



STANBURY
TRAFFIC PLANNING

TRAFFIC, PARKING & TRANSPORT CONSULTANTS

TRAFFIC & PARKING IMPACT ASSESSMENT

**PROPOSED RESIDENTIAL APARTMENT DEVELOPMENT
36 – 38 RODLEY AVENUE
PENRITH**

**PREPARED FOR INGLOW INVESTMENT TWO PTY. LTD.
OUR REF: 18-045**



AUGUST 2018

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1. INTRODUCTION

1.1 Scope of Assessment

Stanbury Traffic Planning has been commissioned by Inglow Investment Two Pty. Ltd. to prepare a Traffic & Parking Impact Assessment to accompany a Development Application to be lodged with Penrith City Council. The Development Application seeks consent for the demolition of two detached residential dwellings and the construction of a residential apartment development containing 21 dwellings at 36 – 38 Rodley Avenue, Penrith (hereafter referred to as the ‘subject site’).

This aim of this assessment is to investigate and report upon the potential traffic and parking consequences of the development application and to recommend appropriate ameliorative measures where required. This report provides the following scope of assessment:

- Section 1 provides a summary of the site location, details, existing and surrounding land-uses;
- Section 2 describes the proposed development;
- Section 3 assesses the adequacy of the proposed site access arrangements, parking provision, internal circulation and servicing arrangements with reference to relevant Council, Roads & Maritime Services and Australian Standard specifications;
- Section 4 assesses the existing traffic, parking and transport conditions surrounding and servicing the subject development site including a description of the surrounding road network, traffic demands, operational performance and available public transport infrastructure; and
- Section 5 estimates the projected traffic generating ability of the proposed development and assesses the ability or otherwise of the surrounding road network to be capable of accommodating the altered demand in a safe and efficient manner.

The report has been prepared pursuant to State Environmental Planning Policy (Infrastructure) 2007. The application is not of sufficient scale to be referred to the Roads & Maritime Services under this Instrument.

1.2 Reference Documents

Reference is made to the following documents throughout this report:

- The Roads & Maritime Services’ *Guide to Traffic Generating Developments* and the more recently released *Technical Direction TDT 203/04a*;
- Penrith City Council’s *Penrith Development Control Plan 2014* (DCP 2014);

- Penrith City Council’s *Residential Flat Building Developments Waste Management Guidelines*;
- Australian Standard for *Parking Facilities Part 1: Off-Street Car Parking* (AS2890.1:2004);
- Australian Standard for *Parking Facilities Part 3: Bicycle Parking Facilities* (AS2890.3:2015); and
- Australian Standard for *Parking Facilities Part 6: Off-Street Parking for People with Disabilities* (AS2890.6:2009).

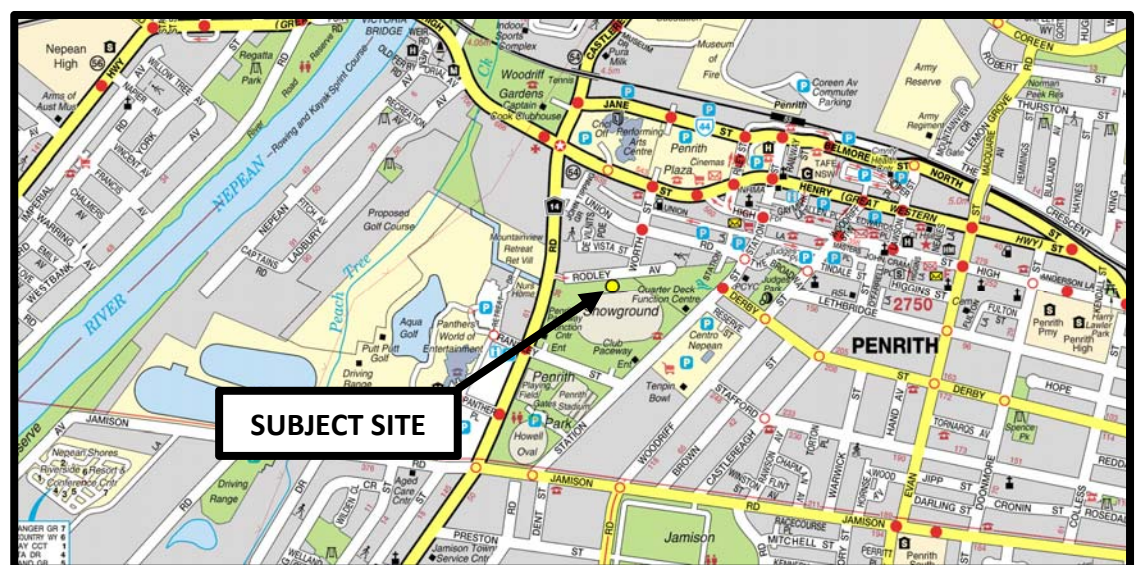
Architectural plans have been prepared by Morson Group and should be read in conjunction with this report, reduced copies of a selection of which (ground and basement plans only) are included as **Appendix 1** for reference.

1.3 Site Details

1.3.1 Site Location

The subject site is situated on the southern side of Rodley Avenue, approximately 60m to the west of Worth Street, Penrith. The site location is illustrated below and overlaid within a local and aerial context by **Figure 1** below and **Figure 2** overleaf, respectively.

FIGURE 1
SITE LOCATION WITHIN A LOCAL CONTEXT



Source: UBD’s Australian City Streets – Version 4

FIGURE 2
SITE LOCATION WITHIN AN AERIAL CONTEXT



Source: Google Earth (accessed 16/08/18)

1.3.2 Site Description

The subject site provides a real property description of Lot 58 and 59 DP 33490 and a street address of 36 and 38 Rodley Avenue, Penrith. Collectively, the allotments form a rectangular shaped parcel of land, providing an approximate frontage of 30.5m to Rodley Avenue. The site extends to the south away from Rodley Avenue some 36.5m, providing a total area of approximately 1,113m².

1.3.3 Existing Site Use

The subject site currently accommodates two detached residential dwellings and associated outbuildings. Each dwelling is serviced by vehicular access driveway connecting separately with Rodley Avenue, situated in the north-western corner of each lot.

1.3.4 Surrounding Uses

The site is adjoined to the north, east and west by similar detached residential dwellings, fronting and serviced by Rodley Avenue.

Penrith Paceway adjoins the site to the south.

2. PROPOSED DEVELOPMENT

2.1 Built Form

The subject application seeks Council's approval to demolish the existing dwellings and the construction of residential apartment development comprising a total of 21 dwellings, made up of the following:

- 12 two bedroom dwellings; and
- 9 three bedroom dwellings.

The dwellings are proposed to be contained within a six storey building located approximately central to the site.

The development is to be serviced by two levels of basement parking accommodating 37 passenger vehicle spaces and six bicycle spaces. Access between this parking area and Rodley Avenue is proposed via combined ingress / egress driveway located within the north-eastern corner of the site.

Pedestrian connectivity is proposed between the development and the southern Rodley Avenue footway to the west and separate from the abovementioned vehicular access driveway.

Further to the above internal site works, the proposal involves the construction of an indented bay within the southern Rodley Avenue footway. This bay, providing approximate dimensions of 20.5m x 2.5m, is proposed to partially encompass the passenger vehicle driveway but be primarily located to the west, to accommodate waste collection activities associated with the proposed development.

3. SITE ACCESS & INTERNAL CIRCULATION

3.1 Passenger Vehicular Access

Vehicular access between the development site and Rodley Avenue is proposed to be provided via a single combined ingress / egress driveway provided within the north-eastern corner of the site. The access driveway is proposed to provide a width of 6.6m.

This driveway is proposed to provide direct connectivity to an internal roadway which provides a 3m wide ingress lane separated from a 3m wide egress lane by a 0.6m wide median for a length of 6m. The internal roadway thence reduces in width and forms a single carriageway providing a minimum width of 3m, facilitating a one-way traffic function providing connectivity to the upper basement parking level.

The one-way section of the internal roadway / ramp proposed to be governed by traffic signal control whereby a green signal will be provided for entering traffic in 'passive' mode so that the signals will only change when a vehicle is exiting the basement levels and a red signal is activated. The separate ingress and egress lanes situated immediately within the site boundary can accommodate vehicular waiting in the unlikely event that an entering vehicle is delayed. The suitability or otherwise of the proposed one-way section of the internal roadway connecting to the driveway is discussed in subsequent sections of this report.

AS2890.1:2004 provides driveway design specifications based on the proposed primary land use, the functional order of the access road and the number of spaces the driveway is to serve. Tables 3.1 and 3.2 of AS2890.1:2004 specify that a Category 1 type driveway is required, providing a combined ingress / egress driveway width of between 3m and 5.5m based on the local (non-arterial) nature of Rodley Avenue, the residential land-use and the on-site passenger vehicle parking provision of less than 100 spaces. The proposed 6.6m wide combined ingress / egress driveway therefore exceeds the minimum AS2890.1-2004 specifications.

Swept path plans have been prepared in order to demonstrate the ability of passenger vehicles to enter and exit the site, copies of which are included as **Appendix 2**.

The safety and efficiency of access / egress movements are also proposed to be assisted by the provision of a relatively level (maximum of 1:20) grade within the first 6m inside the property boundary.

The consistency of the horizontal and vertical alignment of Rodley Avenue in the vicinity of the subject site results in a good level of sight distance prevailing between the driveway and the frontage road. Sight distance between vehicles exiting the site and Rodley Avenue to the west of the site is proposed to be assisted by the provision of a triangle adjoining the southern side of the driveway measuring 2.5m into the site and 2.0m along the boundary being free of obstructions to visibility in accordance with the relevant AS2890.1:2004

requirements. In consideration of this and the abovementioned discussion, the proposed site access arrangement is considered to be satisfactory.

3.2 Parking Provision

3.2.1 Vehicular Parking Provision

The development is serviced by a total of 37 off-street passenger vehicle parking spaces provided as follows:

Basement level 1

Visitor spaces	4
Wash / service space	1
Resident spaces	10 (including 3 adaptable)

Basement level 2

Resident spaces	22
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Total	37 spaces
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3.2.2 Council's Vehicular Parking Requirements

Penrith City Council provides the following locally sensitive parking requirements for residential flat building with DCP 2014:

1 space per 1 or 2 bedrooms
2 spaces per 3 or more bedrooms
1 space per 40 units for service vehicles

1 space per every 5 dwellings, or part thereof for visitors
1 space for car washing for every 50 units, up to a maximum of 4 spaces per building

Table 1 below provides the off-street parking requirements based on the above Penrith City Council's car parking rate.

TABLE 1 OFF-STREET PARKING REQUIREMENTS PENRITH DCP 2014			
Item	Rate	No.	Spaces Required
1 or 2 bedroom dwellings	1 space per dwelling	12	12
3 bedroom dwellings	2 space per dwelling	9	18
Service vehicles	1 space per 40 dwellings	21	0.5 (adopt 1)
Visitor Parking	1 space per 5 dwellings	21	4.2 (adopt 5)
Car Washing	1 space per 50 units	21	0.4 (adopt 1)
		Total	37

Table 1 indicates that DCP 2014 requires the development provide a total of 37 passenger vehicle parking spaces, comprising 30 resident, five visitor, one service and one car wash space.

The proposed total passenger vehicle parking provision of 37 spaces therefore complies with the numerical requirements of DCP 2014.

The following is however acknowledged:

- The service vehicle and washing bay have been combined in a single parking space; and
- The visitor parking requirement of 4.2 spaces has been rounded down to four spaces.

The combining of the service bay and wash bay is considered to be satisfactory given the sporadic nature of the use of such bays. Further the rounding down of the visitor parking calculations is supported as the abovementioned service / wash bay could reasonably be utilised as by visitors if so required. In consideration of this, the proposed passenger vehicle parking provision and allocation is considered to be satisfactory.

3.2.2 Bicycle Parking

The subject development is to provide three bicycle storage racks capable of accommodating up to six bicycles within the upper basement parking level.

Penrith Council refers to NSW Government's *Planning Guidelines for Walking and Cycling* 2004 with respect to the provision of bicycle parking. This publication provides the following recommendations relevant to the subject proposal:

Resident

20% of units should provide a space

Visitors

5% of units should provide a space

Based on 21 dwellings, the NSW Government's *Planning Guidelines for Walking and Cycling* recommends resident and visitor bicycle parking provision of 4.2 (adopt five) resident and 1.05 (adopt one) visitor parking spaces or a total of six spaces.

The proposed provision of six on-site bicycle parking spaces therefore complies with the requirement specified in the NSW Government's guidelines and accordingly, is considered to be satisfactory.

