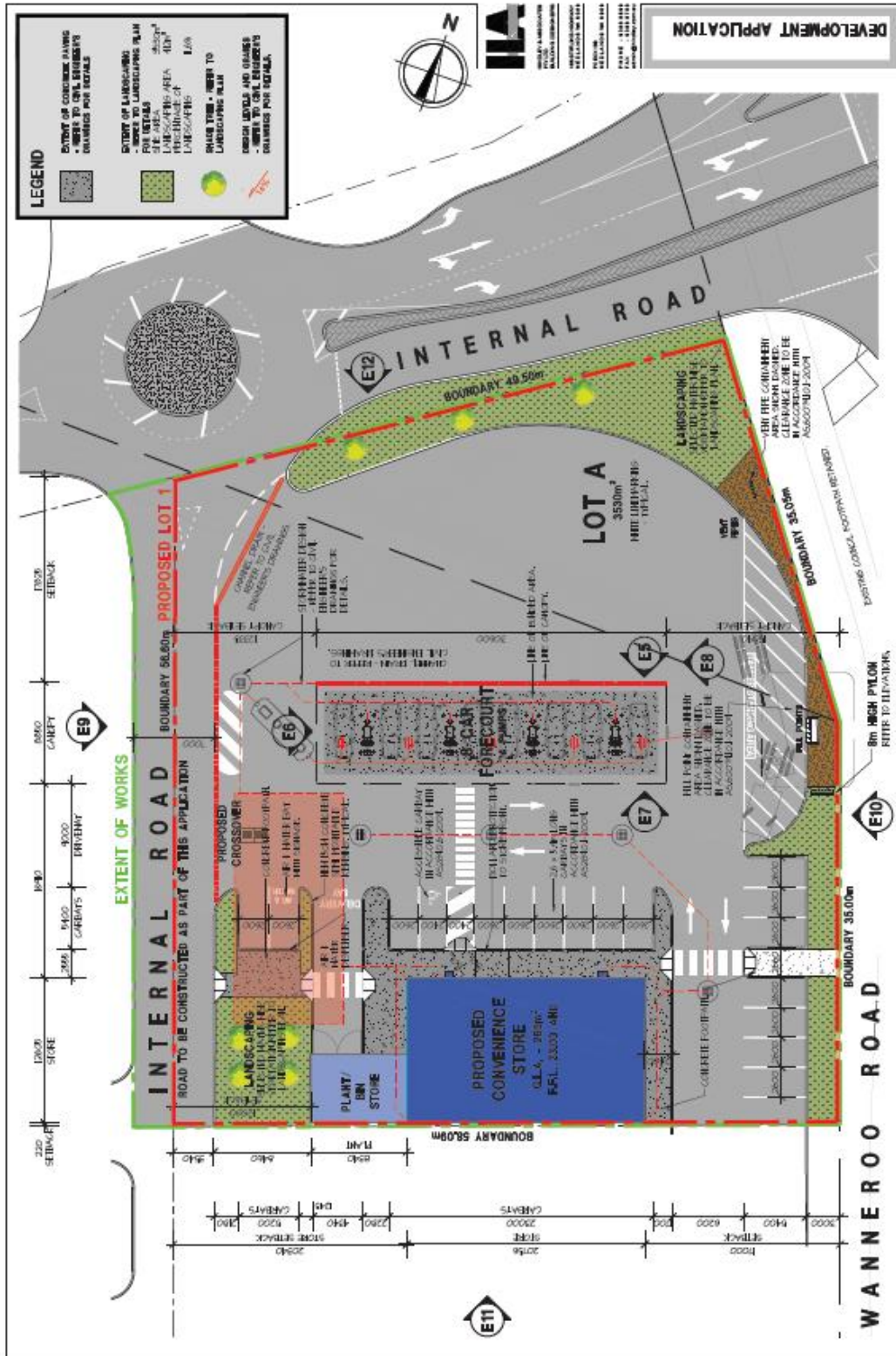
## PROPOSED ORIGINAL SITE PLAN



# Appendix C

---

## DEVELOPMENT SITE PLAN



**LEGEND**

- EXTENT OF CONCRETE FINISHING** - REFER TO CIVIL ENGINEER'S DRAWINGS FOR DETAILS
- EXTENT OF LANDSCAPING** - REFER TO LANDSCAPING PLAN FOR DETAILS
- LANDSCAPING AREA** - 40m<sup>2</sup> MINIMUM
- LANDSCAPING** - 1:50
- PAVE TYPE** - REFER TO LANDSCAPING PLAN
- DESIGN LEVELS AND GRADERS** - REFER TO CIVIL ENGINEER'S DRAWINGS FOR DETAILS

**DEVELOPMENT APPLICATION**

PROJECT NO: DA004  
 DATE: 10/11/2023  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]  
 APPROVED BY: [Name]

**PROPOSED CONVENIENCE STORE**  
**LOT 1, No. 1351 WANNERO ROAD**  
**TAPPING**  
**BP AUSTRALIA Pty Ltd**

**ISSUED FOR DEVELOPMENT APPROVAL**

NO.	DATE	BY	REVISION

**PROPOSED SITE PLAN**  
**SCALE 1:300**

**AS 3**

PROJECT NO: DA004  
 DATE: 10/11/2023  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]  
 APPROVED BY: [Name]

