Molecular + Life Sciences Building - Parking and Traffic Assessment

The University of Wollongong

26th May 2017

Caldwell & Kent CONSULTING

Job No #: CKC UOW MLSB

Version No.	Author	Reviewed by:	Date of issue:
1.0	Glenn Caldwell	A.M.	16.12.16
2.0	Glenn Caldwell	Advisory Team, A.M.	7.2.17
3.0	Glenn Caldwell		20.2.17
4.0	Glenn Caldwell	M.S.	14.03.17
5.0	Glenn Caldwell		30.03.17
5.1	Glenn Caldwell	M.S.	10.04.17
6.1	Glenn Caldwell	Advisory Team	11.05.17
6.2	Glenn Caldwell	Advisory Team	26.05.17

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Abbreviations and definitions

University	**The University of Wollongong**
CKC	**Caldwell & Kent Consulting**
FTE	**Full Time Equivalent**
EFTSL	**Equivalent Full Time Student Load**
IHMRI	**Illawarra Health and Medical Research Institute**
Council	**Wollongong City Council**
SRV	**Small Rigid Vehicle**
Advisory team	**The consulting team for the project including Jacobs, Denton Corker Marshall, Arup, Robert Bird Associates, Aspect Studio etc....**

1. Introduction

Caldwell & Kent Consulting (CKC) have prepared a preliminary Traffic and Parking assessment of the proposed "Molecular and Life Sciences Building" Project (MLSB). Based on the information provided, we understand the proposal involves the construction of a research facility suitable to accommodate 150 staff members.

The proposed site is bounded by the Illawarra Health and Medical Research Institute (IHMRI) to the north face, Building 43 Science Teaching Facility (STF) to the east, Building 42 (The Sciences Annex) and Science Road to the south and Building 41 (Faculty of Science, Medicine & Health) to the west.

The site is accessed via Sciences Road which joins onto the main Ring Road for the Campus.

A review of the proposed plans indicates the MLSB has a potential to generate additional vehicle trips during the peak periods. The Advisory Team has provided a detailed specification of the proposed development. The following is a summary extracted from their documentation and provides an outline of the main elements of the proposal:

- *Accommodation for researchers: 15 groups in PC2 labs and support spaces, with modular, flexible and efficient space*
- *Cryo-TEM suite: Cryo-TEM FEI Krios microscope (or similar), FEI Tecnai screening microscope (or similar), Focussed Ion Beam milling preparation device, PC2 and other preparation space*
- *Newly-equipped and purpose-designed flow cytometry, fluorescence and light-microscopy suites, which articulate directly with cell and molecular support laboratories*
- *Animal House: animal holding for 1500 rodents/aquatics cages, procedural and support space*
- *Atmospheric Chemistry: roof-top platform with horizon view to the east and laboratory space located below the roof-top platform*
- *Office accommodation, masterclass room and teaching laboratory, meeting spaces, networked back of house with adjacent facilities.*

(Source: Project brief Capital Insight)

The main traffic generator for the site will be the total number of staff on duty during normal business hours. This is estimated to be 150 staff in total comprising 138 full-time staff + 12 external visitors for training related activities.

Existing Campus Parking Environment

There is a significant supply of parking provided at the Wollongong campus, to address the latent demand (the total demand for parking if it was free or unlimited).

We understand that The University is planning a new multi-storey car park on campus to support the expansion of the campus including its forecast parking demand. The University's free bus services and green travel plans have been in existence for many years now and it is likely that a further mode shift

away from the private vehicle is likely, however somewhat limited when one considers the long term growth of the campus.

The proposed development will be built within an area currently occupied by an existing car park and will allow pedestrian access between the adjacent science facilities. The existing parking demand will therefore be displaced elsewhere within the campus.

The University of Wollongong (The University) has supplied a copy of their University of Wollongong Campus 2016-2036 Master Plan. This document delineates the issues with the existing campus transport systems, including measures to support each mode of transport going forward. This document is the underlying basis for The University's strategic direction to encourage mode shift away from the car, or at the very least manage its demand.

1.1. The University Master Plan

The University places sustainable transport practices as a high priority. This has been driven by the incumbent long standing parking demand within the residential areas immediately surrounding the campus of Wollongong (as noted within several University studies).

As part of the Parking Management Strategy, Wollongong Council has introduced parking restrictions within some of the residential streets to reduce long-stay commuter parking. To encourage the use of sustainable modes of transport the government has introduced a free shuttle service - covering The Wollongong CBD, The University and intervening suburbs.

In order to assess the effectiveness of the implemented measures (which were introduced to encourage the use of sustainable modes of transport), The University has commissioned regular transport studies. Comparing studies conducted between 2013 and 2015, show an increase in mode share for public transport and active transport. As can be expected these increases correspond with a decrease in private vehicle mode share from 57.0 per cent in 2013 to 55.4 per cent in 2015. This noticeable shift has been an encouraging outcome and The University expects to continue this trend in the coming decade.

The University would like to see private vehicle travel more efficiently utilized and has subsequently introduces a '3 for free' car pooling scheme. Carpooling has remained somewhat consistent with 2013 levels, increasing from 4.8 per cent of all vehicle trips to 5.4 per cent in 2015. Also the studies have indicated that two-person occupancy has been increasing in recent years.

The University encourages people to walk and cycle to the campus. Cycling facilities are provided within the Wollongong campus, mode share of cycling indicates that it is still relatively under utilised. It has been hypothesized that this is due to the minimal amount of connectivity between the cycle routes within the Wollongong area.

Walking and cycling opportunities are somewhat limited for the Wollongong campus, due to the long journey distance that most students and staff are likely to incur.

To promote walking and cycling, The Master Plan includes its vision for several shared zones within the campus that provides amenity and safer interaction between vehicles, cyclists and pedestrians – while also providing an environment that encourages active travel patterns.

2. Site Description

The proposed MLSB site is situated in the north-eastern corner of the campus over the existing car park and Building 42. The following image shows the development site in the shaded area.

Figure 1 - Proposed site area

The existing site includes Building 42 which will be demolished under a separate application. The car park itself is referred to as "P7" on the campus parking plan and accommodates 80 cars (including disabled spaces) and 22 motorcycles. The larger western section of the P7 car park will be removed while the eastern section of P7 will be retained.

There is an existing car park underneath the IHMRI building that is accessed via the P7 car park. The IHMRI car park is boom gate controlled and accommodates 19 parking spaces (17 standard spaces and 2 disabled spaces).

Waste collection for the site is also conducted via the P7 car park. The waste bins are located on the north western side of the site.

Proposed Development

The following image shows the MLSB (shaded in Dark grey) in context to the surrounding buildings and roadways.

1

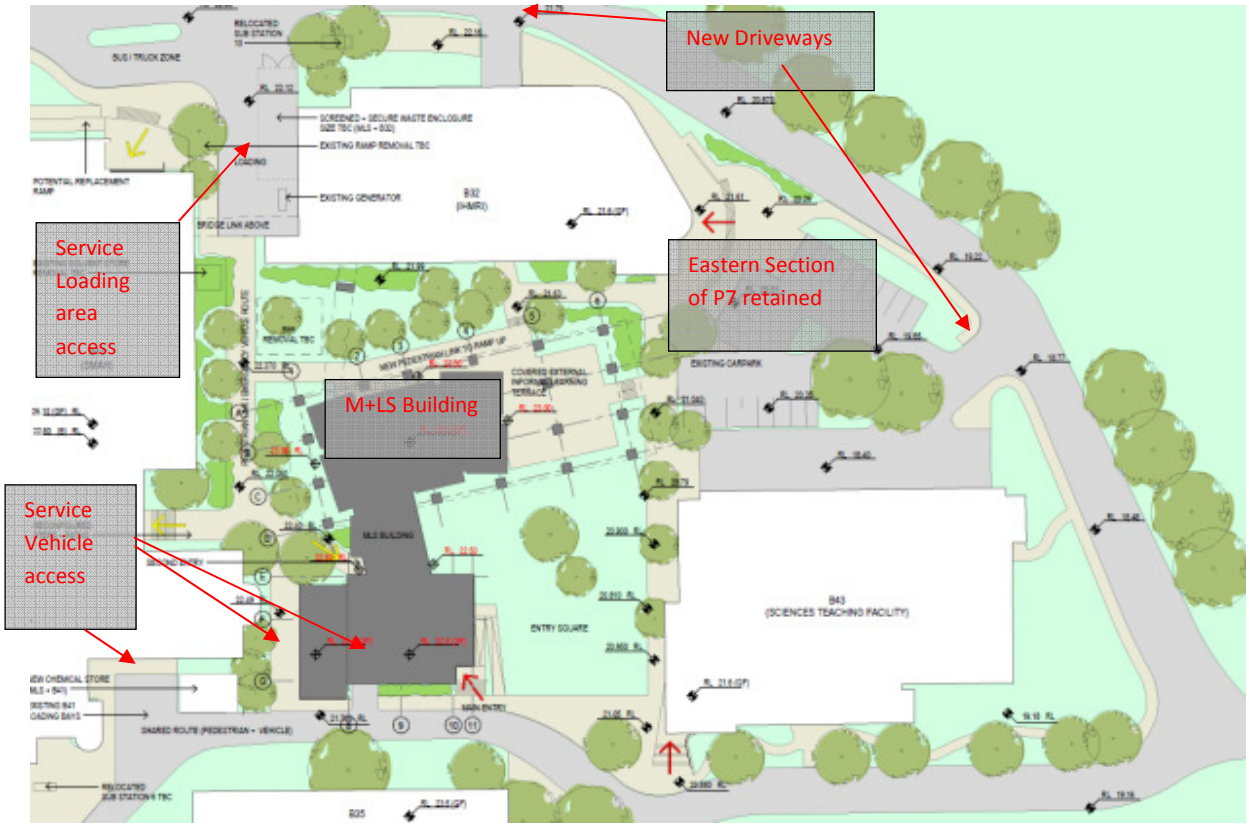


Figure 2 - Proposed MLSB development

The proposed development includes the following elements:

1. Six level research centre (including ground floor and plant rooms) 6922m^2 GFA
2. Type of activity: Research facility
3. Number of employees on site – 150
4. Loading dock off Sciences Road – expected to have infrequent usage.
5. Emergency access lane on the western side of the proposed building
6. Reconfiguration of P7 East car park for DDA spaces only

3. Existing Transport Facilities

3.1. Description of the Road Network

The MLSB site is located within the Wollongong University campus on the northern side of the suburb of Keiraville. The area surrounding the campus is low density residential. The Princes M1 Motorway is the main arterial connecting Wollongong with Sydney and is situated in close proximity to the campus. The site including its surrounding road network is shown in the following image:

Figure 3 – Road network

Northfields Avenue follows an East/West alignment and is the main access road servicing the campus. There are two major entrances into the campus leading off Northfields Avenue, which generate a majority of the inbound traffic flow. Northfields Avenue is classified as a collector road and links the Campus with both the Princes Motorway and Northern Distributor. It has a posted speed limit of "40kph shared zone" and is divided in a few sections. Parking is permitted on both sides. Daily traffic volumes are likely to be close to 9,000 vehicles per day (loosely based on RMS traffic data for May 2015).