3.3 Internal Circulation and Manoeuvrability

3.3.1 Internal Access Ramps

Vehicular connectivity between the access driveway and Basement Level 1 and between Basement Level 1 and Basement Level 2 is proposed to be serviced by one-way vehicular ramps. Clause 3.2.2 of AS2890.1-2004 states that internal roadways accommodating low traffic demands (less than 30 hourly vehicles during peak periods) can provide for one-way traffic without the need for passing

bays and / or control mechanisms. The design of the ramps however impede sight distance between the driveway and Basement Level 1 and between Basement Level 1 and Basement Level 2 and accordingly, it is considered that traffic signal control is warranted and is therefore proposed.

Traffic movements between the site access driveway and Basement Level 1 and between Basement Level 1 and Basement Level 2 are proposed to be governed by an internal traffic signal system, which limits the direction of traffic flow within the ramps to one-way at any given time. The traffic signal system is to utilise red / green traffic lanterns located at the top and bottom of the ramps. The lanterns are to be supplemented with 'Stop Here on Red' signage and stop lines located clear of the ramps thereby allowing vehicles to safely manoeuvre from the ramps clear of queued vehicles.

Direction sensitive vehicle detection loops are to be installed before the stop lines and a directional sensitive vehicle radar detection unit is to be located at the exit of the ramps, to activate and monitor vehicle movements.

The default position will display a green to the movement of vehicles from the site access driveway into the site and a red display for vehicles exiting the basement parking levels. Under this arrangement, when vehicles approach the site, they will be provided with a green display and move down the access ramp to Basement Level 1 and thence onto Basement Level 2 if so desired. An input is to be received by the operating system from the radar direction unit as the vehicle travels down the ramp/s.

When a vehicle stops at the stop line within the basement levels, it will activate the direction sensitive vehicle loop detector. The operating system will then display a red to the entrance lantern and the other basement level while the vehicle/s wishing to exit the specific basement will remain red. The operating system will have recorded any vehicles already in the ramp/s via the radar detection units and commenced a timer to allow a vehicle to complete its journey through the ramp/s. The display for the activated loop detector within the specific basement level will then change from red to green thereby allowing vehicles to exit that specific level of the basement. When the directional sensitive radar unit located at the top of the access ramp is activated by the exiting vehicle/s, the system returns to the default position.

Vehicle detector loops within the access driveway and the basement levels will be fitted with presence timer technology to ensure that they are not unduly impacted by the manoeuvring of vehicles to and from nearby passenger vehicle parking spaces.

It is acknowledged that a number of parking spaces on each basement level are located between the access ramps and the vehicle waiting bay. In order to ensure that vehicles occupying these spaces are not required to manoeuvre to access the waiting bay, a push button will be provided adjacent to these spaces and in-vehicle remotes will be allocated to occupants of the resident spaces. When a vehicle within these spaces is required to exit the basement, the driver will activate the system either through the push button or the in vehicle remote. The operating system, similar to that which occurs if a vehicle triggers the detectors

within the basement waiting bays, will then display a red to the site entrance lantern, and a green the basement parking level/s.

Signage will be provided within the basement specifying that vehicles are not to exit car spaces until a green lantern is displayed within the basement to ensure there is no undesirable conflict within the basement circulation aisles.

The location of stop lines, vehicle detectors, push buttons and lanterns are illustrated on the architectural plans, reduced scale copies of which are included as **Appendix 1**.

The traffic signal system is to be fitted with a battery powered back up system to ensure that it continues to operate during power black outs.

3.3.2 Passenger Vehicle Circulation

Passenger vehicles, upon entry to the site, will travel in a forward direction via a ramp running along the eastern site boundary to access Basement Level 1. Basement Level 1 is proposed to contain a series of standard 90 degree angled parking spaces serviced by an adjoining parking / circulation aisle, with spaces being allocated to residents and visitors.

A further access ramp (also facilitating one-way traffic) is proposed to provide connectivity between Basement Level 1 and Basement Level 2, accommodating the remainder of the resident parking provision in a similar layout to that provided in Basement Level 1.

The passenger vehicle (and bicycle) parking spaces within both basement parking levels have been designed with the following minimum dimensions in accordance with the requirements of AS2890.1:2004, AS2890.3:2015 and AS2890.6:2009:

- Standard vehicular parking space width = 2.4m;
- Disabled vehicular parking space width = 2.4m (with adjoining 2.4m wide shared area);
- Additional vehicular space width where parking spaces adjoins an obstruction = 0.3m;
- Bicycle parking width = 0.6m;
- Standard and disabled vehicular parking space length = 5.4m;
- Horizontal bicycle rack length (depth) = 1.8m;
- Vertical bicycle rack depth = 1.2m;
- Bicycle parking rack aisle width = 1.5m;
- Vehicular parking aisle width adjoining parking spaces = 5.8m;

- One-way straight roadway / ramp = 3m;
- Two-way straight roadway / ramp width = 5.8m;
- Parking aisle extension past dead end parking bays = 1.0m;
- Headroom = 2.2m;
- Headroom above disabled parking spaces and adjoining shared areas = 2.5m;
- Maximum ramp grade = 1 in 4;
- Maximum ramp grade for the first 6m inside the site and within parking module = 1 in 20; and
- Maximum change in grade = 1 in 8.

Safe and efficient internal manoeuvring and parking space accessibility is anticipated to result, taking into consideration the above compliance with the relevant AS2890.1:2004, AS2890.3:2015 and AS2890.6:2009 specifications.

In order to demonstrate the internal passenger vehicle manoeuvrability within the vicinity of these areas and generally throughout the overall parking areas, this Practice has prepared a number of swept path plans which are included as **Appendix 2**. The turning paths provided on the plans have been generated using Autoturn software and derived from B85 and B99 vehicle specifications provided within AS2890.1-2004.

Section B4.4 of AS2890.1-2004 states the following with regard to the use of templates to assess vehicle manoeuvring:

'Constant radius swept turning paths, based on the design vehicle's minimum turning circle are not suitable for determining the aisle width needed for manoeuvring into and out of parking spaces. Drivers can manoeuvre vehicles within smaller spaces than swept turning paths would suggest.'

It would therefore appear that whilst the turning paths provided within AS 2890.1 - 2004 can be utilised to provide a 'general indication' of the suitability or otherwise of internal parking and manoeuvring areas, vehicles can generally manoeuvre more efficiently than the paths indicate. Notwithstanding this, the swept path plans illustrate that passenger vehicles can manoeuvre throughout and enter and exit the most difficult passenger vehicle parking spaces within the parking areas. The proposed site layout as it relates to passenger vehicle manoeuvrability is considered satisfactory.

3.3.3 Waste Collection

The subject site is anticipated to generate the requirement for regular waste collection vehicle servicing. Waste collection vehicles are proposed to service the site via an indented bay provided within the southern Rodley Avenue footway, situated to the immediate west of the development vehicular access driveway.

Garbage bins are proposed to be contained within a storage room located within the upper basement level. These bins are to be transferred to a holding room located approximately central to the site frontage to Rodley Avenue, which can efficiently be wheeled to the proposed indented collection bay within the southern public road footway.

The proposed indented bay provides the following design criteria:

- A width of 2.5m, measured from the existing kerb line to the new kerb line, for a length of 10.5m;
- A 6m ingress splay / manoeuvring space at the rear of the bay, measured along the existing kerb line (and partially encompassing the development access driveway);
- A 4m egress splay / manoeuvring space at the front of the bay, measured along the existing kerb line;
- A 1.2m wide footpath within the southern Rodley Avenue footway between and providing a minimum separation of 0.8m to the northern site boundary and the indented bay; and
- A 2.8m wide kerb ramp to facilitate wheeled bin access to the rear of the indented bay.

It is acknowledged that detailed design of the above arrangements, and any supplementary signage and line marking arrangements, will need to be submitted to and approved by Council through a Section 138 Application, including the payment of application and inspection fees. The requirement for this can reasonably be imposed by Council as a condition of consent.

It is further acknowledged that Council's *Residential Flat Building Waste Management Guidelines* specifies that it is desirable that development design facilitate the provision of on-site collection of waste by Council's 10.5m long collection vehicle and facilitate forward entry and exit movements between the site and the adjoining public road network. The Guidelines however also specify that on-site collection may not be practicable for all development sites due to site dimensions, topography or the resultant associated undesirable planning outcome achieved.

The above proposed waste collection arrangements have accordingly been formulated following a detailed assessment of potential on-site collection arrangements in accordance with Council's *Residential Flat Building Waste Management Guidelines*. These alternate collection arrangements have also

being the subject of various discussions with Council staff through pre-lodgement meetings / assessment and reviews by Council's Urban Design Panel.

In regard to the above, an alternate development scheme was prepared for discussions with Council officers which incorporated the provision of an at-grade heavy vehicle turntable within the south-eastern corner of the site. This alternate on-site collection area was to be accessed via an internal roadway along the eastern site boundary, connecting with Rodley Avenue in the north-eastern corner of the site via a driveway, separate but adjoining the passenger vehicle access driveway servicing the basement parking levels.

The overlaying of indicative swept paths of Council's 10.5m long collection vehicle on the above alternate design scheme illustrated undesirable interaction with public road traffic flow and parking areas as well as vehicular access / egress movements associated with the development basement parking areas.

In comparison, swept path plans which have been prepared by this Practice, copies of which are attached as **Appendix 2**, demonstrate that Council's 10.5m long collection vehicle is capable of manoeuvring to and from the proposed indented bay without unreasonable encroachment on public road traffic flow and parking areas, also being clear of the development access driveway servicing the basement parking areas.

Cognisant of the above, Council's Development Assessment Coordinator, Gavin Cherry, specified the following in an email dated 27 June 2018 to the application architects, Morson Group, following the matter being considered by Council's Urban Design Panel:

...it is acknowledged that waste collection should not be at the expense of quality design outcomes. The provision of on-site collection as proposed in the options plan does significantly reduce critical landscape opportunities and required boundary planting with a diminished streetscape presentation for the development. Basement access is also not likely possible due to lot depth constraints, manoeuvring requirements and the need for a third basement construction.

Whilst it is acknowledged that the proposed indented on-street bay will result in the loss of approximately three on-street parallel parking spaces, a similar loss of on-street parking would eventuate from the excessively wide driveways and manoeuvring which would be required in the event that collection vehicles were required to enter and exit the site.

It should further be acknowledged that any on-street reduction in parking would be limited to that immediately adjacent to the subject site. All adjoining properties provide formal off-street parking infrastructure and additional adjacent on-street kerb-side if so required. It is accordingly not expected that the minor loss of on-street parking supply will unreasonably impact adjoining residential amenity. In fact, it could be argued that the provision of the indented bay will provide for additional roadway capacity by providing additional pavement width to allow oncoming vehicles to pass.

Importantly, it should be noted that the proposed off-site collection arrangements and design are consistent with that recently approved for similar residential apartment development at 50 – 54 Rodley Avenue via DA16/0262. Council's Major Assessment Report for this development dated 16 March 2016 specified the following:

Despite this department not generally accepting the provision of an on-street loading bay, in the circumstances of this case it is the most suitable solution for the development given manoeuvring through the basement with a heavy vehicle is difficult to achieve. The amended proposal provides proximity to the collection area and to the basement driveway, and allows for the waste vehicle to enter and exit the property (bay) in a forward direction as required.

In consideration of the above and the previous discussion, the proposed waste collection arrangements are therefore considered to be satisfactory and consistent with that previously approved within Rodley Avenue.

4. EXISTING TRAFFIC CONDITIONS

4.1 Surrounding Road Network

The following provides a description of the road network surrounding the subject site:

- **Rodley Avenue** performs a local access road function under the care and control of Penrith City Council. It provides an east-west alignment connecting the southbound Mulgoa Road carriageway in the west with Worth Street approximately 60m to the east of the site. Rodley Avenue extends a further 160m to the east of Worth Street, at which point it forms a terminating cul-de-sac.

Rodley Avenue provides an approximate pavement width of 7m providing one through lane of traffic in each direction in conjunction with parallel parking along both kerb alignments. Traffic flow is governed by a sign posted speed limit of 50km/h.

Rodley Avenue provides a half road closure to the west on immediate approach to the Mulgoa Road southbound carriageway, from which left turn entry movements only are facilitated.

Rodley Avenue forms a T-junction with Worth Street to the east, operating under major / minor priority control with Rodley Avenue performing the through route.

- **Worth Street** provides a north-south collector function, also under the care and control of Penrith City Council. It provides a connection between High Street and Penrith Plaza in the north, intersecting with which under traffic signal control, and Rodley Avenue in the south. Worth Street also intersects with Union Road under traffic signal control, some 150m to the north of Rodley Avenue.

Worth Street, between Rodley Avenue and Union Road, provides a 7m wide pavement providing one through lane of traffic in each direction, in conjunction with indented parallel passenger vehicle parking bays. To the north of Union Road, Worth Street forms a 13m wide pavement providing two though lanes of traffic in each direction.

- **Union Road** provides an east-west collector function, linking Station Street in the east with Mulgoa Road in the west. Union Road provides a 13m wide pavement, primarily providing one through lane of traffic in each direction in conjunction with parallel parking along both kerb alignments. Parking restrictions apply on immediate approach to and departure from Worth Street, facilitating two through lanes on approach and departure from the signalised intersection.

