

ST MARYS RESOURCE RECOVERY FACILITY

Appendix L: Traffic Impact Assessment



21 & 25 Dunheved Circuit, St Marys Transport Impact Assessment

Prepared for:
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21 & 25 Dunheved Circuit, St Marys Transport Impact Assessment

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Executive Summary

The aim of this report is to assess the potential transport implications for the proposed development at 21 and 25 Dunheved Circuit, St Marys with respect to parking and access arrangements, layout of internal roads, and traffic impacts on the surrounding road network.

The Proposal is for the extension of the existing resource recovery facility at 25 Dunheved Circuit to include the neighbouring lot, 21 Dunheved Circuit, St Marys. This study involves an analysis of the road network in its existing condition as well as in the future scenario, that is, during the operation of the Proposal.

An assessment of the operational capacity of the key nearby intersection of Ropes Crossing Boulevard, Forrester Road and Links Road has been carried out using SIDRA Intersection modelling software. The results of the analysis show that in both existing and future conditions the intersection operates at an acceptable a level of service B or better in road network peak periods. An additional delay of a few seconds would be expected for the worst-operating approaches of the intersection. Hence, traffic generated due to the Proposal would be expected to have a minor impact on the performance of the intersection.

As assessment of traffic generated during the construction phase of the Proposal has also been assessed. Construction works would be undertaken over a duration of 25 weeks, starting in early 2018. The works would be expected to generate an average of five additional trips per hour during the busiest stage in the construction phase. The assessment concludes that the volume of additional trips due to construction traffic would be considered to cause a negligible impact on the road network.

The study also concludes that the access arrangements, layout of internal roads and onsite stacking arrangements are sufficient to accommodate the largest vehicles anticipated to access the Proposal site, that is, a 25/26m B-double truck. Onsite stacking arrangements would sufficiently accommodate a turn-over of 21 vehicles during the site's peak operation while it is expected that only 12 trucks would arrive across the same period. Therefore, queuing of heavy vehicles would be entirely accommodated and managed within the site.

Based on an empirical assessment, the provision and layout of car parking spaces onsite is deemed adequate to accommodate the proposed 15 full-time staff present onsite at any given time. The proposed parking arrangement of 15 spaces, including one accessible space, is considered suitable.

Overall, the Proposal site would not be expected to cause an adverse impact on the local transport network with respect to road safety and the network capacity.

Abbreviations

ADI	Australian Defence Industries
DCP	Development Control Plan
EIS	Environmental Impact Statement
EPA	Environmental Protection Authority
EPL	Environmental Protection Licence
LEP	Local Environmental Plan
LoS	Level of Service
pcu	Passenger car unit
RRF	Resource Recovery Facility
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
tpa	Tonnes per annum
TTPP	The Transport Planning Partnership

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1 Introduction

The Transport Planning Partnership (TPPP) has conducted a Transport Impact Assessment for St Marys Resource Recovery Facility (the Proposal). This report forms part of the Environmental Impact Statement (EIS) for approval of the Proposal.

1.1 Proposal Overview

S St Mary's Recycling Pty Ltd, a subsidiary of Bingo Industries Limited (Bingo Industries), operates an existing Resource Recovery Facility (RRF) at 25 Dunheved Circuit, St Marys. The RRF operates under development consent (DA01/1034), which was issued by Penrith City Council (Council) in June 2001, development consent (DA15/1042), which was issued by Council in June 2016, and an Environmental Protection Licence (EPL) from the New South Wales (NSW) Environmental Protection Authority (EPA), EPL No. 20621.

Bingo Recycling Pty Ltd (the Applicant), also a subsidiary of Bingo Industries, is seeking approval to extend the existing RRF onto the neighbouring property; 21 Dunheved Circuit (the Proposal). The proposed RRF would extend across 21 Dunheved Circuit and 25 Dunheved Circuit (the Proposal site) in order to optimise operations and facilitate a throughput of 350,000 tonnes per annum (tpa) of general solid waste (non-putrescible).

The EIS is seeking approval, under Part 4, Division 4.1 of the Environmental Planning and Assessment Act 1979 (EP&A Act), for the construction and operation of the Proposal.

The key components of the Proposal would include:

- Demolition of all structures, except for electrical substations, at 21 Dunheved Circuit
- Demolition of a section of the eastern wall of the approved processing shed at 25 Dunheved Circuit to provide access between the existing processing shed and the proposed extension to the processing shed
- Extension of the processing shed and external hardstand onto 21 Dunheved Circuit
- Relocation of existing, and provision of additional, on-site car parking spaces
- Extension of the existing site office on 25 Dunheved Circuit
- Widening the existing driveway access to 25 Dunheved Circuit to separate vehicle access and egress
- Provision of a second vehicle egress point along Dunheved Circuit
- Installation of a new 20 m long in-ground weighbridge at the vehicle egress point
- Installation of two in-ground wheel wash bays at the exit weighbridges
- Relocation of four stormwater detention (OSD) tanks and installation of a new rainwater reuse tank
- Relocation of the 30,000 L self-bunded fuel tank
- Extension of a dust suppression and sprinkler system

- Installation of a designated chemical and Liquefied Petroleum Gas (LPG) storage area
- Installation of landscaping
- Upgrade of two intersections comprising minor widening at the intersections of Dunheved Circuit loop to Dunheved Circuit (both the northern and southern legs)

The key operational components of the Proposal would include:

- Increasing operational (including processing and waste delivery and collection) hours to 24 hours per day, Monday to Saturday (no works on Sundays or public holidays would be undertaken)
- Processing of up to 350,000 tpa of non-putrescible waste
- Waste storage of up to 20,000 tonnes of non-putrescible waste at any given time

Waste streams to be received, and processed waste streams, include a range of non-putrescible waste types. Appendix A provides a list types that would be processed.

Number 25 Dunheved Circuit has operated as a RRF since 2001. Initially the structures consisted of a temporary above-ground weighbridge, small modular cabin and a workshop/storage shed at the rear of the site. The approval allowed for the processing of waste, however waste materials were not permitted to be stored outside buildings (unless within waste bins). Waste was sorted into light and heavy fractions. The light fraction was sent for further recycling at other facilities, with a portion ending up in landfill. The heavy stream was sent to other Bingo recycling facilities for processing and resource recovery.

On 20 June 2016, development consent (DA15/1042) was acquired for the redevelopment of 25 Dunheved Circuit, to construct and operate an enclosed RRF which would substantially improve the resource recovery rate and the environmental performance of the site.

Construction of the RRF at 25 Dunheved Circuit commenced in November 2016 and was completed in April 2017. The RRF at 25 Dunheved Circuit (the existing RRF) has been operational since this time.

1.2 Purpose of this Report

This report supports the EIS for the Proposal and has been prepared as part of a State Significant Development (SSD) Application for which approval is sought under Part 4, Division 4.1 of the EP&A Act.

This report has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) (SSD 8200) for the Proposal, issued by NSW DP&E on 6 February 2017.

Table 1.1 lists the SEAR's requirements and the corresponding sections of the report where these are addressed.

Table 1.1: SEARs Requirements and Relevant Report Sections

Traffic and Transport	Addressed in
Details of all traffic types and volumes likely to be generated during construction and operation, including a description of haul routes.	Section 6
An assessment of the predicted impacts of this traffic on road safety and the capacity of the road network, including consideration of cumulative traffic impacts at key intersections using SIDRA or similar traffic model.	Section 2.4 Section 2.5 Section 6.4 Section 6.5
Detailed plans of the proposed layout of the internal road network and parking on-site in accordance with the relevant Australian Standards.	Section 3.3 Section 4
Turning path diagrams depicting vehicles entering, exiting and manoeuvring throughout the site.	Section 5.3
Plans of any proposed road upgrades, infrastructure works or new roads required for the development.	Section 5.3 Section 7

Further to the above, Penrith City Council and Roads and Maritime Services (Roads and Maritime) require further details on specific requirements relating to their authority. These requirements are discussed throughout the report as indicated in Table 1.2.

Table 1.2: Local and State Authority Requirements and Relevant Report Sections

Traffic and Transport	Addressed in
Penrith City Council	
Review the proposed truck routes, particularly during the period 6pm to 6am, in order to ensure that the route is design to consider and minimise disruption and noise to any residential area.	Section 6.3
Narrowness of Dunheved Circuit for truck access.	Section 5.3
Trucks parking in the reserve area opposite the site.	Section 4.1
Traffic congestion on Links Road increased due to current additional truck traffic to the Central Precinct sub-division along Forrester Road, Links Road to haulage road access off Links Road to the west of Dunheved Circuit. Future traffic generated by Lend Lease Central Precinct sub-division which may access Links Road and is under current traffic modelling reviews with developer, RMS and Council.	Section 2.4.1
Roads and Maritime Services	
Daily and peak traffic movements likely to be generated by the proposed development including the impact on nearby intersections and the need/ associated funding for upgrading or road improvement works (if required).	Section 6
Details of the proposed access and the parking provision associated with the proposed development including compliance with the requirements of the relevant Australian Standards (ie. turn paths, sight distance requirements, aisle width, etc.).	Section 3.3 Section 4
Proposed number of car parking spaces and compliance with the appropriate parking codes.	Section 4
Details of service vehicle movements (including vehicle type and likely arrival and departure times).	Section 6

1.3 References

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

- An inspection of the site and its surrounds
- Penrith City Council Local Environmental Plan (LEP) 2010
- Penrith City Council Development Control Plan (DCP) 2014
- Plans for the proposed development as prepared by Dewcape
- Swept path assessments undertaken by TTPP
- Other documents and data as referenced in this report.

2 Existing Conditions

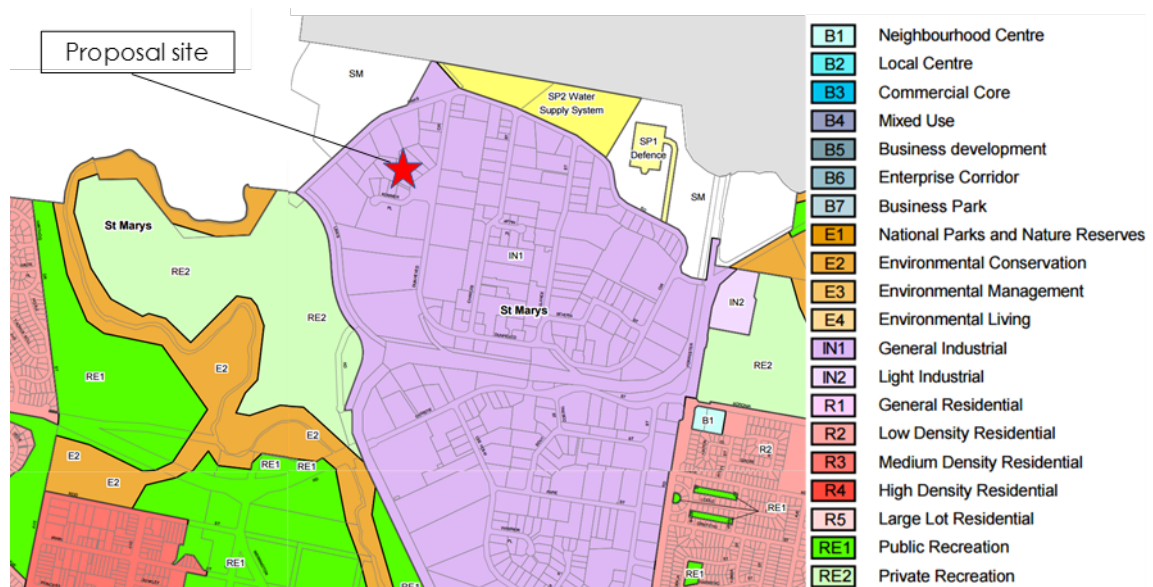
2.1 Site Location

The facility at 25 Dunheved Circuit operates as a resource recovery facility. The Proposal site comprises two adjoining parcels of land, namely, 21 and 25 Dunheved Circuit, St Marys (Lot 9 DP 31908 and Lot 143 DP 1013185). The Proposal site is located within the industrial district of the Penrith local government area which is zoned as General Industrial Zone (IN1) under Penrith Local Environmental Plan (LEP) 2010.

Within the IN1 General Industrial zone, development for the purpose of a 'resource recovery facility' is prohibited. Division 23 of *State Environmental Planning Policy (Infrastructure) (SEPP) 2007* permits the establishment and operation of a waste or resource management facility on land zones IN1 General Industrial with development consent. The provisions of the SEPP prevail over the Penrith LEP 2010 in this regard, and as such, the proposed development is permissible with development consent.

The surrounding land uses to the Proposal site include general industrial, light industrial, low density residential and public and private recreational classifications. Nearby industries include storage businesses, transport depots, plant and equipment hire facilities, mechanical repair workshops and a number of waste facilities and other EPA licensed premises. The location of the site and its surrounding land use zones are shown in Figure 2.1 and Figure 2.2.

Figure 2.1: Proposal Site and Surrounding Land Use Zones



Basemap source: Penrith Local Environmental Plan 2010

Figure 2.2: Site Location



Basemap source: Google Maps 2017

2.2 Road Network

Dunheved Circuit is a local loop road which runs north-east to south-west within the vicinity of the Proposal site. Dunheved Circuit has an unmarked two-lane, two-way carriageway and is 7m in width. There is unrestricted on-street parking permitted on the northern side, toward the north-eastern end of the road, for a length of around 40m. 'No Stopping' restrictions apply along the remainder of the loop road on both sides of the street. The sign posted speed limit along Dunheved Circuit is 60km/h.

Dunheved Circuit loop continues as a no-through local street south of the Proposal site. In this section of the loop road, the carriageway is 12m wide and has unrestricted parking permitted on both sides of the road.

Links Road functions as a collector street and is located towards the north and west of the Proposal site. It is 9m in width and is configured as an undivided two-way, two-lane road. At its eastern end, Links Road connects the industrial district, of where the Proposal site is situated, to the surrounding arterial road network. Parking is permitted on both kerbsides of Links Road and the posted speed along the road is 60km/h.

A notable collector road within the vicinity of the Proposal site is **Ropes Crossing Boulevard/ Forrester Road**. It is a two-lane, two-way road which runs in a north-south direction. The carriageway is 11m in width with double barrier line marking separating opposing traffic movements. The verge width on the east and west sides of the road are a minimum of 10m and 12m, respectively, in which parking is unrestricted. The sign posted speed limit in the area is 70km/h.

Ropes Crossing Boulevard, Forrester Road and Links Road intercept at a roundabout. Access to the subject industrial precinct is provided via this roundabout.

2.3 Surrounding Intersections

The following key intersections currently exist within the vicinity of the Proposal site:

- Dunheved Circuit/ Dunheved Circuit loop (priority intersection)
- Dunheved Circuit/ Links Road (priority intersection)
- Links Road/ Ropes Crossing Boulevard/ Forrester Road (roundabout).

2.4 Traffic Volumes

Traffic movement counts were undertaken at the key nearby intersection of Ropes Crossing Boulevard/ Forrester Road/ Links Road on Wednesday 15th June 2016. Traffic surveys were undertaken during the following road network peak periods:

- AM survey period: 7:00am – 10:00am
- PM survey period: 3:00pm – 6:00pm.

From the analysis of the traffic movement counts, the morning and afternoon peak hours for the local road network have been identified as 7:15am – 8:15am and 4:15pm – 5:15pm. Figure 2.3 and Figure 2.4 present the peak hourly flows derived from the traffic counts while the complete traffic survey data are contained in Appendix A.

Figure 2.3: Ropes Crossing Blvd/ Forrester Rd/ Links Rd Existing Turning Movements

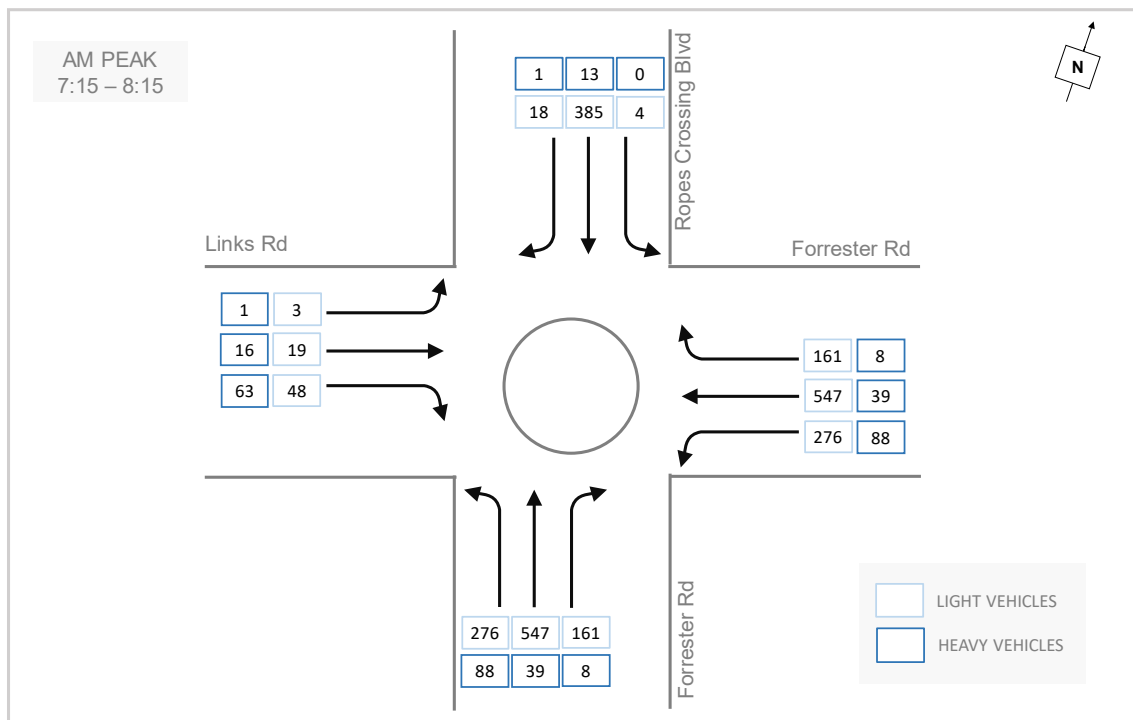
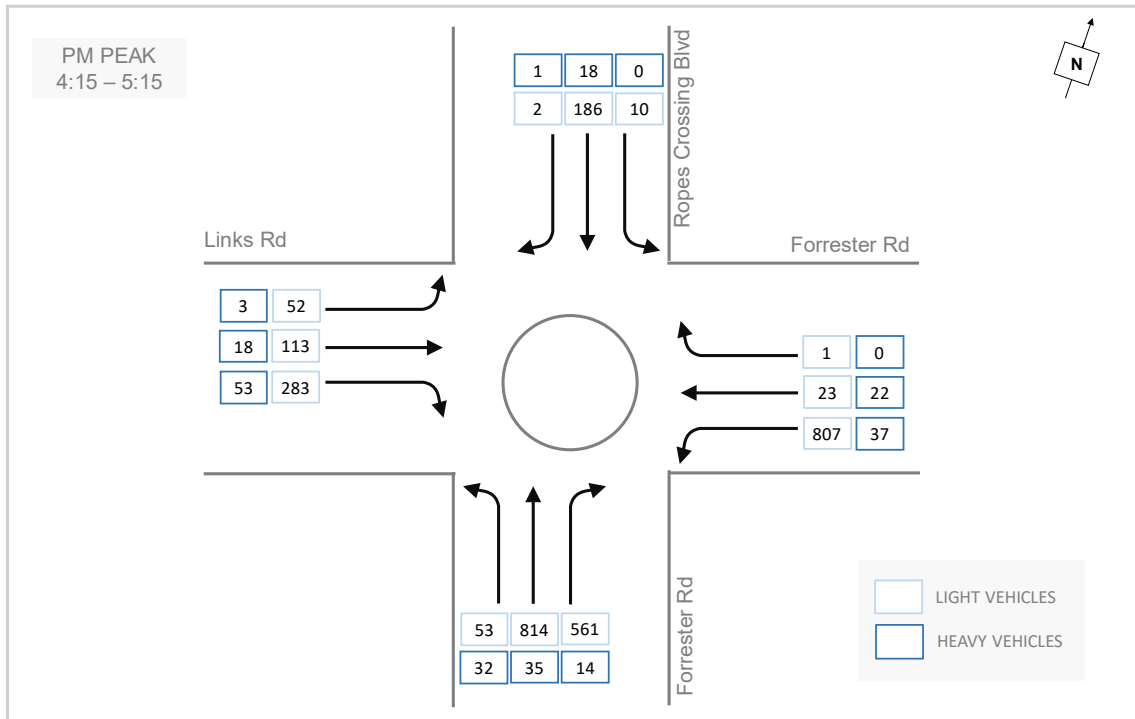
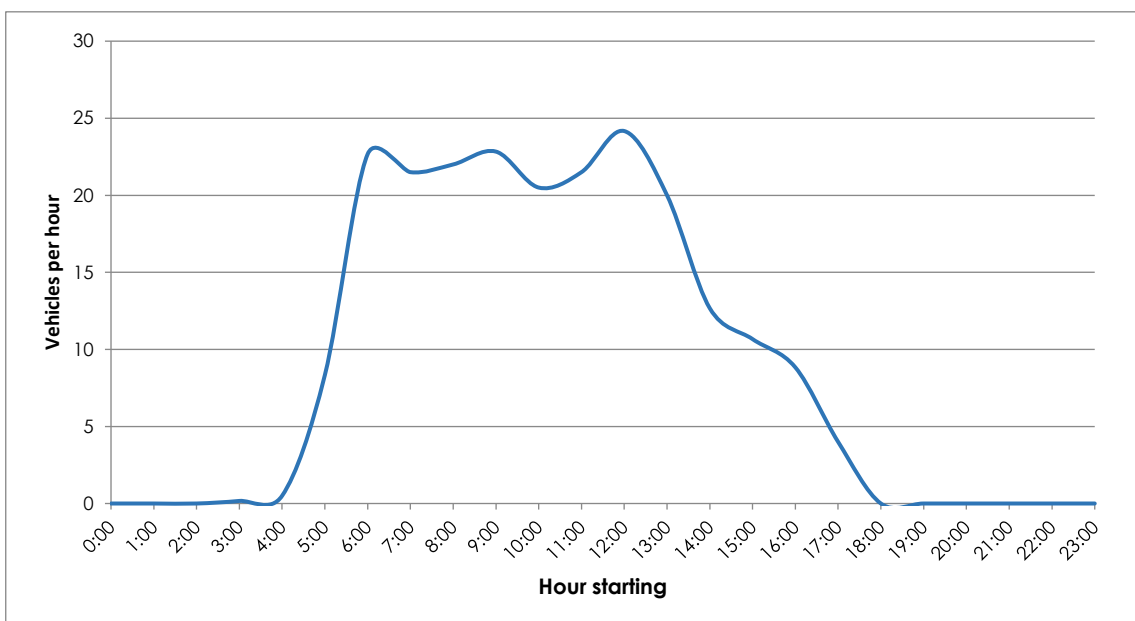


Figure 2.4: Ropes Crossing Blvd/ Forrester Rd/ Links Rd Existing Turning Movements



At the time of writing, the facility at 25 Dunheved Circuit was closed to allow for construction works. Therefore, traffic data during a recent period of the site's operation has been used to quantify traffic demands in the existing condition. To gain an appreciation of traffic volumes associated with the former facility at 25 Dunheved Circuit, 24-hour seven-day traffic counts were undertaken at the access driveway in June 2016 during its operation. The average daily two-way traffic flows in and out of the site are shown in Figure 2.5, while the full data set of is contained in Appendix B.

Figure 2.5: Two-way Traffic Movements at 25 Dunheved Circuit (June 2016)

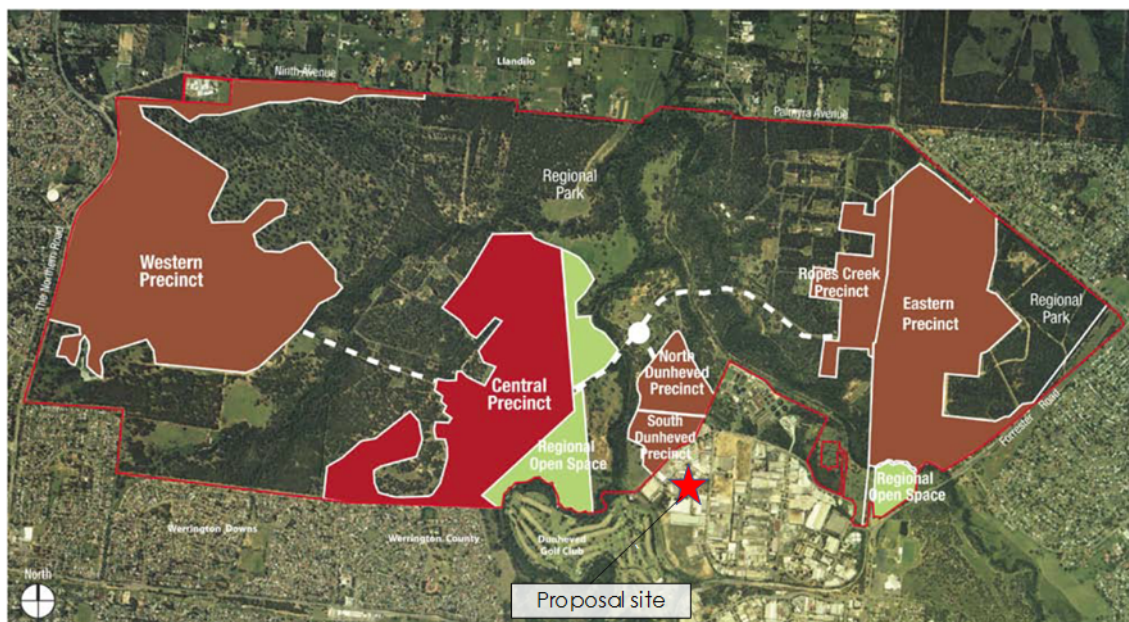


During its operation in June 2016, the site generated a total daily average of 220 two-way vehicle trips; that is, inbound and outbound vehicle movements.

2.4.1 Central Precinct Development

An appreciation for the development of the Central Precinct has been included as part of this TIA. The Central Precinct is located within the St Marys Australian Defence Industries (ADI) site as defined in the *Sydney Regional Environmental Plan No 30 - St Marys*. The development is of considerable scale and is in close proximity to the Proposal site on Dunheved Circuit. Central Precinct has a total area of 133.1 hectares (ha) and borders the industrial precinct in which the Proposal site is situated. The context of the Central Precinct within the wider ADI site and with regard to the RRF is shown in Figure 2.6.

Figure 2.6: Australian Defence Industries (ADI) Site



Source: *Precinct Plan and Development Control Strategy Central Precinct St Marys* (2009)

The Central Precinct is intended to accommodate a residential population of around 2,500, and light industrial and manufacturing sectors generating about 760 jobs. It is appreciated that the scale of the development is likely to impact the local transport network in the vicinity of the Proposal site in the future.

Construction works for the Central Precinct have been underway for since early 2016. Construction traffic associated with Central Precinct currently utilise Links Road to access the Proposal site. Therefore, construction traffic for the Central Precinct is travelling via the Ropes Crossing Boulevard/ Forrester Road/ Links Road roundabout, which is currently the major intersection between the Central Precinct and surrounding arterial road network. This means that the traffic movement counts undertaken in June 2016 would have included construction vehicle movements to/from the Central Precinct site.

In order to qualitatively assess the quantitative effect of traffic flow, traffic modelling is undertaken using SIDRA Intersection software. Level of Service (LoS) is the performance standard used to determine the operational efficiency of an intersection. There are six levels of service which range from LoS A to LoS F (best to worst operating conditions). Traffic conditions that are characteristic of LoS A operations are free-flow traffic and no delays while LoS F operations are flow break-down, queuing and delays.

In light of this, the operational performance of the Ropes Crossing Boulevard/ Forrester Road/ Links Road roundabout during the road network peaks have been assessed. In the morning and afternoon peaks, the intersection operates at a LoS A and LoS B, respectively. Details of the analysis results are discussed in Section 2.6.

As informed by Penrith City Council, traffic modelling at a strategic level is currently being undertaken using EMME/2 software for the general St Marys region as part of the Central Precinct Plan. Hence, at this stage, detailed turning volumes at key intersections in the area are not publicly available. In the context of the overall development works within the vicinity, traffic flows due to the future operations at the resource recovery facility (RRF) are also considered to be minor.