Robsons Road is the main collector road linking a majority of the local roads within the western side of Keiraville. Robsons Road follows a north-south alignment connecting Keiraville with Mount Keira Road (Local Arterial) to the south. The road is undivided and is comprised of one traffic lane in each direction. Parking is permitted on both sides. There is a formal entrance into the University campus off Robsons Road.

The campus Ring Road is the main access route servicing the entire Wollongong campus. Although the road geometry indicates it is a local road, its function is more like a minor collector road. Based on our site observations, typical traffic flow is estimated to be over 440 vehicles per peak hour at the point closest to the MLSB site. Daily vehicle flow is between 3,000 to 4,000 vehicles per day during semester times (cross referenced with traffic count data from CFE Information Technologies 2014). Its interaction with the greater road network and its current traffic volumes, also supports the case that it is more like a minor collector road. The road is undivided and has a posted speed limit of "10kph shared zone"; however vehicles were observed travelling at around 30kph during peak hour.

Sciences Road would be normally be classified as a local access road and does not generate much traffic. It connects with the Ring Road forming a priority controlled intersection, with the Ring Road having priority.

URAC Access Road is a local access road connecting the URAC sports facility at the north of the campus. It connects with the Ring Road forming a priority controlled intersection with the Ring Road having priority.

Ring Road - Section adjacent to the site

The Ring Road provides easy access throughout the campus. The Ring Road includes several traffic management measures at various points to support the pedestrian activity experienced at the campus. The image below is the section of the Ring Road closest to the proposed MLSB site.

Figure 4 – Ring Road near IHMRI Building

The image shown above highlights the complex mix of competing traffic management measures that have tended to evolve over time - rather than in a coordinated plan. Some of the main items to consider in the traffic assessment include the following:

1. Driveway shown on right leads to a small 5 space car park and is not expected to generate much traffic
2. Pedestrian crossing to be relocated
3. Additional pram ramps (not visible in image) encourages people to cross Ring Road at several points rather than focused within one area
4. Drop off zone to be retained
5. Stairs leading into Aquatic building is close the kerb and will affect locations of crossings
6. The streetscape appears fairly deteriorated and in need of refurbishment.
7. Two speed humps are required to ensure traffic slow down within this area
8. Further along the Ring Road to the west is the access lane to URAC

We attended site weekly (over November and early December) to review the traffic conditions of the site for a typical weekday. The traffic conditions were not indicative of what would be expected during a

typical University semester as it was outside of term. However the high level of campus parking occupancy, indicates that staff were still attending the campus in large numbers.

3.2. Public Transport

Most bus services within the central Wollongong area are provided by the Premiere Illawarra Bus Company. The main bus services are listed below (*source: UoW website*)

Route 41 from Dapto via the Princes Highway through Figtree and directly to UOW via Robsons Rd.
Route 11 from Wollongong, Mangerton, Mt. St Thomas, West Wollongong, Figtree, Mt. Keira
Route 39 from Figtree Mt Keira and West Wollongong, connecting via the Gong Shuttle at Wollongong Hospital
Route 24 from Figtree, Mt St Thomas and Mangerton, connecting via Gong Shuttle at Crown St near Wollongong Station.
Princes Highway corridor - Routes 31, 33, 34, 35, 36, 37, 39, 57 from Figtree and West Wollongong connecting via Gong Shuttle at Wollongong Hospital

Traffic surveys conducted by AECOM indicate the buses servicing the area are at capacity during peak hours; therefore there is a potential to increase/improve the frequency of buses services.

Free Community Shuttle Bus Service

Three different shuttle services operate via a loop route around the Wollongong CBD every 10 to 30 minutes during the study semester. The shuttle services connect with the standard bus services stated above, as well as both the Wollongong and North Wollongong train stations - approximately in line with scheduled train services. Refer to map below for existing bus routes.

Figure 5 – Wollongong Free Bus Loops

3.3. Wollongong Cycleways

Wollongong City Council has adopted its "City of Wollongong Bike Plan 2014 - 2018" which includes a city wide strategy and local cycleway measures. The bike plan is a comprehensive strategy that intends to provide bike connectivity through the Local Government Area. The following image provides a snapshot of the cycleways around the Wollongong CBD area specifically.

Figure 6 – Cycleway network

Based on the information provided, there is adequate cycleway infrastructure to provide some encouragement to cycle to the campus – provided the cyclist considers the journey distance is reasonable.

3.4. Pedestrian access

The proposed pedestrian movements around the new site have been prepared by Aspect Design (part of the Advisory team) as per the image below:

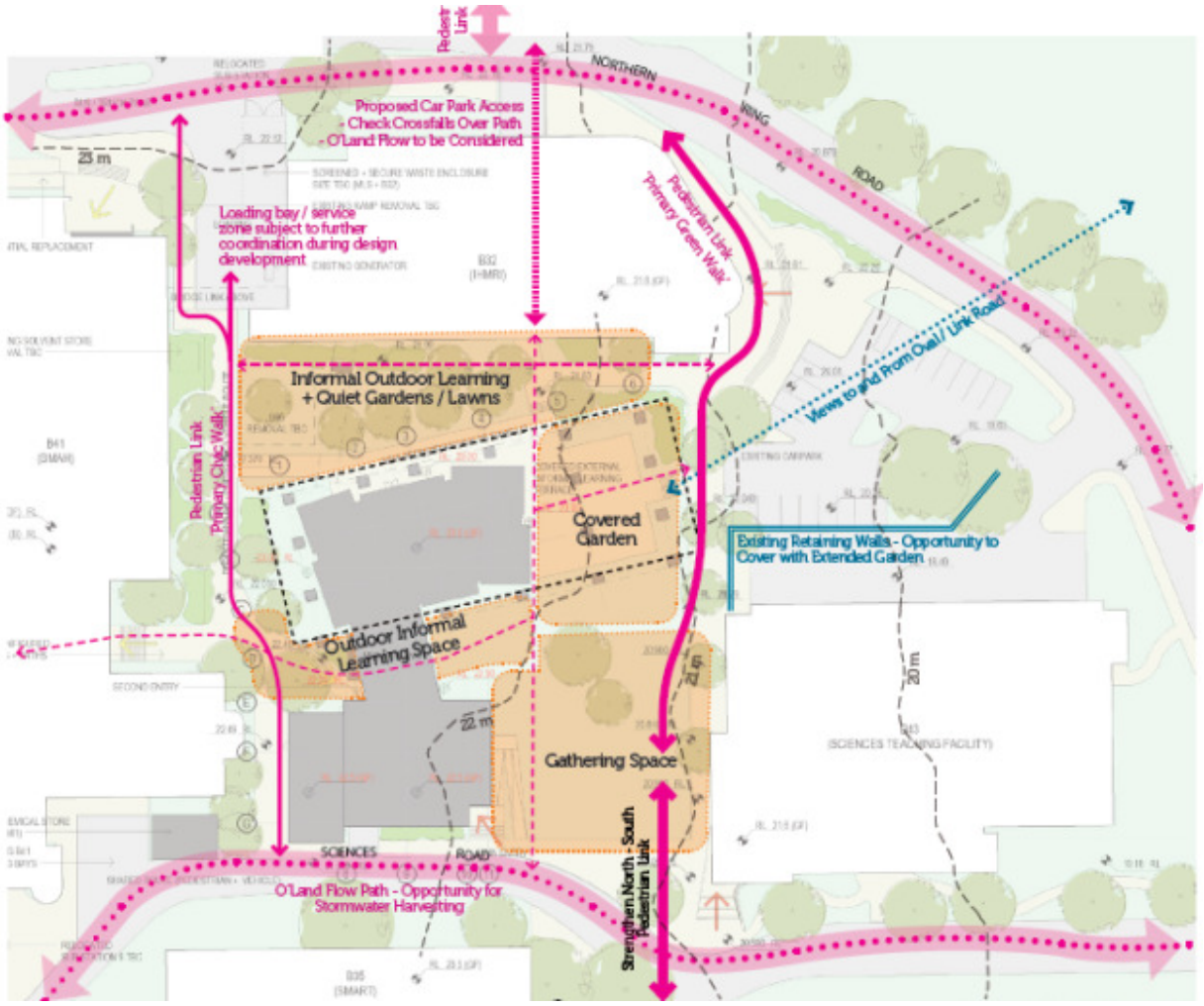


Figure 7 – Pedestrian Routes (Aspect Studios)

The proposed Pedestrian facilities between the bus stop and the proposed MLSB is highly accessible (100m distance) - via the Ring Road at the north eastern side of the site.

In addition to the image above, there will be additional pedestrian access through the IHMRI car park. This will be discussed in more detail in Section 8.

3.5. On street parking

The campus is situated on the northern section of Keiraville which is a low density residential area. Therefore there is significant supply of on-street parking including 531 free and unrestricted on-street spaces and 1,654 additional spaces situated more than 500 metres from the campus. Most of the spaces closest to the campus are well utilised by 9am and therefore do not provide many parking opportunities

for the new development. Thus any remaining parking demand must be provided by permit controlled parking on-campus.

In an attempt to manage on-street parking demand, Council have introduced a variety of measures in the local roads surrounding the campus including the following:

- Time restricted parking during the day (i.e. 2P) in streets with residential dwellings
- Line marked parking bays to improve parking compliance and reduce instances of cars parking on verges and across driveways
- "No Parking" restrictions on weekdays (on some sections of road only)

In sections of streets that do not include private dwellings, parking is usually unrestricted. It is expected that these spaces are usually occupied throughout the weekdays.

3.6. Car parks within the Wollongong Campus

The following map is available via University of Wollongong website and shows the locations and relative size of each car park within the campus. The main car parking areas applicable to the development is P7 and P5 (where the lost spaces in P7 are planned to be relocated). These car parks are restricted to permit holders only until the evening when they revert to pay and display.