Union Road intersects with Station Street (and The Broadway) under single lane circulating roundabout control to the east. To the west, Union Road intersects with Mulgoa Road under major / minor priority control with Mulgoa Road performing the priority route. Whilst a dedicated right turn lane and break is provided within the Mulgoa Road central median, facilitating right turn movements to Union Road, right turn egress movements from Union Road are prohibited.

4.2 Existing Traffic Volumes

Staff of Stanbury Traffic Planning have undertaken surveys of the intersection of Union Road and Worth Street in order to accurately ascertain the traffic demands. Surveys were undertaken between 7:00am – 9:00am and 4:00pm – 6:00pm on the 28th of May 2018.

Figure 3 provides a summary of the surveyed commuter peak hour (8:00am – 9:00am and 4:00pm – 5:00pm) traffic flows at the intersections whilst full details are contained within **Appendix 3** for reference.

FIGURE 3
EXISTING WEEKDAY COMMUTER PEAK HOUR TRAFFIC VOLUMES
INTERSECTION OF UNION ROAD & WORTH STREET

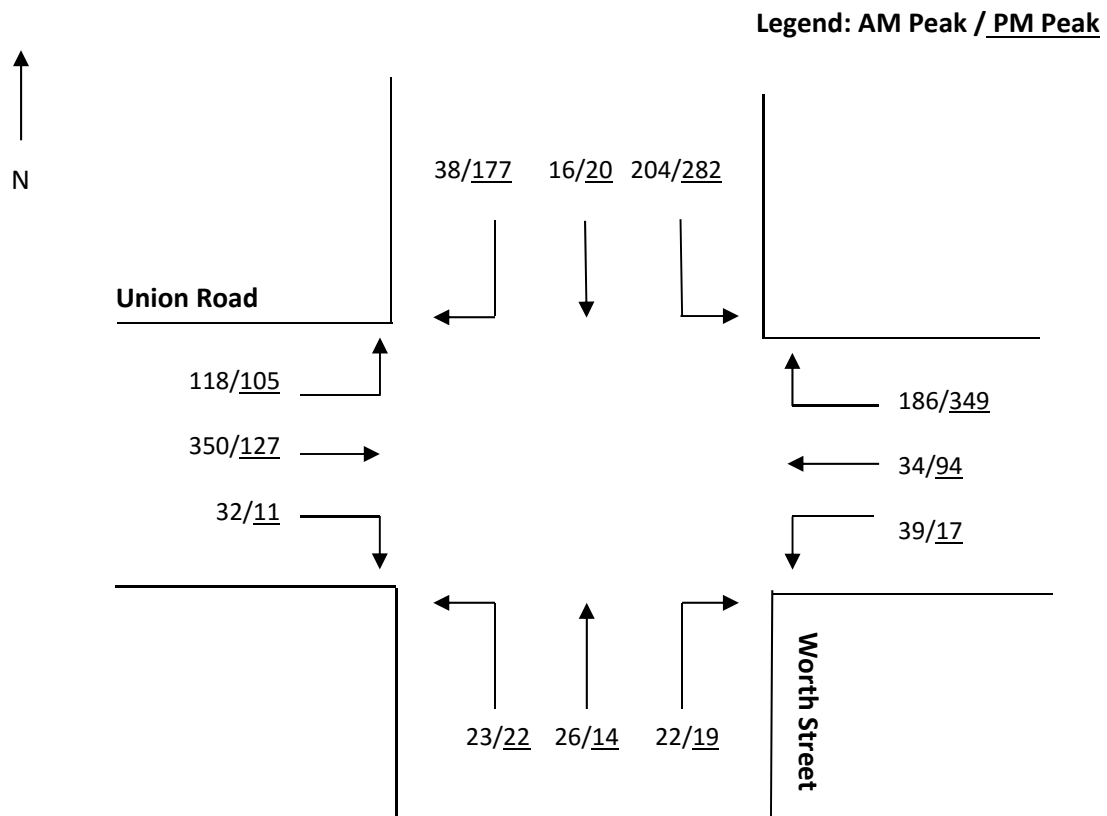


Figure 3 illustrates the following:

- Worth Street, to the south of Union Road, accommodates directional traffic demands of less than 100 vehicles per hour;
- Worth Street, to the north of Union Road, accommodates directional traffic demands of 300 – 500 vehicles per hour; and
- Union Road accommodates directional traffic demands of 300 – 500 vehicles per hour.

4.3 Existing Road Network Operation

4.3.1 Intersection Operation

The surveyed intersection of Union Road and Worth Street has been analysed utilising the SIDRA computer intersection analysis program in order to objectively assess the operation of the surveyed intersections. SIDRA is a computerised traffic arrangement program which, when volume and geometrical configurations of an intersection are imputed, provides an objective assessment of the operation efficiency under varying types of control (i.e. signs, signal and roundabouts). Key indicators of SIDRA include level of service where results are placed on a continuum from A to F, with A providing the greatest intersection efficiency and therefore being the most desirable by the Roads and Maritime Services.

SIDRA uses detailed analytical traffic models coupled with an iterative approximation method to provide estimates of the abovementioned key indicators of capacity and performance statistics. Other key indicators provided by SIDRA are average vehicle delay, the number of stops per hour and the degree of saturation. Degree of saturation is the ratio of the arrival rate of vehicles to the capacity of the approach. Degree of saturation is a useful and professionally accepted measure of intersection performance.

SIDRA provides analysis of the operating conditions that can be compared to the performance criteria set out in **Table 2** (being the RMS NSW method of calculation of Level of Service).

TABLE 2 LEVEL OF SERVICE CRITERIA FOR INTERSECTIONS SIGNALISED INTERSECTIONS		
Level of Service	Average Delay per Vehicle (secs/veh)	Expected Delay
SIGNALISED INTERSECTIONS AND ROUNDABOUTS		
A	Less than 14	Little or no delay
B	15 to 28	Minimal delay and spare capacity
C	29 to 42	Satisfactory delays with spare capacity
D	43 to 56	Satisfactory but near capacity
E	57 to 70	At capacity, incidents will cause excessive delays
F	> 70	Extreme delay, unsatisfactory

The existing conditions have been modelled utilising the peak hour traffic volumes presented within **Figure 3. Table 3** overleaf provides a summary of the SIDRA output data whilst more detailed summaries are included as **Appendix 4**.

TABLE 3		
SIDRA OUTPUT – EXISTING WEEKDAY PEAK HOUR PERFORMANCE		
INTERSECTION OF UNION ROAD & WORTH STREET		
	AM	PM
Average Vehicular Delay (seconds)	26.7	29.9
Degree of Saturation	0.54	0.71
Level of Service	B	C

Table 3 indicates that the intersection of Union Road and Worth Street currently operates with a satisfactory level of service with spare capacity.

4.3.2 Rodley Avenue Performance

Rodley Avenue accommodates low traffic demands commensurate with its access function within the local road hierarchy. In this regard, directional traffic demands have been observed to be less than one vehicle every minute. The Roads & Maritime Services' *Guide to Traffic Generating Developments* specifies that a two-way two-lane roadway accommodating directional traffic demands of less than 200 vehicles per hour provides a level of service 'A' during peak periods, representing free flow where drivers are virtually unaffected by others in the traffic stream.

Notwithstanding the above, the 7m width of the Rodley Avenue pavement in conjunction with the prevalence of kerb side parking along both alignments results in one direction of traffic flow being permitted at any one time. Opposing traffic flow therefore has been observed to occur under courtesy conditions whereby a vehicle will utilise a break in kerb side parking, generally associated with a driveway, to stop and allow a vehicle travelling in the opposite direction to pass. The low traffic demands combined with general diligence displayed by motorists has been observed to ensure that two way traffic flow within Rodley Avenue occurs in a reasonably safe and efficient manner

4.3.3 Abutting Site Access Movements

Traffic movements from abutting development sites and Rodley Avenue have been observed to occur in a safe and efficient manner. These movements are assisted by the low traffic demands within Rodley Avenue resulting in regular and extended gaps in traffic flow, allowing motorists to undertake turning movements from abutting development driveways without unreasonable delay.

The proliferation of driveways servicing abutting development sites in the immediate vicinity result in trailing through traffic movements within Rodley Avenue being aware of the potential for vehicles to decelerate to access private properties. This situation, combined with the consistent vertical and horizontal alignment of Rodley Avenue in the immediate vicinity, results in vehicles being able to undertaken entry and egress movements between private abutting development sites and the public road in a safe and efficient manner.

4.3.4 Arterial Road Network Connectivity

The local road network provides connectivity to the surrounding regional road network as follows:

- Worth Street intersects with High Street to the north under traffic signal control with all movements being facilitated;
- High Street intersects with Mulgoa Road to the north-west under traffic signal control with all movements being facilitated;
- High Street intersects with The Northern Road and Great Western Highway to the east under traffic signal control with all movements being facilitated;
- Both Ransley Street and Jamison Road (accessed via Station Street) intersect with Mulgoa Road, to the south-west under traffic signal with all movements being facilitated;
- Union Road intersects with Mulgoa Road under major / minor control to the north-west, albeit with right turn movements from Union Road being prohibited; and
- Rodley Avenue intersects with the southbound Mulgoa Road carriageway under major / minor priority control to the west, whereby left turn movements to the local road are facilitated.

Whilst traffic demands within the surrounding state road network (High Street, Mulgoa Road, The Northern Road and Great Western Highway) are considerable, commensurate with their functional hierarchy in the road network, the abovementioned precinct access controls provide motorists with safe and efficient connectivity to the surrounding regional and state road network.

4.4 Public Transport

4.4.1 Heavy Rail

The site is located approximately 1km walking distance to the south-west of Penrith Railway Station. Penrith Railway Station provides access to train services which operate along the T1 (North Shore, Northern & Western) Line.

The T1 Line provides regular services between Penrith and the remainder of the Sydney Trains network, servicing The Blue Mountains to the west and Blacktown, Parramatta and The City to the east.

4.4.2 Buses

The following bus routes operate along High Street, with the closest stop being located approximately 500m walking distance from the site:

- Route 688 between Penrith and Emu Heights;
- Route 689 between Penrith and Leonay;
- Route 691 between Penrith and Mount Riverview; and
- Route 690P between Penrith and Springwood.

Further, the following bus routes operate along Station Street, with the closest stop being located approximately 600m walking distance from the site:

- Route 770 between Penrith and Mount Druitt;
- Route 774 between Penrith and Mount Druitt via Nepean Hospital;
- Route 775 between Penrith and Mount Druitt via Erskine Park;
- Route 776 between Penrith and Mount Druitt via St Clair;
- Route 781 between Penrith and St Marys via Glenmore Park;
- Route 791 between Penrith and Jamisontown via South Penrith;
- Route 793 between Penrith and Jamisontown;
- Route 794 between Penrith and Glenmore via The Northern Road;
- Route 795 between Penrith and Warragamba;
- Route 797 between Penrith and Glenmore Park;
- Route 799 between Penrith and Glenmore Park via Regentville; and
- Route S13 between Penrith and Mountainview Village.

4.4.3 Pedestrians / Cyclists

Pedestrians and cyclists are provided with the following access and mobility infrastructure within the immediate vicinity of the subject site:

- A footpath is provided along the northern side of Rodley Avenue;
- A footpath is provided along the western side of Worth Street between Rodley Avenue and Union Road;

- Signalised pedestrian crossings are provided over all approaches of the intersection of Union Road and Worth Street;
- Footpaths are provided along both sides of Worth Street to the north of Union Road and along both sides of Union Road;
- A shared path is provided along the eastern side of Mulgoa Road; and
- Signalised pedestrian crossings are provided over all approaches of the intersection of High Street and Worth Street.

5. PROJECTED TRAFFIC CONDITIONS

5.1 Traffic Generation

Traffic generation rates for various land-uses have been established through extensive surveys undertaken throughout NSW and published within their *Guide to Traffic Generating Developments* and the more recently released *Technical Direction TDT 203/04a*. The following sub-sections provide a summary of the traffic generating potential of the previous and proposed site uses with respect to those rates established by the Roads & Maritime Services.

5.1.1 Existing Site Uses

Section 1.3.3 of this report presented that the subject site currently contains two detached residential dwellings.

The Roads & Maritime Services' *Technical Direction TDT 203/04a* specifies average traffic generation rates of 0.95 peak hour vehicle movements per dwelling during the morning peak and 0.99 peak hour vehicle movements per dwelling during the evening peak.

For the purposes of this assessment and for reasons of simplicity, a traffic generation rate of 1 peak hour vehicle trip per dwelling has been applied to detached residential dwellings. The current site development is therefore capable of generating up to two vehicle trips to and from the site during weekday commuter peaks periods.