In this regard, it is considered sufficient to utilise the traffic movement data collected in June 2016 as a 'base case' for determining the transport impacts due to the RRF, and assess the future intersection operations using the available data.

2.5 Roadway Capacity for Two-Way Urban Road

Dunheved Circuit is a two-way undivided urban road with one lane per direction. With regard to the operational capacity for urban roads, the table as shown in Figure 2.7 has been extracted from Roads and Maritime's 'Guide to Traffic Generating Developments' (2002). The operational capacity of a road is the number of vehicles that a road can physically accommodate. It is generally accepted that on a two-way undivided road, the operational capacity can be as high as 900 passenger car units (pcu) per hour per lane.

Figure 2.7: Operational Capacity for Urban Roads

Table 4.3
Typical mid-block capacities for urban roads with interrupted flow

Type of Road	One-Way Mid-block Lane Capacity (pcu/hr)	
Median or inner lane:	Divided Road	1,000
	Undivided Road	900
Outer or kerb lane:	With Adjacent Parking Lane	900
	Clearway Conditions	900
	Occasional Parked Cars	600
4 lane undivided:	Occasional Parked Cars	1,500
	Clearway Conditions	1,800
4 lane divided:	Clearway Conditions	1,900

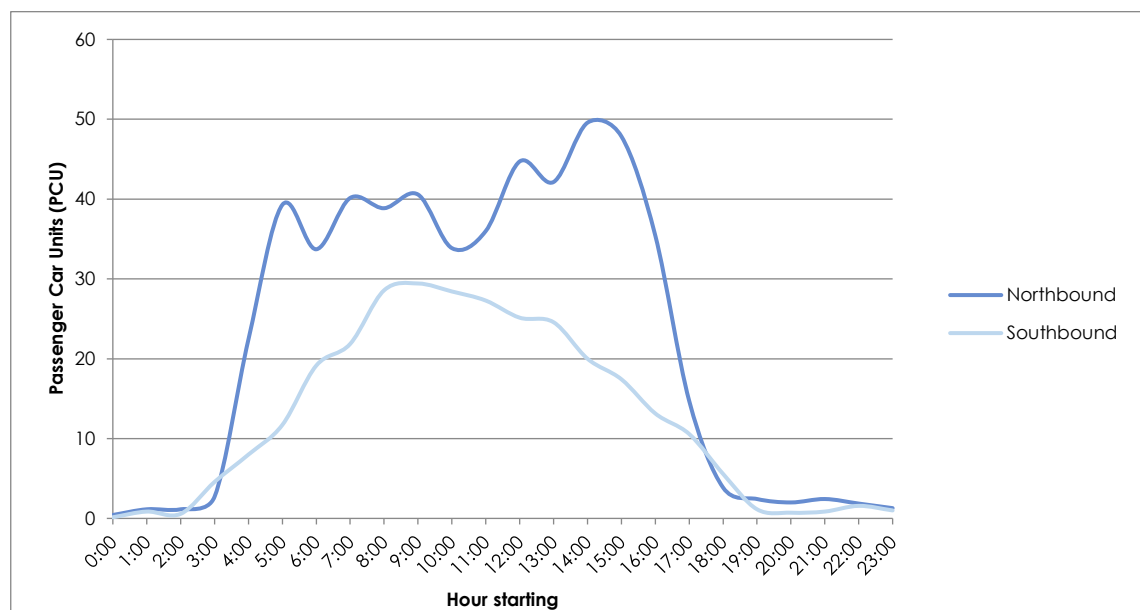
Source: Guide to Traffic Generating Developments (2002)

In June 2016, traffic tube counts were undertaken across 24-hours for seven days on Dunheved Circuit. In order to assess the operational capacity of Dunheved Circuit, the number of light vehicles and heavy vehicles have been converted to a uniform unit of measure; passenger car units (pcu).

To convert the volume of heavy vehicles into pcu, a multiplication factor of two has been applied. This factor is based on the average length of a truck being approximately double the length of a passenger car.

The average daily traffic flows on Dunheved Circuit, measured in passenger car units, are illustrated in Figure 2.8. The raw tube count data is provided in Appendix C.

Figure 2.8: Dunheved Circuit Two-Way Flows (June 2016)



From Figure 2.8, the maximum number of passenger car units per lane per hour is 50 travelling in the northbound direction between 2:00pm and 3:00pm. This is well below Roads and Maritime's threshold of 900 pcu per lane per hour. Having regard to this, the surrounding road operates with traffic volumes well within its operational capacity threshold set within the Roads and Maritime's Traffic Generating Guidelines.

2.6 Intersection Operation

An assessment of the roundabout intersection of Ropes Crossing Boulevard, Forrester Road and Links Road - a key intersection in the study area - has been carried out using SIDRA Intersection, version 7. Table 2.1 presents a summary of the existing operation of the intersection.

Table 2.1: Intersection Analysis Results of Existing Conditions

Intersection	Worst Performing Movement	Peak Period	Average delay (s)	Level of Service (LoS)
Ropes Crossing Boulevard/ Forrester Road/ Links Road	Links Road (western approach), right turn	AM	12.9	A
	Links Road (western approach), right turn	PM	16.5	B

Note: Road and Maritime uses level of service as a performance measure to indicate the operating efficiency of a given intersection. The level of service ranges from A to F. Levels of service between A and D indicate the intersection is operating within capacity with LoS A providing exceptionally good performance to LoS D indicating satisfactory performance. LoS E and F indicate the intersection is operating at or near capacity and would require intersection improvement works to maintain reasonable performance.

The intersection analysis results indicate that the roundabout currently operates with a LoS A and LoS B in the morning and afternoon road network peak periods, respectively. The worst performing movement is determined based on the average delay, in which case, the right turn movement from Links Road (western approach) to Forrester Road (southern approach) experiences delays of 13 seconds and 17 seconds in the morning and afternoon peaks, respectively.

The results of the analysis show that the roundabout intersection operates satisfactorily under existing conditions. Detailed SIDRA Intersection analysis results for the intersection of Ropes Crossing Boulevard/ Forrester Road/ Links Road is contained in Appendix D.

2.7 Vehicle Access and Circulation

Each allotment has its own access driveway which is used by light and heavy vehicles. The site located at 25 Dunheved Circuit has a 14m wide driveway providing two-way access. The driveway is shared with the neighbouring parcel of land, that is, 21 Dunheved Circuit. The site located at 21 Dunheved Circuit has a total of three access driveways; the shared driveway plus two two-way driveways that are 5m in width.

Vehicle circulation throughout the sites are permitted as two-way movements and in a forward direction.

Currently, there are no restrictions around the site vicinity for the existing fleet of heavy vehicles accessing and leaving the site. The largest vehicle accessing the site is a 25/26m B-double.

Vehicles accessing Dunheved Circuit do so via Links Road. Links Road intersects with Ropes Crossing Boulevard and Forrester Road at a roundabout intersection approximately 1km east of the subject site.

Vehicles travelling to 25 Dunheved Circuit arrive via Great Western Highway, M4 Western Motorway and M7 Westlink Motorway. Outbound vehicles utilise the same haul routes. Exits and entrances to/from these motorways are located around 6km, 8km and 15km south of the site, respectively.

2.8 Car Parking

A total of 10 onsite car parking spaces are currently located on 25 Dunheved Circuit; three adjacent to the site office and seven along the south-eastern boundary of the site. At 21 Dunheved Circuit, there are in the order of 20 car parking spaces onsite.

2.9 Public Transport

The nearest bus stop to the Proposal site by walking distance is located along Forrester Road. It is located 1.9km south-east of the Proposal site, which equates to a 23-minute walk. Busways provide two services within the vicinity, namely, routes 759 and 780. The regions serviced by these buses include Mount Druitt, Whalan, Tregear, Ropes Crossing, North St Marys, St Marys, Werrington, Cambridge Park, Kingswood, Wilmot, Lethbridge Park, Blackett, Dharruk, Hebersham, Emerton and Penrith.

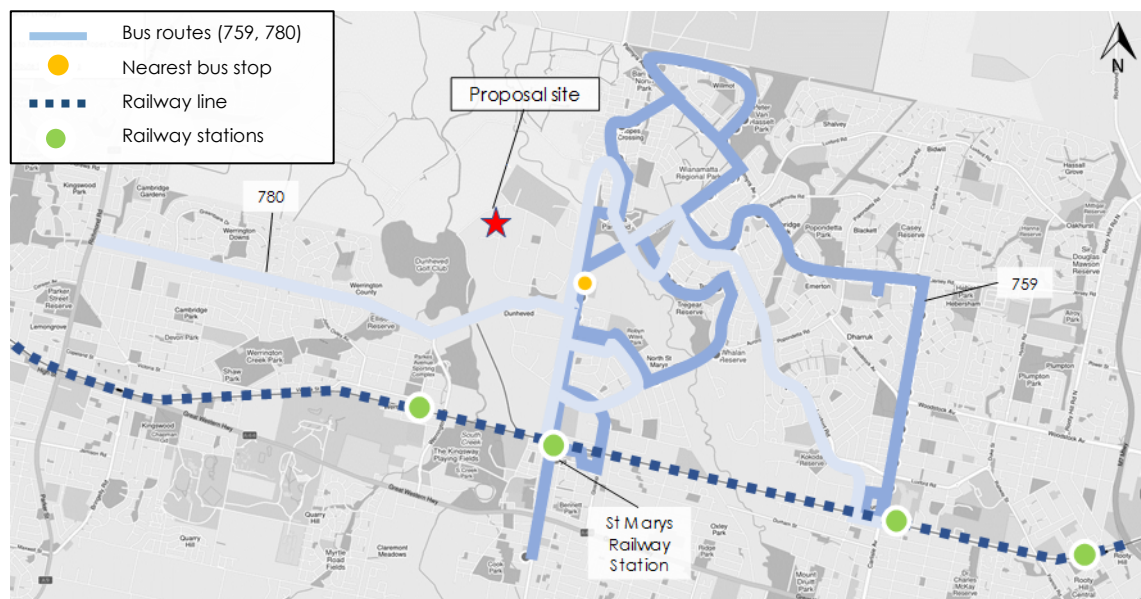
The Proposal site is located 3.3km (40 minute walk) north of St Marys train station, which is serviced by the T1 Western Line. Express train services to St Marys station run from major transport interchanges including Penrith, Blacktown, Paramatta and Central.

A summary of public transport available within the vicinity of the Proposal site is provided in Table 2.2 while the proximity of services is shown in Figure 2.9.

Table 2.2: Public Transport Provision

Service	Route	Direction (to/from)	Peak Frequency	Off-Peak Frequency
Train	T1 Western Line	Parramatta	15 mins	13-17 mins
		Penrith	5-20 mins	12-16 mins
Bus	759	St Marys to Mount Druitt	30 mins	60 mins
	780	Penrith to Mount Druitt	10-15 mins	30 mins

Figure 2.9: Public Transport Routes



Basemap source: Transport for NSW

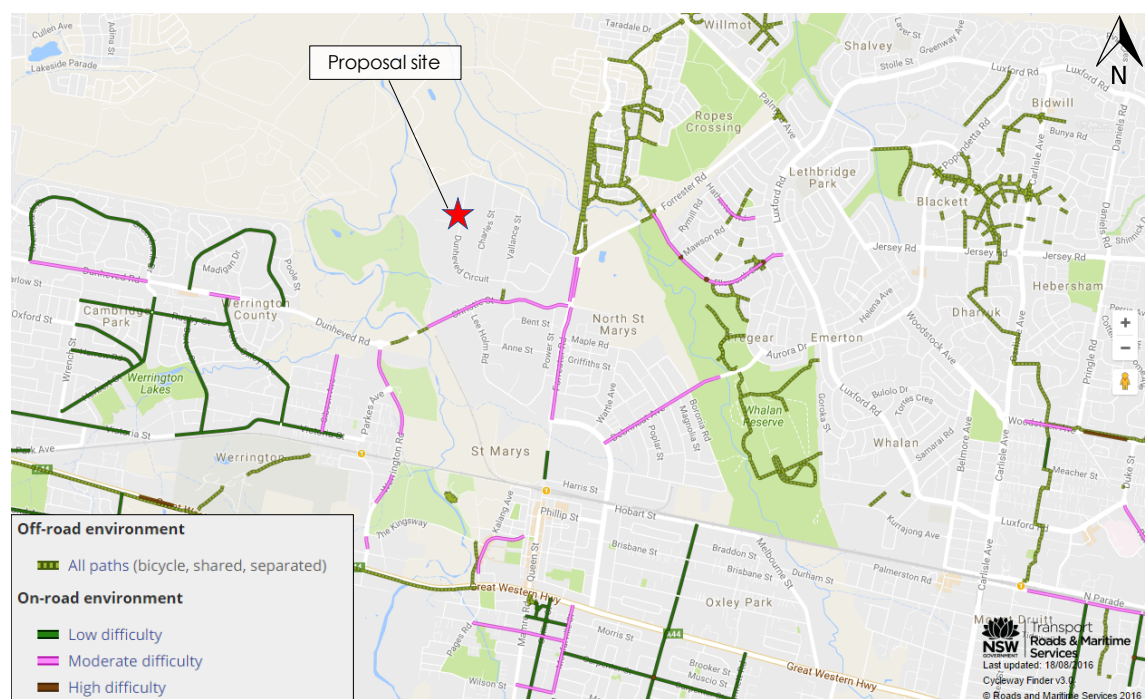
2.10 Pedestrian and Cyclist Facilities

Within the general industrial vicinity of the Proposal site there are scarce pedestrian facilities. A footpath is located along the north-south length of Dunheved Circuit, however, there is no pathway linkage to the site frontage. Similarly, footpaths along walking routes to/from the nearest bus stop and train station are minimal or disconnected.

According to Roads and Maritime's Cycleway Finder map, there is a mixture of off-road and on-road cycleways in the area. The on-road cycle route along Forrester Road is rated as a medium difficulty route, and consist of riding in the road shoulder. As stated on the Cycleway Finder website, such a route is considered for usage by riders who are confident when riding with traffic.

Cycling routes within the vicinity of the site are shown in Figure 2.10.

Figure 2.10: Surrounding Cycleways



Source: Roads and Maritime Services Cycleway Finder 2016

3 Description of the Proposed Development

3.1 Development Description

The Proposal intends to extend the RRF currently operating at 25 Dunheved Circuit onto neighbouring lot, 21 Dunheved Circuit. This will facilitate the operation of an annual waste throughput of 350,000 tonnes.

The key construction components of the Proposal would include:

- Demolition of all structures, except for electrical substations, at 21 Dunheved Circuit
- Demolition of a section of the eastern wall of the approved processing shed at 25 Dunheved Circuit to provide access between the existing processing shed and the proposed extension to the processing shed
- Extension of the processing shed and external hardstand onto 21 Dunheved Circuit
- Relocation of existing, and provision of additional, on-site car parking spaces
- Extension of the existing site office on 25 Dunheved Circuit
- Widening the existing driveway access to 25 Dunheved Circuit to separate vehicle access and egress
- Provision of a second vehicle egress point along Dunheved Circuit
- Installation of a new 20 m long in-ground weighbridge at the vehicle egress point
- Installation of two in-ground wheel wash bays at the exit weighbridges
- Relocation of four stormwater detention (OSD) tanks and installation of a new rainwater reuse tank
- Relocation of the 30,000 L self-bunded fuel tank
- Extension of a dust suppression and sprinkler system
- Installation of a designated chemical and Liquefied Petroleum Gas (LPG) storage area
- Installation of landscaping
- Upgrade of two intersections comprising minor widening at the intersections of Dunheved Circuit loop to Dunheved Circuit (both the northern and southern legs)
- The key operational components of the Proposal would include:
 - Increasing operational (including processing and waste delivery and collection) hours to 24 hours per day, Monday to Saturday (no works on Sundays or public holidays would be undertaken)
 - Processing of up to 350,000 tpa of non-putrescible waste

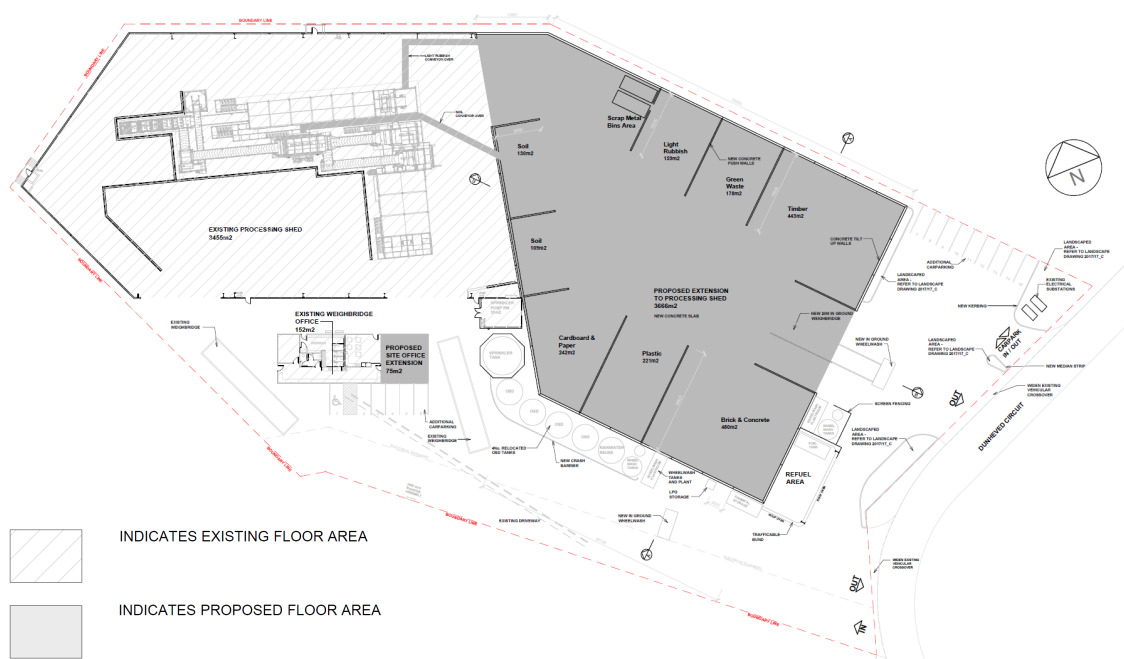
- Waste storage of up to 20,000 tonnes of non-putrescible waste at any given time
- Waste streams to be received, and processed waste streams, include a range of non-putrescible waste types. Appendix A provides a list types that would be processed.

The yields of the Proposal site layout are summarised in Table 3.1 while the Proposal site plan, access and car parking arrangements are shown in Figure 3.1

Table 3.1: Proposal Site Yields

Use	Description	Size
Office	Site office, lunch room, meeting room, amenities	227m ²
Warehouse/ Shed	Waste unloading, storage, tipping, processing, loading	7,121m ²
Remainder of site	Including internal roads, weighbridges, car parking	4,652m ²
Total site area		12,000m²

Figure 3.1: Proposal Site Layout



Source: Dewcape

During the operation of the future facility, it is proposed to have 30 full-time staff and five staff under casual employment arrangements. Full-time employees will be split into two shifts of 15 staff, with casual staff covering for illness and leave of full-time staff. No more than 15 employees would be onsite at the same time.

3.2 Car Parking

It is proposed to provide a total of 15 onsite car parking spaces. Six parking spaces would be located near the weighbridge site office and would be accessible via the southern driveway. The remaining nine parking spaces would be located near the north-eastern perimeter of the Proposal site. The latter would be accessed via the northern driveway designated for use by cars/ light vehicles.

The suitability of the parking provision and layout is discussed in Section 5 of this report.

3.3 Vehicle Access and Circulation

Access to the Proposal site is provided via two separated driveways off Dunheved Circuit. The southern driveway is 25m in width and 75m in length, and would provide access for trucks and cars to 25 Dunheved Circuit. At the western end of the driveway (within the site) there are two heavy vehicle weighbridges whereby all trucks would be weighed and recorded prior and post waste tipping.

All heavy vehicles accessing the facility would enter via the southern driveway to access either the existing recycling shed for waste tipping (on 25 Dunheved Circuit) or the extended processing shed for waste collection (on 21 Dunheved Circuit). A small number of cars would enter via this driveway to access the staff car parking proposed adjacent to the site office.

The northern access comprises two driveways that are 17.2m and 9.4m in width. Once having been loaded with waste, the larger driveway would provide an egress for trucks exiting the extended processing shed. The latter driveway would provide two-way access to the staff car park located near the north-eastern perimeter of the site. The two driveways would be separated by a raised median having a width of 500mm. Driveways would be signposted to indicate to drivers designated entry and exit points.

Trucks accessing the site would serve different functions with regards to waste tipping and waste collection. There are four different scenarios whereby trucks would be required to access the site, namely:

- Scenario 1: Loaded 12.5m Hook-lift and Marrell trucks would enter the site to tip waste in the existing recycling shed and leave the site empty, exiting via 25 Dunheved Circuit. It would also be possible for empty 12.5m trucks to enter the site to collect waste in the extended processing shed and leave the site loaded.

The initial movement would be the predominant movement while the latter is expected to occur infrequently. However, both movements are shown in Figure 3.2.

- Scenario 2: Loaded 19.6m Truck-and-dogs would enter the site to tip waste in the existing recycling shed and proceed to the extended processing shed to collect waste and leave the site loaded via 21 Dunheved Circuit. It would also be possible for Truck-and-dogs to leave the site without loading up prior to exit. In this case, trucks would exit the site via 25 Dunheved Circuit. Further details on load-up of Truck-and-dogs before exiting the site are provided in Section 6.2.1.1.

The initial movement would be the predominant movement (around 90% of all Truck-and-dogs) while the latter is expected to occur infrequently (10% of Truck-and-dogs). However, both movements are shown in Figure 3.3.

- Scenario 3: Empty 19.0m semi-trailers enter the site to collect waste in the extended processing shed and leave the site loaded via 21 Dunheved Circuit. This movement is shown in Figure 3.4.
- Scenario 4: Empty 25/26m B-double trucks enter the site to collect waste in the extended processing shed and leave the site loaded via 21 Dunheved Circuit. This movement is shown in Figure 3.5.

Vehicle circulation within the site would be in a forward direction, with the exception of trucks reversing a short distance (around 20m) into the existing recycling shed to tip waste. A traffic controller would be stationed at the existing recycling shed to supervise truck drivers while reversing into the tipping area.

Site access and internal traffic circulation routes in each of the above scenarios are illustrated in Figure 3.2 to Figure 3.4. A detailed assessment of vehicle swept paths for internal circulation is detailed in Section 5.3 of this report.

Figure 3.2: Scenario 1 – 12.5m Hook-lift and Marrell Truck Circulation

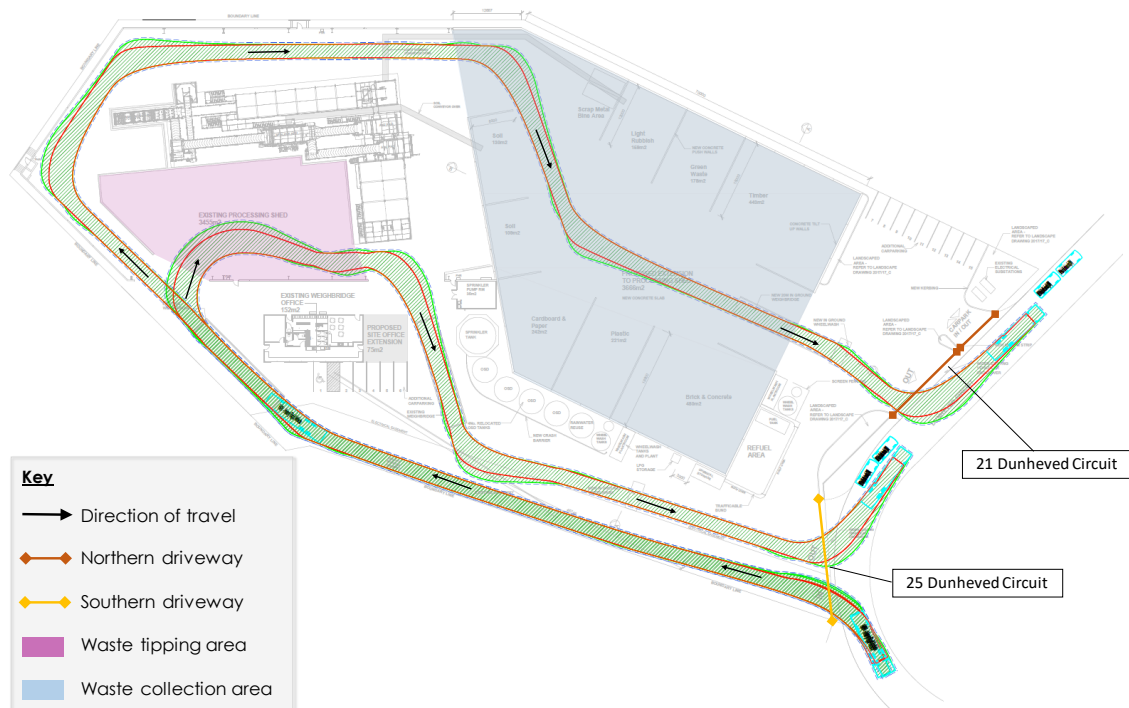


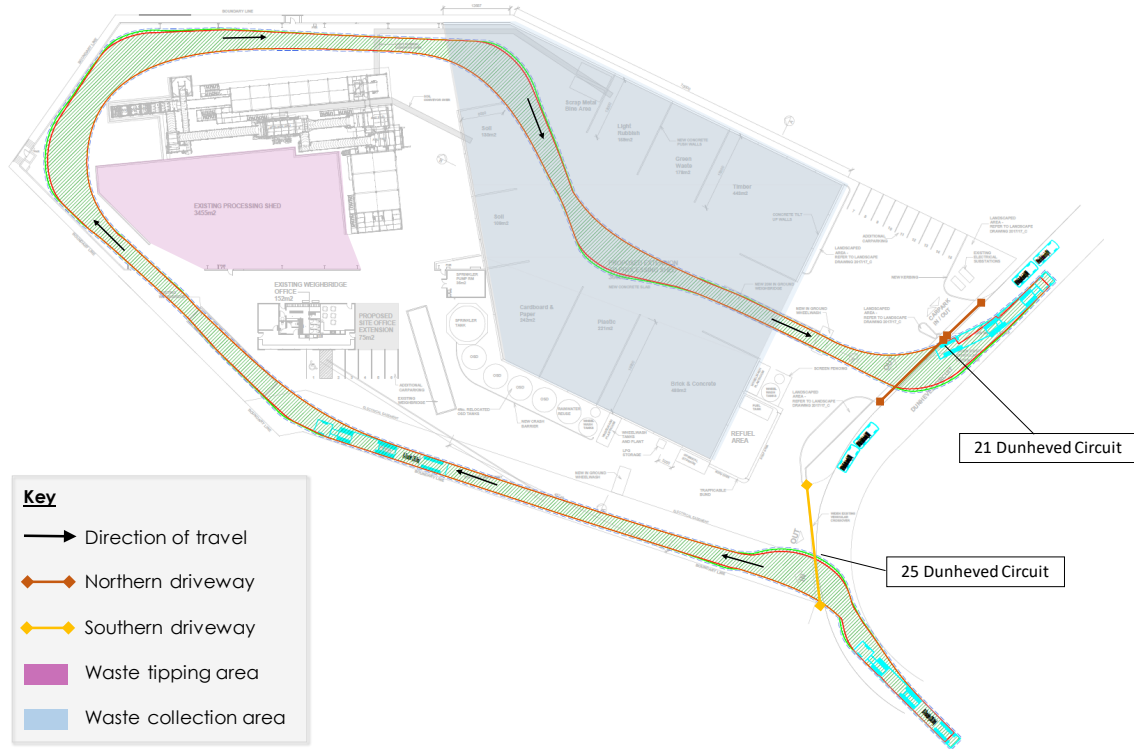
Figure 3.3: Scenario 2 – 19.6m Truck-and-Dog Circulation



Figure 3.4: Scenario 3 – 19.0m Semi-Trailer Circulation



Figure 3.5: Scenario 4 – 25/26m B-double Circulation



4 Car Parking

4.1 Car Parking Requirements

The *State Environmental Planning Policy (State and Regional Development) 2011*, Part 2, Clause 11 stipulates that Council's development control plans do not apply to state significant developments. However, having due regard to the objectives and guidelines as set by Council for industrial developments, the provision for car parking of the proposed development has been assessed in accordance with the Penrith City Council's Development Control Plan (DCP) 2014 as well as undertaking an assessment of the actual operation of the proposal.