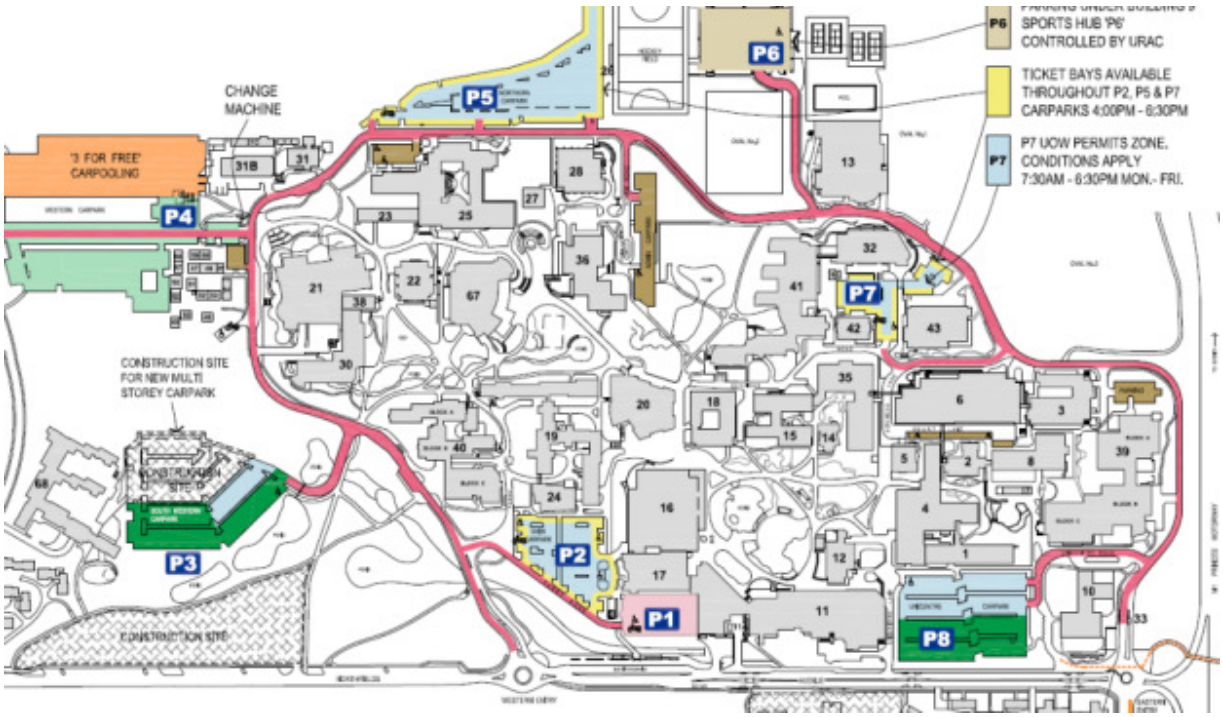


Figure 8 – Campus Parking

All car parks are generally well utilised during the day with some availability within the P1 multi deck car park. Parking fees varies for each type of car park – however are generally priced around $2.30 per hour. Total campus parking capacity is approximately 3,150 spaces.

The existing P7 car park includes the following parking space inventory:

- Standard parking– 69 spaces
- Disabled – 10 spaces
- Motorcycle – 22 spaces

A majority of this parking will be replaced by the MLSB development and relocated to the P5 car park.

The IHMRI building car park is comprised of 17 standard parking spaces and 2 disabled bays. The car park is located at the ground level of the building with 15 spaces undercover and 4 spaces in open space (on the southern side of the car park). These 4 spaces will be removed as part of the MLSB development.

3.7. Opportunities for bicycle facilities

The long term mode share for cycling to the campus is currently around 2.5% of travellers. That being said the University has invested in 1,000 bicycle racks, 6 end-of-trip facilities and 2 maintenance stations. In addition The University has adopted a long term vision for the campus to be a pedestrian/cycling friendly environment with several shared zones. The following images show the existing bicycle facilities on campus including the end of trip bicycle storage underneath the IHMRI building and the bike racks next to the P7 car park.

A campus map including all bike facilities have been included in Figure 11 below.

Figure 9 - Existing Bike Cage at IHMRI Building

Figure 10 – Existing Bike racks P7

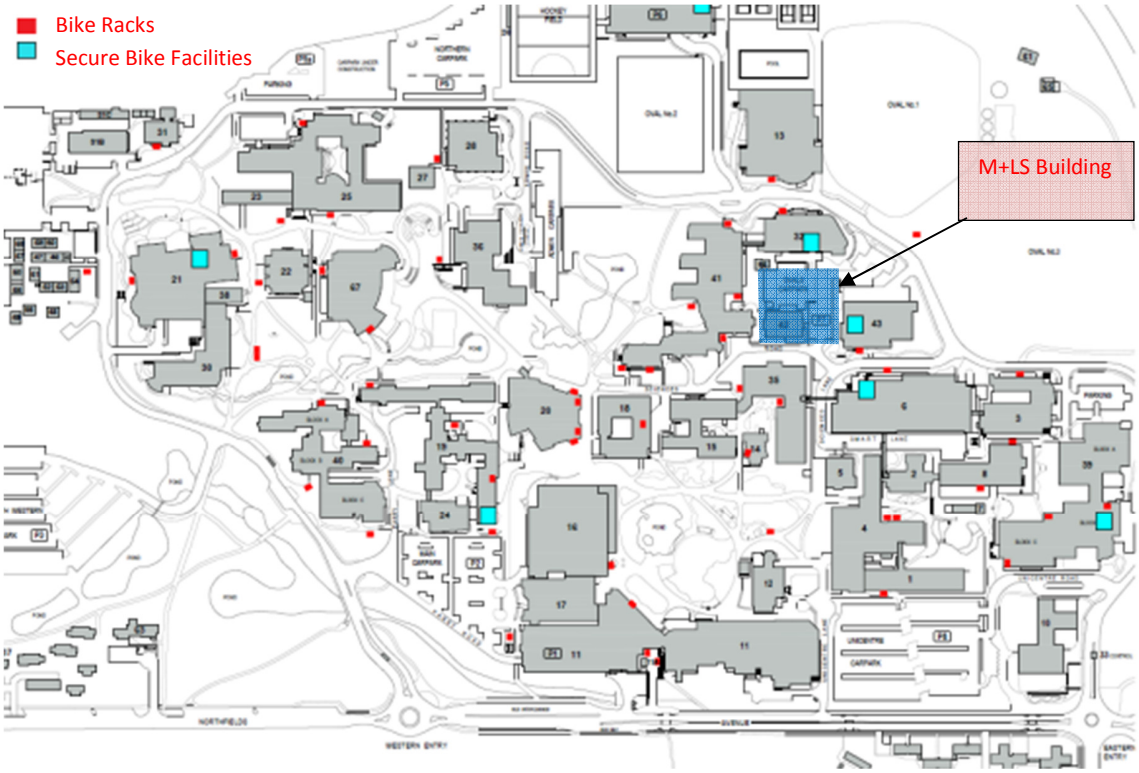


Figure 11 – Campus Bike Facilities

In regards to **End of Trip Facilities**, the University currently has five undercover 'Bike Bases' where students and staff can lock up their bike and have access to shower facilities, change rooms and toilets. The nearest facility is in the IHMRI building at the southern side - access via the car park.

Bike Bases are free to use for staff and students.

3.8. Wollongong Car pooling program

At present The University promotes free car park parking for high occupancy students vehicles. The following link includes a registration program to match students seeking a car pooling arrangement https://www.carpoolworld.com/uow.html

The current take up of car pooling is 5.4% of vehicle trips (i.e. based on a minimum of 3 people per vehicle) for the Wollongong campus which represents an increase of 12.5% (on previous volumes) when compared to the previous study undertaken in 2013.

3.9. M1 Princes Motorway Mount Ousley Interchange Project – RMS

The Roads and Maritime Services (RMS) are planning a new interchange on the M1 Princes Highway at the intersection of Mount Ousley Road. The interchange will replace the existing configuration of the intersection and significantly improve the free flow of traffic. The M1 typically has significant daily truck traffic which greatly affects the safe operation of the road, as light vehicles tend to weave between lanes to avoid them.

The new interchange will include a new entrance into the northern section of the campus. Considering that many students are likely to be travelling from the northern suburbs of Wollongong or the Sutherland Shire, a large proportion of traffic currently on Northfields Avenue will be diverted to the new northern entrance. This will have the impact of alleviating potential traffic congestion during AM/PM peaks within the streets surrounding the campus.

The interchange will include a pedestrian walkway across the Freeway. This will provide better connectivity to the on-street parking within the suburbs of Mount Ousley and Fairy Meadow – which will in turn potentially reduce on-street parking demand within the suburb of Keiraville. There is currently a commuter car park located off Mount Ousley Road that will be retained or perhaps relocated (RMS, Nov 2016).

High level plans have been conducted for the new entrance which includes an access road joining onto the northern P5 car park. The RMS have conducted community consultation on the project, and there were concerns raised that the new entrance may impact parking supply within the P5 car park. Considering that the plans are preliminary high level designs, we should not speculate on the impacts they will have on parking supply – as the design could easily be modified to provide minimal or negligible impact on car parking spaces.

A snapshot of the high level design has been included below:

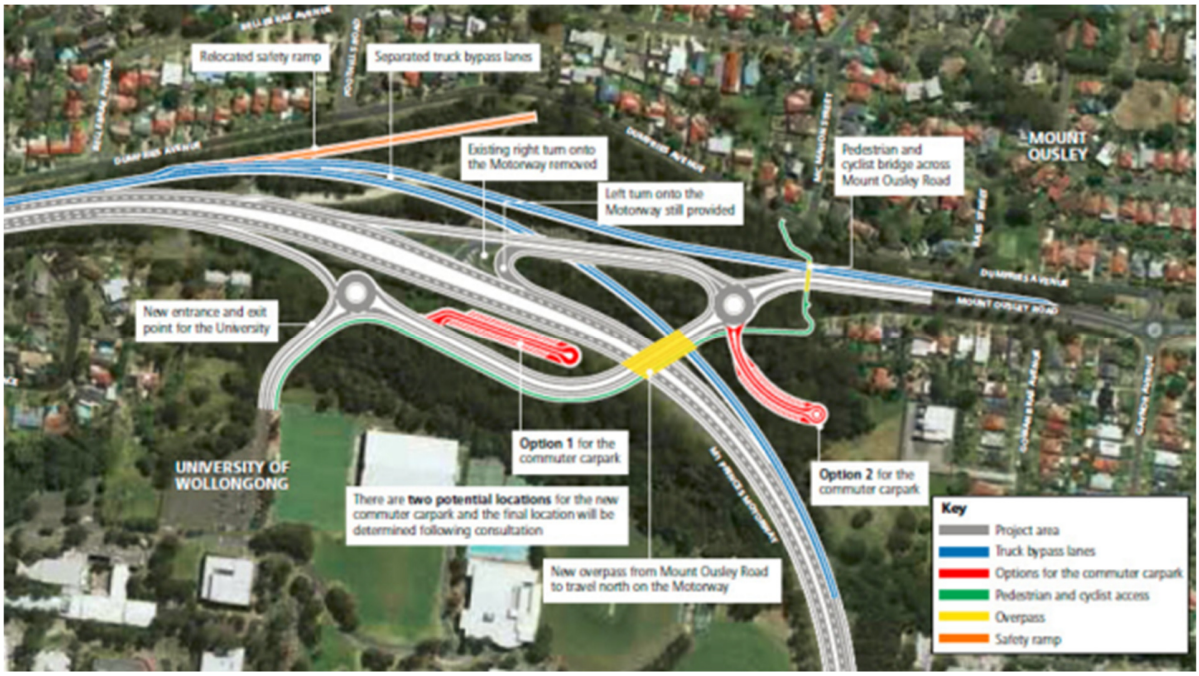


Figure 12 – M1 Interchange Project

4. Existing Travel Behaviour

The existing travel mode share for the University of Wollongong Campus is shown in the table below based on 2015-16 survey data provided by Aecom and UoW. These are based on the entire University population including staff and students.