5.1.2 Proposed Development

The proposed development involves the provision of a high density residential apartment building, accommodating 21 dwellings.

The Roads & Maritime Services' *Technical Direction TDT 203/04a* provides trip generation advice for high-density residential developments, specifying average weekday morning and evening peak hour trip generation of 0.19 and 0.15 trips per unit respectively. It is however considered that the traffic generation rates provided within the Roads & Maritime Services' *Guide to Traffic Generating Developments* of 0.29 trips per dwelling are more likely to be relevant to apartments within the subject locality.

The proposed development is therefore projected to be capable of generating in the order of six vehicular trips during weekday peak hours.

5.2 Traffic Impacts

The proposed development has been projected to generate up to six peak hour trips to and from the site, or four peak hour trips over and above that currently capable of being generated by the existing two detached dwellings provided on-site. This equates to approximately one vehicle movement every 10 minutes during commuter peaks, or one additional vehicle movement every 15 minutes over and above that capable of being generated by existing site uses. Such a level of additional traffic is not projected to, in itself, result in any unreasonable impacts on the existing operational performance of the surrounding local road network. The previous assessment contained within this report has revealed that traffic demands within the surrounding local road network are reasonably low and accordingly motorists are provided with a good level of service with spare capacity.

Whilst it is acknowledged that traffic demands within the surrounding arterial road network are considerable, the positive intersection control servicing connection to / from the surrounding regional and state road network allows motorist to access and egress the local precinct in a safe and efficient manner.

In consideration of the above, the impact of the development is most likely to be a result of the safety and efficiency with which motorists are capable of entering and exiting the development. The low traffic demands within Rodley Avenue combined with the good sight distance provisions is such that it is envisaged that motorists will be capable of entering and exiting the site in a safe and efficient manner.

5.4 Transport Impacts

The subject site is located within reasonably close walking distance to a number of bus services and a 10 minute walk to train services. It is accordingly expected that a proportion of the future residents within the subject development will utilise the surrounding public transport infrastructure to access destinations throughout the Sydney metropolitan area. The capacity of the existing public transport system is however not envisaged to be measurably affected by any additional demand associated with the development, given its limited scale.

6. CONCLUSION

This report assesses the potential traffic and parking implications associated with a residential development containing 21 dwellings at 36 – 38 Rodley Avenue, Penrith. Based on this assessment, the following conclusions are now made:

- The proposed site access arrangements are projected to result in motorists being capable of entering and exiting the subject site in a safe and efficient manner;
- The proposed off-street vehicular parking provision is considered to be satisfactory, given the requirements of DCP 2014;
- The internal passenger vehicle circulation arrangements are capable of providing for safe and efficient internal manoeuvring;
- The proposed indented bay within Rodley Avenue adjacent to the site is projected to safely and efficiently accommodate refuse servicing of the site and is consistent with that previously approved within the immediate precinct;
- The surrounding road network operates with a satisfactory level of service during peak periods;
- The subject development has been projected to generate up to four peak hour vehicle trips to and from the subject site; and
- It is considered that the adjoining road network is capable of accommodating the traffic projected to be generated by the subject development.

It is considered, based on the contents of this report and the conclusions contained herein, there are no traffic or parking related issues that should prevent approval of the subject application. This action is therefore recommended to Council.

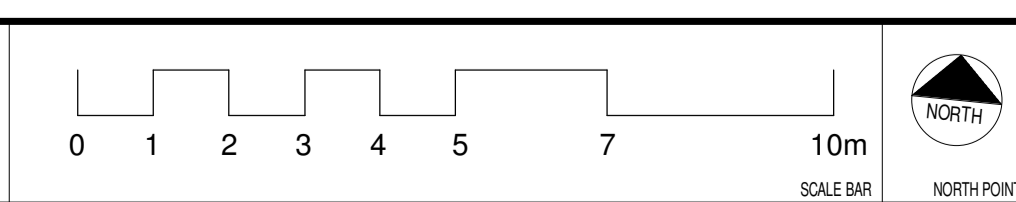
APPENDIX 1

RODLEY AVE

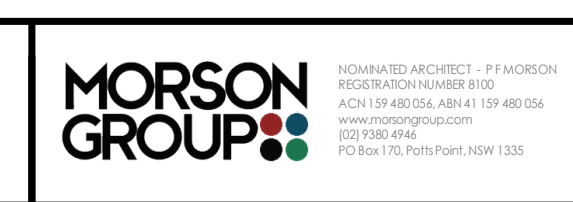


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P3	07-08-2018	SUBMISSION
P4	11-08-2018	FOR COORDINATION
P5	14-08-2018	FOR COORDINATION
P6	17-08-2018	FOR COORDINATION

LEGEND	
	NEW WALL WORK
	EXISTING WALL
	DEMOLITION
	TREE TO BE REMOVED
	TREE TO BE RETAINED
	NEW PLANTING
RL	PROPOSED LEVEL



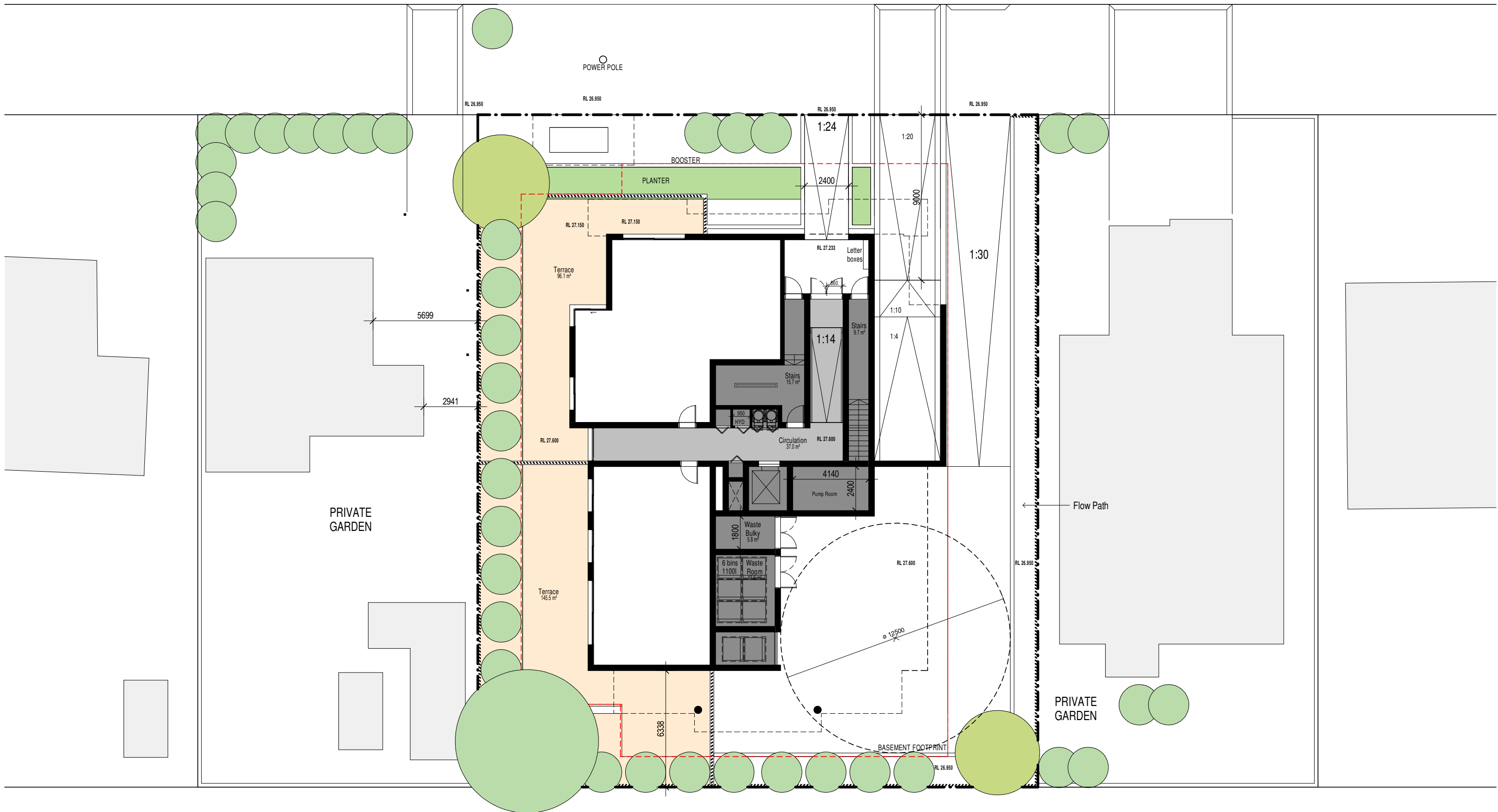
PROJECT
PROPOSED RESIDENTIAL FLAT BUILDING
 ADDRESS
 36-38 Rodley Avenue, Penrith, NSW, 2750
 CLIENT
 Inglow Investments



HONORABLE ARCHITECT - P.F. MORSON
 REGISTRATION NUMBER 8103
 A/C/O P.F. MORSON ARCHITECTS
 203/204/206
 PO Box 170, Parramatta NSW 1505

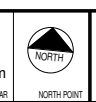
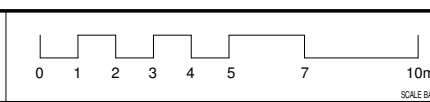
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 ISSUE NO. **P6**



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P2	07-08-2018	SUBMISSION

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	NEW WALL WORK
	EXISTING WALL
	DEMOLITION
	TREE TO BE REMOVED
	TREE TO BE RETAINED
	NEW PLANTING
RL	PROPOSED LEVEL



PROJECT
PROPOSED RESIDENTIAL FLAT BUILDING

ADDRESS
36-38 Rodley Avenue, Penrith, NSW, 2750

CLIENT
Inglow Investments



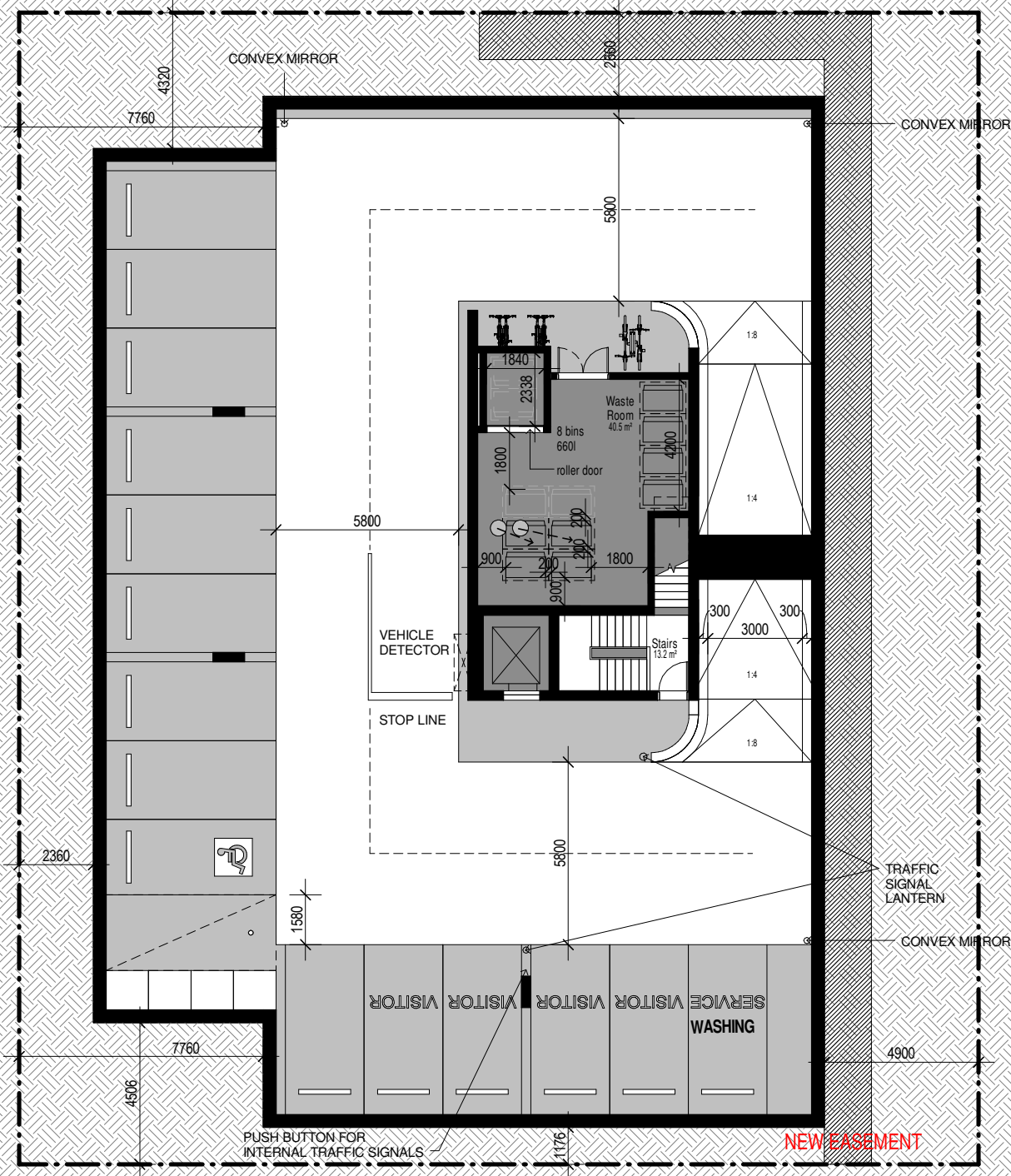
REGISTERED ARCHITECTS - P1 & P2
REGISTERED ARCHITECTS - P1 & P2
ARCHITECTS - P1 & P2
www.morsongroup.com.au
PO Box 100, Penrith NSW 2750