Penrith City Council's DCP sets out a number of objectives to ensure the operational safety and amenity of parking and accessibility for industrial developments, which include:

- ensure the provision of an appropriate number of vehicular spaces having regard to the activities present and proposed on the land, the nature of the locality and the intensity of the use;
- require parking areas to be designed and constructed in accordance with the Australian Standards for efficient and safe vehicle circulation and parking;
- reduce pedestrian and vehicle conflicts on development sites.
- facilitate an appropriate level of on-site parking provision to cater for a mix of development types;

Typically, these objectives are satisfied through the application of Council's DCP parking provisions. Although the DCP does not stipulate parking rates for resource recovery centres exclusively, it does specify rates for industrial developments based on the type of development.

As per the Penrith LEP 2010, an 'industry' is defined as a general industry whereby 'industrial activity' is carried out. Such activities include processing, recycling and any storage or transportation associated with any such activity. Based on this definition, the Proposal site is classified as an 'industry' having a minimum onsite car parking requirement as summarised in Table 4.1.

Table 4.1: DCP Car Parking Requirements – Industrial Land Use

Development Type	Rate	Proposed Area	Minimum Required Parking
Industries, including ancillary office	1 space per 75m ² of GFA or 1 space per 2 employees, whichever is the greater	7,348m ²	98 spaces or 8 spaces

Based on DCP rates, the minimum required onsite car parking spaces would be 98 spaces. For the 15 employees proposed to be present onsite at any given time, 98 parking spaces would be considered to be excessive. In this instance, determination of the required parking is considered to be more appropriately measured based on the number of employees at the site at any given time.

The proposed parking arrangement of 15 spaces, including one accessible space, for 30 full-time employees would sufficiently accommodate all staff onsite. The proposed 30 full-time staff will carry out work across two shifts, whereby 15 employees will be present during each shift. Therefore, 15 staff will be the maximum number of employees onsite at any one time.

Based on infrequent visitation patterns at the current site, visitor parking is not deemed to be required for the operation of the future facility. In the case that a visitor will be attending the site, the Operator will be informed prior to the appointment and parking arrangements would be made accordingly.

Based on this, a total of 15 car parking spaces would adequately accommodate full-time employees at the site per shift while also fulfilling the objectives as set out in the DCP. Therefore, the proposed 15 car parking spaces are considered sufficient to serve the Proposal.

Parking, queuing and short or long-term storage of trucks, cars or any plant associated with the facility would not be permitted within the reserve area opposite the site. As with all other road rules, site-generated traffic would be expected to obey 'No Stopping' restrictions on Dunheved Circuit, particularly along the loop road and opposite the site accessways.

Council's DCP specifies that accessible parking spaces should be provided in accordance with Disability (Access to Premises - Buildings) Standards 2010 and Building Code of Australia (BCA). Under Clause D3.5, the proposed development is classified as a Class 5, 6, 7b, 8 and 9a building and has a disabled car parking provision of one space for every 100 car parking spaces or part thereof. Applying this parking rate, it is required to provide 0.15 accessible parking spaces for the proposed development, or one space.

Based on the nature of the site and the requirements as per BCA, 15 car parking spaces, including a single accessible space, would sufficiently accommodate the parking demand generated by the Proposal. As such, it is proposed to provide these car parking spaces onsite as part of the Proposal.

4.2 Parking Layout

Of the 15 onsite car parking spaces, six would be located adjacent to the weighbridge site office and the remaining nine located along the north-eastern perimeter of the Proposal site. Of the six spaces located nearest to the weighbridge site office, one space would be allocated as an accessible parking space.

The Australian Standard for Off-street car parking (AS2890.1:2004) requires car parking spaces for employee parking to be provided as Class 1A parking spaces. Class 1A car parking spaces are to have the following minimum dimensions:

- Bay length of 5.4m
- Bay width of 2.4m.

The Australian Standard for Off-street parking for people with disabilities (AS2890.6:2009) requires accessible parking spaces to be provided with minimum dimensions of 2.4m wide by 5.4m long and provided with a shared area of the same dimensions.

The proposed car park layout complies with the above minimum requirements. Hence, the proposed car parking layout is satisfactory.

4.3 Bicycle Parking Requirements

The DCP states that bicycle parking should be provided in accordance with the suggested bicycle parking provision rates for different land use types in NSW Government's 'Planning guidelines for walking and cycling' (2004). For 'industrial and warehousing' land uses, the following bicycle parking rates are recommended:

- Staff (long-term use), 3-5% of staff
- Visitor (short-term use), 5-10% of staff.

Applying an average of the above rates, the allocation of bicycle parking would be less than one space for staff and one space for visitors. Due to the low number of bicycle parking spaces that these rates generate, it is not proposed to provide designated bicycle racks or parking spaces onsite. However, in the event that a visitor or member of staff has ridden to the site, there would be sufficient space in the weighbridge site office to safely store the bicycle.

5 Site Layout

5.1 Site Access and Circulation

Penrith City Council's DCP outlines the design controls for accessing industrial developments. It states that the development shall be designed to permit the following:

- allow all vehicles to enter and leave the site in a forward direction
- accommodate heavy vehicle parking and manoeuvring areas
- avoid conflict with staff, visitor vehicular and cycle movements, and
- ensure satisfactory and safe operation within the adjacent road system.

All movements in/out of the Proposal site by light and heavy vehicles would be undertaken in a forward direction only. Reversing into and out of the site would not be permitted under any circumstance.

Similarly, vehicle circulation routes within the site would occur in a forward direction. Trucks would be required to reverse a short distance of around 20m into the existing recycling shed in order to tip waste. Reversing manoeuvres undertaken by heavy vehicles would be supervised by a traffic controller who would be stationed within the existing recycling shed at all times.

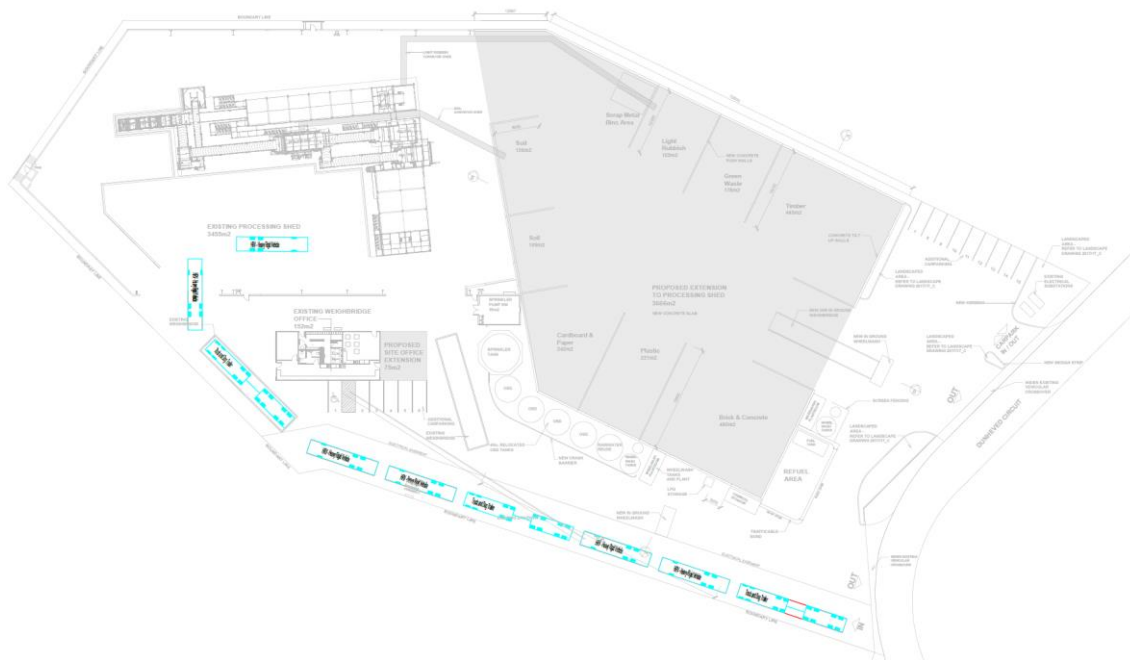
Heavy vehicle routes throughout the site would be separated from light vehicles, and pedestrian movements. An exception to this is along the southern driveway whereby a small number of cars would be accessing the Proposal site. With a total of six car parking spaces located adjacent to the weighbridge site office, it is anticipated that there would be no more than six cars accessing the site via the southern driveway per day. These movements would predominately be undertaken by staff who would typically enter the site during the earlier part of the day for start of work and at the end of the day. These periods generally coincide with the off-peak periods for the site operations. Hence, potential conflict between heavy vehicles and light vehicles into the site would be negligible.

5.2 Onsite Vehicle Stacking

Waste disposal and collection activities would be carried out under four different scenarios, as explained in Section 3.3. The site layout would allow for waste disposal and collection activities to occur concurrently as well as queuing onsite for vehicles.

The driveway access to 25 Dunheved Circuit is 75m in length and could accommodate the stacking of eight trucks, with one truck in the existing recycling shed. This plan shows that there is adequate space for the stacking of six 12.5m trucks and three 19.6m Truck-and-dogs, giving a total of nine stacking spaces. The stacking plan arrangement correlates with the vehicle composition of inbound waste delivery vehicles during future operations. This stacking arrangement is shown in Figure 5.1 while a larger-scale of the same plan is provided in Appendix E.

Figure 5.1: Onsite Vehicle Stacking



A breakdown of the time spent on each activity whilst onsite is summarised in Table 5.1. As a contingency, the 'Total Time Required' has been rounded up to the nearest 10 minutes to factor in additional waiting time.

Table 5.1: Timing of Waste Disposal and Collection Activities

Site	Activity		Scenario 1 (12.5m truck deposits waste)	Scenario 2 (19.6m T+D deposits & collects waste)	Scenario 3 (19.0m Semi-Trailer collects waste)	Scenario 4 (25/26m B-double collects waste)
25 Dunheved Circuit	Truck weigh-in		2 mins	2 mins	2 mins	2 mins
	Truck deposits waste on tipping floor		7 mins	10 mins		
	Visual inspection of waste		3 mins	5 mins		
	Truck weigh-out and wheel wash		2 mins			
21 Dunheved Circuit		Truck proceeds to extended processing shed to collect waste		10 mins	10 mins	15 mins
		Truck weigh-out and wheel wash		2 mins	2 mins	2 mins
Total Time Required			20 mins	30 mins	20 mins	20 mins

Based on the information in Table 5.1, a truck would spend an average of around 25 minutes onsite between entry and exit. Applying this rate, each stacking space could accommodate 2.4 vehicles in one hour (60 minutes / 25 minutes). Therefore, in one hour, there would be a turn-over of 21 vehicles (2.4 vehicles x nine spaces).

As will be discussed in Section 6.2.1, future operations would generate 24 two-way truck movements during the site's peak activity. This considers waste delivery trucks as well as waste collection trucks. Since a single truck generates one inbound movement and one outbound movement, the 24 two-way vehicle movements equate to 12 trucks.

The availability of stacking space within the site would be able to adequately store the 12 trucks expected to arrive during the site's peak hour. Hence, queuing of heavy vehicles would be entirely accommodated and managed within the site, and would not be expected to cause any impact on Dunheved Circuit.

5.3 Vehicle Swept Paths

The internal road layout of the Proposal site is designed to accommodate forward movements by the largest vehicle accessing the site, that is, a 25/26m B-double. Circulation aisles within the site provide sufficient width for 25/26m B-doubles, 19.6m Truck-and-dogs, 19.0m Semi-trailers and heavy rigid vehicles (Hook-lift and Marrell trucks) to adequately move through the site.

All heavy vehicles accessing the site would enter by turning left-in from the southern end of Dunheved Circuit. Upon exit, all trucks would turn left-out towards the northern end of Dunheved Circuit. It is noted that all trucks are to enter and exit the site in a forward direction.

When turning in and out of the site, heavy vehicles would require the full width of the roadway on Dunheved Circuit. As per AS2890.2 Parking facilities, it is considered acceptable for a heavy rigid vehicle or articulated vehicle to take up most of the public road width when turning left into/ out of a driveway.

The current layout of nearby intersections of Dunheved Circuit loop with Dunheved Circuit provide inadequate road space to allow the swept path of a 25/26m B-double truck to/from the Proposal site. It is proposed to upgrade these intersections to accommodate the swept path of B-doubles as shown in Figure 5.2. Plans showing the road widening with B-double swept paths are included in Appendix F of this report.

Figure 5.2: Onsite Vehicle Stacking



As shown in Figure 5.2, a 25/26m B-double would require the full width of the roadway when undertaking a left-turn out and right-turn into the loop road. On average, it is estimated that one B-double truck would access the site per fortnight to move waste off-site. Given the infrequent arrival of B-doubles to the site, low traffic volumes and low traffic speed environment of the road, trucks requiring to use the full width of the road whilst turning is not considered to cause an adverse impact on the road network.

Observations from a drive-through inspection of the area in July 2016 showed that driver sight distances on all approaches at the intersections of Dunheved Circuit loop and Dunheved Circuit are adequate. On this basis, truck drivers would give way to all traffic at and approaching the intersection prior to turning out into the intersection.

Swept path analyses for heavy vehicle at the nearby intersections on Dunheved Circuit, the site's driveways, and the internal circulation routes have been carried out using AutoTURN. The analyses show that the swept paths will operate successfully. The full set of swept path analyses results are contained in Appendix F.

5.4 Pedestrian Access and Internal Movements

All vehicle and pedestrian routes within the site would be separated, and signposted and/ or delineated as such. Pedestrian access to the waste processing and sorting sheds would be prohibited, with permission granted only to the traffic controller on duty. The traffic controller would access the sheds using the pedestrian paths provided.

Pedestrians must give way to all vehicles onsite, including trucks and mobile plant. When moving around onsite, pedestrians must keep to the designated pathway. Where the

pathway intersects with a traffic route, pedestrians are required to give-way to vehicles before crossing the traffic lane.

As a rule-of-thumb, Personal Protective Equipment (PPE) must be worn by all persons when onsite. All persons on site are required to wear high visibility clothing to enhance discernibility of pedestrians during day and night conditions.

The number of pedestrian movements throughout the site would be low and generally limited to the start/end of work shifts and at lunch time. Therefore, interaction between vehicles and pedestrians across the site would be infrequent.

Truck drivers would be permitted to exit their vehicle only when untarpping the load in preparation to enter the existing recycling shed to tip waste. Such activity would be undertaken in the stacking area and under the supervision of the traffic controller in the designated area.

A traffic control plan showing control measures to manage traffic and the separation of vehicle-pedestrian movements throughout the site is contained in Appendix G.

6 Traffic Impact Assessment

6.1 Design Rate

Under the State Environmental Planning Policy (Infrastructure) 2007, the Proposal site is considered a 'traffic-generating development'. Hence, it is a requirement to assess the impact of traffic associated with the future operation of the Proposal site.

Roads and Maritime's 'Guide to Traffic Generating Developments' is used as a tool in determining the future traffic generation rates for different development types and land uses. The guide states that "...peak traffic generation period for industrial land use is generally determined by three key factors: employee density, travel mode and peak period travel distribution." The guide also recognises that peak period traffic generation of industrial land uses differs depending on the specific industrial development type.

Roads and Maritime's Guide contains traffic generation rates for four industrial development types, namely, factories, warehouses, plant nurseries and business parks. Of these development types, factories and warehouses are most similar to that of the Proposal. The traffic generation rates for factories and warehouse are summarised in Table 6.1.

Table 6.1: Roads and Maritime Traffic Distribution Rates – Factories and Warehouses

Development Type	Traffic Generation Rate	
	Peak Hour Vehicle Trips	Daily Vehicle Trips
Factories	1 per 100m ² of GFA	5 per 100m ² of GFA
Warehouses	0.5 per 100m ² of GFA	4 per 100m ² of GFA

The traffic generation rates as per the Guide are based on the gross floor area (GFA) of the development. Vehicle movements associated with the Proposal site is not directly impacted by changes in the GFA; rather it is influenced by the amount of waste throughput. Hence, application of Roads and Maritime's traffic generation rates is not considered to be appropriate.

Furthermore, Roads and Maritime's traffic generation rates are considered to be out-dated since they present survey data from over 20 years ago. Section 3.10.1 of the Guide refers to RTA surveys of average gross floor space per employee of factory developments undertaken in 1978.

Roads and Maritime is in the process of updating the Guide and has recently undertaken detailed traffic generation studies of specific land uses. However, it is understood that surveys for industrial developments do not encapsulate resource recovery facilities.

6.2 Traffic Generation

An estimate of traffic generation due to the Proposal, based on Roads and Maritime's rates for factories and warehouses, is summarised in Table 6.2.

Table 6.2: Traffic Generation Estimates

Development Type	Proposal Site	Peak Hour Trips		Daily Trips	
		Traffic Generation Rate (Roads and Maritime)	Estimated Trips	Traffic Generation Rate (Roads and Maritime)	Estimated Trips
Factories	Existing Recycling Shed (25 Dunheved Circuit)	1 per 100m ² of GFA	37	5 per 100m ² of GFA	183
Warehouses	Extended Processing Shed (21 Dunheved Circuit)	0.5 per 100m ² of GFA	17	4 per 100m ² of GFA	138
Total			54		322

Based on Roads and Maritime's traffic generation rates, the Proposal would generate 54 vehicle trips within a peak hour and 322 vehicle movements across the entire day.

For a resource recovery facility, site-generated vehicle trips are better represented by the volume of waste throughput at the facility. Therefore, the traffic generation for the Proposal site is considered to be more appropriately determined based on an empirical traffic generation assessment. This assessment considers the tonnage of waste to be transported through the site.

6.2.1 Site Traffic Generation Characteristics

The traffic generating characteristics of the proposed development are considered to be directly related to the following parameters:

- Handling/ processing capacity
- Operating hours.

6.2.1.1 Processing Capacity

The Proposal site would have a waste throughput of 350,000 tonnes per annum.

Once operational, 350,000 tpa of inbound waste would be transported into the site by vehicles ranging from a 12.5m Marrell truck to a 25m B-double.

As described in Section 4.3, heavy vehicle movements to/from the site would include:

- the arrival of loaded trucks (25m B-double, 19.6m Truck-and-dog, 12.5m Hook-lift truck and 12.5m Marrell truck) and departure of empty trucks (12.5m Hook-lift truck and 12.5m Marrell truck). Larger sized trucks (25m B-double, 19.6 Truck-and-dog) would load up with waste prior to leaving the site.

- the arrival of empty trucks (25m B-double, 19.6m Truck-and-dog and 19.0m Semi-trailer) and departure of these trucks loaded.

Heavy vehicle trips pertaining to the movement of inbound and outbound waste for typical operations at the Proposal site is summarised in Table 6.3.

Table 6.3: Future Vehicle Movements

Period	Vehicle Movements (one-way)	Vehicle Movements (two-way)	Waste (tonnes)
Inbound waste (ie. Waste Delivery Vehicles)			
Per year	23,451	46,902	350,000
Per week	451	902	6,731
Per day	77	154	1,122
Outbound waste (ie. Waste Collection Vehicles)			
Per year	6,240	12,480	350,000
Per week	120	240	6,731
Per day	20	40	1,122
Total Average (per day)	97	194	2,244

Typical operations at the Proposal site are estimated to generate 194 two-way vehicle movements per day or 97 trucks, as outlined in Table 6.3.

A 'worst case' scenario has been estimated and represented herein to represent the trips expected for a 'busy day' at the Proposal site. Based on weighbridge data for in and out movements at 25 Dunheved Circuit in June 2016, a variance of up to around 20% between the lowest volume day and highest volume day is apparent. Applying this rate, an increase in daily vehicle flows of 20% has been estimated to represent a busy day at the Proposal site.

The expected 24-hour profile of site-generated traffic flows for the delivery and removal of waste to and from the facility is summarised in Table 6.4.

Table 6.4: Future Two-Way Vehicle Trips

Hour Starting	Typical Day Operations	'Busy Day' Operations
0:00	4	5
1:00	4	5
2:00	4	5
3:00	4	5
4:00	4	5
5:00	4	5
6:00	5	6
7:00 ^a	5	6
8:00	6	8
9:00	10	12
10:00	16	20
11:00 ^b	20	24
12:00	18	22
13:00 ^c	20	24
14:00	18	22
15:00	16	20
16:00 ^d	6	8
17:00	5	6
18:00	5	6
19:00	4	5
20:00	4	5
21:00	4	5
22:00	4	5
23:00	4	5
Total	194	239

Notes:

a – AM road network peak (7:15am-8:15am)

b – AM site operation peak (11:00am-12:00pm)

c – PM site operation peak (1:00pm-2:00pm)

d – PM Road network peak (4:15pm-5:15pm)

As presented in Table 6.4, 239 two-way vehicle trips are anticipated to be generated by the Proposal site in the worst-case scenario. This number encapsulates movements undertaken by waste delivery vehicles as well as waste collection trucks.

The estimation of daily vehicle movements considers the arrangement described as 'Scenario 3' in Section 4.3 of this report; that is, all 19.6m Truck-and-dogs depositing waste at the site would load up with waste prior to exiting the site. Ultimately,

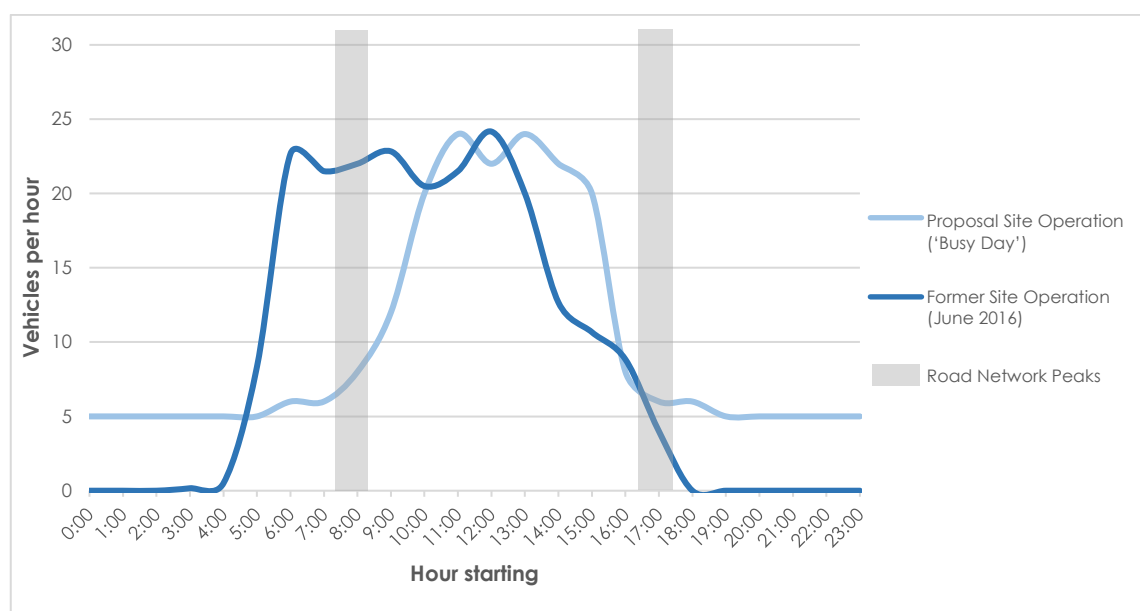
operations at the Proposal site would see all Truck-and-dogs load up before exiting the site. However, as a contingency, 90% of Truck-and-dogs delivering waste to the facility have been assumed to collect waste from the extended processing shed (21 Dunheved Circuit) before leaving the site.

With consideration of the above, the future vehicle volumes summarised in Table 6.3 and Table 6.4 are conservative. Therefore, the site-generated traffic flows presented within this report are anticipated to be greater than those to be observed at the Proposal site.

Under the scheduling system of the future facility as implemented by the Operator, future traffic accessing the site would be shifted to the middle part of the day. The purpose of this would be to reduce the impacts of site-generated traffic on the local road network during the road network peak periods. As such, the peak activity periods for future operations would occur between 11:00am – 12:00pm and 1:00pm – 2:00pm while the road network peaks occur between 7:15am – 8:15am and 4:15pm – 5:15pm. Future two-way traffic flows anticipated during busy day operations are shown in Figure 6.1.

Figure 6.1 also shows two-way traffic flows at the former facility as surveyed in June 2016 (Figure 2.5). It is emphasised in Figure 6.1 that there would be a shift expected in the operational periods between the former site and the Proposal site. The former site typically experienced the bulk of two-way vehicle movements in the period between 6:00am – 12:00pm, which included the morning road network peak hour. In comparison, the Proposal site it anticipated to experience the bulk of two-way movements between 11:00am – 2:00pm, which is outside of both road network peaks.

Figure 6.1: 24-hour Profile of Traffic Flows



Hence, the Proposal is expected to have a reduced impact on the surrounding road network during its peak periods when compared to the former site. Overall, the Proposal site would have minimal impact on the local road network.

6.3 Traffic Distribution

The directional split of traffic generated by the Proposal site is in such a manner that all waste would be transported into the site by inbound vehicles. The same vehicle exits the site empty, in-turn generating a two-way vehicle movement. The exception to this operation is the Truck-and-dog, which would leave the site loaded.

Conversely, larger sized trucks would arrive at the site empty and would be loaded with waste, in-turn, each generating a two-way trip.

In the wider road network, the distribution of the site-generated traffic considers all trucks travelling via Great Western Highway, M4 Western Motorway and M7 Westlink Motorway. Within the vicinity of the site, heavy vehicles would travel to/from the site via Forrester Road, Links Road and Dunheved Circuit.

Traffic associated with the Proposal site would travel to/from the site using the same haulage routes as current. Within the local context of the Proposal site, this includes Links Road and Forrester Road. The nearest residential precinct is located along the eastern side of Forrester Road.

During a busy day, it is estimated that there would be between four and six two-way truck movements to/from the site per hour in the evening and night time periods (ie. 6:00pm – 6:00am). This equates to an average of one truck movement every 10 minutes along Forrester Road. As addressed in the Noise Assessment Report within the EIS, this rate is within the noise thresholds for the nominated route. Hence, the heavy vehicle haul route is considered acceptable.

Heavy vehicle haul routes to and from the site are illustrated in Figure 6.2 and Figure 6.3, respectively.