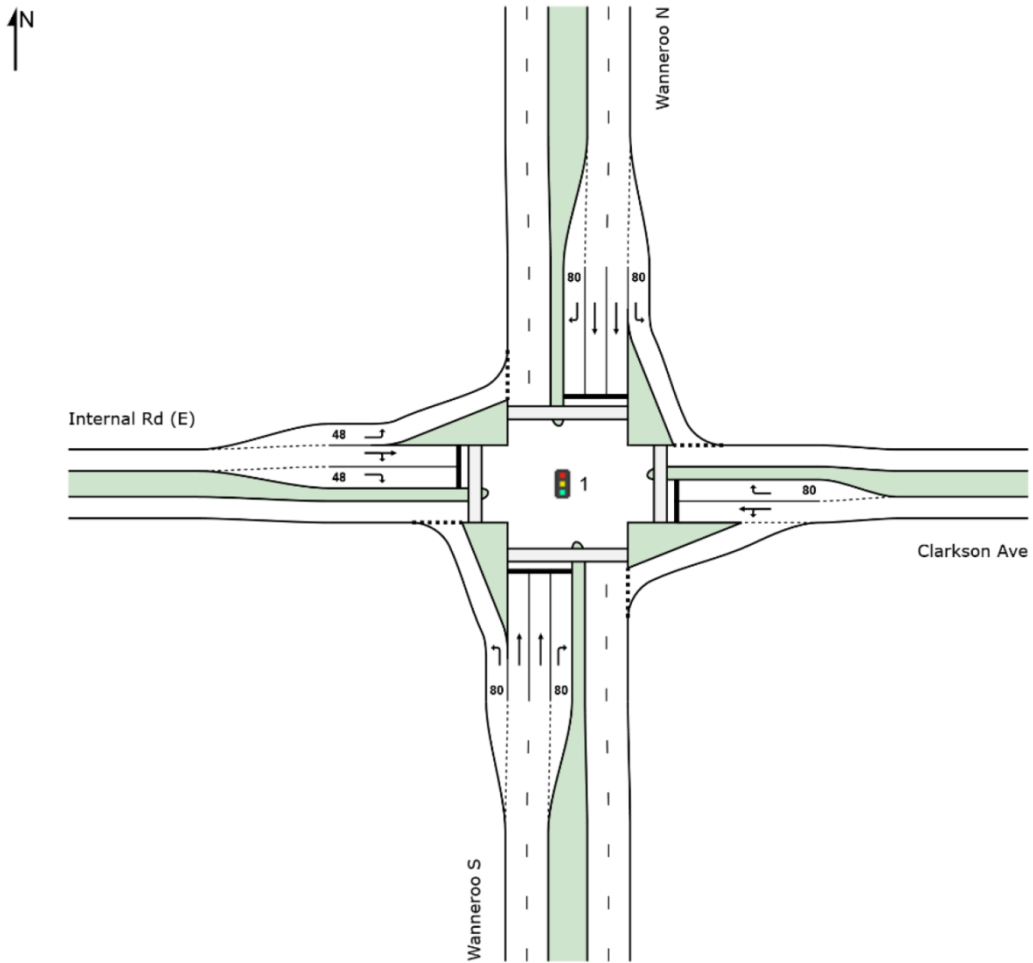
# Appendix D

---

## SIDRA OUTPUTS



# SIDRA model layout



# MOVEMENT SUMMARY

Site: 1 [(2019) - AM - Signal]

Network: N101 [(2019) - AM]

Wanneroo Rd/ Clarkson Ave

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %				Vehicles	Distance				
South: Wanneroo S														
1	L2	55	3.9	55	3.9	0.047	12.1	LOS B	1.0	7.8	0.33	0.65	0.33	48.3
2	T1	966	9.7	966	9.7	0.799	31.9	LOS C	24.9	205.8	0.95	0.86	0.99	43.5
3	R2	72	4.1	72	4.1	0.275	36.5	LOS D	2.4	18.6	0.92	0.75	0.92	38.5
Approach		1093	9.1	1093	9.1	0.799	31.2	LOS C	24.9	205.8	0.92	0.84	0.95	43.2
East: Clarkson Ave														
4	L2	57	4.1	57	4.1	0.068	12.0	LOS B	1.1	8.4	0.44	0.61	0.44	51.6
5	T1	10	6.1	10	6.1	0.068	6.3	LOS A	1.1	8.4	0.44	0.61	0.44	44.3
6	R2	80	3.9	80	3.9	0.304	63.5	LOS E	4.9	38.3	0.93	0.77	0.93	29.6
Approach		147	4.1	147	4.1	0.304	39.6	LOS D	4.9	38.3	0.71	0.70	0.71	36.3
North: Wanneroo N														
7	L2	132	4.3	132	4.3	0.090	6.8	LOS A	0.2	1.2	0.03	0.59	0.03	56.9
8	T1	772	10.3	772	10.3	0.709	40.9	LOS D	20.9	172.9	0.85	0.74	0.85	39.3
9	R2	55	4.1	55	4.1	0.367	44.2	LOS D	2.4	18.5	0.96	0.74	0.96	26.3
Approach		959	9.1	959	9.1	0.709	36.4	LOS D	20.9	172.9	0.74	0.72	0.74	40.5
West: Internal Rd (E)														
10	L2	55	4.1	55	4.1	0.061	12.9	LOS B	1.3	9.9	0.41	0.64	0.41	44.9
11	T1	9	3.7	9	3.7	0.121	55.8	LOS E	1.9	14.9	0.90	0.71	0.90	22.3
12	R2	55	3.8	55	3.8	0.121	60.2	LOS E	1.9	14.9	0.90	0.72	0.90	22.3
Approach		119	3.9	119	3.9	0.121	38.0	LOS D	1.9	14.9	0.67	0.68	0.67	29.1
All Vehicles		2318	8.5	2318	8.5	0.799	34.2	LOS C	24.9	205.8	0.82	0.77	0.83	40.9