SHEET NAME: **GROUND LEVEL - OPTION 2 - ONSITE COLLECTION**

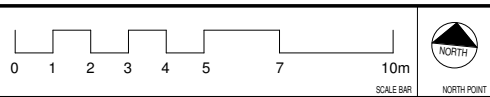
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ISSUE NO.: **P2**



ISSUE	DATE	AMENDMENT
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P2	06-08-2018	SUBMISSION
P3	07-08-2018	SUBMISSION



PROJECT
PROPOSED RESIDENTIAL FLAT BUILDING
 ADDRESS
 36-38 Rodley Avenue, Penrith, NSW, 2750

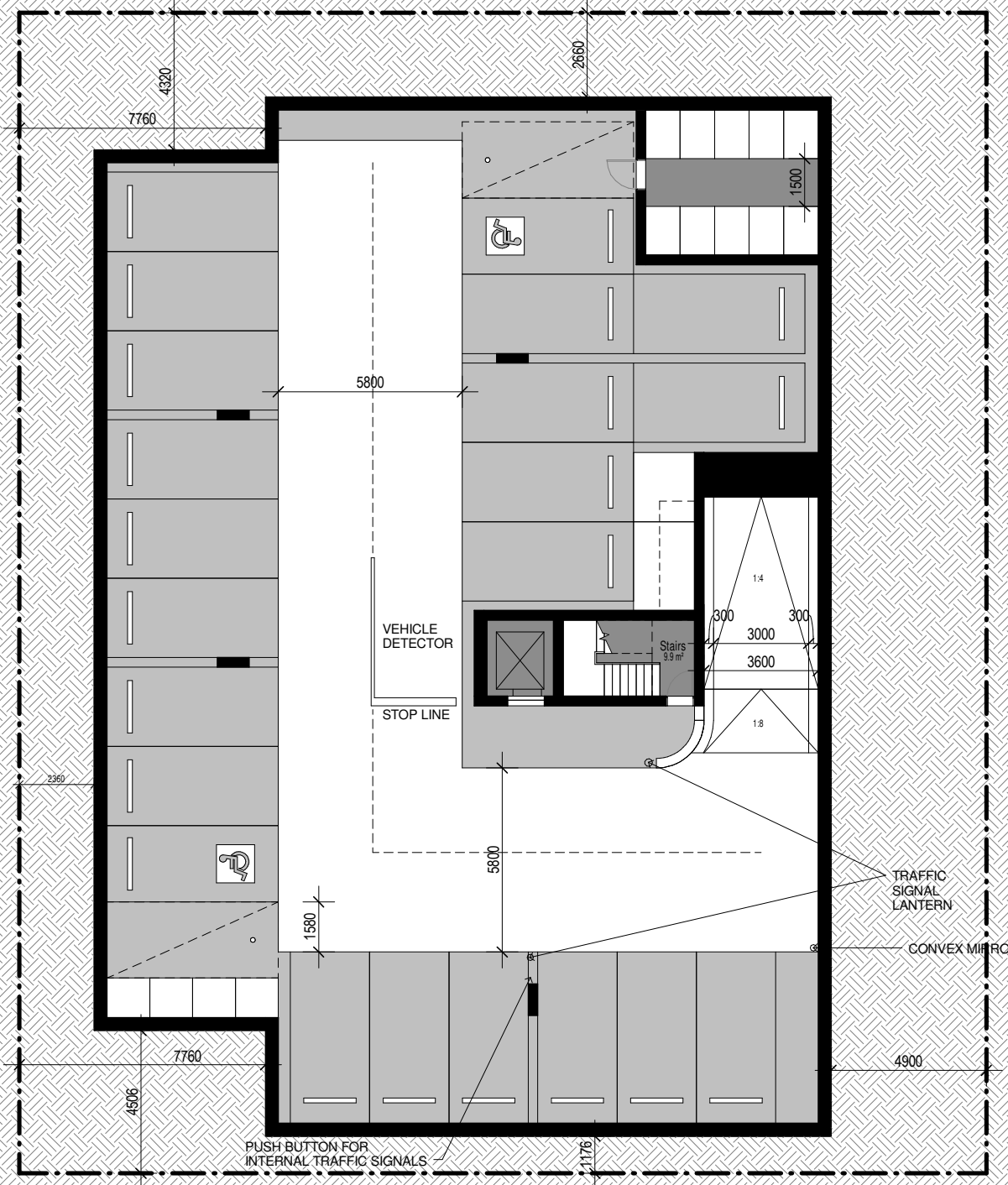
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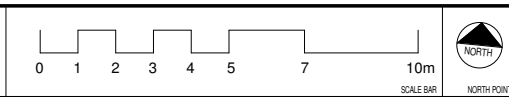
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DRAWING NUMBER
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P3



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P2	06-08-2018	SUBMISSION
P3	07-08-2018	SUBMISSION



PROJECT
PROPOSED RESIDENTIAL FLAT BUILDING
 ADDRESS
 36-38 Rodley Avenue, Penrith, NSW, 2750
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SHEET SIZE: A1
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SHEET NAME: **BASEMENT 2**
 DRAWING NUMBER: **DA13**
 ISSUE NO.: **P3**

APPENDIX 2



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PH: (02) 8971 8314
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EMAIL: info@stanburytraffic.com.au
WEBSITE: www.stanburytraffic.com.au

NOTES:

1. THIS PLAN IS BASED ON ARCHITECTURAL PLANS PREPARED BY MORSON GROUP.
2. THE SWEEP PATHS PROVIDED ON THIS PLAN HAVE BEEN GENERATED UTILISING AUTOTURN PRO VERSION 10 IN CONJUNCTION WITH MANOEUVRING SPECIFICATIONS FOR A 10.5m LONG REFUSE COLLECTION VEHICLE.

STANBURY TRAFFIC PLANNING

10.5m LONG REFUSE COLLECTION VEHICLE SWEEP PATHS
INDENTED BAY INGRESS MOVEMENT
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

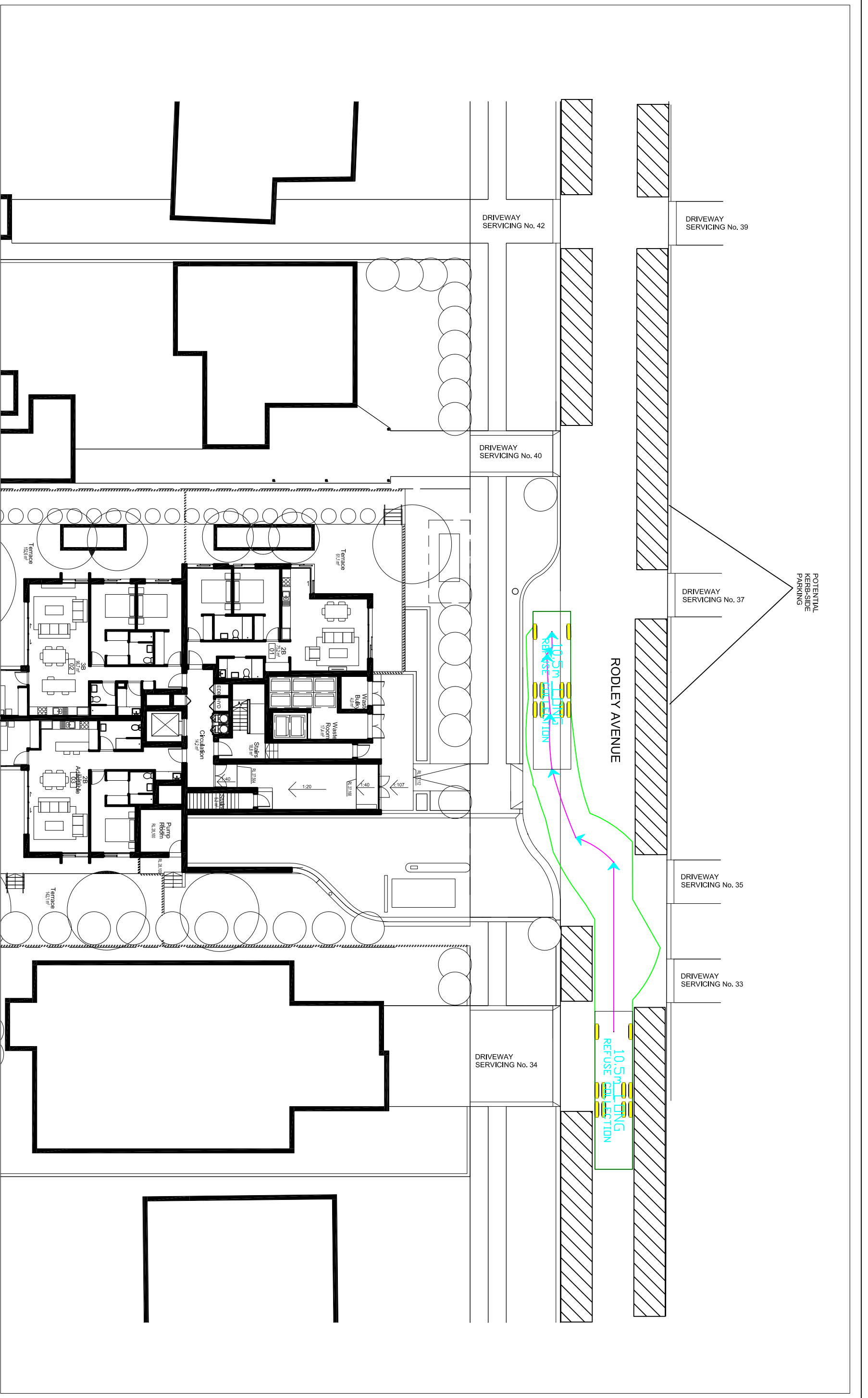
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DATE: 23/08/2018

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STANBURY TRAFFIC PLANNING

10.5m LONG REFUSE COLLECTION VEHICLE SWEEP PATHS
INDENTED BAY EGRESS MOVEMENT
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