Figure 6.2: Inbound Heavy Vehicle Haul Route

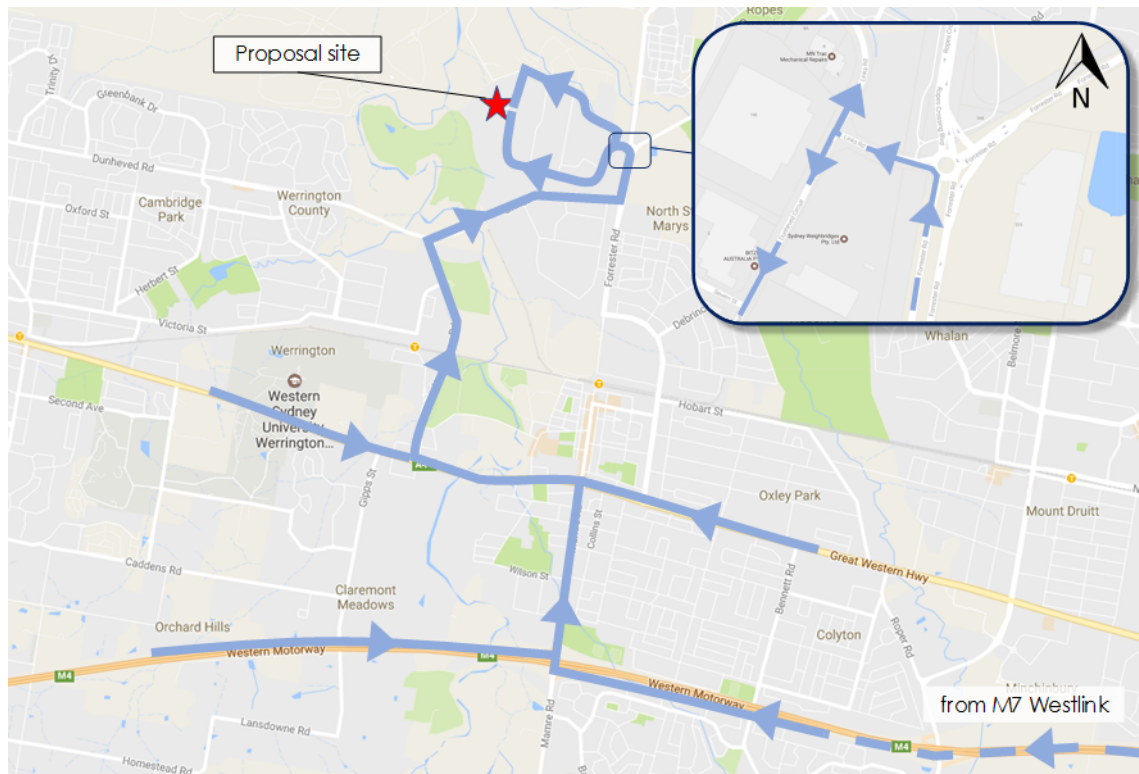
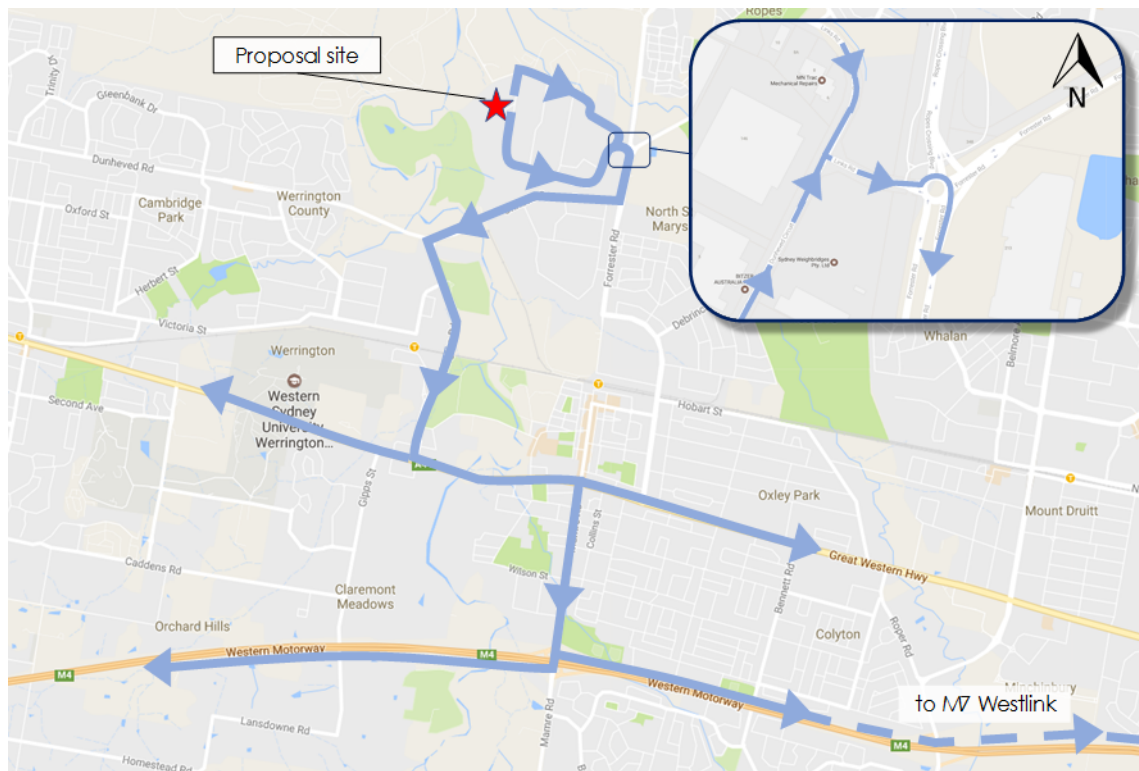


Figure 6.3: Outbound Heavy Vehicle Haul Route



6.4 Operational Traffic Impact

Current operations limit the volume of waste that can be processed at the site and, consequently, the associated traffic movements. Traffic volumes are anticipated to be commensurate or greater than those currently experience at the site.

The Proposal would facilitate a spread of the future traffic volumes over a larger period and, as such, would slightly ameliorate traffic activity and somewhat mitigate impacts on the local road network. Notwithstanding this, a robust assessment has been completed to confirm that proposed traffic volumes in the vicinity are appropriate having regard to the function of the surrounding road network.

A conservative assessment of the traffic impacts during the operational phase of the Proposal site has been undertaken herein. As detailed in Section 6.2.1.1, data that is representative of a 'busy day' during future operations has been used to model a worst-case scenario.

As assessed in Section 2.4, morning and afternoon peak periods on the surrounding road network occur between 7:15am – 8:15am and 4:15pm – 5:15pm, respectively. As per Table 6.4, peak traffic movements at the Proposal site are anticipated between 11:00am – 12:00pm and 1:00pm – 2:00pm, which occur outside of the surrounding road network peak periods. In the worst-case scenario, four trucks would be expected to travel to the site in the road network peaks. This translates to eight two-way vehicle movements; four inbound trips plus four outbound trips.

Adopting the traffic distribution as detailed in Section 4.6, the four trucks travelling to the site would head northbound on Forrester Road, then westbound on Links Road by turning left at the Ropes Crossing Boulevard/ Forrester Road/ Links Road roundabout. Trucks leaving the site would travel in the opposite direction, namely, travelling eastbound on Links Road then southbound on Forrester Road by turning right at the roundabout. The future peak hour traffic movements at the Ropes Crossing Boulevard/ Forrester Road/ Links Road roundabout are shown in Figure 6.4 and Figure 6.5.

Figure 6.4: Ropes Crossing Blvd/ Forrester Rd/ Links Rd Future Turning Movements

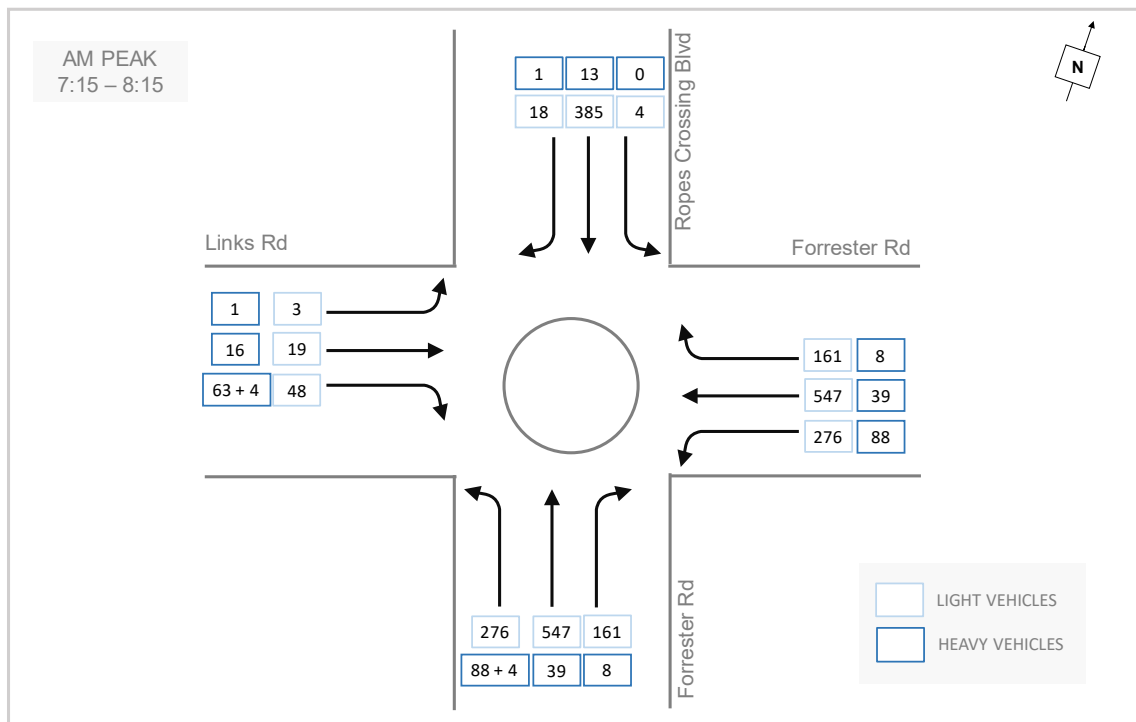
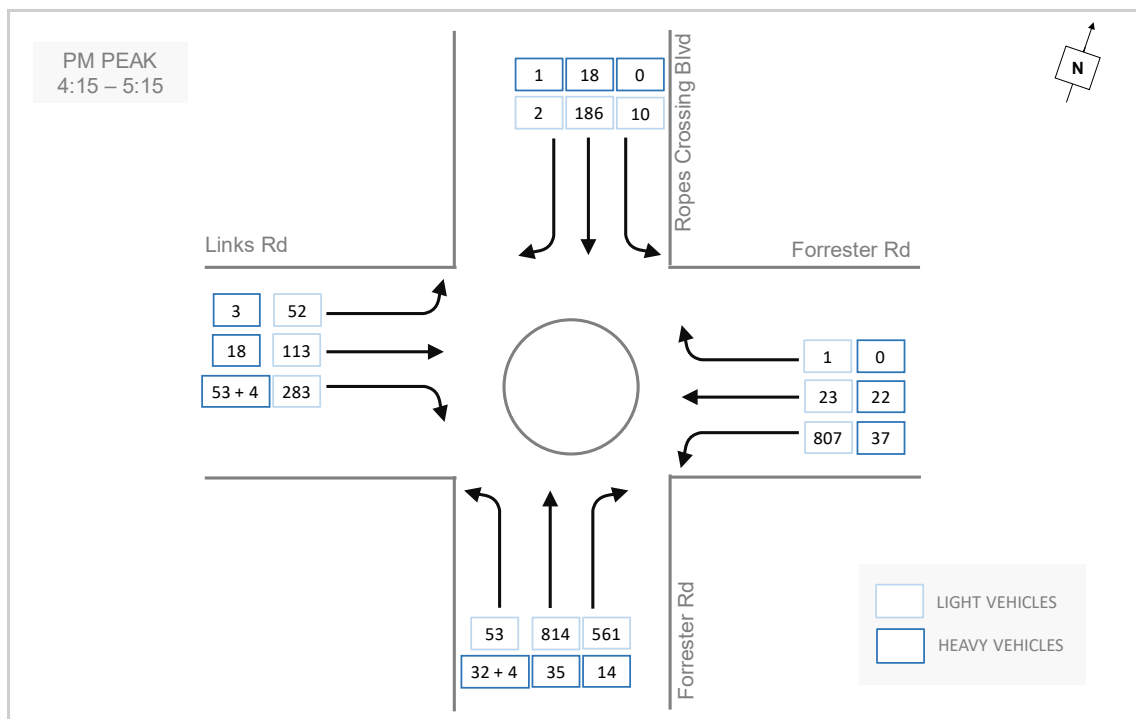


Figure 6.5: Ropes Crossing Blvd/ Forrester Rd/ Links Rd Future Turning Movements



The operational impacts of the Proposal site on the nearby key roundabout has been undertaken using SIDRA Intersection. The results of this assessment are summarised in Table 6.5.

Table 6.5: Intersection Analysis Results of Future Conditions

Intersection	Worst Performing Movement	Peak Period	Average delay (s)	Level of Service (LoS)
Ropes Crossing Boulevard/ Forrester Road/ Links Road	Links Road (western approach), right turn	AM	13.0	A
	Links Road (western approach), right turn	PM	16.8	B

Note: Roads and Maritime uses level of service as a performance measure to indicate the operating efficiency of a given intersection. The level of service ranges from A to F. Levels of service between A and D indicate the intersection is operating within capacity with LoS A providing exceptionally good performance to LoS D indicating satisfactory performance. LoS E and F indicate the intersection is operating at or near capacity and would require intersection improvement works to maintain reasonable performance.

The results of the intersection performance analysis show that the intersection would continue to operate at a LoS A in the morning peak and LoS B in the afternoon peak, with very little increase in the average delay. The worst performing movement remains as the right turn movement from Links Road (western approach) to Forrester Road (southern approach), experiencing similar delays to existing conditions.

This indicates that the key intersection for which all site-generated traffic would pass through would operate satisfactorily under future conditions and with similar performance levels to existing conditions. Hence, in the worst-case scenario, the local road network would operate at an acceptable level of service during the road network peaks.

These results support the inference made in Section 6.2, namely, that the Proposal site would be expected to have minimal impacts on the surrounding road network during its peak periods. Detailed outputs of the SIDRA intersection analysis for the site operations are contained in Appendix H.

Given that the Proposal includes the extension of operating hours to 24-hours per day, any potential increase in traffic flows would be spread out across the day and night causing a 'flattening out' of traffic volumes outside of the site's peak activity and local road network peaks.

During a busy day, the daily two-way traffic movements generated by the Proposal site is 239 trips; this equates to around 120 trucks. The peak period for future operations would occur between 11:00am – 12:00pm and 1:00pm – 2:00pm during which there would be 24 two-way truck movements (ie. 12 inbound truck movements plus 12 outbound truck movements).

In comparison to existing traffic volumes in the vicinity of the site, the additional traffic generated by the Proposal site is not expected to compromise the safety or function of the surrounding road network. Overall, the operation of the surrounding road network, public transport services and pedestrian connections will remain unchanged as a result of the proposal.

6.5 Construction Traffic Impact

Construction activities associated with the Proposal would commence in early 2018 and would be undertaken in five key stages:

- Stage 1 – Site preparation and demolition
- Stage 2 – Bulk earthworks and installation of drainage systems utilities
- Stage 3 – Intersection upgrade works
- Stage 4 – Extension of the processing shed and ancillary facilities
- Stage 5 – Commissioning and demobilisation.

Construction works would be carried out over a duration of 25 weeks, and would include the activities as summarised in Table 6.6.

Table 6.6: Construction Staging

Stage	Duration	Works
Stage 1	3 weeks	▪ Installation of a portable office and amenities building on 21 Dunheved Circuit for use throughout construction period ▪ Installation of additional temporary fencing along site frontage of 21 Dunheved Circuit ▪ Removal of existing structures at 21 Dunheved Circuit including, ○ A steel-clad portal frame shed and attached office ○ Concrete hardstand covering the remainder of the site ○ Four OSD tanks ○ Installation of sedimentation and erosion controls.
Stage 2	4 weeks	▪ Minor bulk earthworks (levelling, excavation or filling) to prepare site for the RRF extension and hardstand areas ▪ Excavation of utility trenches ▪ Installation of pipes, stormwater drainage pits and backfilling of trenches ▪ Pouring of concrete slab across entire construction area on 21 Dunheved Circuit.
Stage 3	4 weeks	▪ Minor widening of two intersection between Dunheved Circuit loop and Dunheved Circuit. Widening would comprise: ○ Site establishment ○ Removal of existing kerbing ○ Minor excavations and levelling ○ Installation of new concrete kerbing ○ Excavation and reinstatement of pavements ○ Relocation of stormwater pit and drainage works.
Stage 4	12 weeks	▪ Construction of RRF extension foundations, slab and external hardstand, involving excavation of footings, laying formwork, placing reinforcement, concrete pouring and curing ▪ Partial demolition of eastern wall of processing shed, disassembly of metal cladding and metal framing. ▪ Construction of shed extension, including the erection of the external and internal walls, frames and roofing. ▪ Installation of building utilities, such as the sprinkler system, lighting and plumbing in shed ▪ Construction of maintenance shed

Stage	Duration	Works
		- Installation of the weighbridge and wheel wash on 21 Dunheved Circuit - Installation of second wheel wash near existing outbound weighbridge on 25 Dunheved Circuit - Installation of an additional in-ground wheel wash in the south-eastern portion of the Proposal site - Relocation of the four OSD tanks and connection to the stormwater pipe system - Construction of bunded area, awning and relocation of the fuel tank - Delineation of on-site car parking and erection of signage.
Stage 5	2 weeks	- Commissioning of site utilities and the sprinkler system ancillary plant - Operation of the facility, utilising both 21 and 25 Dunheved Circuit would recommence during this stage - Demobilisation and removal of temporary site structures, including site office and amenities, and temporary fencing.
Total	25 weeks	

It is anticipated that between 5 and 30 staff would be on site at any one time during the construction phase. Construction works would primarily be undertaken during standard construction hours, namely, 7:00am – 6:00pm Monday to Friday and 8:00am – 1:00pm on Saturday. No works would be carried out on Sunday or public holidays.

Construction vehicles, plant and equipment, and materials would be accommodated onsite.

It is anticipated that heavy vehicles associated with construction would travel from surrounding precincts, either Penrith or Blacktown. Construction vehicles would therefore travel to/from the site using the same haulage routes that would be used during the site's operational phase.

Vehicles associated with the construction works would include light vehicles (workers travelling to/from the site) and heavy vehicles delivering construction plant and equipment, and removing waste from demolition and construction activities.

The estimated average and peak daily traffic movements during the construction phase are outlined in Table 6.7. 'Average daily movements' are indicative of the average two-way vehicle flows throughout the construction period while 'peak daily movements' represent two-way vehicle flows during the peak period of the construction phase.

The peak period for construction works are expected to occur during Stage 2 and Stage 4.

Table 6.7: Construction Works Traffic Movements

Vehicle Class	Average Daily Movements (two-way flows)	Peak Daily Movements (two-way flows)
Light vehicles	45	90
Heavy vehicles	8	16
Total	53	106

Operation of resource recovery activities would continue to be undertaken at 25 Dunheved Circuit during the construction of the Proposal.

To fully appreciate the two-way traffic flows in each of the construction stages, a breakdown of the vehicle movements is provided below and summarised in Table 6.8.

- During Stage 1, site-generated traffic would comprise existing operational traffic and construction traffic (average daily movements)
- During Stage 2, site-generated traffic would comprise existing operational traffic and construction traffic (peak daily movements)
- During Stage 3, site-generated traffic would comprise existing operational traffic and construction traffic (peak daily movements)
- During Stage 4, site-generated traffic would comprise construction traffic only (peak daily movements)
- During Stage 5, site-generated traffic would comprise future operational traffic and some construction traffic (average daily movements).

Table 6.8: Construction Phase Traffic Movements

Construction Stage	Site-Generated Traffic			Additional Average Vehicle Movements
	Existing Operations	Construction Phase	Future Operations	
Stage 1	✓	✓	×	6 trips per hour
Stage 2	✓	✓	×	12 trips per hour
Stage 3	✓	✓	×	12 trips per hour
Stage 4	✓	✓	×	12 trips per hour
Stage 5	×	✓	✓	6 trips per hour

In any Stage, the maximum additional average vehicle movements are 12 trips per hour, which equates to one additional vehicle trip every 10 minutes. The associated traffic generation is considered to be minor and would be able to be absorbed by the local road network without causing noticeable impacts on the network.

6.6 Roadway Capacity and Safety

As discussed in Section 2.5, Roads and Maritime's Guide alludes that the operational capacity of Dunheved Circuit is around 900 vehicles per hour per lane.

The critical periods for the future development would be 11:00am – 12:00pm and 1:00pm – 2:00pm which is estimated to experience 24 two-way movements.

Superimposing the highest average existing traffic flows experienced across the day (50 northbound trips between 2:00pm-3:00pm) and future anticipated traffic flows (12 northbound) generates a maximum of 62 trips. This value remains significantly lower than the prescribed threshold. It is noted that traffic volumes in the southbound direction are lower in comparison to the northbound direction.

Based on the above, it is anticipated that the local road would function satisfactorily with traffic volumes well within the operational capacity thresholds as per Roads and Maritime's Guide.

7 Mitigation Measures

As assessed within this report, traffic generated by the Proposal is not expected to compromise the safety or function of the surrounding road network. However, in order to fully accommodate the future fleet of trucks accessing the site, the current layout of two nearby intersections are required to be upgraded. The details of the proposed road widening at the intersections of Dunheved Circuit loop and Dunheved Circuit have been discussed in Section 5.3 of this report.

7.1 Onsite Traffic Management Measures

Measures to further manage operation and safety of traffic within the site are proposed to include the preparation of a Construction Traffic Management Plan and an Operational Traffic Management Plan, as discussed below.

7.1.1 Operational Traffic Management Plan

The Operational Traffic Management Plan would address the specific traffic control requirements during the operational phase of the Proposal site. The Plan would assess the provision of traffic control measures, including:

- Site signage
- Enforcement of speed limits
- Site-internal pedestrian routes
- Site induction for staff and visitors
- Contracts outlining site traffic rules and traffic management requirements.

7.1.2 Construction Traffic Management Plan

The Construction Traffic Management Plan (CTMP) would address the specific traffic control requirements during the construction phase of the Proposal site as well as during the road widening works. The Plan would assess the provision of traffic control measures, including:

- Site signage and road signage
- Enforcement of speed limits for construction traffic
- Site-internal pedestrian routes
- Site induction for construction staff and visitors
- Contracts outlining site traffic rules and traffic management requirements
- Any road closures and associated traffic detour routes.

8 Conclusion and Summary

Based on the analysis and discussions presented within this report, the following summary and conclusions are made:

- The Proposal is for the extension of the existing resource recovery facility at 25 Dunheved Circuit to include the neighbouring lot, 21 Dunheved Circuit, St Marys. The Proposal seeks to facilitate an annual waste throughput of 350,000 tonnes and increase its hours of operations to 24-hours per day Monday to Saturday.
- As stated in the *State Environmental Planning Policy (State and Regional Development) 2011*, Part 2, Clause 11, Council Development Control Plans do not apply to state significant developments. However, having regard to the DCP the proposed development generates a DCP parking requirement of 98 car parking spaces. However, based on first principles, the proposed supply of 15 staff parking spaces, including one accessible space, would adequately accommodate the proposed 15 full-time employees onsite at any given time.
- The proposed parking layout is consistent with the dimensional requirements as set out in the Penrith City Council DCP and Australian Standard for Off Street Car Parking (AS2890.1:2004 and AS2890.6:2009).
- The proposed site ingress and egress points are consistent with the requirements as set out in the Council's DCP and Australian Standards.
- On the busiest day (ie. 'worst-case scenario'), the Proposal site is expected to generate 239 two-way vehicles across a 24-hour period. During the future site's peak operation, namely 11:00am – 12:00pm and 1:00pm – 2:00pm, 24 two-way vehicle movements are anticipated.
- A comparison of the existing and future intersection operating conditions shows that the impact of traffic generated by the development would not result in a significant change to the existing intersection Level of Service for the roundabout of Ropes Crossing Boulevard, Forrester Road and Links Road. Therefore, there is adequate capacity in the surrounding road network to cater for the traffic generated by the proposed development.
- Construction works would be undertaken over a duration of 25 weeks. The works are expected to generate an average of 12 additional vehicle trips per hour in the busiest stage in the construction phase. Construction traffic is considered to be minimal and have a negligible impact on site operations as well as on the surrounding road network.
- The proposed development warrants road widening upgrades to the intersection of Dunheved Circuit loop and Dunheved Circuit (straight road) for which a swept path analysis has been undertaken and demonstrates that the largest vehicle accessing the site (25/26m B-double truck) can be adequately accommodated.

Appendix A

Intersection Turning Movement Traffic Survey Data

Location Ropes Crossing BLVD
Forrester Road
Forrester Road
Link Road
Suburb St. Mary

Duration 0700 - 1000
1500 - 1800
-
Day/Date Wednesday, 15 June 2016
Weather Raining

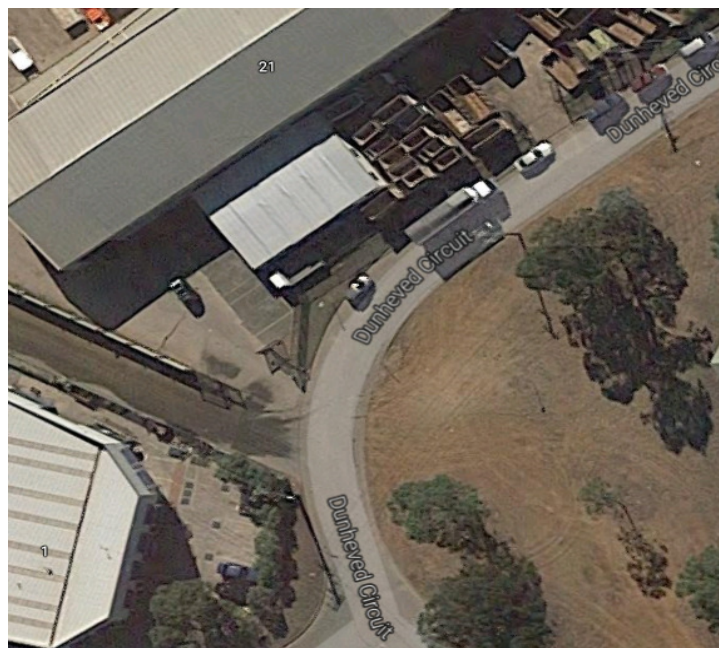
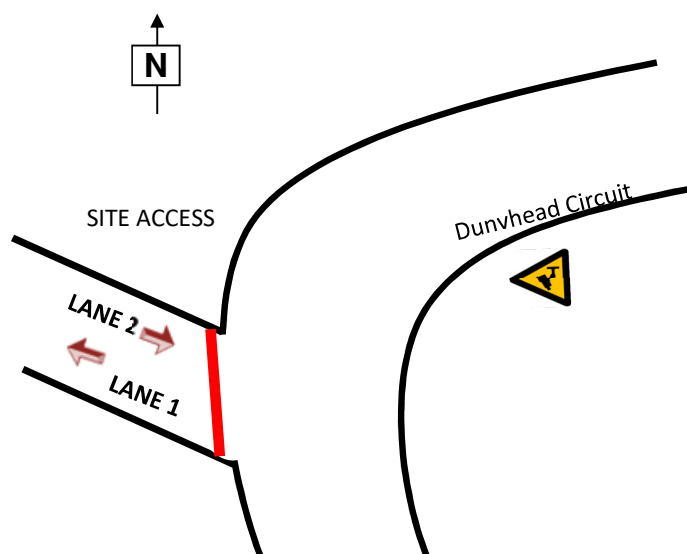
All Vehicles Time Per 15 Mins	NORTH												EAST												TOTAL		
	Ropes Crossing BLVD												Forrester Road														
	L			T			R			U			TOTAL	L			T			R			U			TOTAL	
	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ		LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY	Σ	LIGHT	HEAVY			Σ
7:00 - 7:15	0	0	0	81	3	84	10	1	11	0	0	0	95	131	9	140	31	1	32	0	1	1	0	0	0	173	562
7:15 - 7:30	1	0	1	107	5	112	6	1	7	0	0	0	120	141	13	154	29	3	32	1	0	1	0	0	0	187	638
7:30 - 7:45	1	0	1	89	1	90	3	0	3	0	0	0	94	169	5	174	21	1	22	0	0	0	0	0	0	196	603
7:45 - 8:00	1	0	1	101	4	105	5	0	5	0	0	0	111	176	15	191	26	5	31	0	0	0	0	0	0	222	648
8:00 - 8:15	1	0	1	88	3	91	4	0	4	0	0	0	96	173	6	179	26	5	31	0	0	0	0	0	0	210	616
8:15 - 8:30	0	0	0	70	3	73	3	0	3	0	0	0	76	167	10	177	23	6	29	1	0	1	0	1	1	208	605
8:30 - 8:45	1	2	3	90	3	93	2	0	2	0	0	0	98	162	10	172	15	6	21	0	0	0	0	0	0	193	561
8:45 - 9:00	1	0	1	75	0	75	4	0	4	0	0	0	80	160	8	168	14	6	20	0	0	0	0	0	0	188	542
9:00 - 9:15	1	0	1	67	4	71	3	0	3	0	0	0	75	133	8	141	17	2	19	0	0	0	0	0	0	160	504
9:15 - 9:30	0	0	0	53	3	56	0	1	1	0	0	0	57	144	13	157	6	1	7	1	0	1	0	0	0	165	476
9:30 - 9:45	1	0	1	42	5	47	1	0	1	0	0	0	49	113	14	127	8	4	12	0	0	0	0	0	0	139	449
9:45 - 10:00	0	0	0	48	3	51	2	0	2	0	0	0	53	114	13	127	11	6	17	1	0	1	1	0	1	146	436
Period End	8	2	10	911	37	948	43	3	46	0	0	0	1004	1783	124	1907	227	46	273	4	1	5	1	1	2	2187	6640
15:00 - 15:15	2	0	2	46	3	49	0	0	0	0	0	0	51	152	15	167	12	3	15	1	0	1	0	0	0	183	676
15:15 - 15:30	5	0	5	43	5	48	0	1	1	0	0	0	54	211	13	224	6	6	12	0	0	0	0	0	0	236	688
15:30 - 15:45	2	0	2	37	4	41	0	0	0	0	0	0	43	152	15	167	11	10	21	0	1	1	0	0	0	189	695
15:45 - 16:00	1	0	1	47	0	47	0	0	0	0	0	0	48	195	18	213	6	13	19	2	0	2	0	0	0	234	714
16:00 - 16:15	3	0	3	41	6	47	0	0	0	0	0	0	50	175	16	191	5	5	10	0	0	0	0	0	0	201	745
16:15 - 16:30	1	0	1	40	6	46	0	0	0	0	0	0	47	193	12	205	7	7	14	0	0	0	0	0	0	219	807
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16:45 - 17:00	2	0	2	53	5	58	1	0	1	0	0	0	61	193	12	205	8	2	10	0	0	0	0	0	0	215	731
17:00 - 17:15	4	0	4	51	4	55	1	1	2	0	0	0	61	204	7	211	3	3	6	0	0	0	0	0	0	217	785
17:15 - 17:30	2	0	2	52	5	57	1	0	1	0	0	0	60	209	2	211	3	3	6	0	0	0	0	0	0	217	684
17:30 - 17:45	2	0	2	58	4	62	0	0	0	0	0	0	64	194	8	202	2	2	4	0	0	0	0	0	0	206	642
17:45 - 18:00	1	0	1	61	0	61	0	0	0	0	0	0	62	197	10	207	6	4	10	0	0	0	0	0	0	217	615
Period End	28	0	28	571	45	616	3	2	5	0	0	0	649	2292	134	2426	74	68	142	4	1	5	0	0	0	2573	8597