# MOVEMENT SUMMARY

Site: 1 [(2019) - PM - Signal]

Network: N101 [(2019) - PM]

Wanneroo Rd/ Clarkson Ave

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 145 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %				Vehicles	Distance				
South: Wanneroo S														
1	L2	51	3.9	51	3.9	0.042	11.6	LOS B	0.9	7.0	0.31	0.65	0.31	48.9
2	T1	1043	9.7	1043	9.7	0.825	33.1	LOS C	28.7	236.8	0.95	0.88	1.00	42.9
3	R2	112	4.1	112	4.1	0.444	38.9	LOS D	3.9	30.1	0.96	0.78	0.96	37.6
Approach		1206	9.0	1206	9.0	0.825	32.7	LOS C	28.7	236.8	0.92	0.86	0.97	42.4
East: Clarkson Ave														
4	L2	45	4.1	45	4.1	0.064	15.0	LOS B	1.0	8.0	0.52	0.62	0.52	49.6
5	T1	10	6.1	10	6.1	0.064	9.4	LOS A	1.0	8.0	0.52	0.62	0.52	41.5
6	R2	36	3.9	36	3.9	0.142	64.4	LOS E	2.2	17.4	0.91	0.73	0.91	29.4
Approach		91	4.3	91	4.3	0.142	33.9	LOS C	2.2	17.4	0.68	0.67	0.68	38.2
North: Wanneroo N														
7	L2	107	4.3	107	4.3	0.074	6.8	LOS A	0.1	1.1	0.03	0.59	0.03	56.8
8	T1	796	10.3	796	10.3	0.681	39.0	LOS D	21.4	177.4	0.81	0.71	0.81	40.1
9	R2	51	4.1	51	4.1	0.353	44.9	LOS D	2.2	17.1	0.96	0.74	0.96	26.1
Approach		954	9.3	954	9.3	0.681	35.7	LOS D	21.4	177.4	0.73	0.70	0.73	40.9
West: Internal Rd (E)														
10	L2	51	4.1	51	4.1	0.058	13.3	LOS B	1.2	9.5	0.41	0.64	0.41	44.5
11	T1	10	3.7	10	3.7	0.119	58.4	LOS E	1.9	14.8	0.90	0.70	0.90	21.7
12	R2	51	3.8	51	3.8	0.119	62.8	LOS E	1.9	14.8	0.90	0.71	0.90	21.7
Approach		112	3.9	112	3.9	0.119	39.9	LOS D	1.9	14.8	0.68	0.68	0.68	28.3
All Vehicles		2363	8.7	2363	8.7	0.825	34.3	LOS C	28.7	236.8	0.83	0.78	0.85	41.0

# MOVEMENT SUMMARY

Site: 1 [Ultimate (2031) - AM - Signal]

Network: N101 [Ultimate - 2031 - AM]

Wanneroo Rd/ Clarkson Ave

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %				Vehicles	Distance				
South: Wanneroo S														
1	L2	53	3.9	53	3.9	0.043	11.7	LOS B	1.0	7.5	0.31	0.65	0.31	48.8
2	T1	1184	9.7	1184	9.7	0.882	40.1	LOS D	36.7	303.3	0.98	0.95	1.09	39.6
3	R2	76	4.1	76	4.1	0.311	39.5	LOS D	2.8	21.5	0.94	0.76	0.94	37.3
Approach		1313	9.2	1313	9.2	0.882	38.9	LOS D	36.7	303.3	0.95	0.93	1.05	39.6
East: Clarkson Ave														
4	L2	65	4.1	65	4.1	0.102	17.1	LOS B	1.7	13.3	0.57	0.65	0.57	48.3
5	T1	16	6.1	16	6.1	0.102	11.5	LOS B	1.7	13.3	0.57	0.65	0.57	39.8
6	R2	93	3.9	93	3.9	0.379	69.7	LOS E	6.3	48.7	0.95	0.78	0.95	28.2
Approach		174	4.2	174	4.2	0.379	44.7	LOS D	6.3	48.7	0.78	0.72	0.78	34.3
North: Wanneroo N														
7	L2	149	4.3	149	4.3	0.101	6.8	LOS A	0.2	1.6	0.03	0.59	0.03	56.8
8	T1	948	10.3	948	10.3	0.785	40.0	LOS D	28.3	234.1	0.84	0.76	0.86	39.7
9	R2	53	4.1	53	4.1	0.379	45.8	LOS D	2.3	17.9	0.97	0.74	0.97	25.8
Approach		1150	9.3	1150	9.3	0.785	35.9	LOS D	28.3	234.1	0.74	0.74	0.75	40.8
West: Internal Rd (E)														
10	L2	53	4.1	53	4.1	0.067	17.8	LOS B	1.6	12.4	0.48	0.66	0.48	40.6
11	T1	16	3.7	16	3.7	0.139	61.3	LOS E	2.3	17.5	0.91	0.71	0.91	21.2
12	R2	53	3.8	53	3.8	0.139	65.7	LOS E	2.3	17.5	0.91	0.72	0.91	21.1
Approach		122	3.9	122	3.9	0.139	44.3	LOS D	2.3	17.5	0.72	0.69	0.72	26.7
All Vehicles		2759	8.7	2759	8.7	0.882	38.3	LOS D	36.7	303.3	0.84	0.82	0.89	39.2