Table 1 Existing Mode Share - *Based on 2016 estimates (UoW Master Plan 2016)*

Travel Mode	Mode share %
Car as Driver or Passenger	55.4%
Train and Bus	29.2%
Walk	12.9%
Cycle	2.5%
Taxi	NA
Other.....	NA

To develop an understanding of the existing travel behaviours within Wollongong generally, the following data has been extracted from Profile.ID website in regards to basic travel-to-work statistics (2011)

Car as Driver	65.2%
Cars as Passenger	5.9%
Train	4.8%
Bus	1.9%
Did not go to work/ none stated	11.8%
Active and other (i.e. worked at home, motorcycle etc...)	10.4%

Source: http://profile.id.com.au/wollongong/travel-to-work

The current private vehicle travel mode share for Wollongong is well above the existing mode share for the Wollongong campus (currently 55.4% private transport). It is expected that students will generally have lower income and subsequently lower car ownership, which results in the adoption of car sharing and alternative transport modes.

As the MLSB site relates to staff activity (rather than teaching), we will need to refer to additional mode share data. The following table shows the demographic breakdown of mode share for private vehicle (source: University of Wollongong, Transport Survey 2015 AECOM).

Table 2 Existing private vehicle mode share – based on demographic

Private Vehicle Travel Mode by Demographic	Mode share %
International students	10%
Post graduate student / researcher	35%
Full time students	48%
Undergraduate students	51%
Casual staff	52%
Domestic students	55%
Part time students	68%
Part time staff	76%
Full time staff	79%

It is important to note that the mode share for staff is significantly higher than the campus average. For the purposes of the traffic assessment, we will need to determine the weighted mode share for staff across casual, part time and full time staff as per the below table (ratios of each category based on transport survey responses):

Table 3 Existing private vehicle mode share for staff- average weighted (source: AECOM, 2015)

	Estimates % of total staff	Mode share	Weighted
Casual staff	29%	52%	*15.08%*
Part time staff	15%	76%	*11.4%*
Full time staff	56%	79%	*44.24%*
Average weighted mode share			**70.7%**

The above mode share is based on "Total private vehicle mode share" which includes drivers and passengers. Upon review of the source data, we have determined the revised weighted mode share for "Car as driver" to be **62.7%** of all staff weighted – which is more relevant.

Existing travel demand on site

The site is currently being used as an at-grade car park which is reserved for permit holders during standard business hours. The western section of the P7 car park includes 9 disabled bays (there are 10 in total across the eastern and western sections) which are rarely occupied. On the other hand the standard parking spaces are fully occupied by 8.30am and are likely to remain fully occupied for most of the day. This equates to a net parking demand of 73 spaces (refer to Section 7 for how this is calculated). Assuming the worst case scenario that each space has a turnover ratio of 1 (i.e. each space is used only once per day during weekdays), the site is expected to generate 73 trips during the AM peak and another 73 trips during the PM peak. Based on the highly desirable location of the car parking areas,

we anticipate that the site will attract a majority of its trips within the early peak times (i.e. 7am to 8am); however PM egress rates are likely to be distributed over a wider time interval (i.e. over a 2 – 3 hour period) as people commute home.

Due to the proximity of the site within several key campus buildings, we would expect that the subsequent pedestrian movements out of the car park would be distributed in multiple directions, rather than concentrated on a few key pedestrian desire lines.

5. Projected Traffic Activity

In order to understand the magnitude of travel issues relating to the Wollongong campus, it is prudent to estimate the travel demand for the site.

Gross Floor Area GFA

Estimating travel demand for a new development can be done against the Gross Floor Area (or Gross Leased Area), or it can be based on student/staff numbers.

University of Wollongong Innovation Campus Master Plan, (Traffic and Transport Assessment, Prepared by Aecom 2012 Table 4.1) has adopted the following trip generation rates for education based developments.

Table 4 - Wollongong Traffic Generation Rates for Education Facilities (Aecom 2012)

	AM Peak	PM Peak
Trips per m^2 (GFA)	0.021	0.023

If we base our forecasts on a floor area of 6,922 m^2 GFA for the MLSB, we can estimate the PM peak travel demand to be approximately 159 trips for the PM peak and 145 trips for the AM peak per hour.

Mode Share method

Alternatively we can estimate the travel demand based on the number of staff and their expected work roster. Based on the information provided to us, we understand that an estimated 150 staff are likely to be working at the MLSB during a typical weekday. This will comprise of 138 full time staff and 12 visiting staff.

Based on the above numbers, we can estimate the total trips for an average weekday. To do this we need to apply the following assumptions in regards to site:

- FTE staff equates to head count
- Staff will typically take 4 weeks leave per year which will not be backfilled by casual staff.
- One (1) staff member currently stationed at Building 42 (to be demolished), will be relocated to the MLSB
- 68 staff will be relocated from Building 18 and IHMRI. We have assumed that all relocated staff are not going to be backfilled at their current location. If so, this would be part of a separate DA application by The University

If we apply the above points to the number of staff, we can assume that on a typical day the average net increase in staff on-site is as follows:

Total staff at MLSB	150
Less relocated staff	-69
Net new staff at MLSB	81

Adjusted for Annual leave:

$$\left(\frac{48 \text{ weeks}}{52 \text{ weeks}}\right) \text{X } 81 \text{ staff} = 75 \text{ staff per day}$$

Therefore we estimate a total of 75 new trips per day inbound and subsequently 75 trips outbound, will be generated by the MLSB. In this instance, given that the end users and the nature of the operation is known, it is considered appropriate to determine the traffic/vehicle demand based on the FTE numbers and associated staff levels. If we apply the existing staff mode share for the Wollongong campus, we can expect the following travel demand (by mode) based on the number of staff.

Table 5 - Wollongong Campus Forecast Mode Share for staff

Travel Mode	Est. Mode Share %*	Est. No. Of trips
Car as Driver	62.7%	47
Car Pool/Passenger	*7.5% Included in above*	6
Bus	15.1%	11
Cycle	6.7%	5
Walk/Other	8%	6

*mode share is based on surveyed data provided by The University for Staff travel

Based on the above, the MLSB is likely to generate a peak vehicle travel demand of 94 vehicles per day (i.e. 47 for the AM peak and 47 for the PM peak period).

In addition the MLSB will generate a peak travel demand of 22 bus journeys (11 inbound and 11 outbound).

Additional considerations when calculating mode share

The Aecom traffic generation rates are not representative of the typical activity at the MLSB. The MLSB gross floor area will not be related to staff numbers as a majority of floor space will be used for its research activities. In addition it does not address the prevailing mode share of the campus based on long term historical data.

The current mode share of 62.7% for staff is well above the University's travel mode targets. As discussed in previous sections, several measures to reduce private vehicle usage have been implemented by the University. If we were to refer to parking strategies employed across many

Australian campuses today, we can expect that mode share for private vehicle should drop by at least 5% in the medium to long term (i.e. in line with University targets set out in the Master Plan).

"UOW Transport Strategy Review Report - February 2012" by Cardno highlights the fact that between 2009 and 2011 there was already a significant mode shift away from the private vehicle (by 6.8% across both staff and students). This was the result of The University implementing only a few of their initiatives within the campus' parking policy. The report noted that further improvements could be made if more initiatives were employed.

The University Master Plan references a target reduction on private vehicle mode share of 5.4% total private vehicle usage after 2020. If this reduced mode share of 5.4% were to be realised, we could expect further reduction in vehicle related trips for the MLSB development.

"Wollongong DCP 2009 Chapter D14 Wollongong Innovation Campus 2 Section 11", is a formal planning instrument for the Innovation campus that references the Universities objectives and initiatives with regards to reducing private vehicle usage on campus. This implies that the Council acknowledges The University's key objectives with regards to mode shift and the need to reduce car dependency. This further reinforces the need to provide a 'minimum parking requirement for the MLSB site' rather than a maximum parking provision.

6. Traffic impacts on the surrounding road network

As per the previous section, the net trip generation for the site is estimated to be 47 vehicles for each Peak period. The following sections summarise the main impacts the proposal will have within the immediate vicinity of the site.

Intersection with Sciences Road

There will no longer be an access driveway into the main P7 car park as this will be replaced by the MLSB. Some loading vehicles will attend site from time to time however, this will be uncommon based on the information provided. Therefore the intersection of Sciences Road and The Ring Road will experience a reduction in turning traffic - resulting in improved service levels.

Sciences Road itself will be converted to a shared zone for both pedestrians and vehicles. Based on existing traffic volumes, we anticipate no negative impact on the free flow of traffic through Sciences Road.

Performance of the Ring Road

The new MLSB will cut off access to the IHMRI building car park, thereby requiring the construction of a new driveway off the Ring Road. However on site observations indicate that this section of the Ring Road is performing satisfactorily in regards to the free flow of traffic. The existing traffic measures (speed humps, crossings etc...) is causing minimal interference.

The IHMRI car park will include about 15 car spaces which is likely to become fully occupied by 9am (with minimal vehicle turnover), therefore the impact of a new driveway off the Ring Road is likely to be negligible

Northfields Avenue

This road operates as a distributor/collector road and would accommodate close to 9,000 vehicle movements on a typical weekday. The new facility will generate an additional 47 trips during the peak period, which we anticipate will have negligible impact on the operation of Northfields avenue – specifically where is intersects with the Ring Road.

CKC have reviewed traffic data provided by the RMS for May 2015 for the entire road network surrounding the campus. The main items to note include the following:

- Outbound traffic is approximately equally distributed (50/50) between the western and eastern entrances onto Northfields Avenue
- Peak traffic flows between 7AM and 9AM is approximately distributed as follows:
    - 7AM to 8AM – 30%
    - 8AM to 9AM – 70%
- Peak traffic flows between 4PM and 6PM is approximately distributed as follows:
    - 4PM to 5PM – 60%
    - 5PM to 6PM – 40%
- The review of the mid-block traffic flows along Northfields Avenue indicates it is operating at Level of Service (LOS) B in the AM Peak and LOS C in the PM Peak (refer to table below for definitions).

The operation of the road network is determined by the capacity of the intersection to accommodate the peak period traffic flows. Intersections are assessed against various performance indicators comprising Level of Service (LOS), Avg. Delay, Queue Lengths and Degree of Saturation etc.

Based on Average delay, which is defined as the average delay experienced by all the vehicles accessing the intersection, the RMS Guide to Traffic Generation have categorised the operation of an intersection utilising an indicator known as Level of Service (LoS). The table below indicates, the bands adopted by RMS:

Table 6 – RMS Level of Service Classification

LoS	Avg. Delay (sec/veh)	Operation of Intersection
A	0-14	Good
B	15-28	Good with minimal delays and spare capacity
C	29-42	Satisfactory with spare capacity
D	43-56	Operating near Capacity
E	57-70	At capacity and incidents will cause excessive delays
F	>70	Unsatisfactory and requires additional capacity

Source-RMS Guide to Traffic Generating Developments

Based on an estimated traffic generation rate of 94 additional vehicles per day (47 inbound and 47 outbound), we can estimate the additional traffic volumes for the network and its associated impacts.