All Vehicles Time Per 15 Mins	SOUTH												WEST												TOTAL		
	Forrester Road												Link Road														
	L			T			R			U			TOTAL	L			T			R			U			TOTAL	
	LIGHT	HEAVY	S	LIGHT	HEAVY	S	LIGHT	HEAVY	S	LIGHT	HEAVY	S		LIGHT	HEAVY	S	LIGHT	HEAVY	S	LIGHT	HEAVY	S	LIGHT	HEAVY			S
7:00 - 7:15	74	12	86	129	8	137	36	2	38	0	0	0	261	2	0	2	4	3	7	13	11	24	0	0	0	33	294
7:15 - 7:30	81	22	103	130	8	138	49	3	52	0	0	0	293	1	0	1	3	8	11	11	15	26	0	0	0	38	331
7:30 - 7:45	58	16	74	146	8	154	48	3	51	0	0	0	279	1	1	2	6	1	7	8	17	25	0	0	0	34	313
7:45 - 8:00	80	26	106	127	18	145	27	2	29	0	0	0	280	0	0	0	6	3	9	8	18	26	0	0	0	35	315
8:00 - 8:15	57	24	81	144	5	149	37	0	37	0	0	0	267	1	0	1	4	4	8	21	13	34	0	0	0	43	310
8:15 - 8:30	67	29	96	117	10	127	34	2	36	0	0	0	259	1	0	1	9	7	16	17	28	45	0	0	0	62	321
8:30 - 8:45	56	23	79	97	7	104	35	2	37	0	0	0	220	1	0	1	6	6	12	14	23	37	0	0	0	50	270
8:45 - 9:00	50	30	80	91	8	99	39	2	41	0	0	0	220	1	0	1	13	7	20	15	18	33	0	0	0	54	274
9:00 - 9:15	46	19	65	86	6	92	52	2	54	0	0	0	211	2	0	2	6	6	12	27	17	44	0	0	0	58	269
9:15 - 9:30	51	17	68	71	6	77	39	2	41	0	0	0	186	0	1	1	10	5	15	22	30	52	0	0	0	68	254
9:30 - 9:45	53	19	72	70	7	77	36	2	38	0	0	0	187	2	1	3	6	6	12	42	17	59	0	0	0	74	261
9:45 - 10:00	43	20	63	68	7	75	35	0	35	0	0	0	173	6	0	6	7	7	14	31	13	44	0	0	0	64	237
Period End	716	257	973	1276	98	1374	467	22	489	0	0	0	2836	18	3	21	80	63	143	229	220	449	0	0	0	613	3449
15:00 - 15:15	20	22	42	192	9	201	42	1	43	0	0	0	286	8	0	8	35	12	47	78	23	101	0	0	0	156	442
15:15 - 15:30	33	31	64	167	7	174	45	3	48	0	0	0	286	10	1	11	24	9	33	50	18	68	0	0	0	112	398
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15:45 - 16:00	22	22	44	187	5	192	83	2	85	0	0	0	321	5	0	5	23	1	24	61	21	82	0	0	0	111	432
16:00 - 16:15	25	26	51	190	4	194	95	1	96	0	0	0	341	12	0	12	46	3	49	83	9	92	0	0	0	153	494
16:15 - 16:30	26	12	38	210	15	225	149	4	153	0	0	0	416	17	1	18	23	3	26	61	20	81	0	0	0	125	541
16:30 - 16:45	16	7	23	204	9	213	144	3	147	0	0	0	383	15	1	16	33	6	39	80	10	90	0	0	0	145	528
16:45 - 17:00	7	9	16	199	6	205	138	5	143	0	0	0	364	6	1	7	28	4	32	39	13	52	0	0	0	91	455
17:00 - 17:15	4	4	8	201	5	206	130	2	132	0	0	0	346	14	0	14	29	5	34	103	10	113	0	0	0	161	507
17:15 - 17:30	7	6	13	156	4	160	124	1	125	0	0	0	298	4	0	4	19	2	21	74	10	84	0	0	0	109	407
17:30 - 17:45	13	5	18	130	6	136	123	2	125	0	0	0	279	6	1	7	22	2	24	55	7	62	0	0	0	93	372
17:45 - 18:00	16	4	20	117	7	124	135	5	140	0	0	0	284	5	0	5	14	2	16	29	2	31	0	0	0	52	336
Period End	209	171	380	2135	81	2216	1279	31	1310	0	0	0	3906	113	17	130	336	52	388	790	161	951	0	0	0	1469	5375

Appendix B

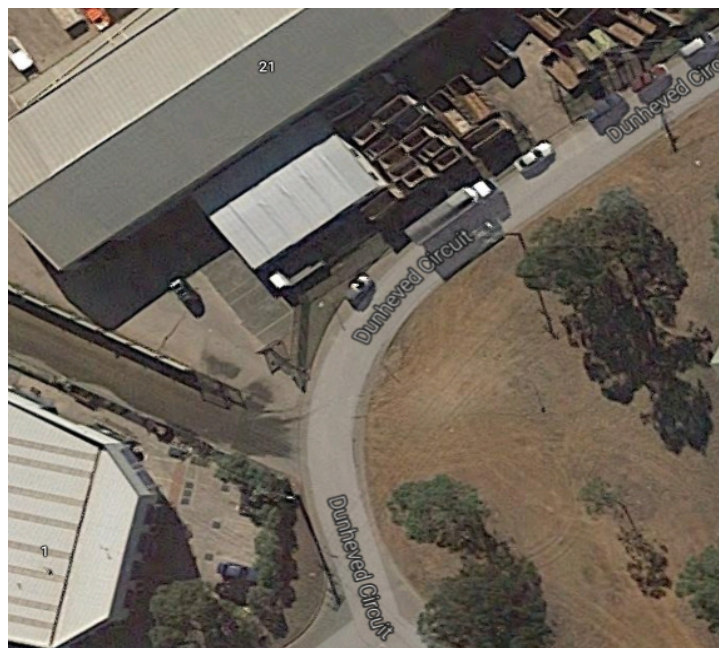
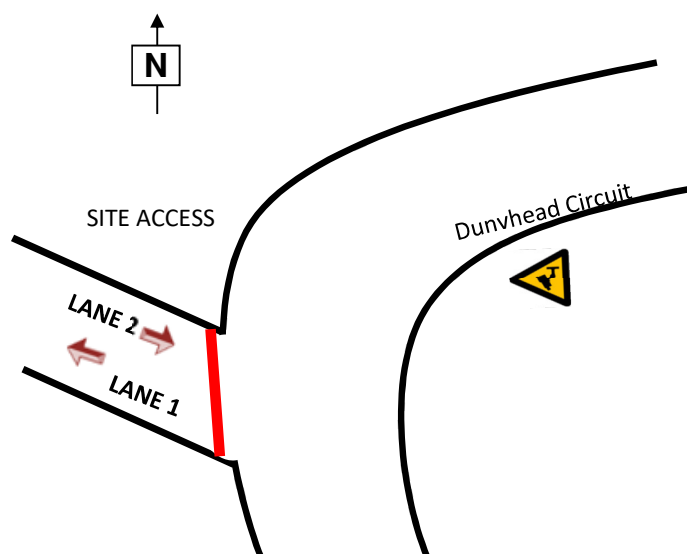
25 Dunheved Circuit Site Access Tube Count Data

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Wednesday, 15 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



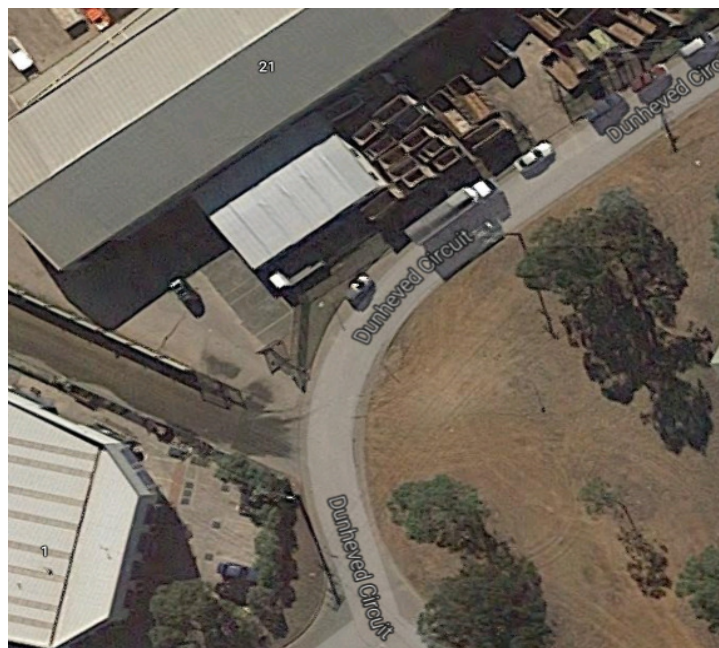
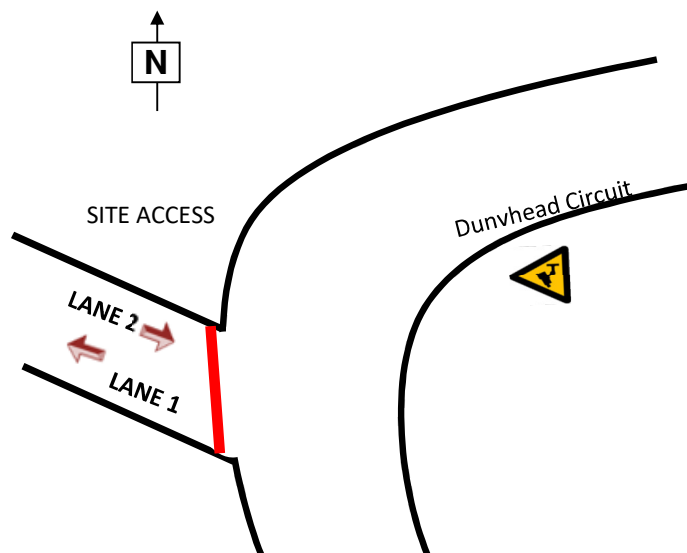
DATE	Wednesday, June 15, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	1	0	1	1
4:00 - 5:00	1	0	1	0	0	0	1
5:00 - 6:00	3	1	4	0	2	2	6
6:00 - 7:00	1	1	2	2	5	7	9
7:00 - 8:00	5	5	10	2	5	7	17
8:00 - 9:00	1	13	14	0	10	10	24
9:00 - 10:00	0	9	9	0	6	6	15
10:00 - 11:00	0	10	10	0	11	11	21
11:00 - 12:00	0	10	10	1	15	16	26
12:00 - 13:00	1	10	11	1	11	12	23
13:00 - 14:00	0	14	14	1	11	12	26
14:00 - 15:00	0	7	7	0	5	5	12
15:00 - 16:00	1	3	4	3	3	6	10
16:00 - 17:00	2	2	4	2	4	6	10
17:00 - 18:00	0	0	0	2	1	3	3
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	15	85	100	15	89	104	204

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Thursday, 16 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



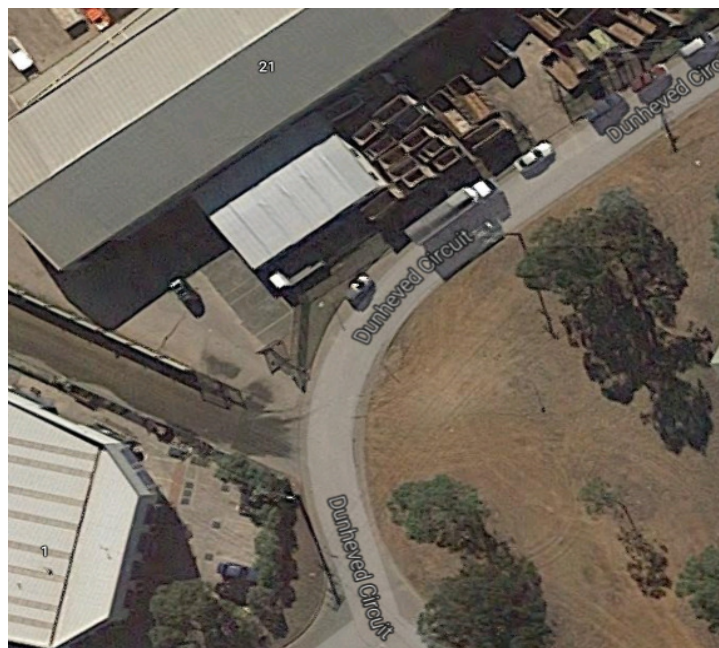
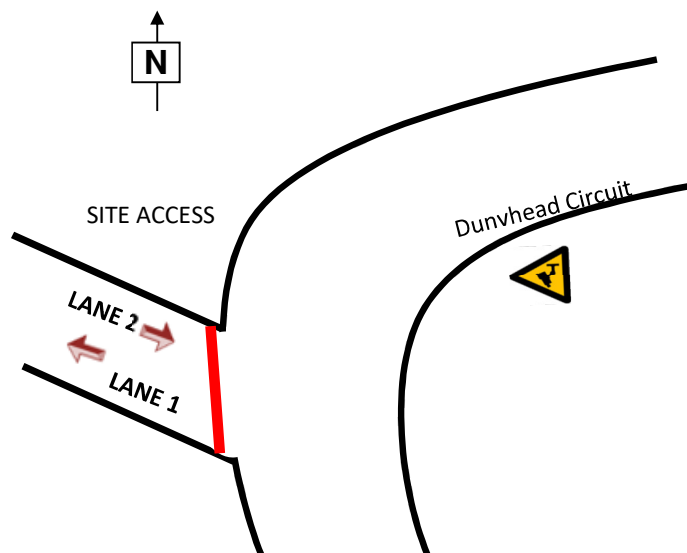
DATE	Thursday, June 16, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	0	0	0	0	0	0	0
5:00 - 6:00	4	4	8	2	2	4	12
6:00 - 7:00	1	8	9	0	25	25	34
7:00 - 8:00	1	9	10	0	12	12	22
8:00 - 9:00	0	9	9	0	9	9	18
9:00 - 10:00	2	16	18	3	8	11	29
10:00 - 11:00	1	13	14	0	16	16	30
11:00 - 12:00	1	5	6	1	11	12	18
12:00 - 13:00	2	17	19	2	13	15	34
13:00 - 14:00	0	9	9	0	13	0	9
14:00 - 15:00	0	6	6	1	11	0	6
15:00 - 16:00	0	14	14	0	2	2	16
16:00 - 17:00	0	8	8	2	3	5	13
17:00 - 18:00	0	4	4	2	0	2	6
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	12	122	134	13	125	113	247

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Friday, 17 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



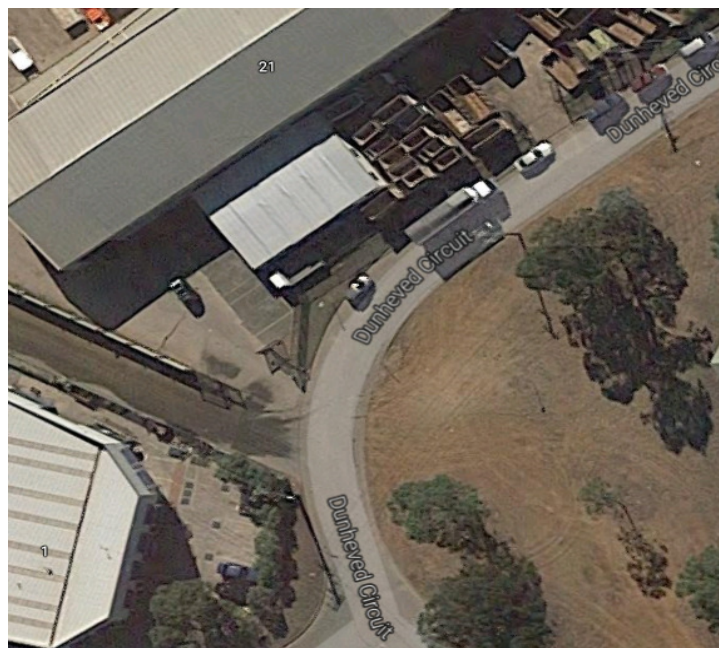
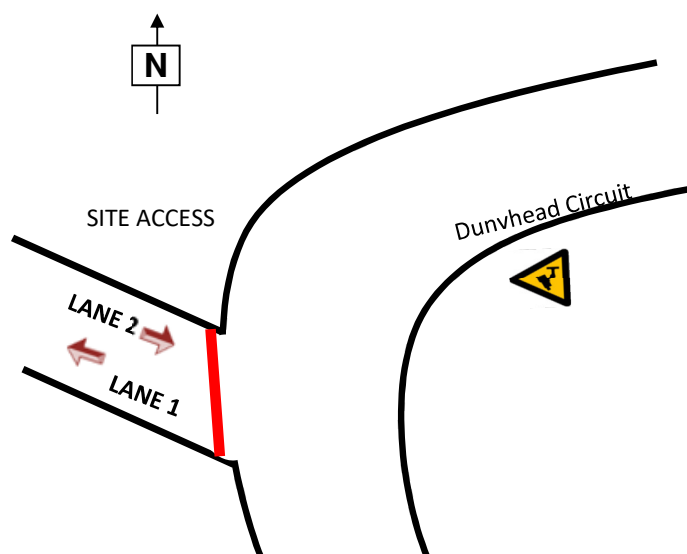
DATE	Friday, June 17, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	0	0	0	0	0	0	0
5:00 - 6:00	0	0	0	0	0	0	0
6:00 - 7:00	7	0	7	0	1	1	8
7:00 - 8:00	0	1	1	0	25	25	26
8:00 - 9:00	2	16	18	0	5	5	23
9:00 - 10:00	0	19	19	0	14	14	33
10:00 - 11:00	0	8	8	0	10	10	18
11:00 - 12:00	1	7	8	1	3	4	12
12:00 - 13:00	1	12	13	1	11	12	25
13:00 - 14:00	0	11	11	1	12	13	24
14:00 - 15:00	0	7	7	2	8	10	17
15:00 - 16:00	0	6	6	3	2	5	11
16:00 - 17:00	0	3	3	2	1	3	6
17:00 - 18:00	2	3	5	2	2	4	9
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	13	93	106	12	94	106	212

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Saturday, 18 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



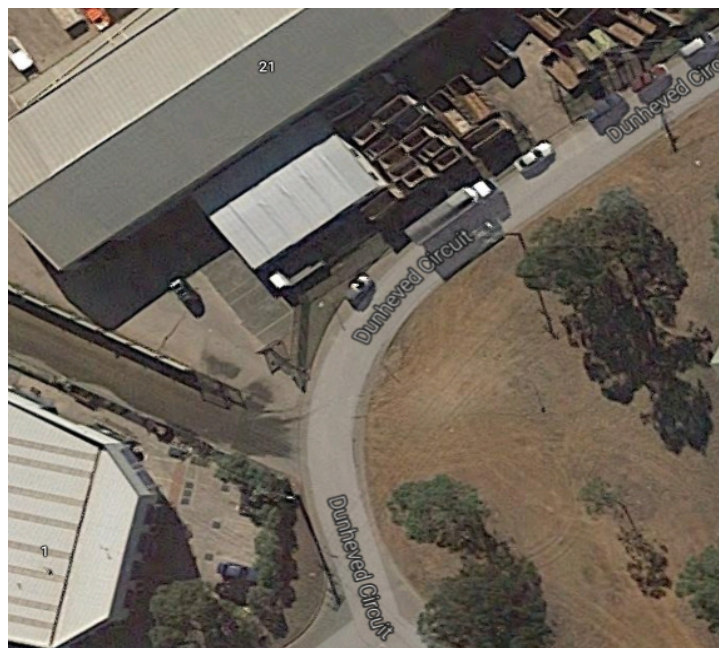
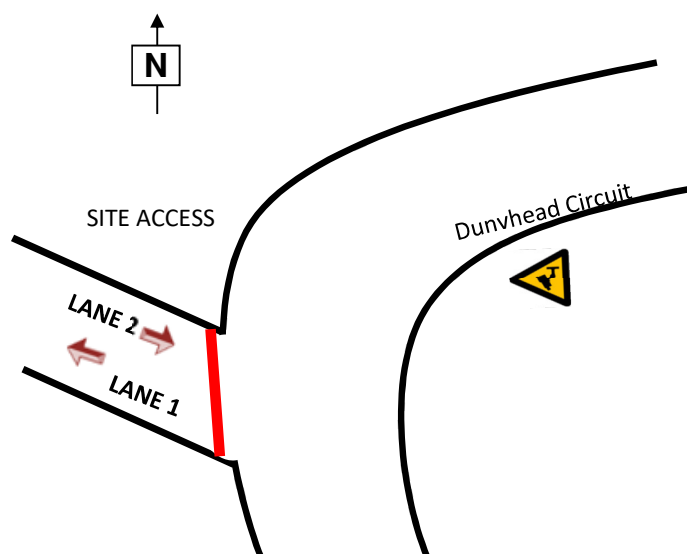
DATE	Saturday, June 18, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	0	0	0	0	0	0	0
5:00 - 6:00	8	1	9	0	0	0	9
6:00 - 7:00	2	4	6	1	17	18	24
7:00 - 8:00	0	5	5	1	11	12	17
8:00 - 9:00	1	12	13	0	4	4	17
9:00 - 10:00	0	6	6	0	6	6	12
10:00 - 11:00	0	6	6	0	4	4	10
11:00 - 12:00	0	13	13	1	7	8	21
12:00 - 13:00	0	13	13	0	2	2	15
13:00 - 14:00	0	1	1	2	3	5	6
14:00 - 15:00	0	0	0	2	1	3	3
15:00 - 16:00	0	0	0	3	0	3	3
16:00 - 17:00	0	0	0	0	0	0	0
17:00 - 18:00	0	0	0	0	0	0	0
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	11	61	72	10	55	65	137

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Sunday, 19 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



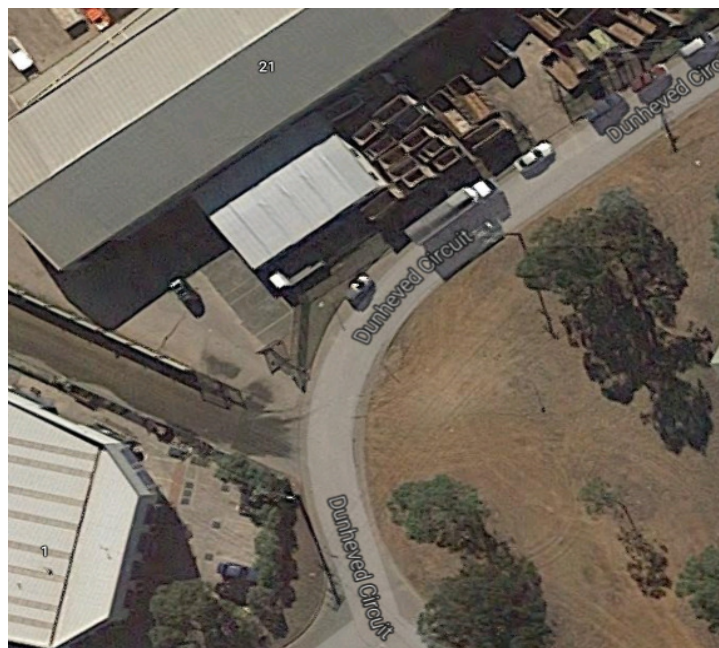
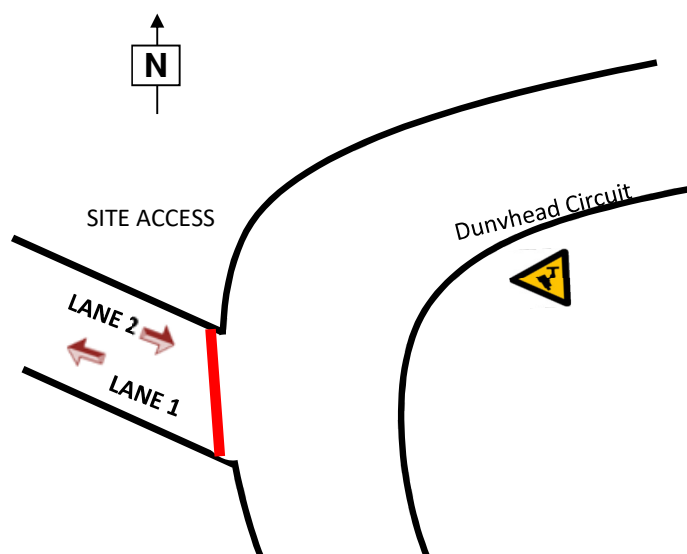
DATE	Sunday, June 19, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	0	0	0	0	0	0	0
5:00 - 6:00	0	0	0	0	0	0	0
6:00 - 7:00	0	0	0	0	0	0	0
7:00 - 8:00	0	0	0	0	0	0	0
8:00 - 9:00	0	0	0	0	0	0	0
9:00 - 10:00	0	0	0	0	0	0	0
10:00 - 11:00	0	0	0	0	0	0	0
11:00 - 12:00	0	0	0	0	0	0	0
12:00 - 13:00	0	0	0	0	0	0	0
13:00 - 14:00	0	0	0	0	0	0	0
14:00 - 15:00	0	0	0	0	0	0	0
15:00 - 16:00	0	0	0	0	0	0	0
16:00 - 17:00	0	0	0	0	0	0	0
17:00 - 18:00	0	0	0	0	0	0	0
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Monday, 4 July 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