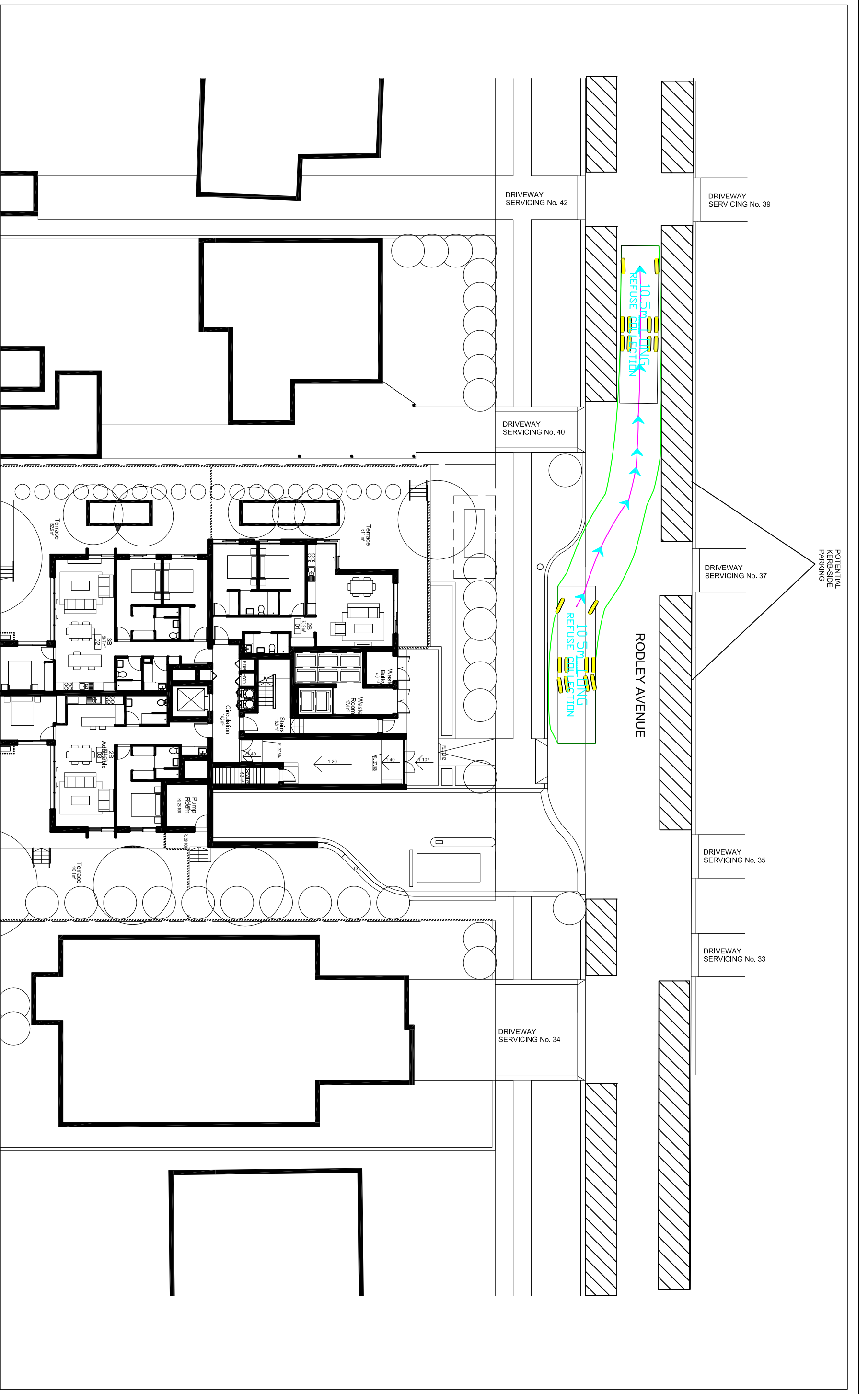
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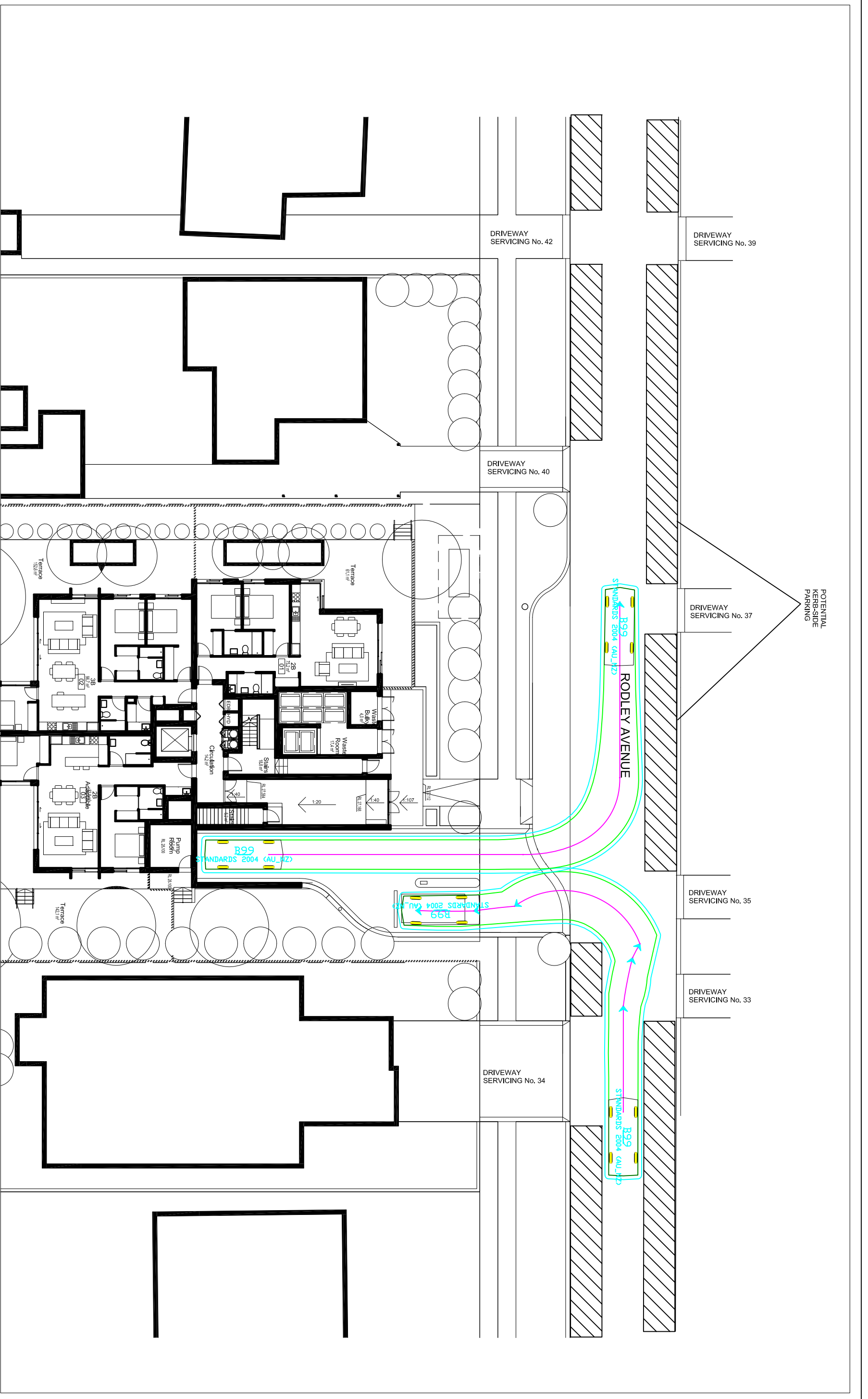
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STANBURY TRAFFIC PLANNING

PASSENGER VEHICLE SWEEP PATHS
SITE INGRESS / EGRESS MOVEMENTS
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH



SCALE: 1:250 AT A3

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STANBURY TRAFFIC PLANNING

PASSENGER VEHICLE SWEEP PATHS
**BASEMENT ACCESS MOVEMENT FROM GROUND FLOOR WAITING BAY
PROPOSED RESIDENTIAL DEVELOPMENT**
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

FILE: 18-045

DATE: 23/08/2018

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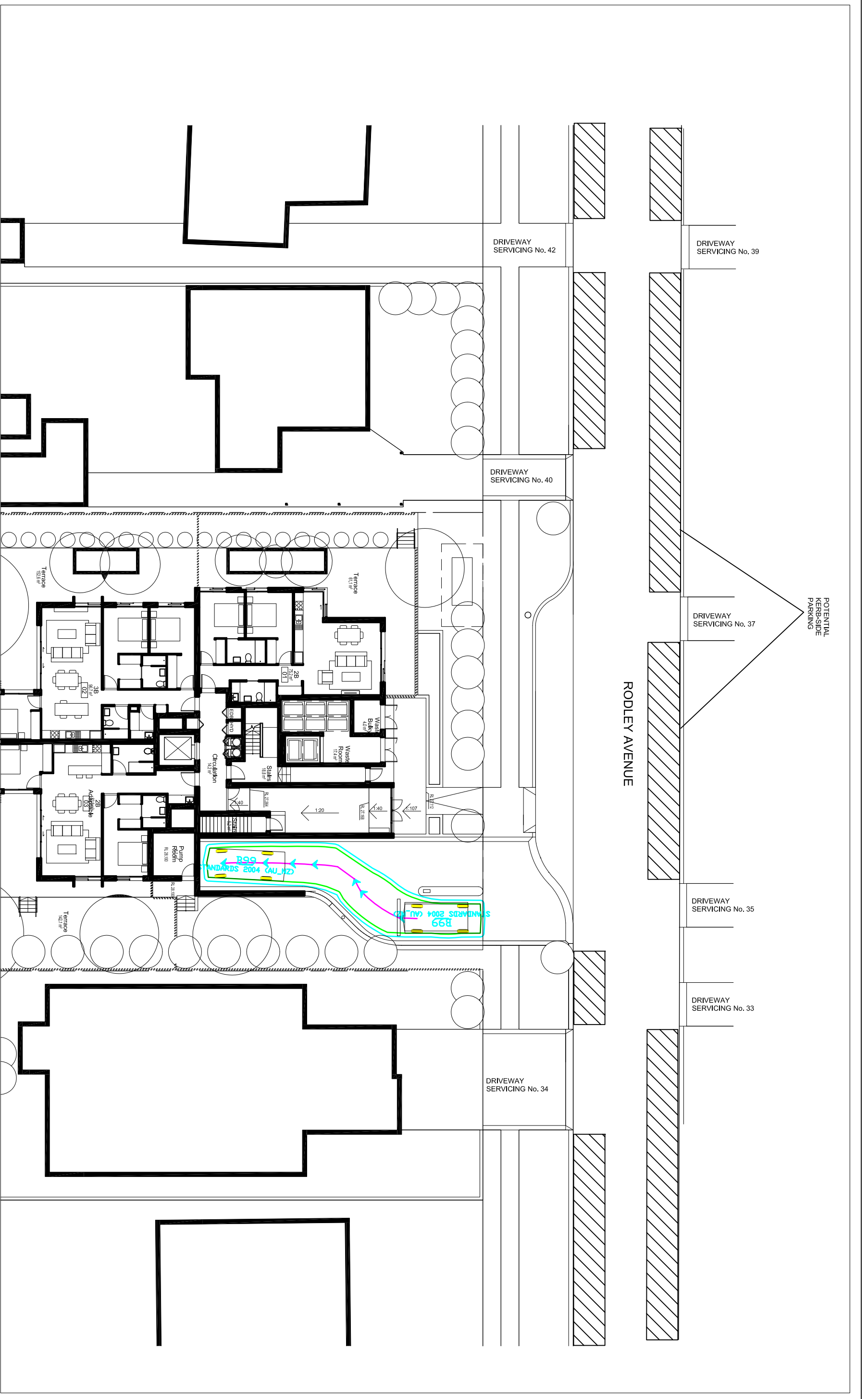
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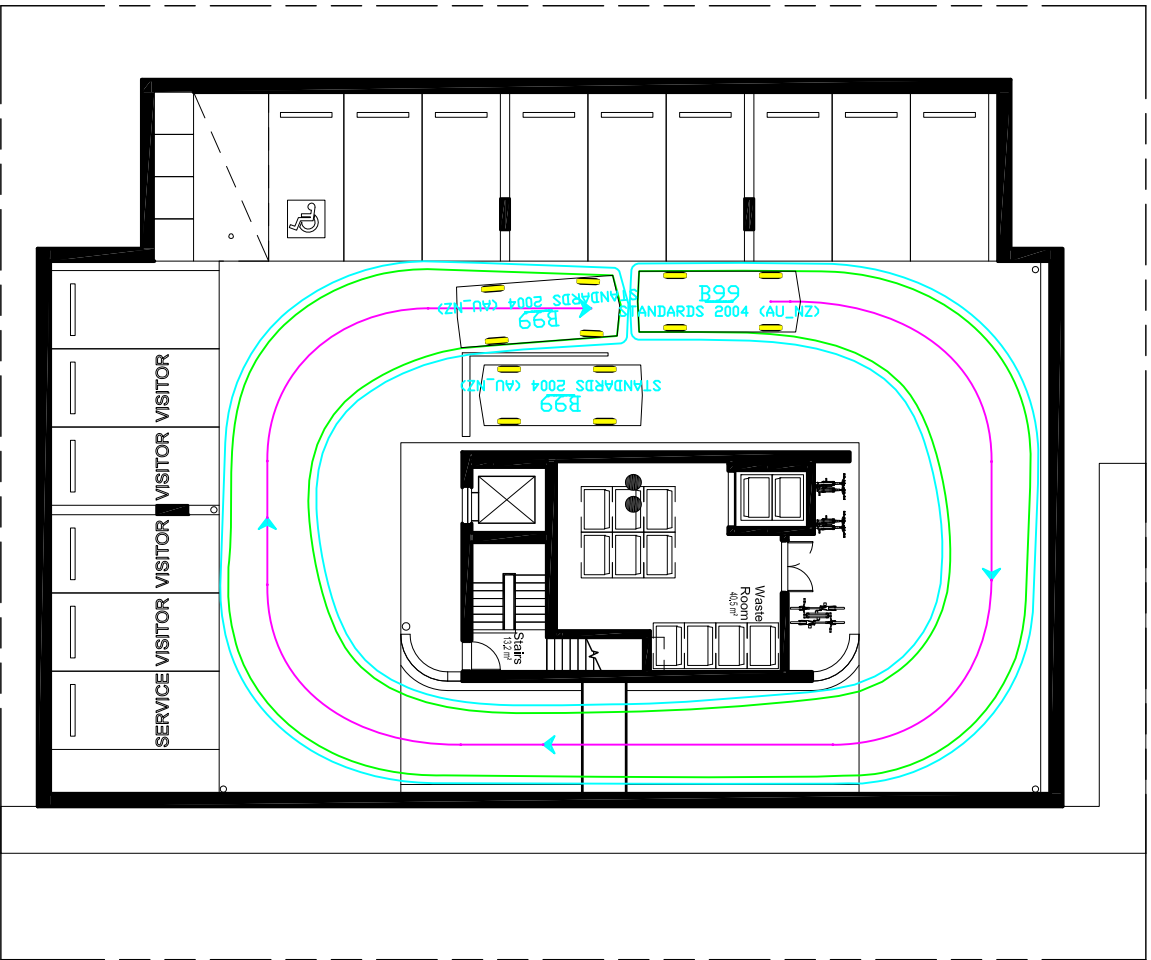
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STANBURY TRAFFIC PLANNING