The additional peak hour traffic volumes for Northfields Avenue (at either the eastern entrance or the western entrance) is calculated as (47 x 50% x 70%) = 16 vehicles.

Based on the data available Northfields Avenue is operating well below capacity, and therefore the marginal increase in traffic activity associated with the MLSB is unlikely to have any detrimental impact on the performance of Northfields Avenue.

The P5 Car park

This is one of the larger at-grade car parks located on the north side of the campus. UoW intend to extend this car park northwards by an additional 170 parking spaces.

The existing P5 car park includes three entry/exit driveways to distribute the flow of traffic turning into and out of the car park.

On each site observation, the P5 car park appears close to full utilisation by 9am. In addition the performance of the Ring Road does not seem impacted by the volume of cars turning into the car park. Once the additional 170 spaces are added to the northern side of P5, the performance of the Ring Road should be assessed to determine if additional traffic treatments are required to assist vehicles accessing the car parks (e.g. auxiliary turning lanes etc...)

Based on the available traffic data and on-site observations, the performance of the Ring Road near the P5 car park is performing well with no observable traffic friction.

The Proposed Mount Ousley Interchange

Section 3.9 introduces the proposed Mount Ousley Interchange and its connection into the main campus. As discussed above, the forecast traffic impacts will not be significant enough to warrant additional road works or changes in the road network.

Should the Interchange proceed, we can expect that any traffic friction experienced at the existing campus entrances will be ameliorated. This will in turn increase the capacity of the overall road network absorbing any additional traffic generation from new developments within the campus.

Public Transport Services

As stated in Section 3.2 the existing bus services are approaching capacity. Reviewing the source data from The 2015 transport study (Aecom), including the bus dwell time data for the PM peak, we note that only a small portion of services would not allow passengers to board the bus (i.e. about 6%). This at least indicates that the existing services are generally not preventing people from commuting home.

As per Table 5 above, the MLSB is expected to generate 11 bus trips during each peak period. These 11 trips will be distributed across several bus services and therefore will only make a marginal impact on any one particular service. That being said 'Section 5.1' of the University of Wollongong Master Plan outlines their broad vision with respect to expanding bus accessibility through additional bus bays.

7. Parking Provision

7.1. Parking space displacement

The proposed MLSB development will result in a net loss of parking spaces within the subject site that will need to be relocated elsewhere within the campus.

Proposed Provision: Optimum provision of disabled spaces in the eastern section of P7 car park plus an additional 2 contractor spaces. This option will result in the displacement of 82 parking spaces which include the following:

- 69 standard parking spaces removed from the P7 car park. This is comprised of 48 in the western section and 19 in the eastern section to accommodate an additional 13 disabled spaces from the IHMRI and P7 car parks – including associated six (6) new shared spaces (i.e. for 2 disabled spaces, 1 central shared space is required).
- Loss in two (2) standard parking spaces at the rear of the IHMRI building. (i.e. a total of 71 standard spaces).
- Loss in 22 motorcycle spaces which is the equivalent of 11 standard car spaces (in regards to car park space allocation).

The following table summarised the proposed changes to the parking provision at the MLSB site:

Table 7 – Net change in Parking at the MLSB Site

	EXISTING	PROPOSED
P7 Car park west section		
Standard spaces	48	0
disabled spaces	9	0
shared spaces between disabled spaces	3	0
Motorbike spaces	22	0
P7 car park east section		
Standard spaces	21	0
disabled spaces	2	15
shared spaces between disabled spaces	1	9
Contractor Spaces	0	0
IHMRI car park (external)		
Standard spaces	2	0
Disabled spaces	2	0
TOTAL standard spaces	**71**	**0**
TOTAL Disabled spaces	13	15
TOTAL Motorbike spaces	22	0
Shared spaces between disabled spaces	4	9
Contractor spaces	0	0
Net change in Standard spaces		-71
Net change in disabled spaces		2
Net change in Motorbike spaces		-22
Net change in shared spaces		-5
Contractor spaces	NA	0
Total number of car spaces that must be relocated		
Standard spaces		71
Disabled spaces		0
shared spaces between disabled spaces		0
Net equivalent to replace Motorbike spaces (i.e. 2 MB spaces = 1 car space		11
TOTAL physical parking bays (standard size bay)		**82**

Standard | Disabled + Shared

IHMRI | Motorbike

7.2. Increased Parking provision under the Master Plan

The UoW master plan 2015 states that the university will be increasing the overall parking provision for the entire campus by an additional 312 spaces within two existing car parks. There is also an additional 170 parking spaces being developed north of the existing P5 car park. The P5 expansion is likely to be built by January 2018. The following image shows the proposed new car park at the north of P5 which is planned to accommodate the displaced parking spaces from the MSLB.

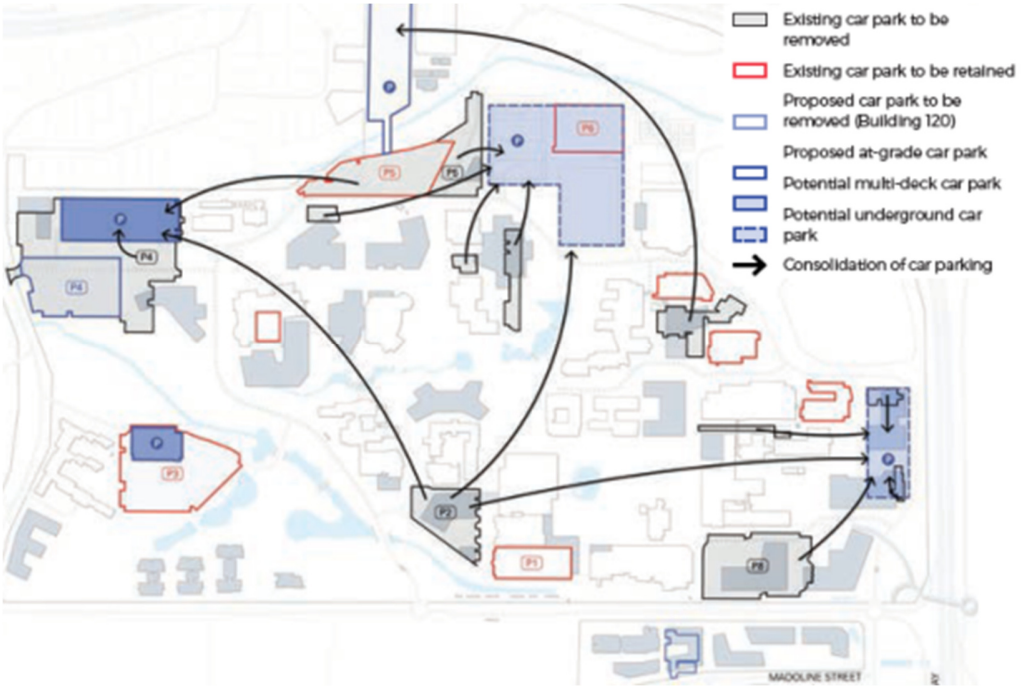


Figure 13 – Campus parking areas – Existing and proposed (Source: UoW)

The following table highlights the planned changes to parking supply across the campus over the next 10 years based on University data. The table indicates a net increase in parking provision for the campus.

Table 8 – Proposed changes to Campus parking provision

CHANGES TO EXISTING CAR PARKS				
Car Park #	**Name**	**Existing Spaces**	**0-5 years**	**5-10 years**
P1	UniCentre Multi Storey	550	550	550
P2	Main	130	130	0
P3	South Western	341	341	341
P4	Western	684	604	524
P5	Northern	361	361	177
P6	Sports Hub	128	128	128
P7	Sciences	79	0	0
P8	Unicentre	287	287	0
	Graduate House	29	29	0
	All other car parks	*430*	418	418
SUB TOTAL		**3019**	**2848**	**2138**
NEW PARKING				
Car Park #	**Name**	**Existing Spaces**	**0-5 years**	**5-10 years**
WP-P1	Proposed South western Multi-deck	NA	270	270
SP-P1	Proposed P5 extension	NA	170	170
P120	Proposed Student accomodation	NA	42	42
SP-P2	MP Hockey field/oval 2	NA	NA	NA
CW-P1	Robsons Road Multideck	NA		864
CE-P1	Engineering underground	NA	NA	NA
WP-P2	Security Car Park	NA	7	7
SUB TOTAL			**489**	**1353**
TOTAL PARKING SUPPLY			**3337**	**3491**
NET CHANGE FROM 2016			**318**	**472**
% change			**10.5%**	**15.6%**

7.3. Estimated Parking demand

One approach to estimating parking demand is to reference The Wollongong Development Control Plan (DCP 2009) which includes the following parking ratios for education faculties (which we consider the closest match the proposed development):

1 parking space per staff member
1 bicycle space per 10 students
1 motorcycle space over 25 parking spaces

Based on the above, this translates to approximately 150 spaces for the MLSB. This type of calculation is helpful when the operation of the end users is unknown. Given the operation of the end user is known and adequate data (i.e. travel mode share) is available, we can determine the potential parking demand more appropriately. As discussed in Section 5 of the report, we concluded that the MLSB generates additional peak demand of 47 vehicles per day. If we assume the worst case scenario that each vehicle on-site is parked for an entire day, this would translate to a maximum requirement of 47 car parking spaces.

In addition the development will displace 82 parking spaces as stated previously. Therefore a total of 129 new parking spaces are required. We note that the University are planning to introduce 170 new parking spaces at the northern side of the P5 car park – as stated previously to support the MLSB development.

To provide disabled parking amenities, a total of 13 disabled parking bays will be provided in the eastern section of P7.

To calculate the motorcycle parking provision for the site, we will assume that the total parking provision relating to the site includes: the IHMRI car park, P7 car park, displaced vehicles into P5 and the additional parking for the MLSB building. This equate to (129 + 15 + 2) = 144 car parking spaces. For this number of parking spaces, as per the DCP, there is a requirement of 6 motorcycle spaces. There are currently 4 motorcycle spaces within the IHMRI building, therefore an additional 2 motorcycle spaces are to be accommodated within the P5 car park extension or elsewhere near the MLSB site.

As part of this assessment, we have assumed that the existing 22 motorcycle spaces (calculated at 11 car spaces as part of this exercise), will be provided elsewhere within the campus as part of a broader campus parking strategy. The University may consider retaining some of the displaced motorcycle spaces, from the western section of the P7 car park, within the new expanded P5 parking area. This will affect the number of additional motorcycle spaces required – as stated above.