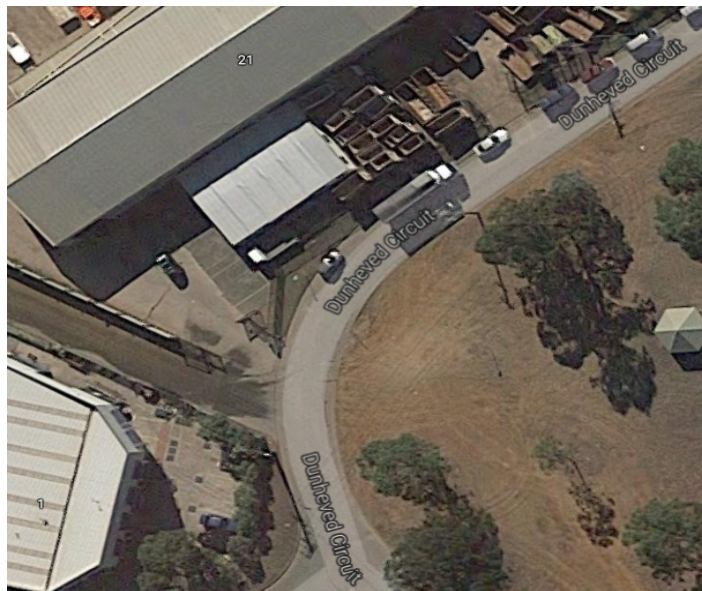
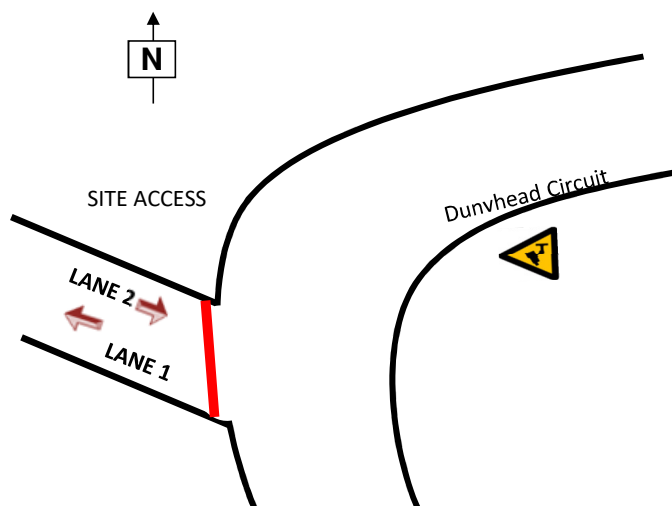
DATE	Monday, July 4, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	0	0	0	2	0	2	2
5:00 - 6:00	3	4	7	1	2	3	10
6:00 - 7:00	2	7	9	0	23	23	32
7:00 - 8:00	0	10	10	0	13	13	23
8:00 - 9:00	1	13	14	2	7	9	23
9:00 - 10:00	2	13	15	1	9	10	25
10:00 - 11:00	1	8	9	0	13	13	22
11:00 - 12:00	0	10	10	0	12	12	22
12:00 - 13:00	0	14	14	1	10	11	25
13:00 - 14:00	1	11	12	1	8	9	21
14:00 - 15:00	0	5	5	2	4	6	11
15:00 - 16:00	2	7	9	0	6	6	15
16:00 - 17:00	1	6	7	3	3	6	13
17:00 - 18:00	1	3	4	0	2	2	6
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	14	111	125	13	112	125	250

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Tuesday, 5 July 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



DATE	Tuesday, July 5, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	0	0	0	0	0	0	0
5:00 - 6:00	5	3	8	2	3	5	13
6:00 - 7:00	0	7	7	0	22	22	29
7:00 - 8:00	0	10	10	0	14	14	24
8:00 - 9:00	3	15	18	1	8	9	27
9:00 - 10:00	1	12	13	2	8	10	23
10:00 - 11:00	1	4	5	0	17	17	22
11:00 - 12:00	1	18	19	1	10	11	30
12:00 - 13:00	0	10	10	0	13	13	23
13:00 - 14:00	0	5	5	4	12	16	21
14:00 - 15:00	0	12	12	0	3	3	15
15:00 - 16:00	0	6	6	3	0	3	9
16:00 - 17:00	0	7	7	1	3	4	11
17:00 - 18:00	0	0	0	0	0	0	0
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	11	109	120	14	113	127	247

Location	25 Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Average Daily	
Weather Condition		
Classification	HEAVY/LIGHT	

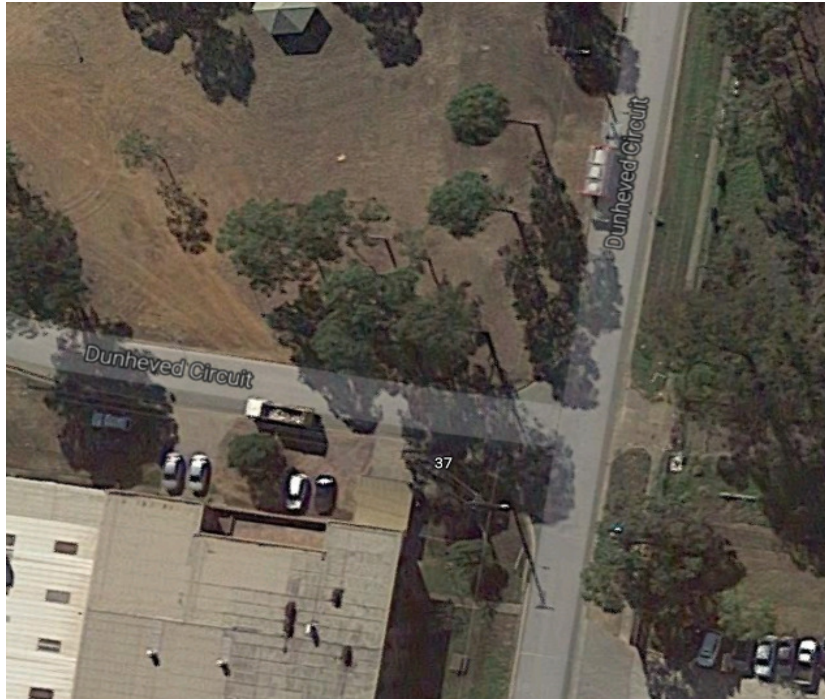
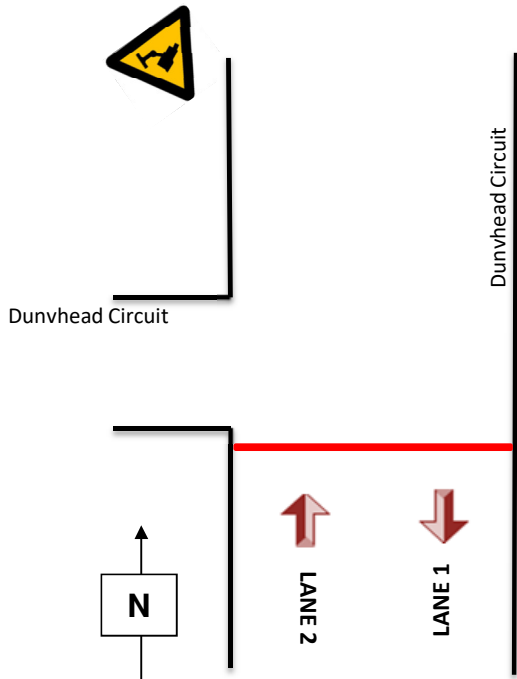


DATE	Average Daily						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	0	0	0	0	0	0	1
5:00 - 6:00	4	2	6	1	2	2	8
6:00 - 7:00	2	5	7	1	16	16	23
7:00 - 8:00	1	7	8	1	13	14	22
8:00 - 9:00	1	13	14	1	7	8	22
9:00 - 10:00	1	13	13	1	9	10	23
10:00 - 11:00	1	8	9	0	12	12	21
11:00 - 12:00	1	11	11	1	10	11	22
12:00 - 13:00	1	13	13	1	10	11	24
13:00 - 14:00	0	9	9	2	10	11	20
14:00 - 15:00	0	6	6	1	5	7	13
15:00 - 16:00	1	6	7	2	2	4	11
16:00 - 17:00	1	4	5	2	2	4	9
17:00 - 18:00	1	2	2	1	1	2	4
18:00 - 19:00	0	0	0	0	0	0	0
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	0	0	0	0
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - 0:00	0	0	0	0	0	0	0
Total	13	97	110	13	98	111	220

Appendix C

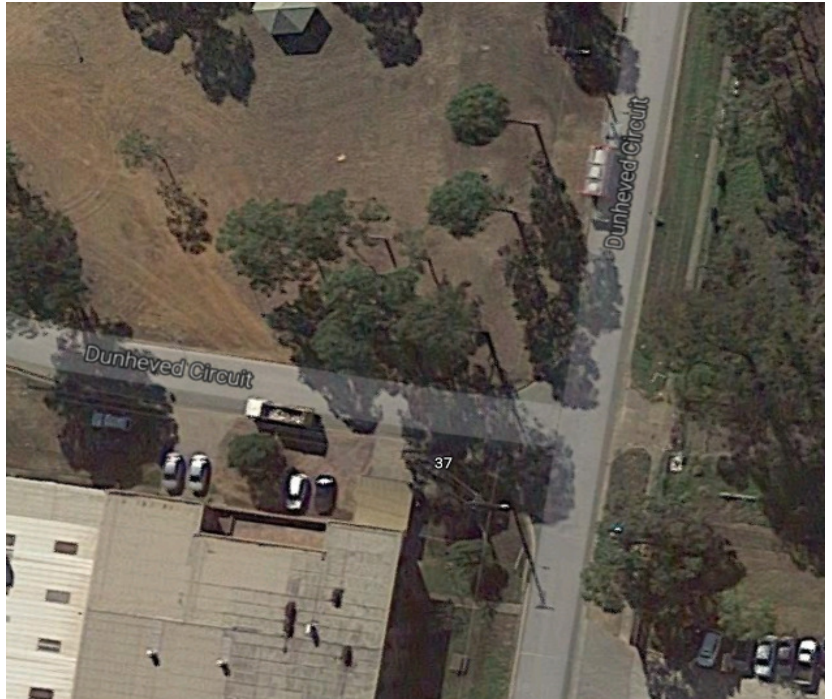
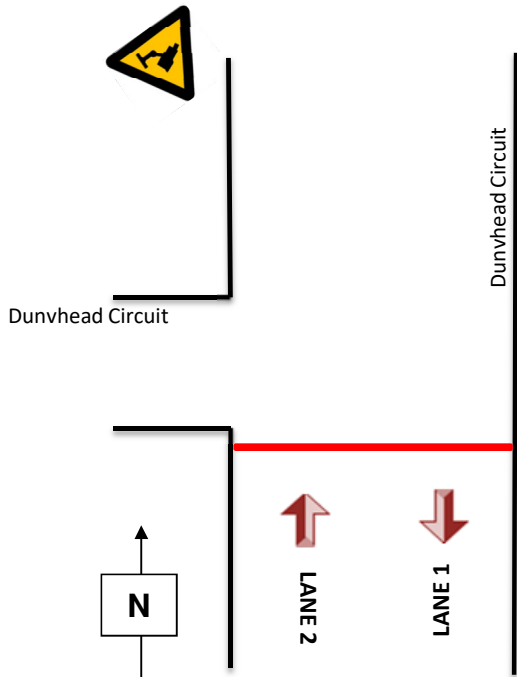
Dunheved Circuit Tube Count Data

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Wednesday, 15 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



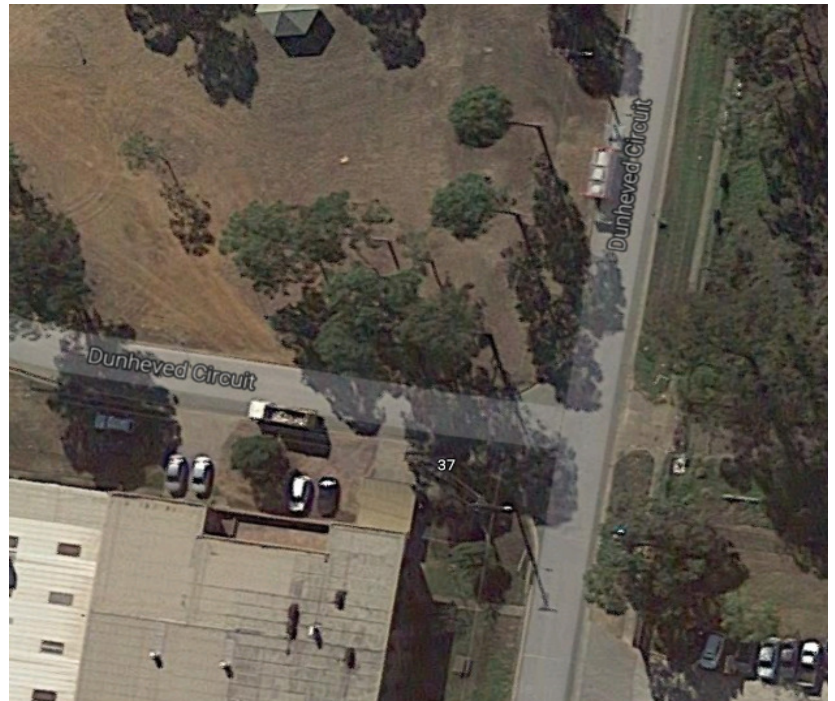
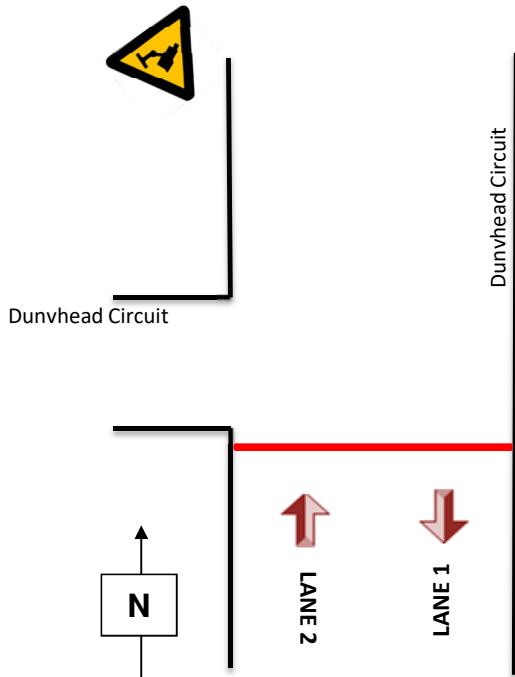
DATE	Wednesday, June 15, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	3	4	7	0	0	0	7
4:00 - 5:00	6	4	10	17	17	34	44
5:00 - 6:00	10	11	21	19	14	33	54
6:00 - 7:00	10	12	22	15	17	32	54
7:00 - 8:00	12	9	21	18	19	37	58
8:00 - 9:00	11	16	27	15	18	33	60
9:00 - 10:00	13	14	27	13	16	29	56
10:00 - 11:00	9	13	22	9	7	16	38
11:00 - 12:00	13	2	15	12	9	21	36
12:00 - 13:00	9	0	9	11	15	26	35
13:00 - 14:00	12	0	12	22	22	44	56
14:00 - 15:00	8	1	9	21	26	47	56
15:00 - 16:00	12	0	12	25	14	39	51
16:00 - 17:00	4	1	5	14	11	25	30
17:00 - 18:00	0	0	0	3	0	3	3
18:00 - 19:00	0	2	2	1	0	1	3
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	1	0	1	1
22:00 - 23:00	0	1	1	0	1	1	2
23:00 - Total	0	0	0	0	0	0	0
Total	132	90	222	216	206	422	644

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Thursday, 16 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



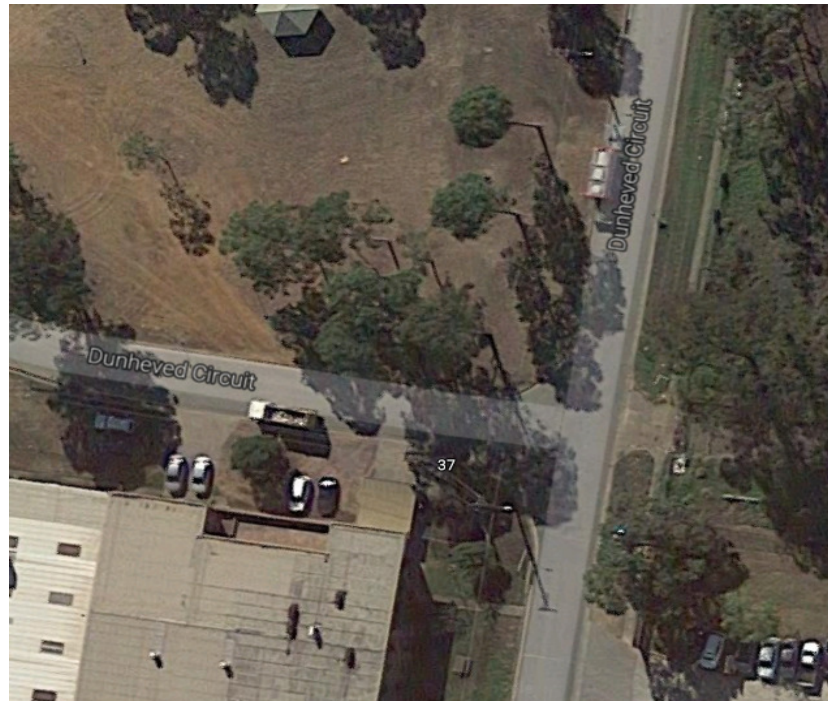
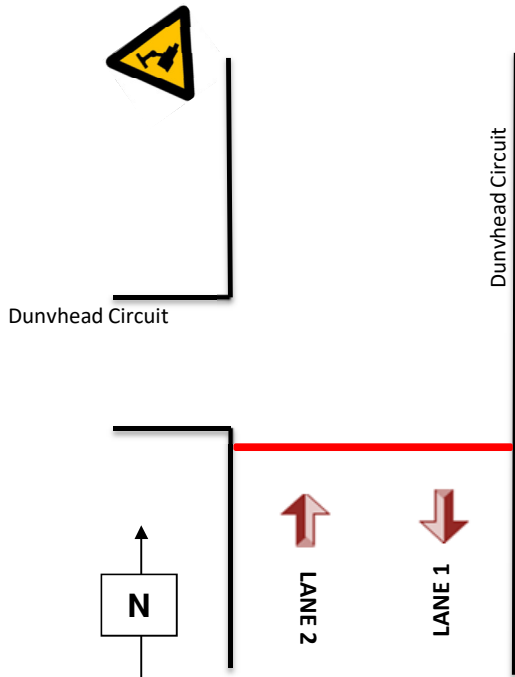
DATE	Thursday, June 16, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	1	0	1	1
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	1	2	3	0	0	0	3
4:00 - 5:00	5	3	8	21	1	22	30
5:00 - 6:00	2	5	7	18	16	34	41
6:00 - 7:00	4	4	8	17	17	34	42
7:00 - 8:00	9	8	17	16	18	34	51
8:00 - 9:00	13	11	24	17	21	38	62
9:00 - 10:00	9	14	23	11	19	30	53
10:00 - 11:00	11	13	24	11	18	29	53
11:00 - 12:00	14	11	25	10	7	17	42
12:00 - 13:00	11	16	27	13	11	24	51
13:00 - 14:00	15	9	24	14	16	30	54
14:00 - 15:00	9	1	10	25	20	45	55
15:00 - 16:00	17	3	20	24	24	48	68
16:00 - 17:00	5	2	7	27	15	42	49
17:00 - 18:00	0	0	0	16	9	25	25
18:00 - 19:00	0	1	1	5	1	6	7
19:00 - 20:00	1	0	1	5	2	7	8
20:00 - 21:00	0	1	1	0	1	1	2
21:00 - 22:00	0	2	2	0	0	0	2
22:00 - 23:00	0	1	1	0	0	0	1
23:00 - Total	1	0	1	2	0	2	3
Total	127	107	234	253	216	469	703

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Friday, 17 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



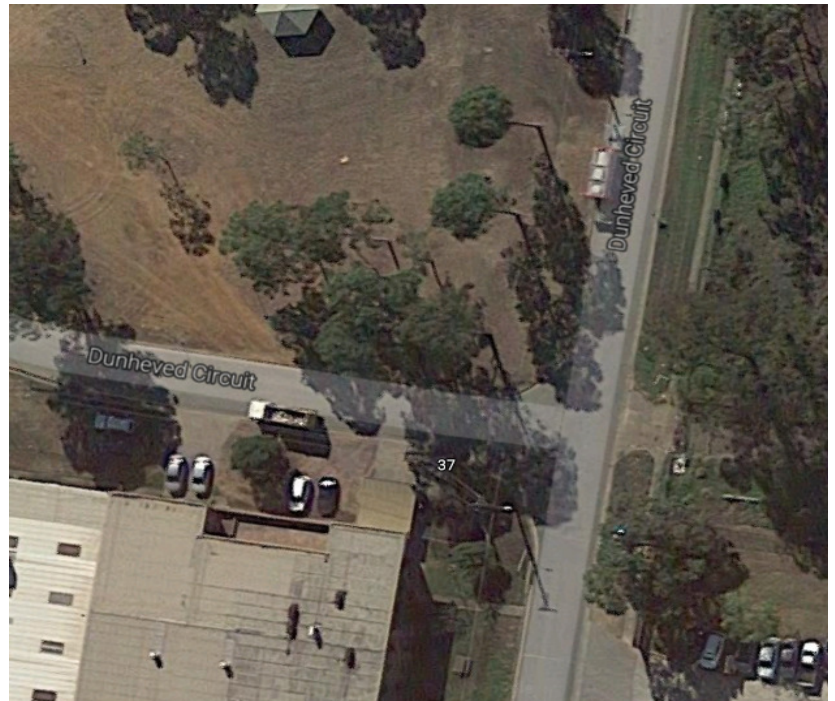
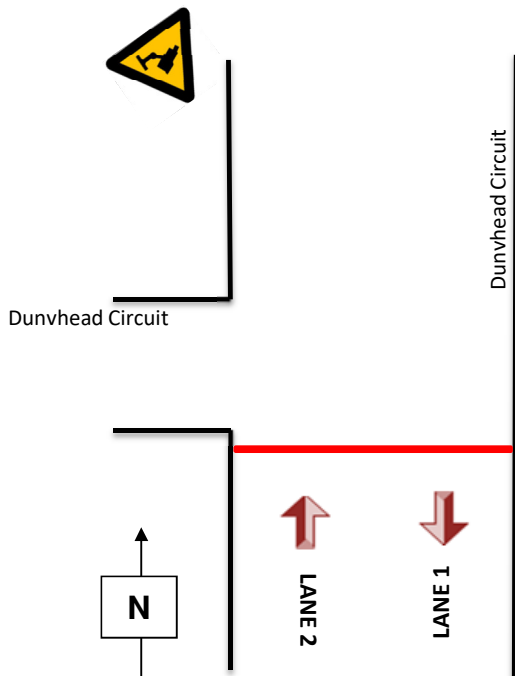
DATE	Friday, June 17, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	1	0	1	0	0	0	1
1:00 - 2:00	0	0	0	0	0	0	0
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	1	1	1	0	1	2
4:00 - 5:00	2	1	3	0	1	1	4
5:00 - 6:00	8	4	12	6	19	25	37
6:00 - 7:00	2	7	9	7	13	20	29
7:00 - 8:00	9	11	20	21	20	41	61
8:00 - 9:00	12	11	23	22	14	36	59
9:00 - 10:00	18	11	29	23	20	43	72
10:00 - 11:00	15	9	24	30	10	40	64
11:00 - 12:00	12	15	27	21	25	46	73
12:00 - 13:00	16	11	27	28	31	59	86
13:00 - 14:00	18	14	32	13	17	30	62
14:00 - 15:00	6	9	15	14	19	33	48
15:00 - 16:00	14	7	21	9	17	26	47
16:00 - 17:00	3	12	15	10	14	24	39
17:00 - 18:00	3	13	16	2	7	9	25
18:00 - 19:00	0	10	10	4	2	6	16
19:00 - 20:00	0	0	0	0	1	1	1
20:00 - 21:00	0	1	1	3	0	3	4
21:00 - 22:00	0	0	0	0	1	1	1
22:00 - 23:00	0	2	2	1	0	1	3
23:00 - Total	0	1	1	0	0	0	1
Total	139	150	289	215	231	446	735

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Saturday, 18 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



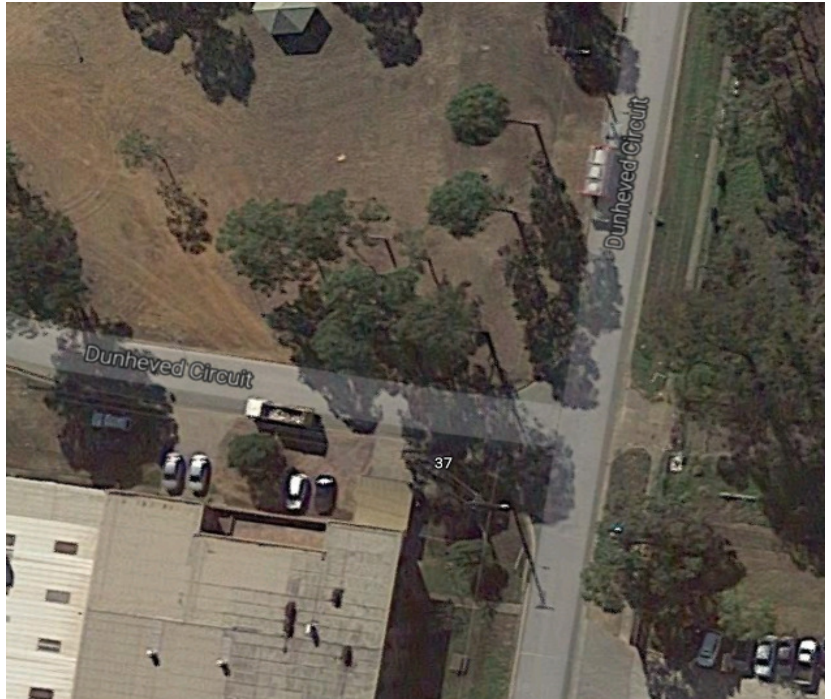
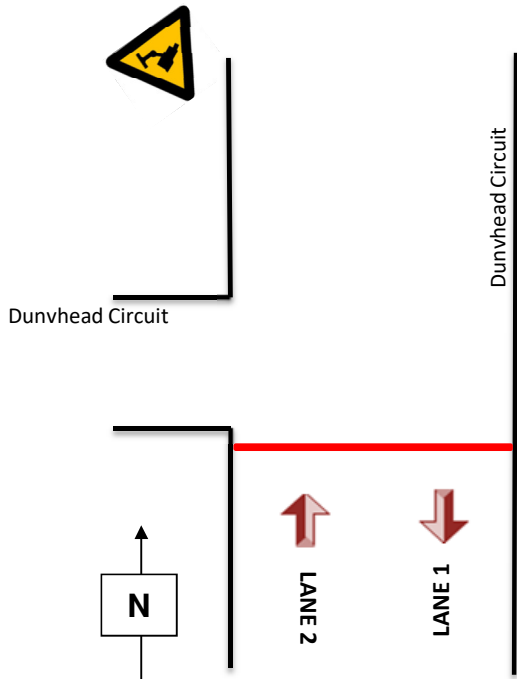
DATE	Saturday, June 18, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	1	1	2	2
1:00 - 2:00	0	2	2	2	0	2	4
2:00 - 3:00	4	0	4	3	1	4	8
3:00 - 4:00	2	2	4	3	0	3	7
4:00 - 5:00	0	1	1	3	5	8	9
5:00 - 6:00	0	1	1	9	7	16	17
6:00 - 7:00	5	5	10	8	4	12	22
7:00 - 8:00	1	2	3	1	5	6	9
8:00 - 9:00	6	0	6	3	10	13	19
9:00 - 10:00	7	4	11	6	8	14	25
10:00 - 11:00	8	3	11	6	7	13	24
11:00 - 12:00	5	5	10	6	9	15	25
12:00 - 13:00	11	2	13	6	12	18	31
13:00 - 14:00	8	1	9	5	4	9	18
14:00 - 15:00	4	3	7	5	1	6	13
15:00 - 16:00	4	2	6	6	1	7	13
16:00 - 17:00	1	1	2	3	0	3	5
17:00 - 18:00	1	1	2	2	0	2	4
18:00 - 19:00	0	1	1	0	0	0	1
19:00 - 20:00	0	0	0	0	0	0	0
20:00 - 21:00	0	0	0	1	0	1	1
21:00 - 22:00	1	0	1	0	0	0	1
22:00 - 23:00	0	0	0	0	0	0	0
23:00 - Total	0	1	1	2	0	2	3
Total	68	37	105	81	75	156	261

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Sunday, 19 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