# MOVEMENT SUMMARY

Site: 1 [Ultimate (2031) - PM - Signal]

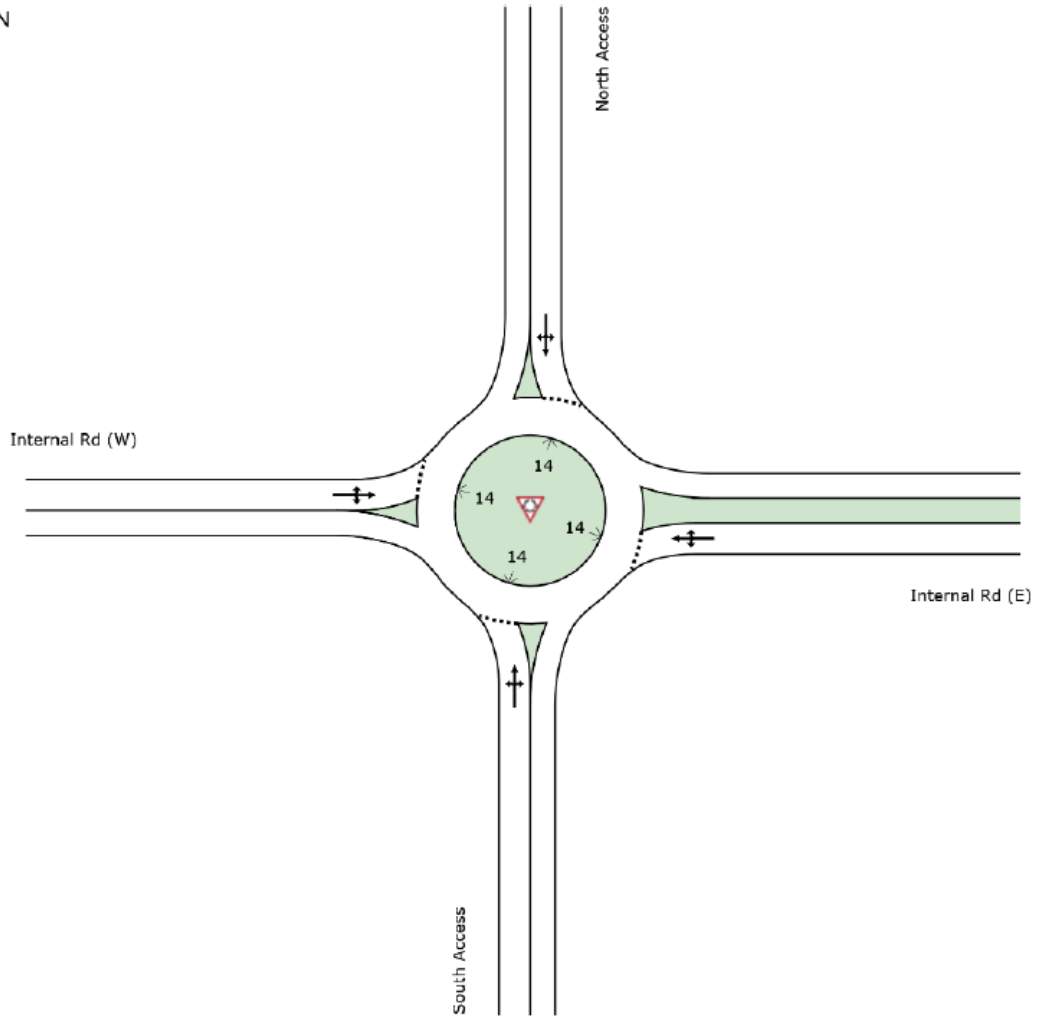
Network: N101 [Ultimate - 2031 - PM]

Wanneroo Rd/ Clarkson Ave

Site Category: (None)