Bicycle Parking

The MLSB will require additional bicycle parking spaces and racks. There are existing racks within the P7 car park that are currently underutilised. The final location and configuration of the bicycle facilities will be determined by Aspect Studios as part of their landscape plans.

As a starting point, we can assess the existing bike facility provision across the campus based the on ratio of bike faculties - to students and staff:

Student # EFTSL	17,080	
Staff # FTE	2,170	
Total population	19,250	
Est. No. of racks	1,000	
No. of racks per person		19.25
No. of racks actually in demand based on 2.5% mode share		481.25

If we were to apply the Wollongong DCP ratios as state earlier (i.e. 1 bike rack per 10 people), we would need (17,080 + 2,170)/10 = 1,925 racks across the Wollongong campus. As highlighted above, there are 1,000 racks that are generally observed to be underutilised – which correlates with the lower mode share of 2.5%.

However as there are long term plans to increase mode share for active transport, The University must be seem as encouraging cycling, and therefore should provide facilities that are situated as closely as possible to their destination/office.

The existing secure bicycle storage facility underneath the IHMRI Building may be reconfigured to include vertically mounted racks. The facility's current capacity is approximately 20 bikes based on the provisions of 4 bike racks that are supposedly able to accommodate 5 bikes per rack. It is likely that opportunity exists to increase its capacity by introducing vertically mounted racks.

AS2890.3 "New Bicycle Parking Requirements" (The Standard) recommends railing type bike racks (as currently installed around the campus) to have a separation of 500mm between each loop/rail. The bike rail type that is used at the university is 1500mm wide and is supposed to accommodate 5 bikes within this width (i.e. less than 300mm spacing between each bike). This may not be viable and it is likely that when the racks are occupied by three (3) bikes, additional bikes are probably locked onto the end rails.

Vertical bike racks are an efficient method of storing multiple bicycles. The standard recommends that vertical storage is 500mm between each wheel with an apron width of 1200mm. As the dimensions of the enclosure is approximately 3.6m X 10m (internally), there should be sufficient room to easily

accommodate 2 rows of 18 bicycles (i.e. 36 cycles) with a central aisle for convenience. This will increase the effective provision of bike racks by **16 bicycles**. Of course this is a secure facility and casual users visiting the site will not have easy access. We therefore recommend that at least one bike rack (5 bike capacity) is retained next to the MLSB building for ad hoc usage. Please refer to figure below for the proposed configuration of the facility.

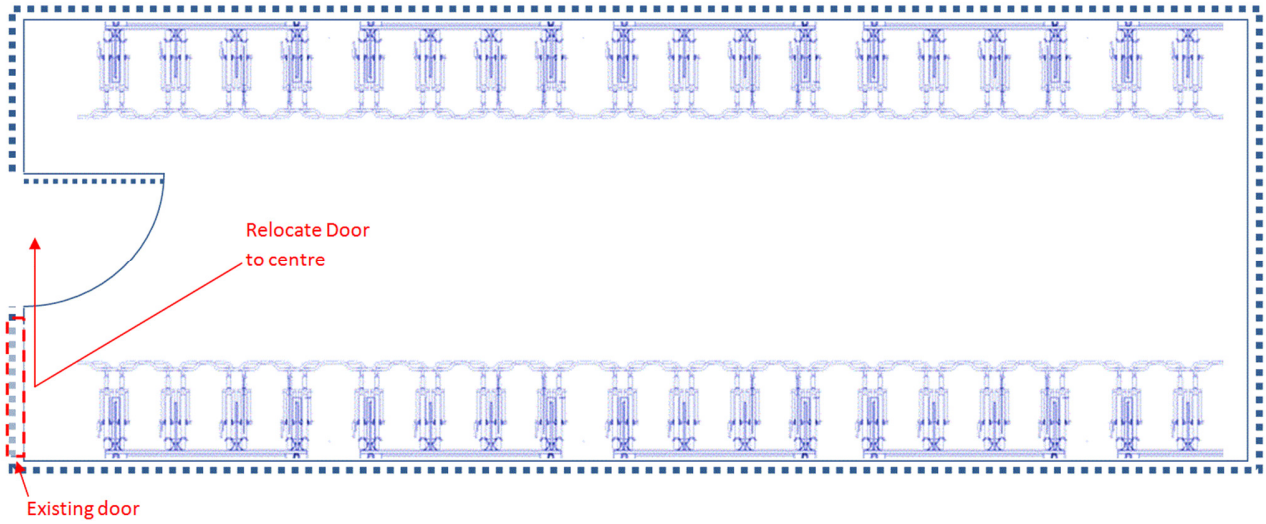


Figure 14 – Reconfiguration of Bike Facility to accommodate vertical parking

Managing Parking Displacement during Construction Stage

As stated earlier, the P5 car park expansion project is expected to be completed January 2018. During the construction phase, there will be no additional staff on campus prior to the completion of the MLSB. Therefore all spaces within the P7 car park (including all sections), can be accommodated within the new P5 parking area.

As a contingency measure, The University has arrangements with Wollongong TAFE whereby spaces can be leased to staff.

In Summary:

- In the event that a majority of the disabled spaces are relocated into the eastern section of P7, an additional 129 new spaces are required within the campus
- The additional 170 spaces The University are introducing in the Northern side of P5, is sufficient to manage the additional parking demand as well as the loss of the parking spaces from the MLSB development. It is anticipated that the P5 car park expansion will be completed prior to the closure of the P7 car park and therefore will be able to accommodate the displaced parking arrangements during construction stage.
- An additional two (2) motorcycle spaces are required
- Reconfigure the existing IHMRI secure bike facility to allow for vertical bike parking – thereby increasing capacity for an additional 16 bikes.
- The updated plans of the MLSB are to include a minimum of 5 bicycle spaces in addition to retaining the existing provision.

8. Traffic Management Measures

The following initiatives are considered the most relevant to the MLSB taking into account the traffic and parking conditions immediately around the site area including nearby Ring Roads

Reconfiguration of the IHMRI building car park

As discussed previously the IHMRI building car park will be reconfigured to allow access off the Ring Road. This will be done under a separate approval process.

The reconfiguration will allow the site to retain 15 standard parking spaces on the ground level.

To coincide with this project, the Ring Road will require some additional works including new pedestrian facilities (i.e. relocated crossing, new pram ramps, footway reconstructions, integration of new driveways into shared pathways etc…).

The P7 East Car Park

The additional disabled spaces will be located as close as practical to the MLSB. They will be allocated in sets of two (2) car parking spaces with a central shared space to assist access. They will be designed in accordance with AS2890.6

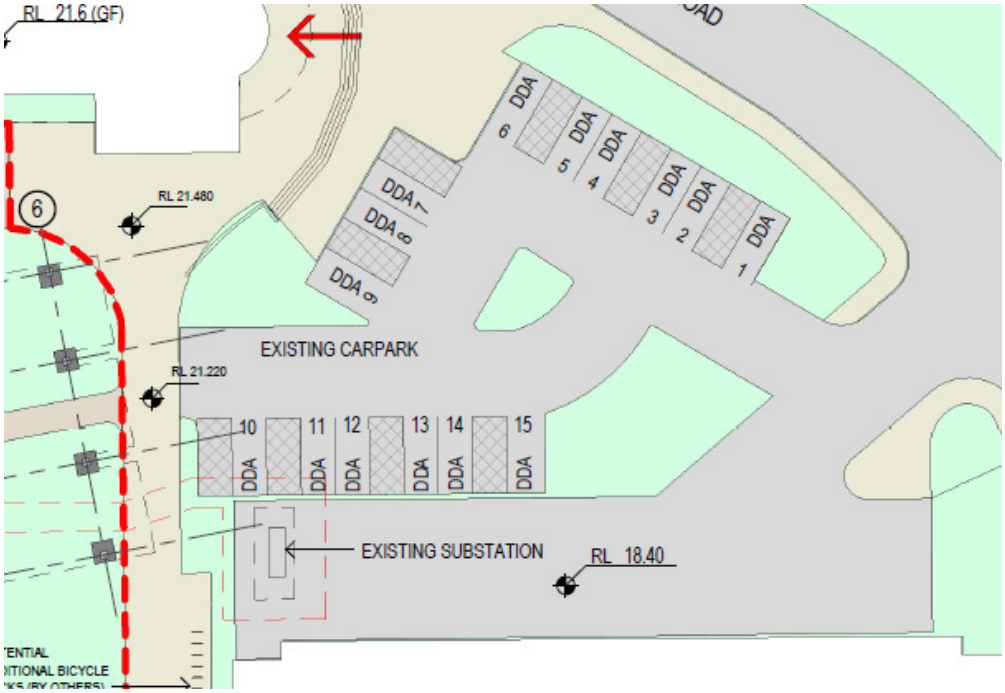


Figure 15 – P7 layout all DDA spaces

Please note Australian Standard for Off-Street Parking for people with disabilities (AS2890.6 -2009) specifies the following dimensions for a disabled car space:

Space width - 2.4m; Space length- 5.4m; and aisle width - minimum 5.8m.

In additional to the above The standard warrants a shared space (2.4m wide x 5.4m long) should be located in-between two disabled car spaces; and include a bollard to prevent motorists from parking in this shared area.

9. Access Arrangements

We understand that a separate application has been prepared to support the expansion of the existing P5 car park which will accommodate the required parking provision to service the MLS building. It is standard practice to ensure that all the additional parking spaces are compliant with the Australian Standard AS2890.1-2004.

Therefore, the review of P5 car park was not included as part of this report. It has been assumed to be compliant with the Standards and adequate to service the proposed MLS Building.

9.1. Car Parking Arrangement IMHRI Building

As part of the proposal, a new driveway will be introduced off The Ring Road leading into the northern side of the IHMRI car park. The existing entrance from southern end (including Boom gates) will be closed off.

At this stage we do not recommend including boom gates at the entry/exit driveway as this will complicate the configuration of the entry driveway. In addition the limited number of spaces (15) warrants a simpler means of access control via the reserved permit scheme.

Table 3.1 & Table 3.2 of AS2890.1 specifies the width of the access driveway, which is directly proportional to the on-site parking provision and also the type of frontage road. Taking into account the driveway is located on the Ring Road, which is classified as a minor collector Road (i.e. a local road for the purposes of this exercise) , and the car park has a capacity of fifteen (15) parking spaces, Table 3.1 classifies the proposed driveway as 'Category 1'. Table 3.2 therefore recommends the driveway width should be within a range of 3.0-5.5 metres, as a combined entry and exit. Initial concept designs include an access driveway of 5.5 metres which is therefore considered compliant with the Standard. The driveway will be splayed to at least 6 metres where it connects to the Ring Road.

Driveway Gradient

A review of the site topography indicates that the driveway gradient will be approximately 1 in 15 which is compliant to the standard. We anticipate that the driveway will not be a dedicated bitumen or concrete surface (i.e. with kerbing). Instead it will crossover a pedestrian paved footway – in keeping with the existing streetscape and proposed shared zones.