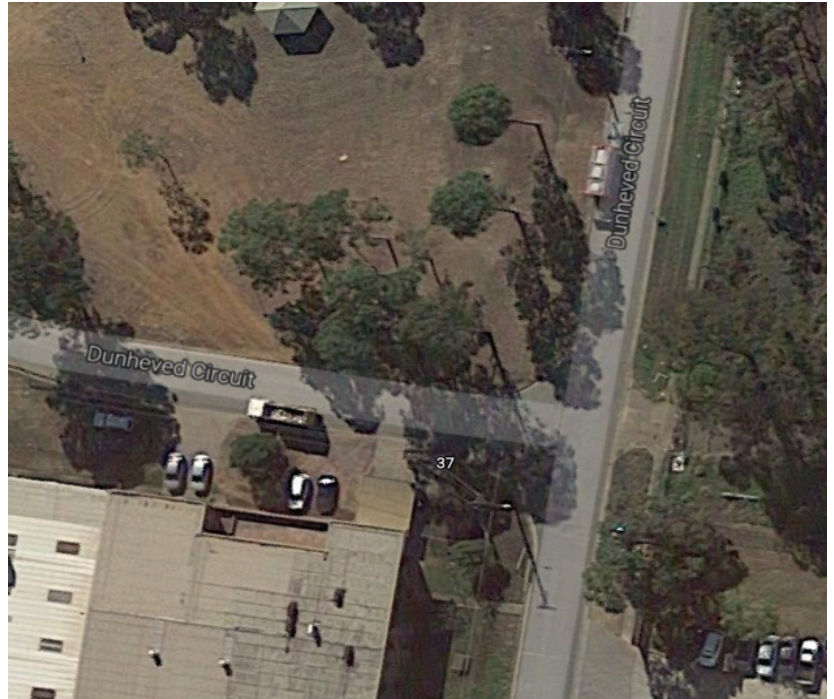
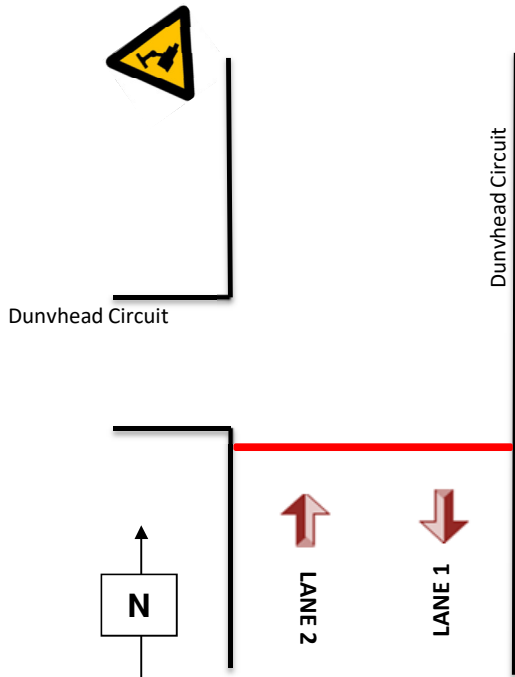
DATE			Sunday, June 19, 2016						
			LANE 1			LANE 2			TOTAL
Time Period			Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00			0	0	0	0	0	0	0
1:00 - 2:00			0	0	0	0	0	0	0
2:00 - 3:00			0	0	0	2	0	2	2
3:00 - 4:00			0	1	1	2	0	2	3
4:00 - 5:00			0	0	0	1	1	2	2
5:00 - 6:00			0	0	0	0	2	2	2
6:00 - 7:00			1	0	1	1	0	1	2
7:00 - 8:00			0	0	0	1	1	2	2
8:00 - 9:00			0	0	0	0	0	0	0
9:00 - 10:00			4	0	4	2	4	6	10
10:00 - 11:00			0	0	0	1	3	4	4
11:00 - 12:00			5	0	5	4	4	8	13
12:00 - 13:00			3	0	3	4	2	6	9
13:00 - 14:00			4	2	6	5	4	9	15
14:00 - 15:00			2	0	2	3	2	5	7
15:00 - 16:00			4	2	6	6	2	8	14
16:00 - 17:00			4	4	8	7	3	10	18
17:00 - 18:00			4	2	6	2	2	4	10
18:00 - 19:00			0	1	1	1	0	1	2
19:00 - 20:00			1	0	1	5	0	5	6
20:00 - 21:00			0	0	0	5	0	5	5
21:00 - 22:00			1	0	1	4	0	4	5
22:00 - 23:00			0	0	0	0	0	0	0
23:00 - Total			0	0	0	0	0	0	0
Total			33	12	45	56	30	86	131

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Monday, 20 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



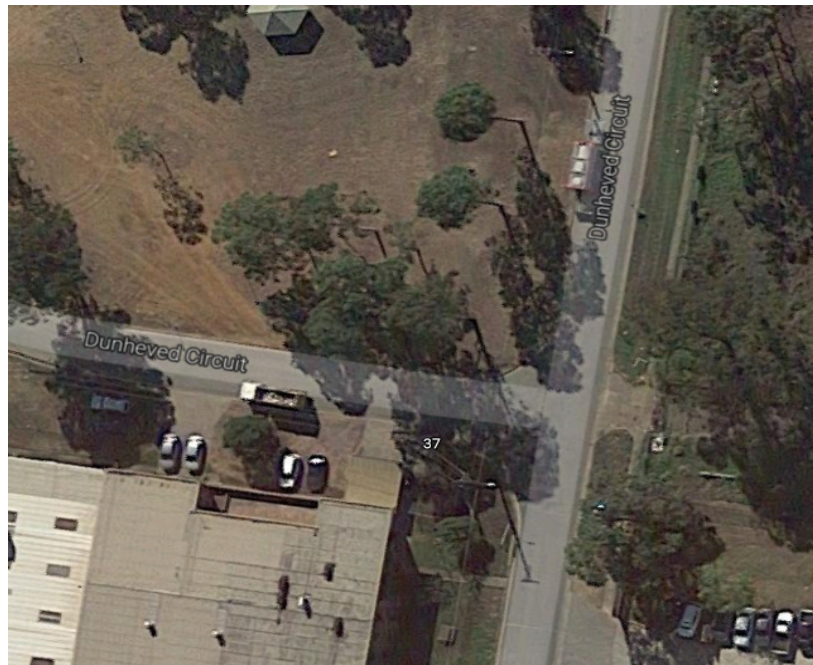
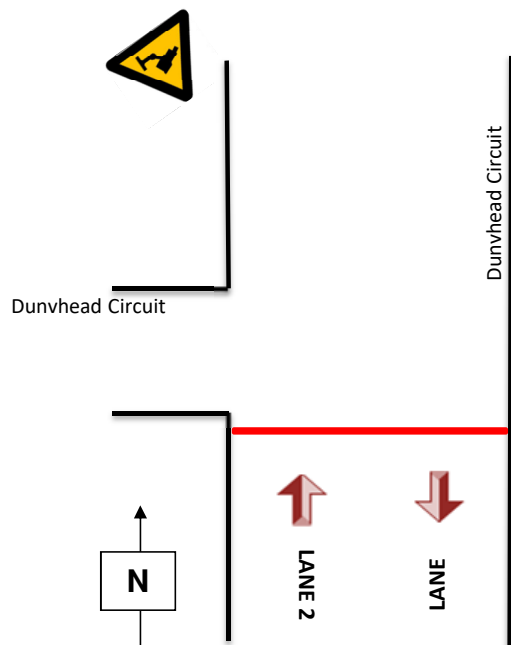
DATE	Monday, June 20, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	2	0	2	1	0	1	3
2:00 - 3:00	0	0	0	0	0	0	0
3:00 - 4:00	0	0	0	0	0	0	0
4:00 - 5:00	2	7	9	17	0	17	26
5:00 - 6:00	3	1	4	22	3	25	29
6:00 - 7:00	10	11	21	17	6	23	44
7:00 - 8:00	10	12	22	17	18	35	57
8:00 - 9:00	16	11	27	14	24	38	65
9:00 - 10:00	8	16	24	12	16	28	52
10:00 - 11:00	11	13	24	9	18	27	51
11:00 - 12:00	15	10	25	10	22	32	57
12:00 - 13:00	7	9	16	17	7	24	40
13:00 - 14:00	12	5	17	19	22	41	58
14:00 - 15:00	7	15	22	22	24	46	68
15:00 - 16:00	8	9	17	29	12	41	58
16:00 - 17:00	11	7	18	17	15	32	50
17:00 - 18:00	13	0	13	7	2	9	22
18:00 - 19:00	1	0	1	2	1	3	4
19:00 - 20:00	5	0	5	0	0	0	5
20:00 - 21:00	1	0	1	1	0	1	2
21:00 - 22:00	0	0	0	3	0	3	3
22:00 - 23:00	0	0	0	2	0	2	2
23:00 - Total	0	1	1	1	1	2	3
Total	142	127	269	239	191	430	699

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Tuesday, 21 June 2016	
Weather Condition		
Classification	HEAVY/LIGHT	



DATE	Tuesday, June 21, 2016						
	LANE 1			LANE 2			TOTAL
Time Period	Light	Heavy	Σ	Light	Heavy	Σ	
0:00 - 1:00	0	0	0	0	0	0	0
1:00 - 2:00	0	0	0	2	0	2	2
2:00 - 3:00	0	0	0	1	0	1	1
3:00 - 4:00	2	2	4	7	3	10	14
4:00 - 5:00	3	3	6	6	4	10	16
5:00 - 6:00	5	5	10	29	6	35	45
6:00 - 7:00	10	7	17	13	11	24	41
7:00 - 8:00	6	11	17	15	16	31	48
8:00 - 9:00	8	18	26	5	21	26	52
9:00 - 10:00	9	10	19	15	22	37	56
10:00 - 11:00	15	14	29	15	24	39	68
11:00 - 12:00	19	11	30	11	25	36	66
12:00 - 13:00	15	14	29	10	24	34	63
13:00 - 14:00	13	14	27	13	20	33	60
14:00 - 15:00	10	18	28	23	27	50	78
15:00 - 16:00	13	2	15	18	22	40	55
16:00 - 17:00	10	0	10	18	16	34	44
17:00 - 18:00	15	3	18	7	7	14	32
18:00 - 19:00	6	1	7	2	1	3	10
19:00 - 20:00	1	0	1	1	0	1	2
20:00 - 21:00	0	0	0	0	0	0	0
21:00 - 22:00	0	0	0	1	0	1	1
22:00 - 23:00	1	1	2	2	1	3	5
23:00 - Total	0	0	0	2	0	2	2
Total	161	134	295	216	250	466	761

Location	Dunvhead Circuit	
Suburb	ST. MARY	
Client	TTPP	
Job No/Name	16054	
Survey Duration	Wednesday, 15 June 2016	Tuesday, 21 June 2016
Day/Date	Average Daily	
Weather Condition		
Classification	Passenger Car Vehicles (PCU)	



DATE	Average Daily PCUs			
	LANE 1		LANE 2	Two-way
Time Period		Σ (PCU)		Σ (PCU)
0:00 - 1:00		0		1
1:00 - 2:00		1		2
2:00 - 3:00		1		2
3:00 - 4:00		4		7
4:00 - 5:00		7		25
5:00 - 6:00		8		46
6:00 - 7:00		17		48
7:00 - 8:00		21		58
8:00 - 9:00		26		63
9:00 - 10:00		28		67
10:00 - 11:00		28		63
11:00 - 12:00		29		66
12:00 - 13:00		28		73
13:00 - 14:00		27		65
14:00 - 15:00		21		67
15:00 - 16:00		18		65
16:00 - 17:00		14		50
17:00 - 18:00		12		29
18:00 - 19:00		6		10
19:00 - 20:00		1		4
20:00 - 21:00		1		3
21:00 - 22:00		1		4
22:00 - 23:00		2		3
23:00 - Total		1		3
Total		301		825

Appendix D

SIDRA Intersection Analysis Results – Existing Conditions

MOVEMENT SUMMARY

 **Site: [AM Peak (Existing)]**

Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forrester Road											
1	L2	383	24.2	0.754	5.6	LOS A	8.3	65.1	0.64	0.54	47.4
2	T1	617	6.7	0.754	5.2	LOS A	8.3	65.1	0.64	0.54	50.3
3	R2	178	4.7	0.217	10.2	LOS A	1.0	7.6	0.37	0.65	51.9
Approach		1178	12.1	0.754	6.1	LOS A	8.3	65.1	0.60	0.55	49.9
East: Forrester Road											
4	L2	735	5.6	0.397	3.5	LOS A	0.0	0.0	0.00	0.43	56.2
5	T1	122	12.1	0.135	6.6	LOS A	0.7	5.6	0.60	0.63	31.2
6	R2	1	0.0	0.135	11.4	LOS A	0.7	5.6	0.60	0.63	51.3
Approach		858	6.5	0.397	3.9	LOS A	0.7	5.6	0.09	0.46	51.9
North: Rope Crossing Boulevard											
7	L2	4	0.0	0.003	3.1	LOS A	0.0	0.1	0.30	0.38	51.2
8	T1	419	3.3	0.382	4.0	LOS A	2.1	15.0	0.51	0.47	50.5
9	R2	20	5.3	0.382	9.0	LOS A	2.1	15.0	0.51	0.47	37.5
Approach		443	3.3	0.382	4.2	LOS A	2.1	15.0	0.51	0.47	49.9
West: Links Road											
10	L2	4	25.0	0.089	8.3	LOS A	0.4	3.4	0.64	0.76	43.4
11	T1	37	45.7	0.089	9.1	LOS A	0.4	3.4	0.64	0.76	49.2
12	R2	117	56.8	0.183	12.9	LOS A	0.8	8.6	0.65	0.85	43.5
Approach		158	53.3	0.183	11.9	LOS A	0.8	8.6	0.64	0.82	44.8
All Vehicles		2637	11.3	0.754	5.4	LOS A	8.3	65.1	0.42	0.53	50.3

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

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

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

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Organisation: TTPP - THE TRANSPORT PLANNING PARTNERSHIP | Processed: Monday, 27 February 2017 6:05:42 PM

Project: X:\16342 21 & 25 Dunheved Circuit, St Marys - EIS\07 Modelling Files\170227 Ropes Crossing Blvd-Forrester Rd-Links Rd.sip7

MOVEMENT SUMMARY

 **Site: [PM Peak (Existing)]**

Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forrester Road											
1	L2	89	37.6	0.648	4.8	LOS A	6.5	48.5	0.35	0.41	48.5
2	T1	894	4.1	0.648	4.4	LOS A	6.5	48.5	0.35	0.41	51.5
3	R2	605	2.4	0.467	9.4	LOS A	3.4	24.2	0.28	0.60	52.2
Approach		1588	5.4	0.648	6.3	LOS A	6.5	48.5	0.33	0.48	51.7
East: Forrester Road											
4	L2	888	4.4	0.476	3.5	LOS A	0.0	0.0	0.00	0.43	56.2
5	T1	47	48.9	0.068	7.4	LOS A	0.3	3.3	0.61	0.63	30.8
6	R2	1	0.0	0.068	11.3	LOS A	0.3	3.3	0.61	0.63	51.1
Approach		937	6.6	0.476	3.7	LOS A	0.3	3.3	0.03	0.44	54.6
North: Rope Crossing Boulevard											
7	L2	11	0.0	0.011	4.4	LOS A	0.0	0.3	0.53	0.52	50.5
8	T1	215	8.8	0.314	7.5	LOS A	1.8	13.6	0.79	0.85	49.2
9	R2	3	33.3	0.314	13.4	LOS A	1.8	13.6	0.79	0.85	36.0
Approach		228	8.8	0.314	7.4	LOS A	1.8	13.6	0.78	0.84	49.1
West: Links Road											
10	L2	58	5.5	0.396	11.4	LOS A	2.0	15.1	0.78	0.91	41.4
11	T1	138	13.7	0.396	11.8	LOS A	2.0	15.1	0.78	0.91	47.1
12	R2	354	15.8	0.533	16.5	LOS B	3.4	26.8	0.82	1.03	41.9
Approach		549	14.2	0.533	14.8	LOS B	3.4	26.8	0.81	0.99	43.1
All Vehicles		3303	7.4	0.648	7.1	LOS A	6.5	48.5	0.35	0.58	51.1

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

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

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

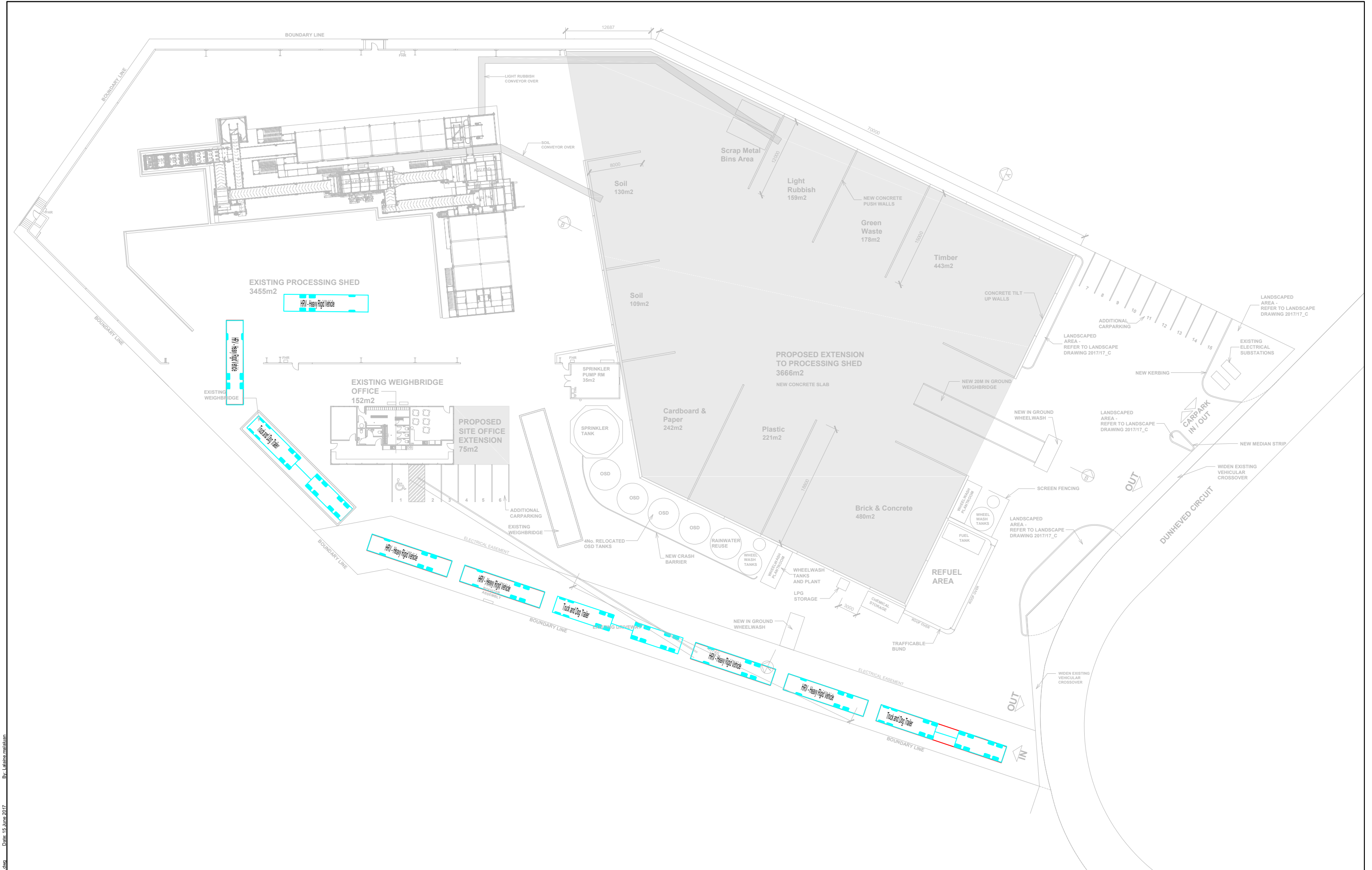
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Appendix E

Vehicle Stacking Plan



Filename: 16342DA16-Stacking-70615.dwg Date: 15 June 2017 By: Leanne Maluan

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT

21-25 DUNHEVED CIRCUIT, ST. MARYS

TITLE

STACKING PLAN 1

DWG No.

FIGURE 1

DATE STAMP

15 JUNE 2017

PROJECT No.

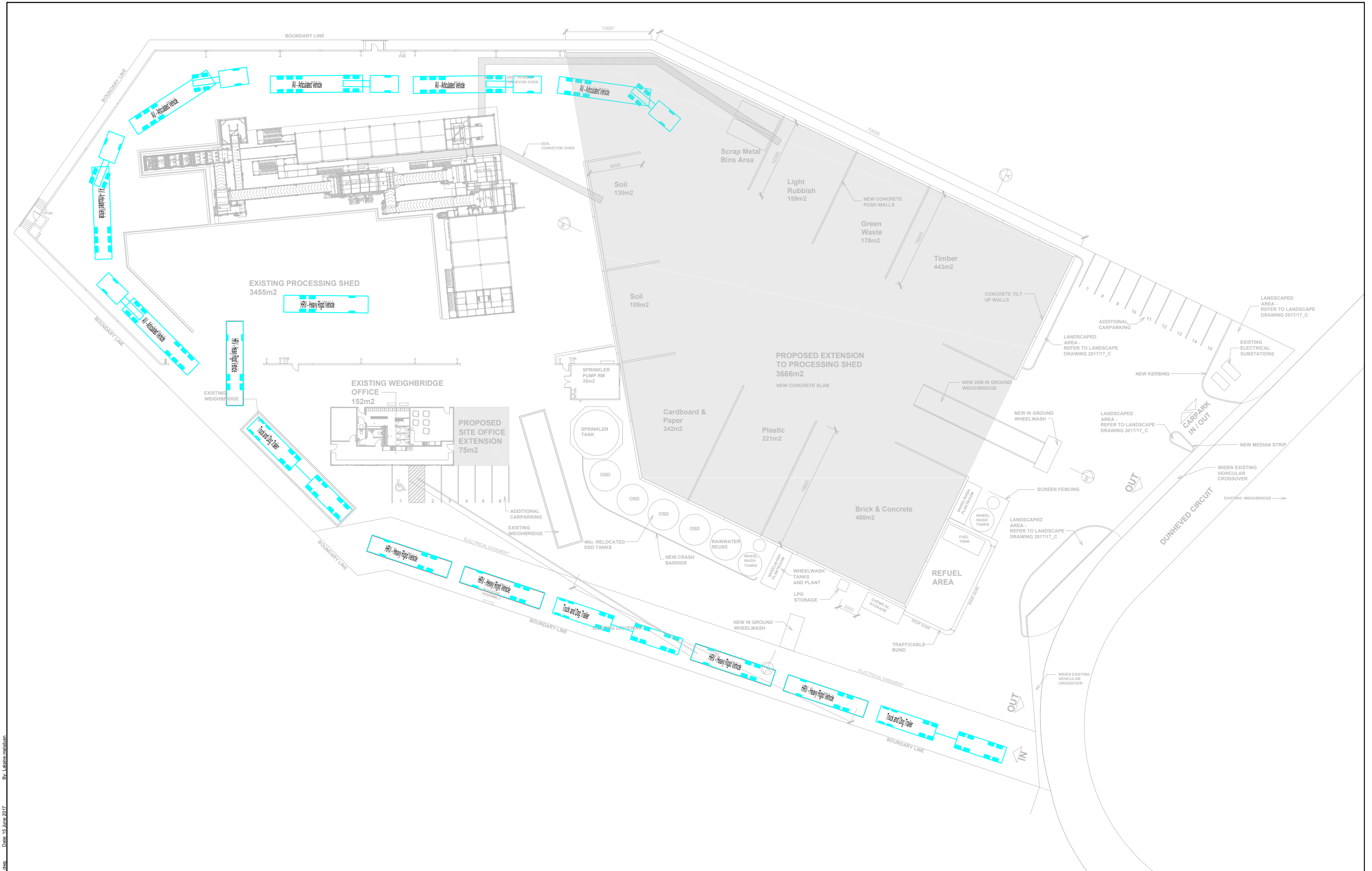
16342

SCALE

1:500@A3

REV.

A



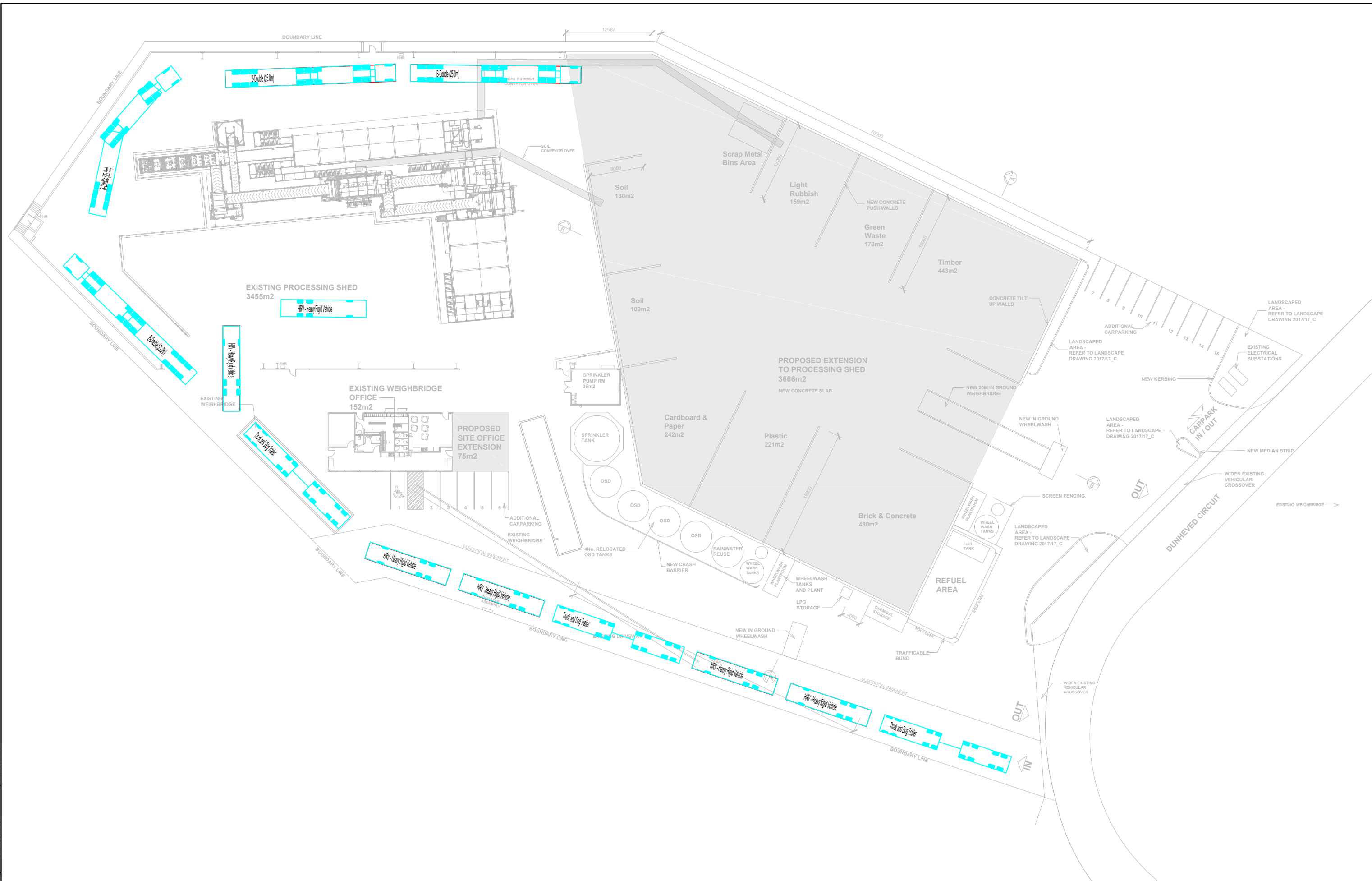
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PROJECT	21-25 DUNHEVED CIRCUIT, ST. MARYS		
TITLE	STACKING PLAN 2		

DWG No.		FIGURE 2	
DATE STAMP		15 JUNE 2017	
PROJECT No.	SCALE	REV.	
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REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
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DWG No.			FIGURE 3		
DATE STAMP			15 JUNE 2017		
PROJECT No.		SCALE		REV.	
16342		1:500@A3		A	

Appendix F

Vehicle Turning Paths

Filename: 16342DAB-Sheet Path: 170614.dwg Date: 15 June 2017 By: Lalana malalan



REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	14/06/17

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PROJECT	21-25 DUNHEVED CIRCUIT, ST. MARYS
TITLE	25m/26m B-DOUBLE