Signals - Fixed Time Coordinated Cycle Time = 165 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %				Vehicles	Distance m				
South: Wanneroo S														
1	L2	212	3.9	212	3.9	0.150	7.6	LOS A	1.8	13.6	0.16	0.63	0.16	54.6
2	T1	1278	9.7	1278	9.7	0.989	78.9	LOS E	55.3	456.3	1.00	1.14	1.35	27.9
3	R2	126	4.1	126	4.1	0.426	41.5	LOS D	5.2	40.4	0.94	0.79	0.94	36.6
Approach		1616	8.5	1616	8.5	0.989	66.6	LOS E	55.3	456.3	0.88	1.05	1.16	29.5
East: Clarkson Ave														
4	L2	50	4.1	50	4.1	0.258	34.3	LOS C	3.5	27.6	0.86	0.72	0.86	40.2
5	T1	52	6.1	52	6.1	0.258	28.6	LOS C	3.5	27.6	0.86	0.72	0.86	30.0
6	R2	39	3.9	39	3.9	0.175	75.4	LOS E	2.8	21.9	0.93	0.74	0.93	27.0
Approach		141	4.8	141	4.8	0.258	43.6	LOS D	3.5	27.6	0.88	0.72	0.88	32.4
North: Wanneroo N														
7	L2	120	4.3	120	4.3	0.085	6.9	LOS A	0.2	1.6	0.03	0.59	0.03	56.7
8	T1	977	10.3	977	10.3	0.852	46.5	LOS D	35.2	291.5	0.83	0.79	0.89	37.1
9	R2	212	4.1	212	4.1	0.953	90.6	LOS F	15.0	116.8	1.00	1.04	1.63	15.9
Approach		1309	8.8	1309	8.8	0.953	50.0	LOS D	35.2	291.5	0.78	0.81	0.93	34.2
West: Internal Rd (E)														
10	L2	212	4.1	212	4.1	0.259	22.1	LOS C	8.2	63.7	0.56	0.72	0.56	37.5
11	T1	52	3.7	52	3.7	0.586	74.4	LOS E	10.3	79.9	0.99	0.80	0.99	18.7
12	R2	212	3.8	212	3.8	0.586	78.8	LOS E	10.3	79.9	0.99	0.80	0.99	18.6
Approach		476	3.9	476	3.9	0.586	53.1	LOS D	10.3	79.9	0.80	0.76	0.80	24.0
All Vehicles		3542	7.8	3542	7.8	0.989	57.8	LOS E	55.3	456.3	0.84	0.91	1.02	30.6



# MOVEMENT SUMMARY

Site: [(2019) - AM]

Network: N101 [(2019) - AM]

Site Category: (None)  
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %				Vehicles	Distance				
South: South Access														
1	L2	1	4.0	1	4.0	0.041	4.6	LOS A	0.2	1.4	0.16	0.61	0.16	51.3
2	T1	1	4.0	1	4.0	0.041	4.8	LOS A	0.2	1.4	0.16	0.61	0.16	52.4
3	R2	50	4.0	50	4.0	0.041	8.7	LOS A	0.2	1.4	0.16	0.61	0.16	47.1
Approach		52	4.0	52	4.0	0.041	8.5	LOS A	0.2	1.4	0.16	0.61	0.16	47.4
East: Internal Rd (E)														
4	L2	50	4.0	50	4.0	0.075	3.1	LOS A	0.2	1.8	0.02	0.60	0.02	50.0
5	T1	4	4.0	4	4.0	0.075	3.4	LOS A	0.2	1.8	0.02	0.60	0.02	51.9
6	R2	65	4.0	65	4.0	0.075	7.2	LOS A	0.2	1.8	0.02	0.60	0.02	51.4
Approach		119	4.0	119	4.0	0.075	5.3	LOS A	0.2	1.8	0.02	0.60	0.02	50.8
North: North Access														
7	L2	63	4.0	63	4.0	0.051	4.5	LOS A	0.2	1.5	0.14	0.50	0.14	51.7
8	T1	1	4.0	1	4.0	0.051	4.7	LOS A	0.2	1.5	0.14	0.50	0.14	55.4
9	R2	1	4.0	1	4.0	0.051	8.6	LOS A	0.2	1.5	0.14	0.50	0.14	55.0
Approach		65	4.0	65	4.0	0.051	4.6	LOS A	0.2	1.5	0.14	0.50	0.14	51.9
West: Internal Rd (W)														
10	L2	1	4.0	1	4.0	0.005	4.7	LOS A	0.0	0.2	0.21	0.48	0.21	53.3
11	T1	4	4.0	4	4.0	0.005	4.9	LOS A	0.0	0.2	0.21	0.48	0.21	50.3
12	R2	1	4.0	1	4.0	0.005	8.8	LOS A	0.0	0.2	0.21	0.48	0.21	54.2
Approach		6	4.0	6	4.0	0.005	5.5	LOS A	0.0	0.2	0.21	0.48	0.21	51.9
All Vehicles		242	4.0	242	4.0	0.075	5.8	LOS A	0.2	1.8	0.09	0.57	0.09	50.3

# MOVEMENT SUMMARY

Site: [(2019) - PM]

Network: N101 [(2019) - PM]