Height Clearance

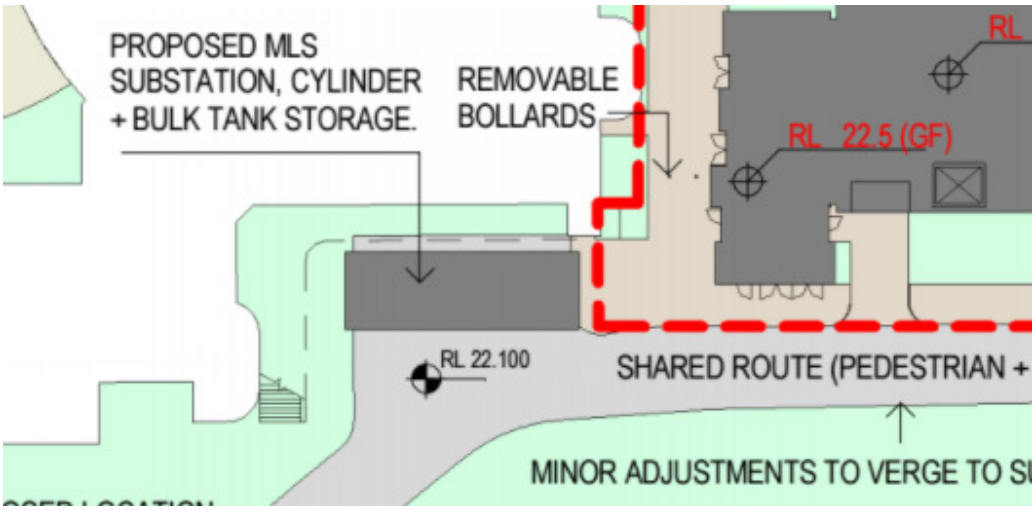
Height clearance will remain the same for the north as what has been operating at the southern end of the car parks.

9.2. Service Vehicle Access

The MLSB will include a loading dock which is accessible of Sciences Road. Discussions with University Facilities Management indicate that deliveries will be relatively infrequent.

There are five (5) spaces dedicated to service vehicles and deliveries. They are configured as a single parking module - 90 degree parking off Sciences Road in front of Building 42. These will be removed and replaced with the driveway into the loading dock. There will be five (5) spaces retained on the east side of the development site to the west of Building 41. These spaces will be accessible via Sciences Road and are expected to service Building 41.

The proposed gas storage facility at the south of Building 41 (shown below) is suitable to accommodate the occasional service vehicle accessing the facility off Sciences Road.



9.3. Turning Path Assessment

CKC conducted swept path assessments of the main access points of the site including the following:

1. Shared Service Loading area
2. MLSB Loading dock off Sciences Road
3. Emergency access off Sciences Road
4. Service vehicle parking off Sciences Road
5. MRV access off Sciences Road
6. Fire Truck Access

The following swept Path Assessments have been included as Attachments to the report:

Attachment CKC UOWV01; Attachment CKC UOWV02; Attachment CKC UOWV04; Attachment CKC UOWV05; Attachment CKC UOWV06; Attachment CKC UOWV08.

Attachment CKC UOWV02 - shows the reverse entry turning path of a waste collection vehicle via the bus bay in front of Building 41. For this exercise we have used a Heavy Rigid Vehicle (HRV) with 12.5m length and 12.5m turning radius. The turning path shown in UOWV02 is the preferred method of vehicle entry compared to reversing back directly from the Ring Road. We have included the turning path for the waste collection vehicle reversing from the Ring Road in Attachment CKC UOWV01 for comparison. Both UOWV01and UOWV02 have the turning path for vehicles entering the IHMRI car park off the Ring Road.

Attachment CKC UOWV04 - shows the turning path for an SRV (rather than an MRV) accessing both the loading dock and the emergency access lane. The first image shows the sequence of an SRV: reversing into the loading dock, exiting loading dock turning right onto Sciences Road, entering the emergency lane in a forward direction, making a two point turn, and then commencing to exit the emergency lane in a forward direction. It also shows the SRV exiting in a forward direction from the loading dock – left onto Sciences Road.

Attachment CKC UOWV06 shows the turning path into the reconfigured eastern car parking area using a standard vehicle. In addition it shows an SRV reversing into the MLSB loading dock.

Attachment CKC UOWV05 - shows the turning path for an SRV (rather than an MRV) reversing into the area at the rear of Building 41 off Sciences Road, in front of the MLSB substation. It also shows an SRV making a simple forward parking manoeuvre.

Attachment CKC UOWV08 - show an MRV reversing into the emergency access lane. The MRV is used to approximate a small fire truck, which will need to reverse to the B41 fire fighting position. The image indicates that some widening of Sciences Road is required. The Attachment also shows the MRV exiting in a forward direction, turning left onto Sciences Road.

10.Study Limitations

The report was prepared based on the information provided at the time. The following are the main assumptions and limitations relating to the traffic study:

- Site observations were conducted after Spring Student Semester was completed – i.e. November to December. This means that pedestrian activity and vehicle movements were not observed during the peak times of the year
- There is no pedestrian statistics for the existing P7 car parking area specifically, however there is pedestrian movement data for the various entry points into the campus.
- The car parking requirements were based primarily on standard 'car spaces' – rather than on the existing mix of car/motorcycle spaces. The original car park plans for the P7 car park showed car spaces only. Since then 11 of these have been converted to motorcycle spaces. The overall provision of motorcycle spaces on campus has not been included as part of this assessment

11.Conclusions and Recommendations

1. The Proposed Molecular + Life Sciences Building does not adversely impact the operation of the road network including Sciences Road, Northfields Avenue and The Ring Road.
2. The development allows for major changes to pedestrian amenity and a simplification of the various traffic management measures particularly along the Ring Road.
3. The provision of 170 parking spaces in the P5 car park is sufficient to cater to the increased parking demand as well as the net loss in parking spaces on site
4. The loading dock and emergency road is suitable for an SRV with some minor modification
5. The shared service access driveway is suitable for a reverse maneuver
6. The total number of disabled spaces will be retained
7. The Bike facility underneath the IHMRI building can be reconfigured to increase capacity by an additional 16 bicycles

12.References

University of Wollongong 2016 – 2036 Master Plan (July 2016)

University of Wollongong 2016 – 2036 Master Plan Implementation Document (August 2016)

Aecom, University of Wollongong, Transport Survey 2015 - Survey and Strategy Summary (Oct 2015)

Aecom, University of Wollongong, Innovation Campus, Master Plan, Traffic and Transport Assessment (2012)

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University of Wollongong website (2016)

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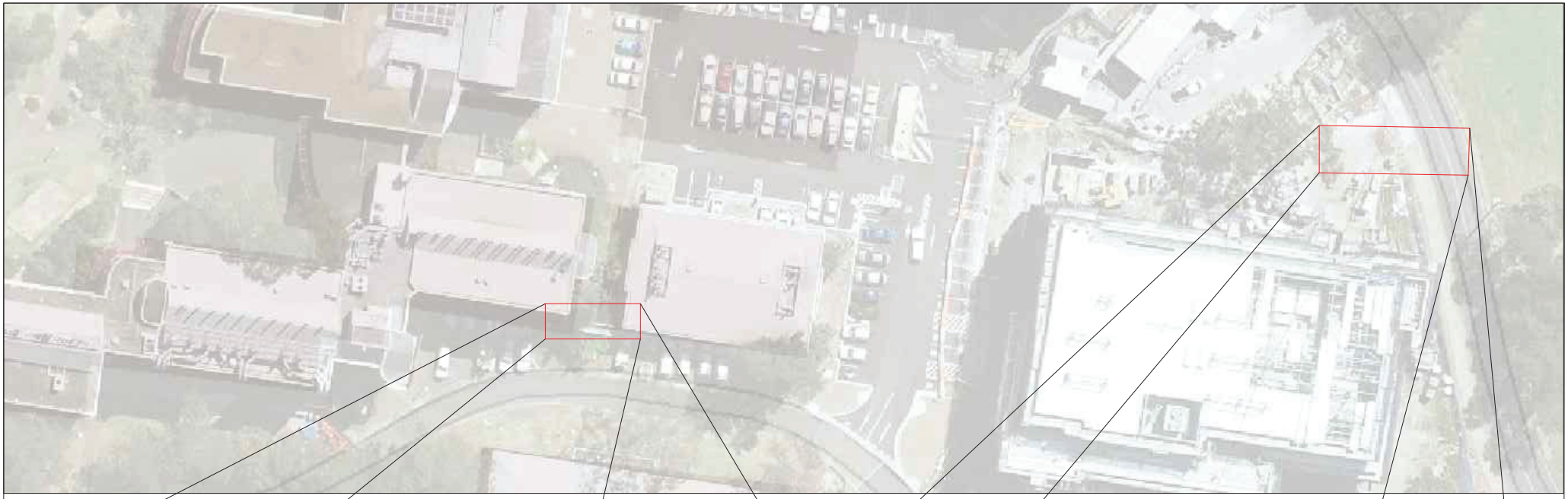
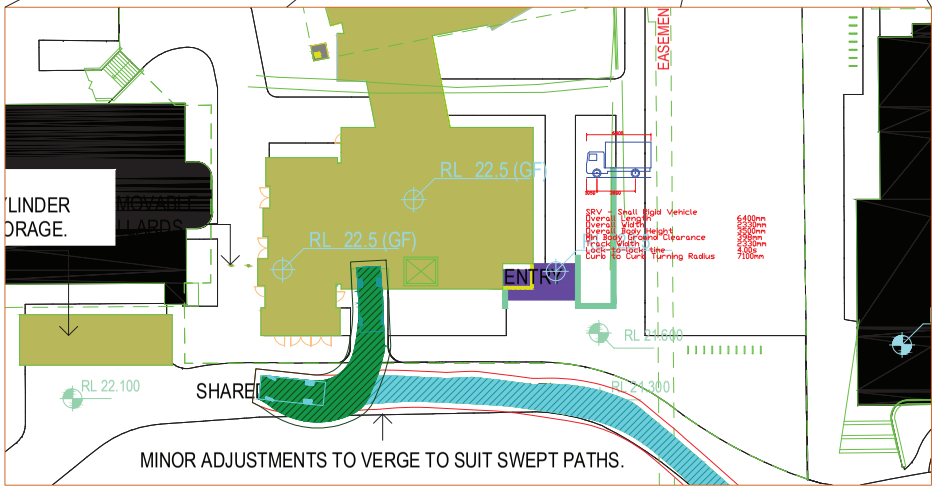
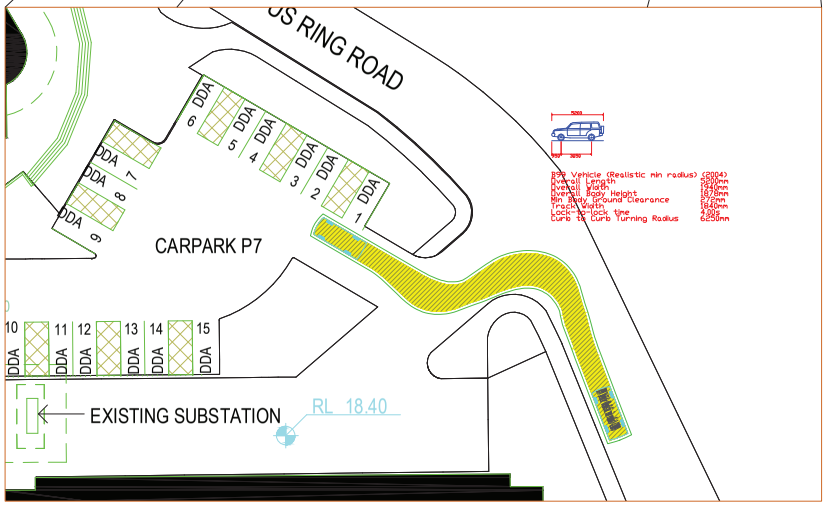
M1 Princes Motorway Mount Ousley Interchange, Preferred Option Consultation Summary, November 2016, RMS