DWG No.	FIGURE 1		
DATE STAMP	14 JUNE 2017		
PROJECT No.	SCALE	REV.	
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Filename: 16342DAB-Sheet Path: 170614.dwg Date: 15 June 2017 By: Lalana malalan



REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
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PROJECT	21-25 DUNHEVED CIRCUIT, ST. MARYS
TITLE	19m SEMI-TRAILER

DWG No.	FIGURE 3		
DATE STAMP	14 JUNE 2017		
PROJECT No.	SCALE	REV.	
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Filename: 16342DAB-Sheet Path: 170614.dwg
Date: 15 June 2017
By: Lalana malalan



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PROJECT	21-25 DUNHEVED CIRCUIT, ST. MARYS
TITLE	12.5m HRV

DWG No.	FIGURE 4		
DATE STAMP	14 JUNE 2017		
PROJECT No.	SCALE	REV.	
16342	1:600 (@A3)	A	



Filename: 163420A1-Intersection-Swept-Path-170616.dwg
By: Laibne.mallam
Date: 16 June 2017

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT	DUNHEVED CIRCUIT, ST. MARYS
TITLE	25m/26m B-DOUBLE SWEEP PATH

DWG No.	FIGURE 1		
DATE STAMP	15 JUNE 2017		
PROJECT No. 16342	SCALE 1:250 (@A3)	REV. A	



Filename: 163420A1-1-Intersection Swept Path-170616.dwg
By: Laibne.mallam
Date: 16 June 2017

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE	The Transport Planning Partnership Suite 402, 22 Atchison Street St. Leonards NSW 2045 Tel: 02 8437 7800 Email: info@tpp.net.au	PROJECT		DUNHEVED CIRCUIT, ST. MARYS			DWG No.		FIGURE 2	
A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17		TITLE		19.6m TRUCK-AND-DOG SWEPT PATH			DATE STAMP		15 JUNE 2017	
												PROJECT No.		SCALE	
												16342		1:250 (@A3)	
												REV.		A	



By: Lorraine Mahalan Date: 16 June 2017 Filename: 163420A1-1-Intersection Sweep Path-170616.dwg

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT	DUNHEVED CIRCUIT, ST. MARYS
TITLE	19m SEMI-TRAILER SWEEP PATH

DWG No.		FIGURE 3	
DATE STAMP			
15 JUNE 2017			
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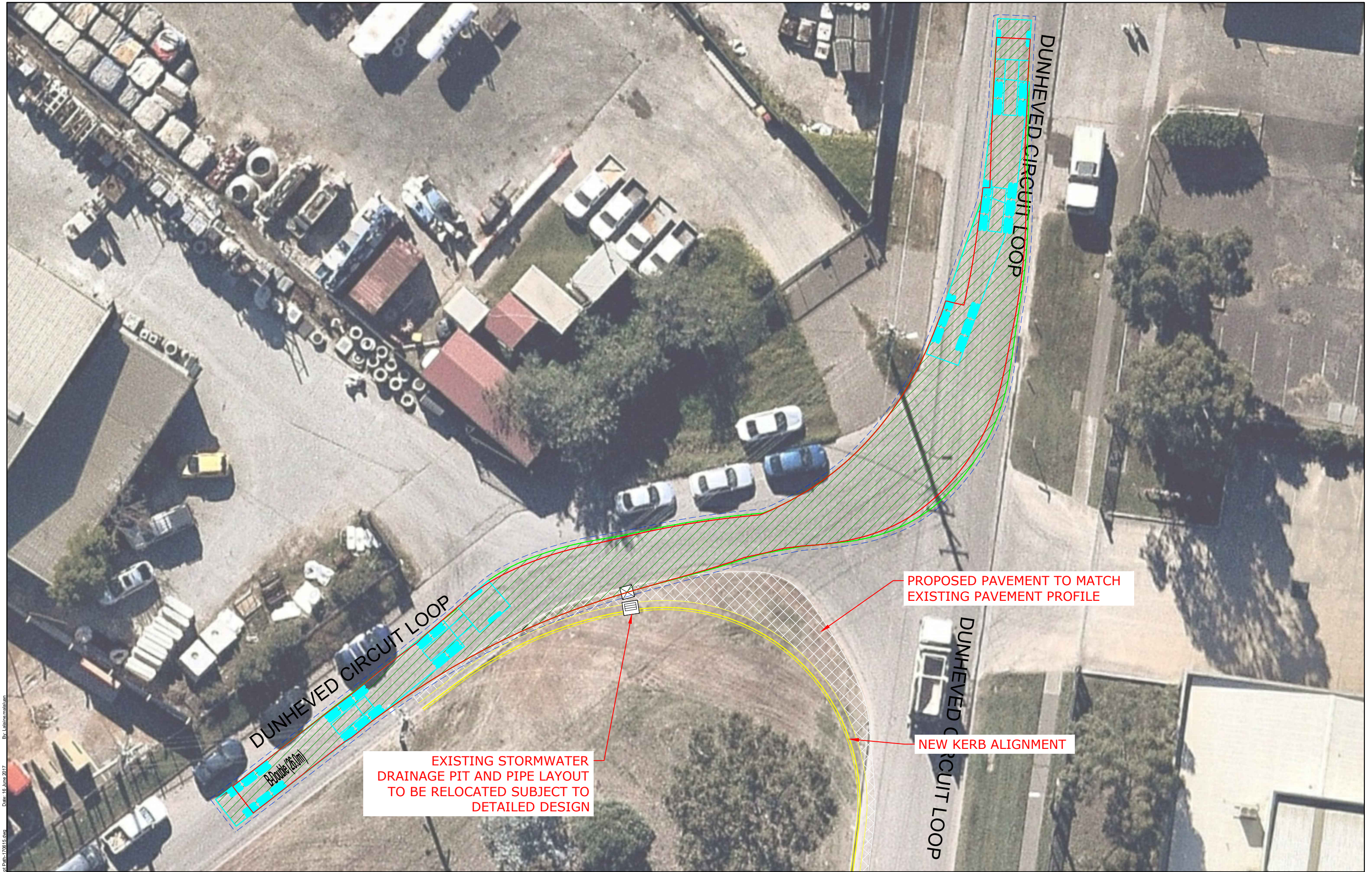
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A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT	DUNHEVED CIRCUIT, ST. MARYS
TITLE	12.5m HRV SWEPT PATH

DWG No.			FIGURE 4		
DATE STAMP			15 JUNE 2017		
PROJECT No.		SCALE		REV.	
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By: Laibne.mahdian
Date: 16 June 2017
Filename: 163420A1-Intersection-Swpt-Path-170616.dwg

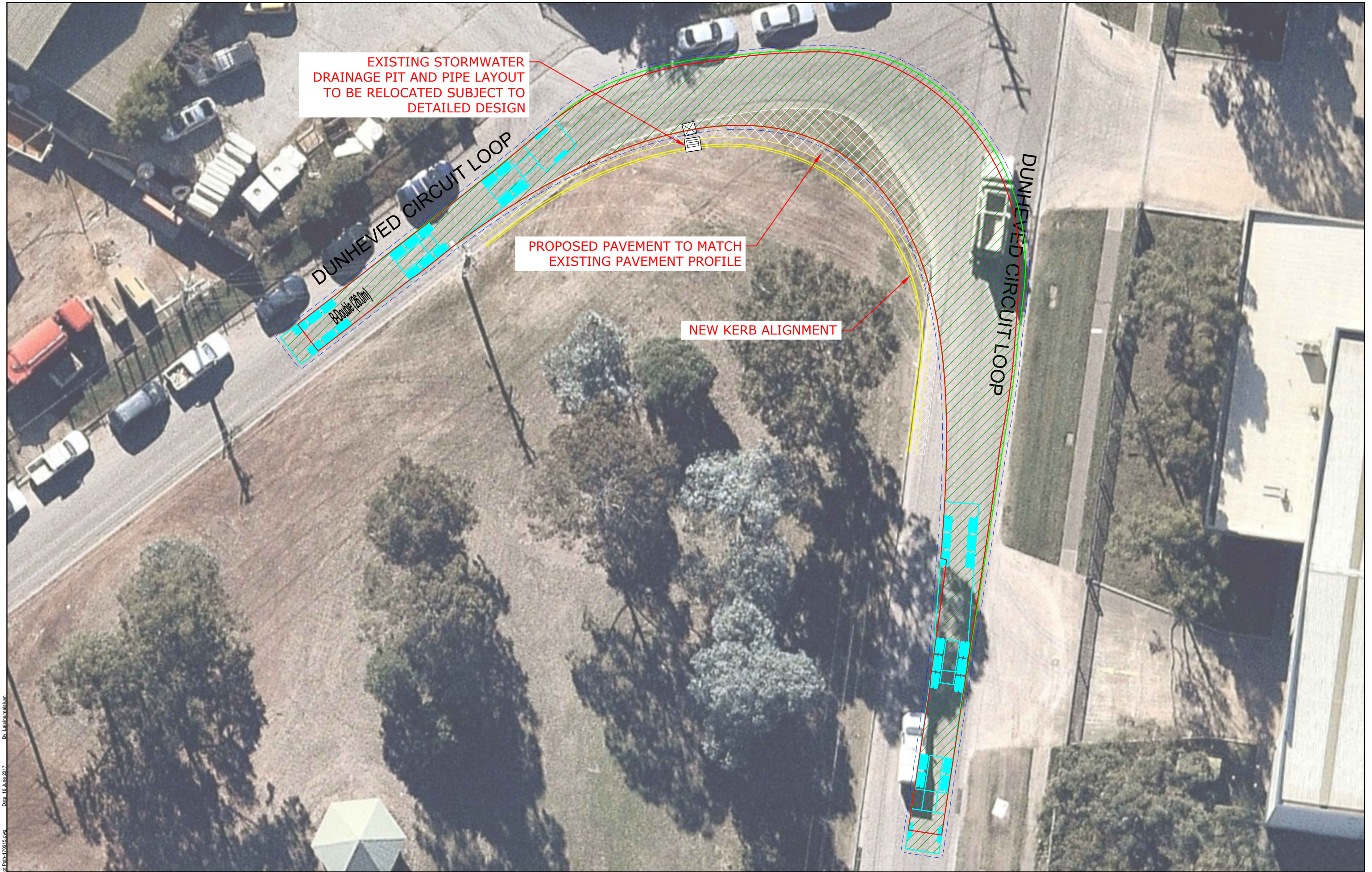
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A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT	DUNHEVED CIRCUIT, ST. MARYS	
TITLE	25m/26m B-DOUBLE SWEPT PATH	

DWG No.		FIGURE 5	
DATE STAMP		15 JUNE 2017	
PROJECT No.	SCALE	REV.	
16342	1:250 (@A3)	A	



By: Laibne.mahdian
Date: 16 June 2017
Filename: 163420A1-Intersection-Swpt-Path-170616.dwg

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT	DUNHEVED CIRCUIT, ST. MARYS
TITLE	25m/26m B-DOUBLE SWEPT PATH

DWG No.	FIGURE 6		
DATE STAMP	15 JUNE 2017		
PROJECT No.	SCALE	REV.	
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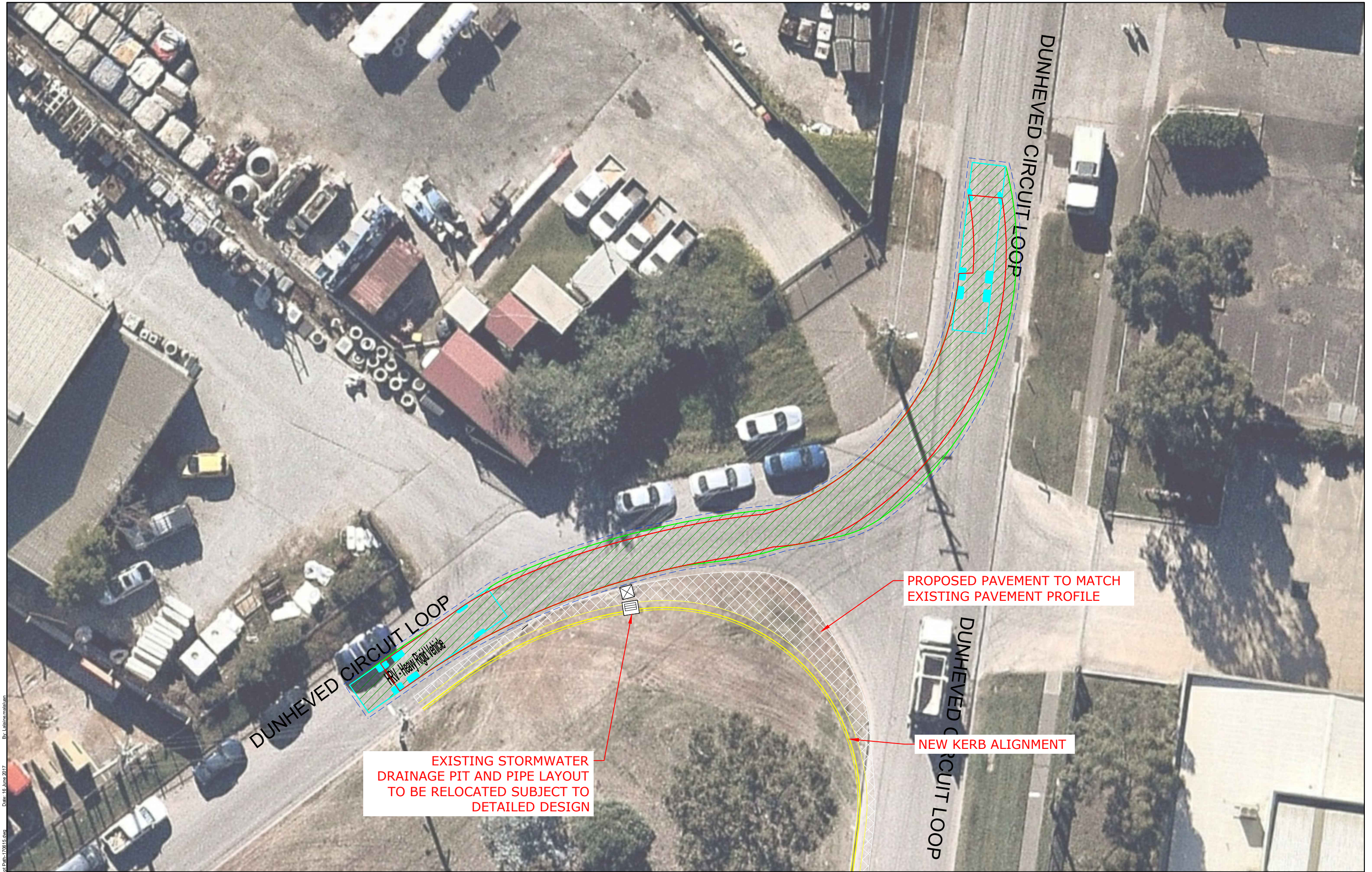
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A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT	DUNHEVED CIRCUIT, ST. MARYS
TITLE	19m SEMI-TRAILER SWEPT PATH

DWG No.		FIGURE 8	
DATE STAMP			
15 JUNE 2017			
PROJECT No.	SCALE	REV.	
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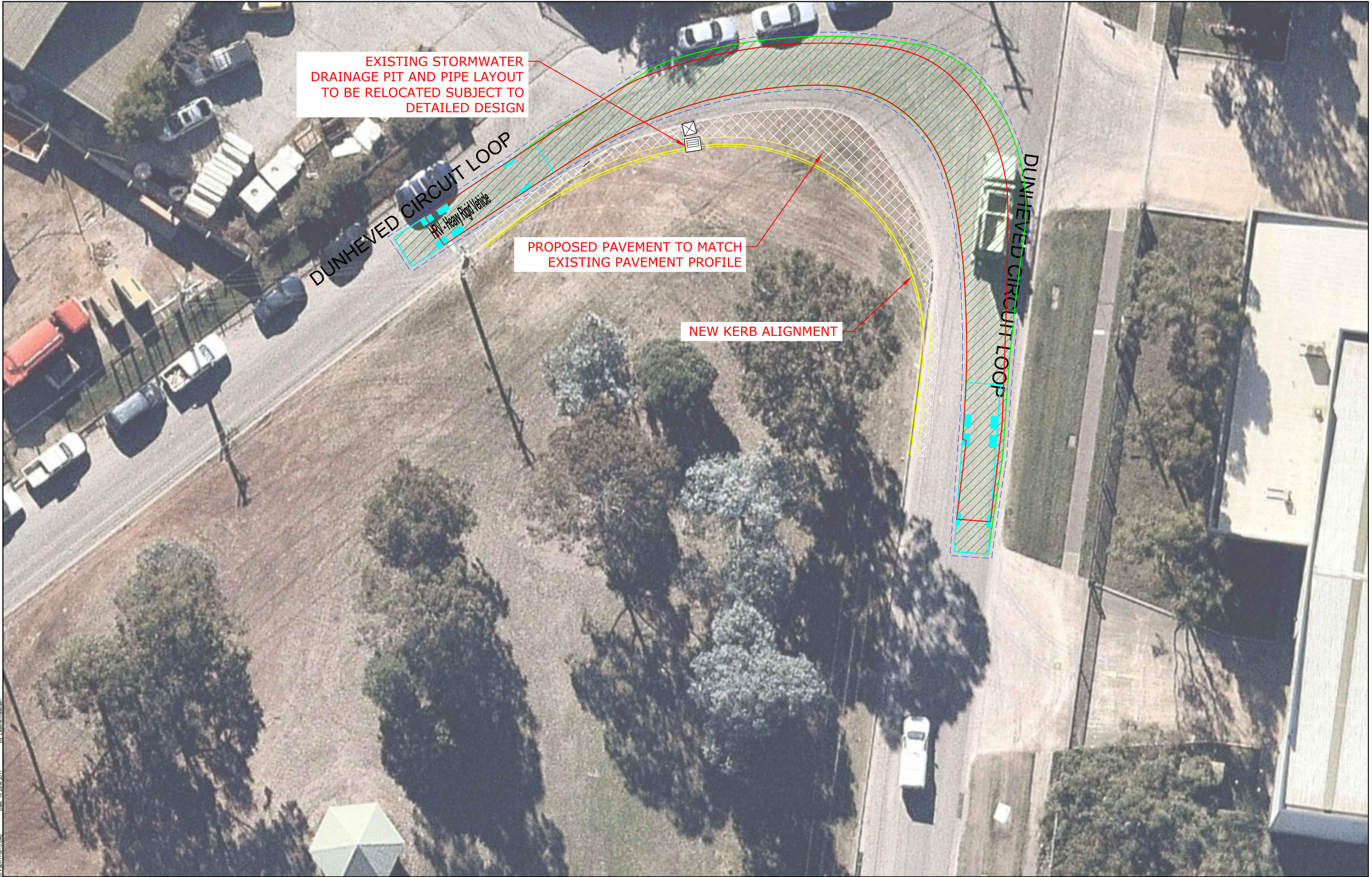
REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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PROJECT	DUNHEVED CIRCUIT, ST. MARYS		
TITLE	12.5m HRV SWEPT PATH		

DWG No.		FIGURE 9	
DATE STAMP		15 JUNE 2017	
PROJECT No.	SCALE	REV.	
16342	1:250 (@A3)	A	



REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	15/06/17

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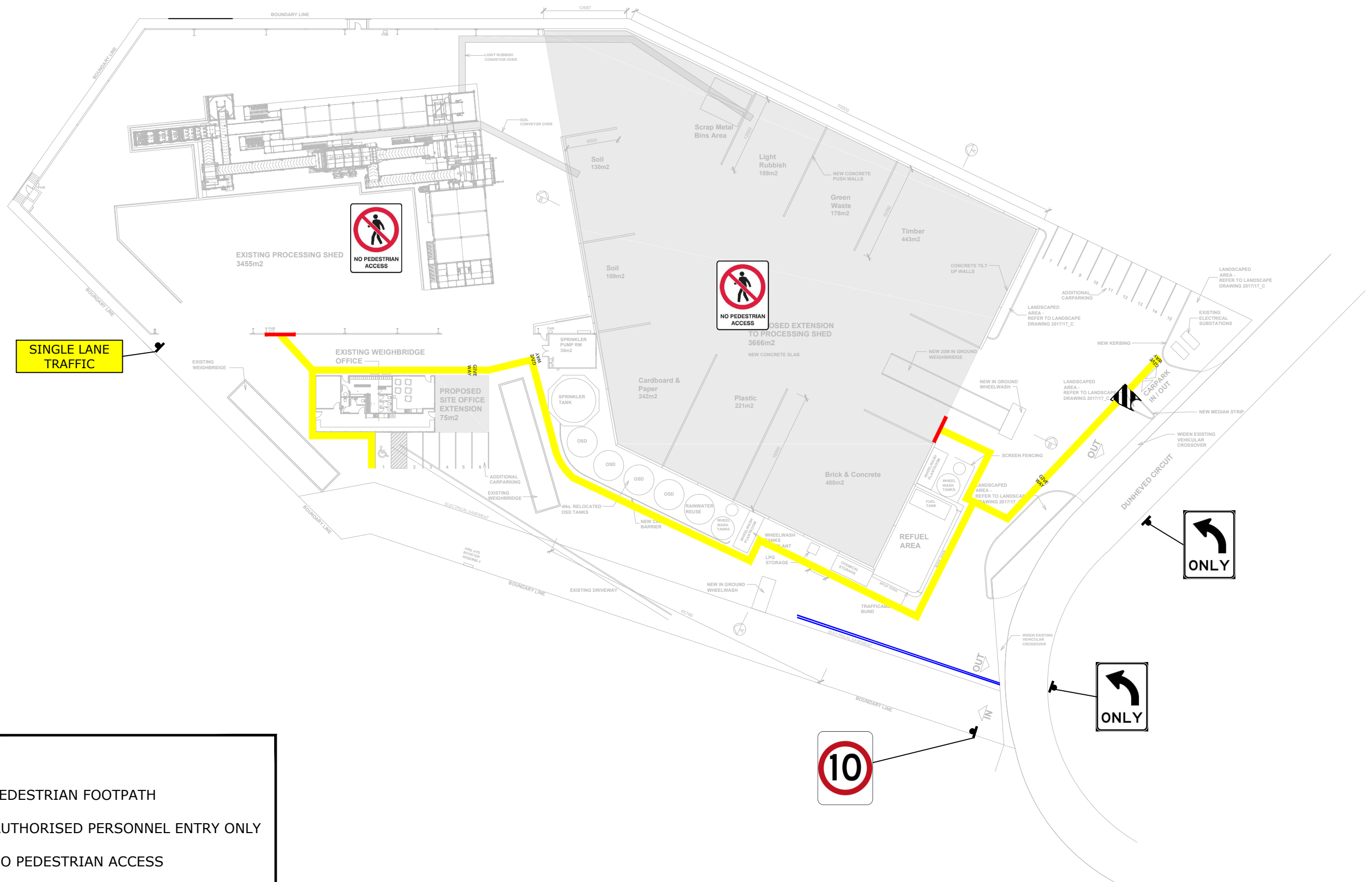
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Tel: 02 8437 7800
Email: info@tpp.net.au

PROJECT	DUNHEVED CIRCUIT, ST. MARYS		
TITLE	12.5m HRV SWEPT PATH		

DWG No. FIGURE 10		
DATE STAMP 15 JUNE 2017		
PROJECT No. 16342	SCALE 1:250 (@A3)	REV. A

Appendix G

Traffic Control Plan



LEGEND:

-  PEDESTRIAN FOOTPATH
-  AUTHORISED PERSONNEL ENTRY ONLY
-  NO PEDESTRIAN ACCESS
-  BB LINE

REV.	DESCRIPTION	DRAWN	CHECK	APP'D	DATE
A	ISSUE FOR DISCUSSION	LM	SB	SB	16/06/17

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PROJECT
21-25 DUNHEVED CIRCUIT, ST. MARYS

TITLE
TRAFFIC PLAN

DWG No.
FIGURE 1

DATE STAMP
16 JUNE 2017

PROJECT No. 16342	SCALE 1:600 (@A3)	REV. A
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Appendix H

SIDRA Intersection Analysis Results – Future Conditions

MOVEMENT SUMMARY

 **Site: [AM Peak (Future)]**

Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forrester Road											
1	L2	387	25.0	0.758	5.7	LOS A	8.5	66.3	0.65	0.54	48.4
2	T1	617	6.7	0.758	5.2	LOS A	8.5	66.3	0.65	0.54	50.9
3	R2	178	4.7	0.217	10.2	LOS A	1.0	7.6	0.37	0.65	52.3
Approach		1182	12.4	0.758	6.1	LOS A	8.5	66.3	0.61	0.56	50.5
East: Forrester Road											
4	L2	735	5.6	0.397	3.5	LOS A	0.0	0.0	0.00	0.43	56.4
5	T1	122	12.1	0.136	6.6	LOS A	0.7	5.6	0.60	0.64	31.2
6	R2	1	0.0	0.136	11.4	LOS A	0.7	5.6	0.60	0.64	51.3
Approach		858	6.5	0.397	3.9	LOS A	0.7	5.6	0.09	0.46	52.3
North: Rope Crossing Boulevard											
7	L2	4	0.0	0.003	3.1	LOS A	0.0	0.1	0.30	0.38	51.2
8	T1	419	3.3	0.384	4.0	LOS A	2.1	15.1	0.52	0.47	51.0
9	R2	20	5.3	0.384	9.0	LOS A	2.1	15.1	0.52	0.47	35.1
Approach		443	3.3	0.384	4.3	LOS A	2.1	15.1	0.52	0.47	50.3
West: Links Road											
10	L2	4	25.0	0.090	8.3	LOS A	0.4	3.5	0.64	0.76	43.4
11	T1	37	45.7	0.090	9.1	LOS A	0.4	3.5	0.64	0.76	49.1
12	R2	121	58.3	0.191	13.0	LOS A	0.9	9.1	0.65	0.85	44.7
Approach		162	54.5	0.191	12.0	LOS A	0.9	9.1	0.65	0.83	45.5
All Vehicles		2645	11.5	0.758	5.5	LOS A	8.5	66.3	0.43	0.53	50.8

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

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

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

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MOVEMENT SUMMARY

 **Site: [PM Peak (Future)]**

Links Rd/ Ropes Crossing Blvd/ Forrester Rd
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Forrester Road											
1	L2	94	40.4	0.652	4.9	LOS A	6.6	49.4	0.36	0.41	48.3
2	T1	894	4.1	0.652	4.4	LOS A	6.6	49.4	0.36	0.41	51.5
3	R2	605	2.4	0.468	9.4	LOS A	3.4	24.3	0.28	0.60	52.2
Approach		1593	5.6	0.652	6.3	LOS A	6.6	49.4	0.33	0.48	51.7
East: Forrester Road											
4	L2	888	4.4	0.476	3.5	LOS A	0.0	0.0	0.00	0.43	56.2
5	T1	47	48.9	0.068	7.4	LOS A	0.3	3.4	0.61	0.64	30.8
6	R2	1	0.0	0.068	11.3	LOS A	0.3	3.4	0.61	0.64	51.1
Approach		937	6.6	0.476	3.7	LOS A	0.3	3.4	0.03	0.44	54.6
North: Rope Crossing Boulevard											
7	L2	11	0.0	0.011	4.4	LOS A	0.0	0.3	0.53	0.52	50.5
8	T1	215	8.8	0.316	7.6	LOS A	1.8	13.7	0.79	0.85	49.1
9	R2	3	33.3	0.316	13.5	LOS A	1.8	13.7	0.79	0.85	36.0
Approach		228	8.8	0.316	7.5	LOS A	1.8	13.7	0.78	0.84	49.0
West: Links Road											
10	L2	58	5.5	0.397	11.4	LOS A	2.0	15.1	0.78	0.92	41.3
11	T1	138	13.7	0.397	11.9	LOS A	2.0	15.1	0.78	0.92	47.1
12	R2	358	16.8	0.543	16.8	LOS B	3.5	27.8	0.83	1.04	41.7
Approach		554	14.8	0.543	15.0	LOS B	3.5	27.8	0.81	0.99	42.9
All Vehicles		3312	7.7	0.652	7.1	LOS A	6.6	49.4	0.36	0.58	51.1

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

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

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

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

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

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