Site Category: (None)  
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows		Arrival Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	Total veh/h	HV %				Vehicles	Distance				
South: South Access														
1	L2	2	4.0	2	4.0	0.041	4.6	LOS A	0.2	1.4	0.15	0.60	0.15	51.6
2	T1	5	4.0	5	4.0	0.041	4.8	LOS A	0.2	1.4	0.15	0.60	0.15	52.7
3	R2	45	4.0	45	4.0	0.041	8.7	LOS A	0.2	1.4	0.15	0.60	0.15	47.5
Approach		52	4.0	52	4.0	0.041	8.1	LOS A	0.2	1.4	0.15	0.60	0.15	48.6
East: Internal Rd (E)														
4	L2	45	4.0	45	4.0	0.073	3.2	LOS A	0.2	1.8	0.03	0.60	0.03	49.8
5	T1	2	4.0	2	4.0	0.073	3.5	LOS A	0.2	1.8	0.03	0.60	0.03	51.7
6	R2	62	4.0	62	4.0	0.073	7.2	LOS A	0.2	1.8	0.03	0.60	0.03	51.2
Approach		109	4.0	109	4.0	0.073	5.4	LOS A	0.2	1.8	0.03	0.60	0.03	50.6
North: North Access														
7	L2	63	4.0	63	4.0	0.054	4.5	LOS A	0.2	1.6	0.14	0.50	0.14	51.7
8	T1	5	4.0	5	4.0	0.054	4.7	LOS A	0.2	1.6	0.14	0.50	0.14	55.4
9	R2	1	4.0	1	4.0	0.054	8.6	LOS A	0.2	1.6	0.14	0.50	0.14	55.1
Approach		69	4.0	69	4.0	0.054	4.6	LOS A	0.2	1.6	0.14	0.50	0.14	52.3
West: Internal Rd (W)														
10	L2	1	4.0	1	4.0	0.007	4.7	LOS A	0.0	0.2	0.20	0.49	0.20	53.1
11	T1	5	4.0	5	4.0	0.007	4.9	LOS A	0.0	0.2	0.20	0.49	0.20	49.9
12	R2	2	4.0	2	4.0	0.007	8.8	LOS A	0.0	0.2	0.20	0.49	0.20	53.9
Approach		8	4.0	8	4.0	0.007	5.9	LOS A	0.0	0.2	0.20	0.49	0.20	51.9
All Vehicles		238	4.0	238	4.0	0.073	5.8	LOS A	0.2	1.8	0.10	0.57	0.10	50.6



# MOVEMENT SUMMARY

Site: [Ultimate (2031) - AM]

Network: N101 [Ultimate - 2031 - AM]

Site Category: (None)  
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows	Arrival Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed			
		Total veh/h	HV % veh/h	Total HV %	v/c	sec	Vehicles veh	Distance m			km/h			
South: South Access														
1	L2	1	4.0	1	4.0	0.041	4.6	LOS A	0.2	1.4	0.16	0.61	0.16	51.3
2	T1	1	4.0	1	4.0	0.041	4.8	LOS A	0.2	1.4	0.16	0.61	0.16	52.5
3	R2	50	4.0	50	4.0	0.041	8.7	LOS A	0.2	1.4	0.16	0.61	0.16	47.1
Approach		52	4.0	52	4.0	0.041	8.5	LOS A	0.2	1.4	0.16	0.61	0.16	47.4
East: Internal Rd (E)														
4	L2	50	4.0	50	4.0	0.074	3.1	LOS A	0.2	1.8	0.02	0.60	0.02	50.0
5	T1	5	4.0	5	4.0	0.074	3.4	LOS A	0.2	1.8	0.02	0.60	0.02	51.9
6	R2	63	4.0	63	4.0	0.074	7.2	LOS A	0.2	1.8	0.02	0.60	0.02	51.4
Approach		118	4.0	118	4.0	0.074	5.3	LOS A	0.2	1.8	0.02	0.60	0.02	50.8
North: North Access														
7	L2	63	4.0	63	4.0	0.051	4.5	LOS A	0.2	1.5	0.14	0.50	0.14	51.7
8	T1	1	4.0	1	4.0	0.051	4.7	LOS A	0.2	1.5	0.14	0.50	0.14	55.4
9	R2	1	4.0	1	4.0	0.051	8.6	LOS A	0.2	1.5	0.14	0.50	0.14	55.0
Approach		65	4.0	65	4.0	0.051	4.6	LOS A	0.2	1.5	0.14	0.50	0.14	51.9
West: Internal Rd (W)														
10	L2	1	4.0	1	4.0	0.006	4.7	LOS A	0.0	0.2	0.21	0.47	0.21	53.3
11	T1	5	4.0	5	4.0	0.006	4.9	LOS A	0.0	0.2	0.21	0.47	0.21	50.4
12	R2	1	4.0	1	4.0	0.006	8.8	LOS A	0.0	0.2	0.21	0.47	0.21	54.2
Approach		7	4.0	7	4.0	0.006	5.4	LOS A	0.0	0.2	0.21	0.47	0.21	51.8
All Vehicles		242	4.0	242	4.0	0.074	5.8	LOS A	0.2	1.8	0.09	0.57	0.09	50.4

# MOVEMENT SUMMARY

Site: [Ultimate (2031) - PM]

Network: N101 [Ultimate - 2031 - PM]