PASSENGER VEHICLE SWEEP PATHS
UPPER BASEMENT CIRCULATION & LOWER BASEMENT ACCESS MOVEMENTS
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

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STANBURY TRAFFIC PLANNING

PASSENGER VEHICLE SWEEP PATHS
UPPER BASEMENT LEVEL EGRESS FROM WAITING BAY
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

FILE: 18-045

DATE: 23/08/2018

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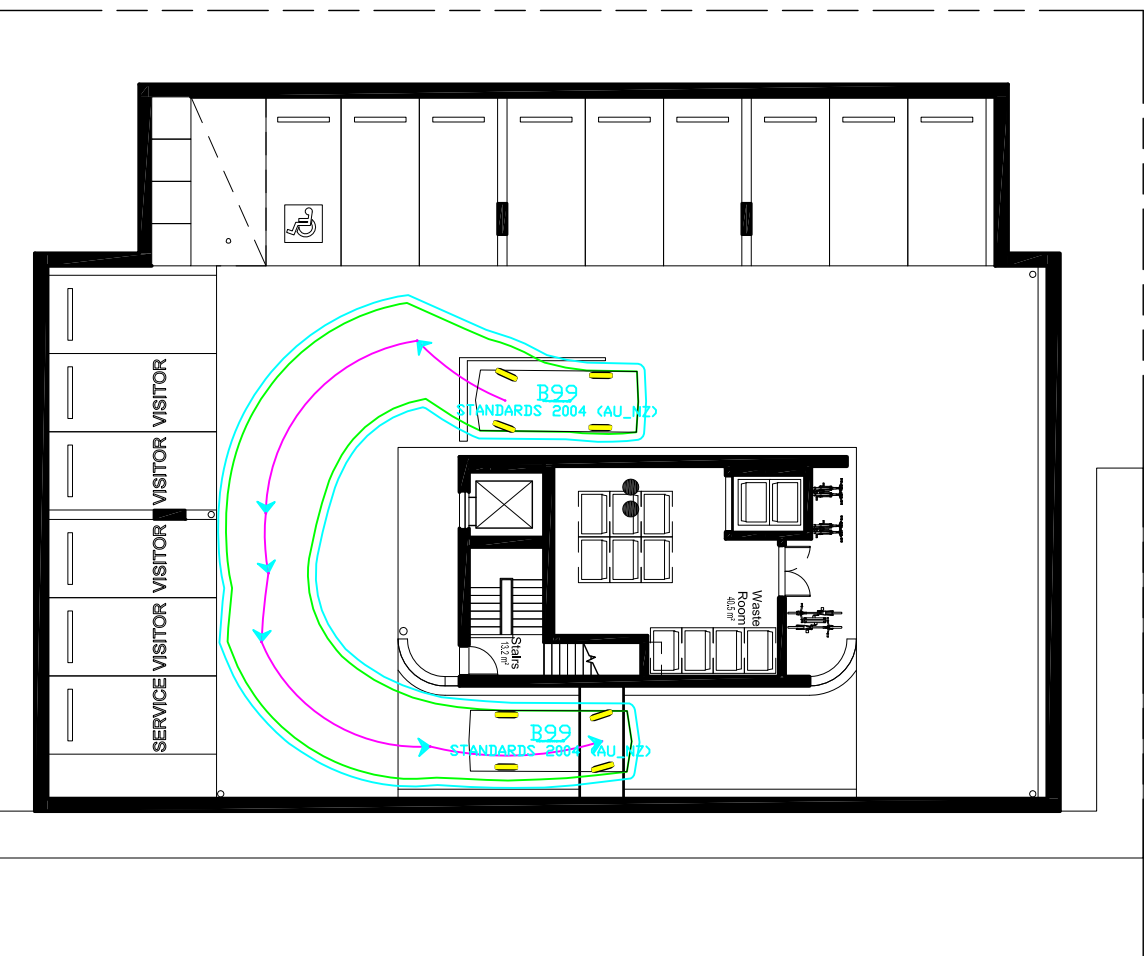
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STANBURY TRAFFIC PLANNING

PASSENGER VEHICLE SWEEP PATHS
UPPER BASEMENT LEVEL PARKING SPACE MANOEUVRING
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

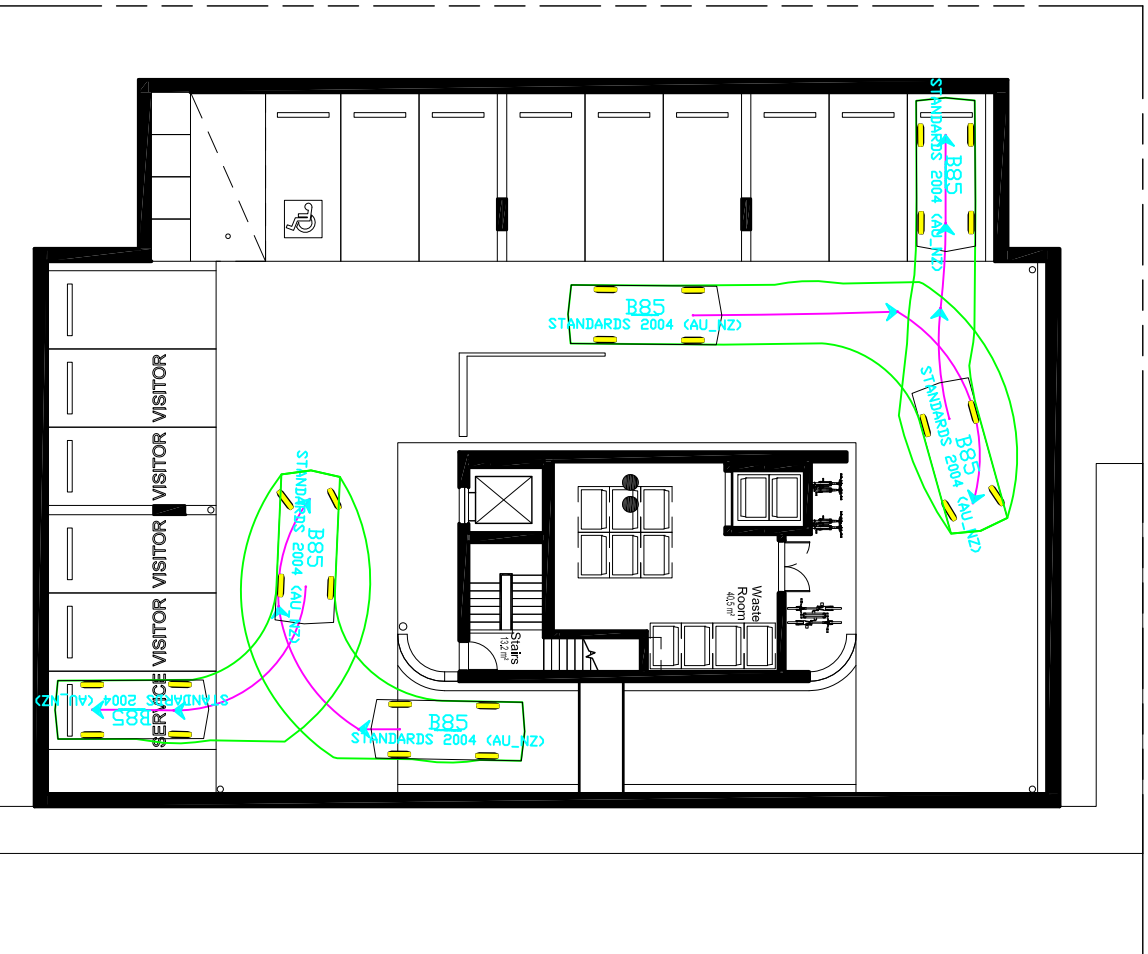
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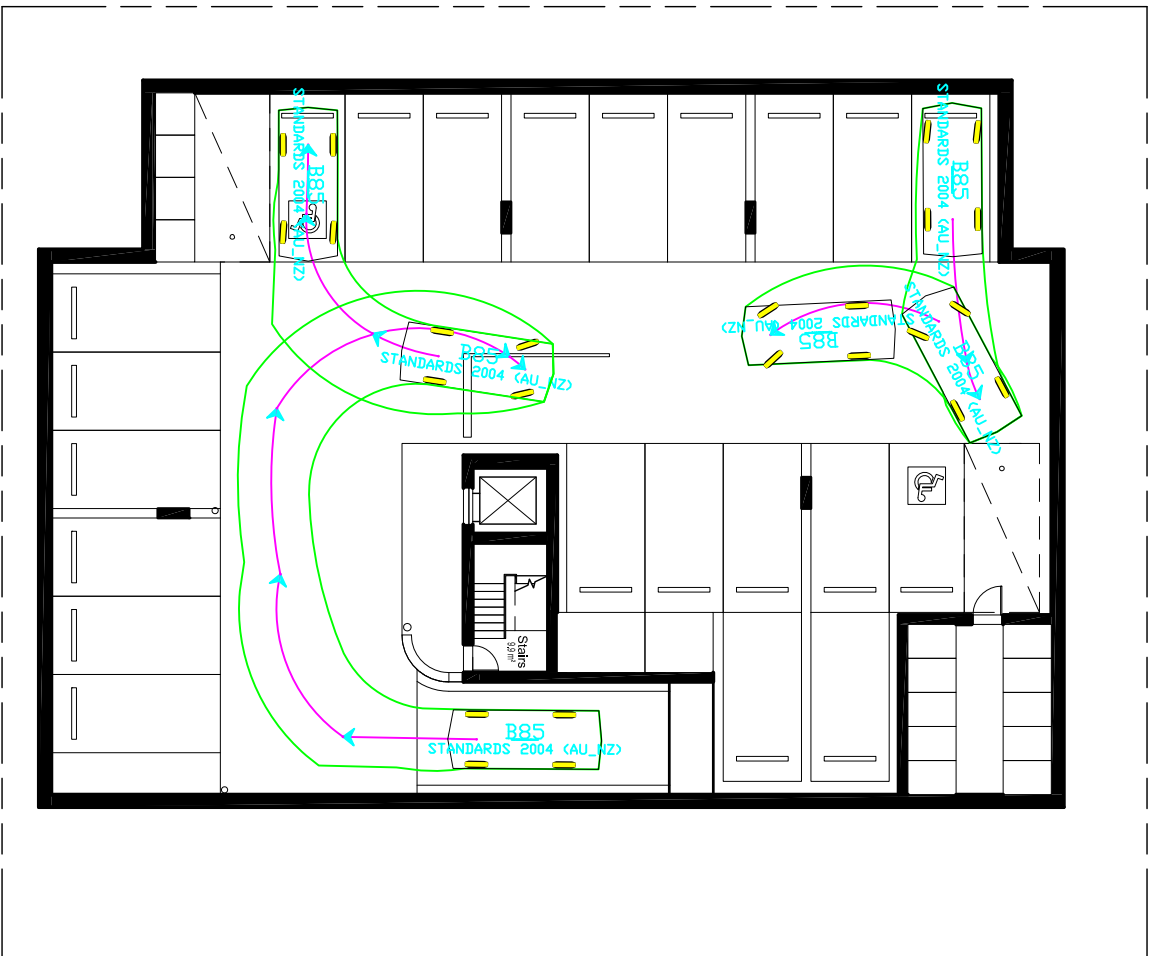
STANBURY
TRAFFIC
PLANNING

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STANBURY TRAFFIC PLANNING

PASSENGER VEHICLE SWEEP PATHS
LOWER BASEMENT LEVEL PARKING SPACE MANOEUVRING
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

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TRAFFIC, PARKING & TRANSPORT CONSULTANTS