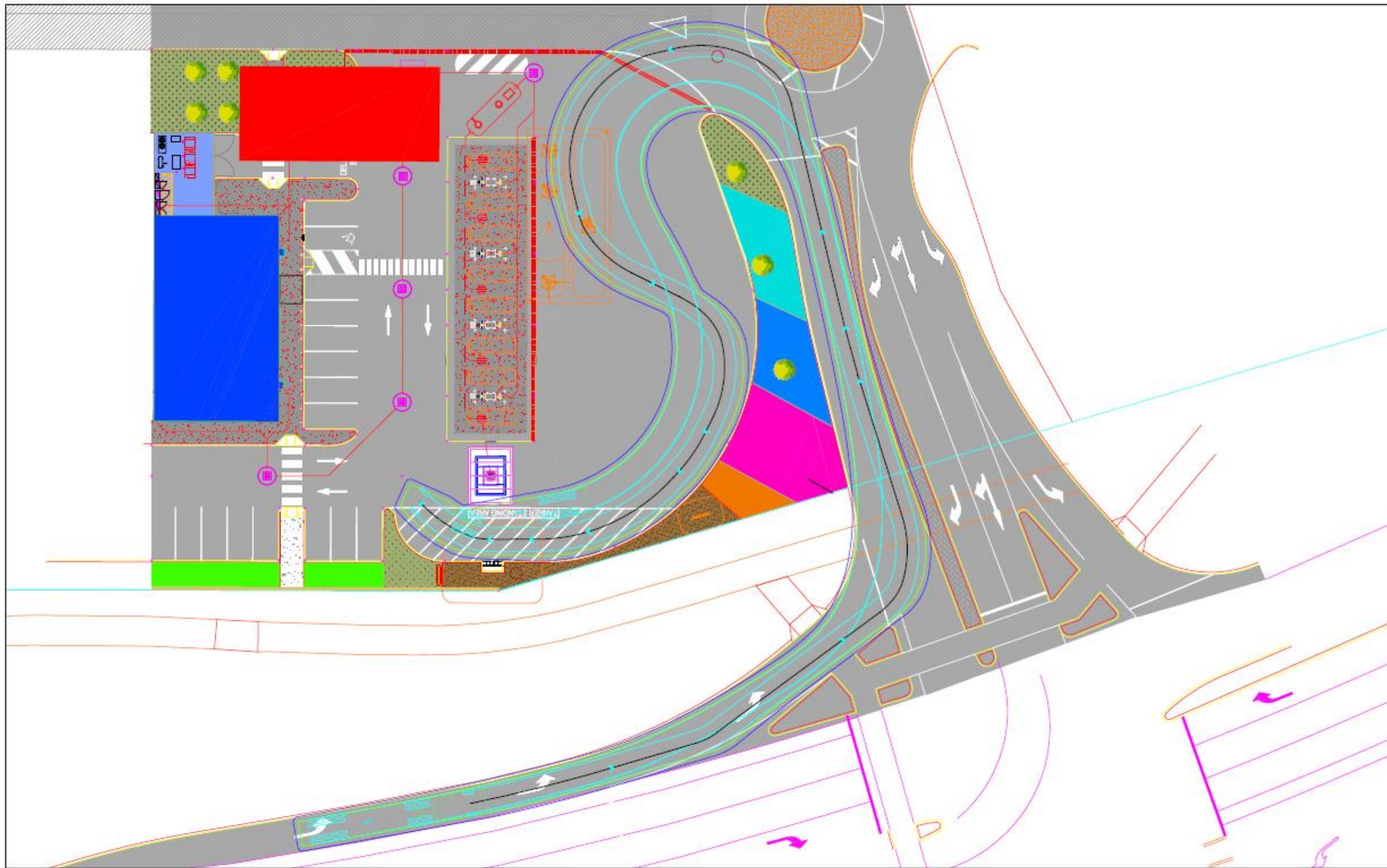
Site Category: (None)  
Roundabout

Movement Performance - Vehicles														
Mov ID	Turn	Demand Flows	Arrival Flows	Deg. Satn	Average Delay	Level of Service	95% Back of Queue	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed			
		Total veh/h	HV % veh/h	Total HV %	v/c	sec	Vehicles veh	Distance m			km/h			
South: South Access														
1	L2	2	4.0	2	4.0	0.198	5.9	LOS A	0.8	5.9	0.43	0.66	0.43	50.6
2	T1	5	4.0	5	4.0	0.198	6.1	LOS A	0.8	5.9	0.43	0.66	0.43	51.7
3	R2	142	4.0	142	4.0	0.198	10.0	LOS B	0.8	5.9	0.43	0.66	0.43	45.9
Approach		149	4.0	149	4.0	0.198	9.8	LOS A	0.8	5.9	0.43	0.66	0.43	46.4
East: Internal Rd (E)														
4	L2	142	4.0	142	4.0	0.294	3.2	LOS A	1.4	10.7	0.05	0.48	0.05	51.6
5	T1	267	4.0	267	4.0	0.294	3.5	LOS A	1.4	10.7	0.05	0.48	0.05	53.7
6	R2	62	4.0	62	4.0	0.294	7.2	LOS A	1.4	10.7	0.05	0.48	0.05	53.1
Approach		471	4.0	471	4.0	0.294	3.9	LOS A	1.4	10.7	0.05	0.48	0.05	53.0
North: North Access														
7	L2	62	4.0	62	4.0	0.097	6.0	LOS A	0.3	2.4	0.45	0.62	0.45	49.9
8	T1	5	4.0	5	4.0	0.097	6.1	LOS A	0.3	2.4	0.45	0.62	0.45	54.3
9	R2	2	4.0	2	4.0	0.097	10.0	LOS B	0.3	2.4	0.45	0.62	0.45	54.0
Approach		69	4.0	69	4.0	0.097	6.1	LOS A	0.3	2.4	0.45	0.62	0.45	50.7
West: Internal Rd (W)														
10	L2	2	4.0	2	4.0	0.343	5.3	LOS A	1.2	9.4	0.37	0.53	0.37	52.9
11	T1	267	4.0	267	4.0	0.343	5.5	LOS A	1.2	9.4	0.37	0.53	0.37	49.7
12	R2	2	4.0	2	4.0	0.343	9.4	LOS A	1.2	9.4	0.37	0.53	0.37	53.8
Approach		271	4.0	271	4.0	0.343	5.5	LOS A	1.2	9.4	0.37	0.53	0.37	49.8
All Vehicles		960	4.0	960	4.0	0.343	5.4	LOS A	1.4	10.7	0.23	0.53	0.23	50.8