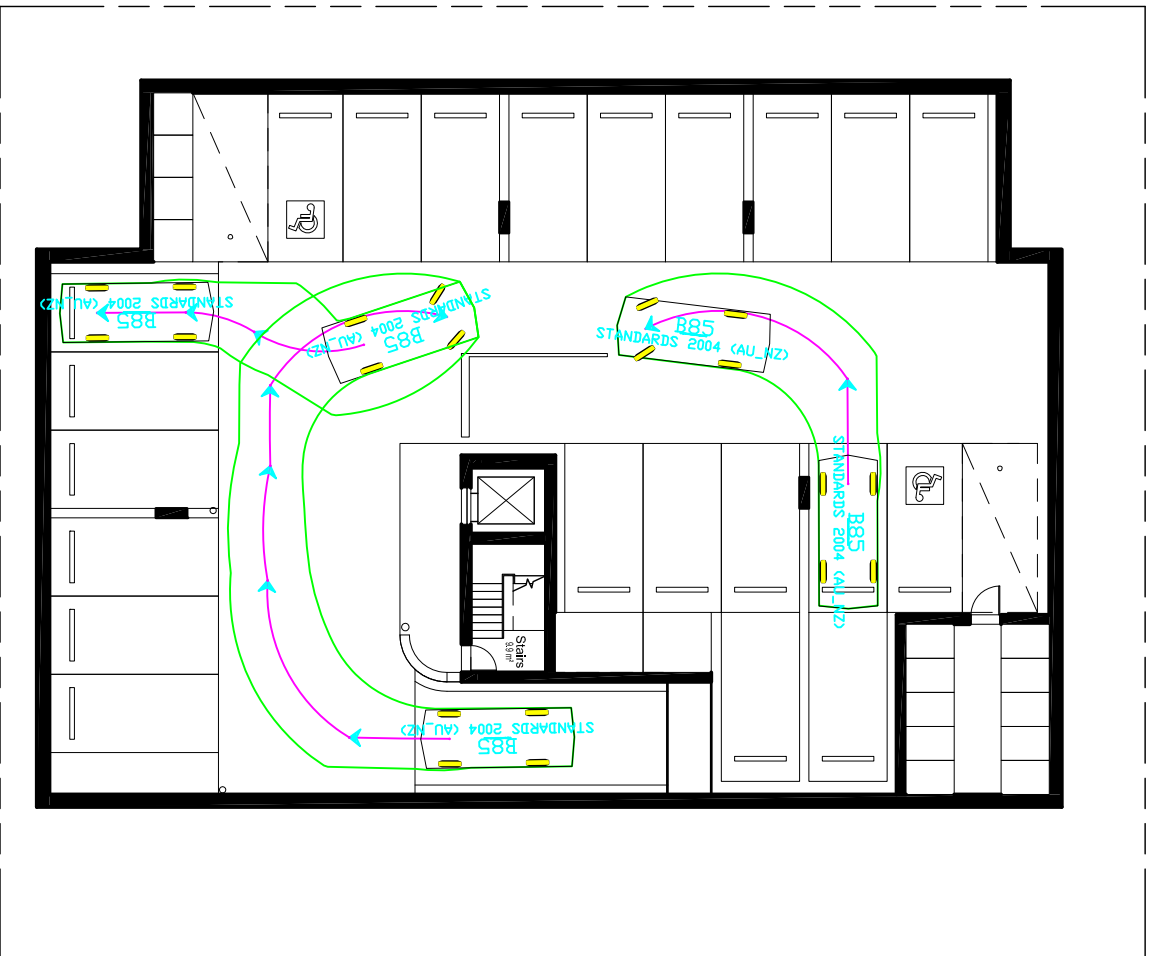
STANBURY
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STANBURY TRAFFIC PLANNING

PASSENGER VEHICLE SWEEP PATHS
LOWER BASEMENT LEVEL PARKING SPACE MANOEUVRING
PROPOSED RESIDENTIAL DEVELOPMENT
36 - 38 RODLEY AVENUE, PENRITH

SCALE: 1:250 AT A3

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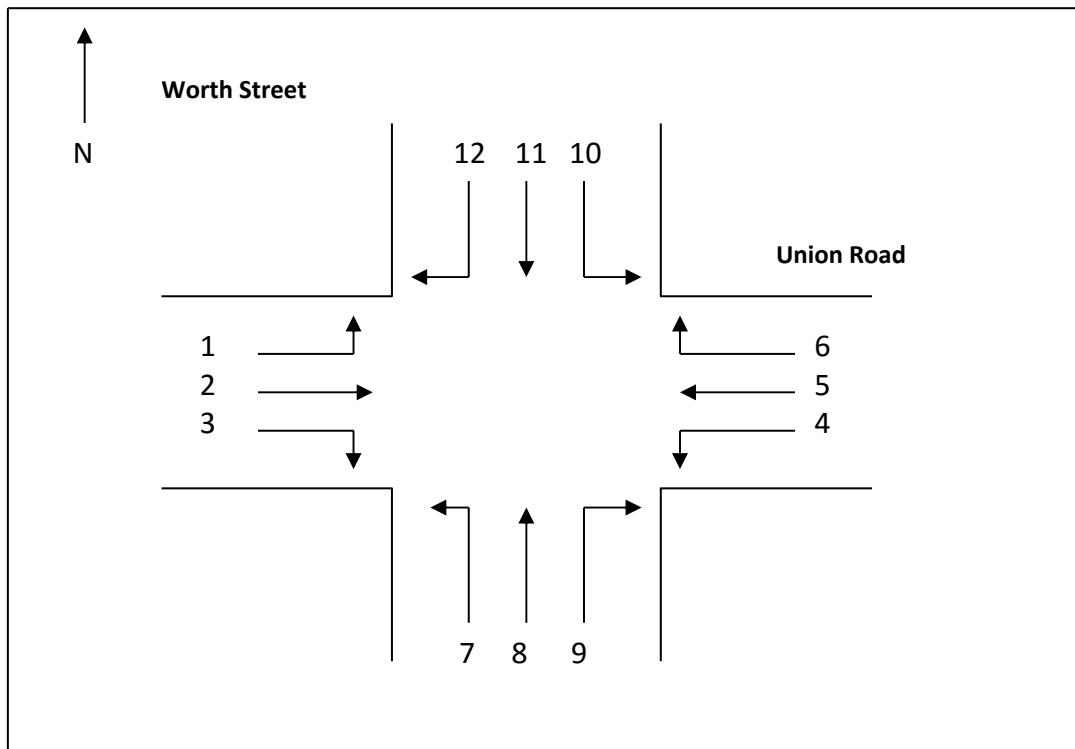
9

APPENDIX 3



TRAFFIC COUNTS AT: Union Road & Worth Street, Penrith
 DATE: 28th May 2018
 TIME: Fine

Time	Direction of Vehicular Traffic											
	1	2	3	4	5	6	7	8	9	10	11	12
7.00 – 7.15pm	19	98	4	4	8	35	3	2	3	39	3	9
7.15 – 7.30pm	20	90	3	5	7	25	7	5	5	49	2	8
7.30 – 7.45pm	15	101	2	2	9	30	5	3	3	45	1	6
7.45 – 8.00pm	18	108	4	4	8	22	2	6	4	44	1	10
TOTAL	72	397	13	15	32	112	17	16	15	177	7	33
8.00 – 8.15pm	28	110	5	6	10	37	6	8	7	55	5	9
8.15 – 8.30pm	22	90	6	12	9	45	5	5	8	51	3	6
8.30 – 8.45pm	35	85	9	9	10	49	7	7	5	57	5	12
8.45 – 9.00pm	33	65	12	12	5	55	5	6	2	41	3	11
TOTAL	118	350	32	39	34	186	23	26	22	204	16	38
4.00 – 4.15pm	25	29	3	5	25	95	5	1	5	67	5	40
4.15 – 4.30pm	24	35	2	5	29	80	6	3	5	75	4	38
4.30 – 4.45pm	34	34	2	4	23	91	8	3	6	57	7	45
4.45 – 5.00pm	22	29	4	3	17	83	3	7	3	83	4	54
TOTAL	105	127	11	17	94	349	22	14	19	282	20	177
5.00 – 5.15pm	29	25	5	6	25	101	8	5	5	79	5	55
5.15 – 5.30pm	25	30	7	5	30	84	5	2	6	80	3	55
5.30 – 5.45pm	20	36	4	4	17	99	5	1	7	71	5	35
5.45 – 6.00pm	8	30	4	4	10	90	8	2	6	50	2	28
TOTAL	82	121	20	19	82	374	26	10	24	280	15	173



APPENDIX 4

MOVEMENT SUMMARY

 Site: [Union Road & Worth Street]

Existing AM

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	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	Aver. No. Cycles	Average Speed km/h
South: Worth Street South												
1	L2	23	5.0	0.350	47.3	LOS D	3.0	22.1	0.96	0.75	0.96	33.8
2	T1	26	5.0	0.350	41.7	LOS C	3.0	22.1	0.96	0.75	0.96	34.4
3	R2	22	5.0	0.350	47.3	LOS D	3.0	22.1	0.96	0.75	0.96	33.7
Approach		71	5.0	0.350	45.3	LOS D	3.0	22.1	0.96	0.75	0.96	34.0
East: Union Road East												
4	L2	39	5.0	0.079	17.5	LOS B	1.6	11.7	0.54	0.57	0.54	47.0
5	T1	34	5.0	0.079	11.9	LOS A	1.6	11.7	0.54	0.57	0.54	48.2
6	R2	186	5.0	0.529	30.6	LOS C	6.7	48.6	0.84	0.81	0.84	39.1
Approach		259	5.0	0.529	26.2	LOS B	6.7	48.6	0.75	0.74	0.75	41.2
North: Worth Street North												
7	L2	204	5.0	0.539	40.5	LOS C	8.2	59.7	0.94	0.81	0.94	35.4
8	T1	16	5.0	0.141	31.5	LOS C	2.0	14.3	0.85	0.71	0.85	38.0
9	R2	38	5.0	0.141	37.1	LOS C	2.0	14.3	0.85	0.71	0.85	37.2
Approach		258	5.0	0.539	39.4	LOS C	8.2	59.7	0.92	0.79	0.92	35.8
West: Union Road West												
10	L2	118	5.0	0.135	19.5	LOS B	2.9	21.2	0.59	0.71	0.59	44.5
11	T1	350	5.0	0.441	16.7	LOS B	11.0	80.3	0.71	0.63	0.71	46.8
12	R2	32	5.0	0.441	22.2	LOS B	11.0	80.3	0.71	0.63	0.71	45.5
Approach		500	5.0	0.441	17.7	LOS B	11.0	80.3	0.68	0.65	0.68	46.2
All Vehicles		1088	5.0	0.539	26.7	LOS B	11.0	80.3	0.77	0.71	0.77	41.2

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.

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.

Movement Performance - Pedestrians									
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Pedestrian	Back of Queue Distance m	Prop. Queued	Effective Stop Rate	
P1	South Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P2	East Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P3	North Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
All Pedestrians		211	39.3	LOS D			0.94	0.94	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

 Site: [Union Road & Worth Street]

Existing PM

Site Category: (None)

Signals - Fixed Time Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	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	Aver. No. Cycles	Average Speed km/h
South: Worth Street South												
1	L2	22	5.0	0.272	46.9	LOS D	2.3	16.9	0.95	0.74	0.95	33.8
2	T1	14	5.0	0.272	41.3	LOS C	2.3	16.9	0.95	0.74	0.95	34.4
3	R2	19	5.0	0.272	46.8	LOS D	2.3	16.9	0.95	0.74	0.95	33.7
Approach		55	5.0	0.272	45.4	LOS D	2.3	16.9	0.95	0.74	0.95	33.9
East: Union Road East												
4	L2	17	5.0	0.126	19.5	LOS B	2.7	19.6	0.59	0.51	0.59	47.1
5	T1	94	5.0	0.126	13.9	LOS A	2.7	19.6	0.59	0.51	0.59	48.3
6	R2	349	5.0	0.704	29.4	LOS C	13.0	94.9	0.86	0.85	0.90	39.6
Approach		460	5.0	0.704	25.8	LOS B	13.0	94.9	0.80	0.77	0.82	41.4
North: Worth Street North												
7	L2	282	5.0	0.708	42.4	LOS C	12.0	87.7	0.98	0.86	1.04	34.7
8	T1	20	5.0	0.492	33.7	LOS C	7.7	56.4	0.92	0.80	0.92	36.7
9	R2	177	5.0	0.492	39.3	LOS C	7.7	56.4	0.92	0.80	0.92	36.0
Approach		479	5.0	0.708	40.9	LOS C	12.0	87.7	0.96	0.84	0.99	35.3
West: Union Road West												
10	L2	105	5.0	0.077	8.6	LOS A	1.2	8.5	0.27	0.64	0.27	51.2
11	T1	127	5.0	0.164	14.8	LOS B	3.5	25.3	0.61	0.52	0.61	48.0
12	R2	11	5.0	0.164	20.4	LOS B	3.5	25.3	0.61	0.52	0.61	46.6
Approach		243	5.0	0.164	12.4	LOS A	3.5	25.3	0.47	0.57	0.47	49.3
All Vehicles		1237	5.0	0.708	29.9	LOS C	13.0	94.9	0.80	0.76	0.82	39.6

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

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

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

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

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P2	East Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P3	North Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94	
All Pedestrians		211	39.3	LOS D			0.94	0.94	

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