# Appendix E

---

## TURN PATH ANALYSIS



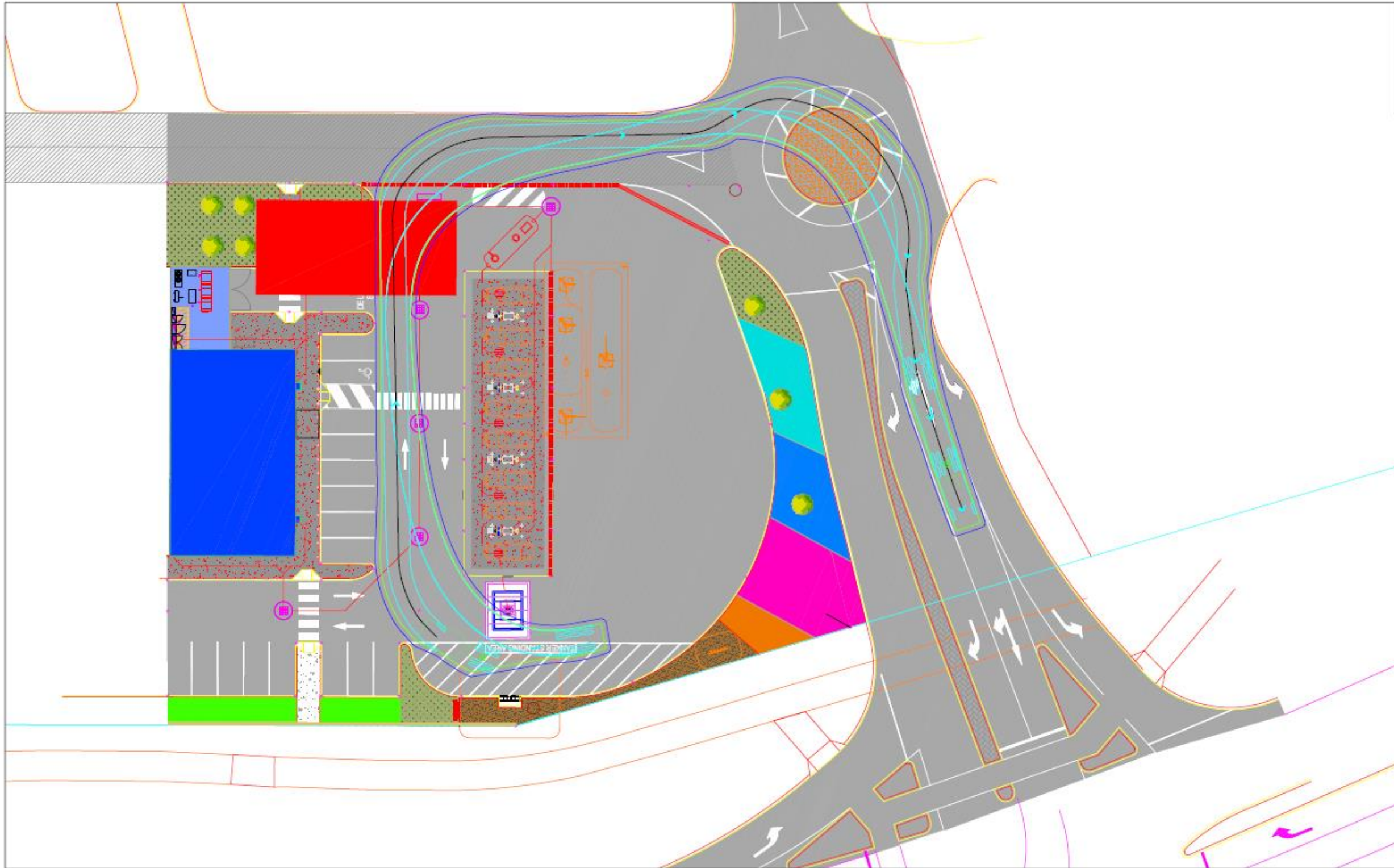
Lot 1 & 132 Wanneroo Road, Tapping  
 Austroads 2013: 19.0m Semi-Trailer  
 Fuel Tanker Circulation

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t19.016.sk01g  
 18/11/2019  
 Scale: 1:350 @ A3





Lot 1 & 132 Wanneroo Road, Tapping  
 Austroads 2013: 19.0m Semi-Trailer  
 Fuel Tanker Circulation

**LEGEND**  
 Vehicle Body  
 Wheel Path  
 500mm Clearance



t19.016.sk02f  
 18/11/2019  
 Scale: 1:350 @ A3