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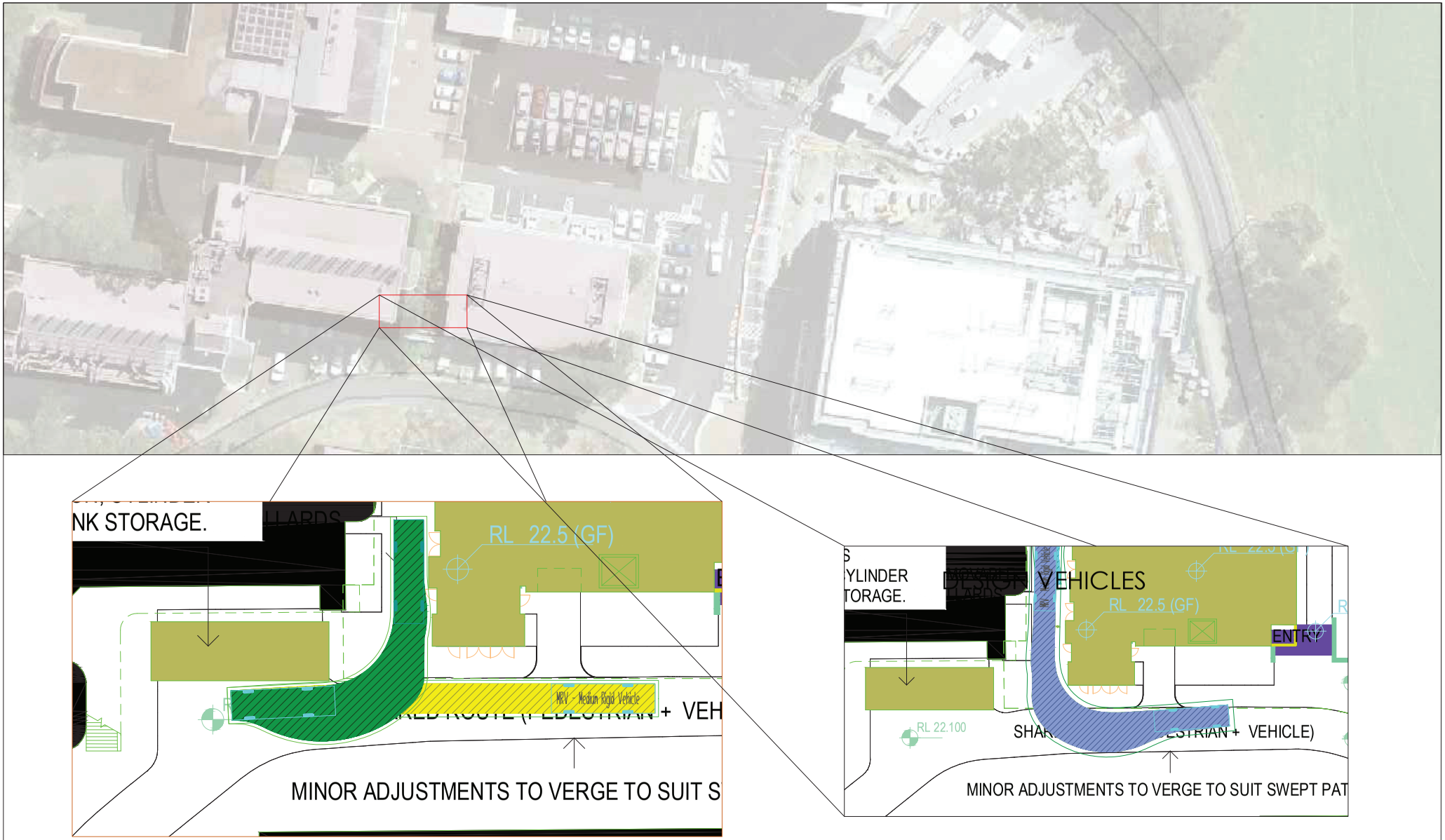

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Caldwell&Kent CONSULTING	CLIENT- UNIVERSITY OF WOLLONGONG	DRAWING NO - CKC UOWV08	DATE - 26/05/2017
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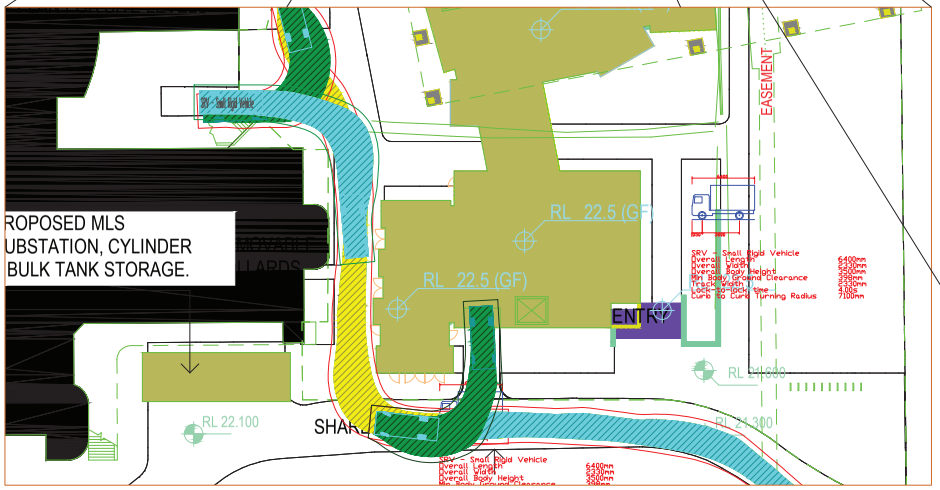

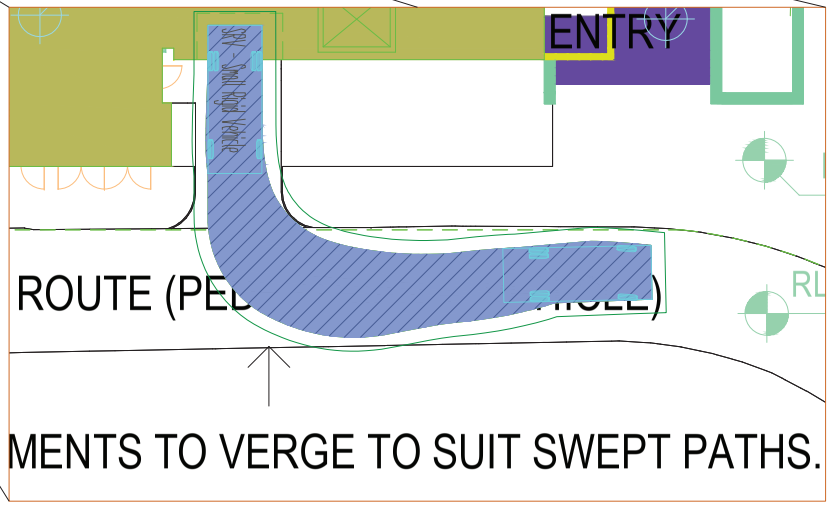

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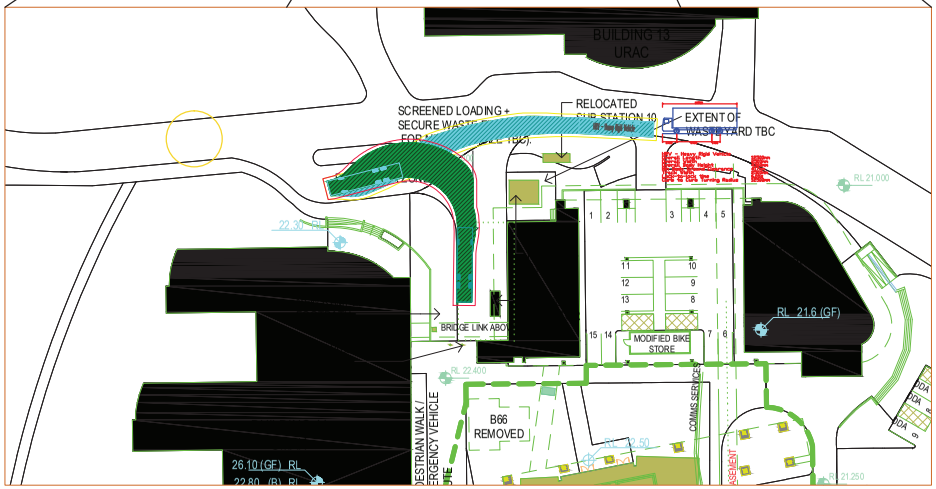

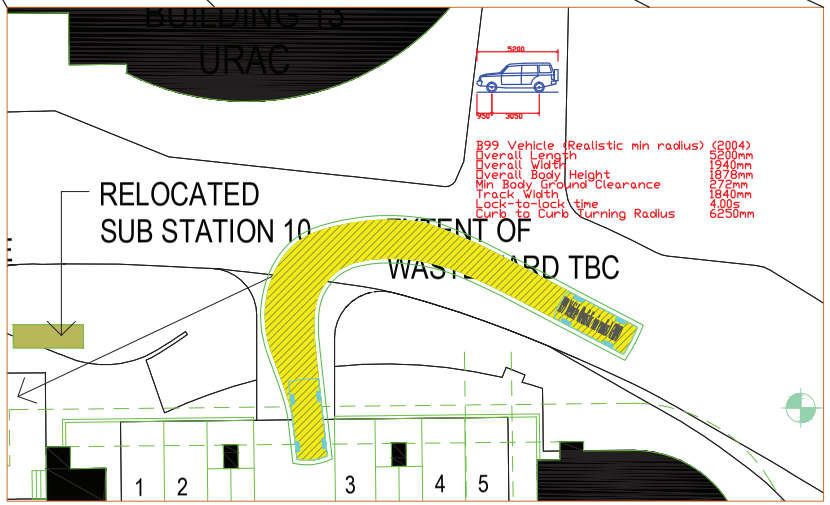

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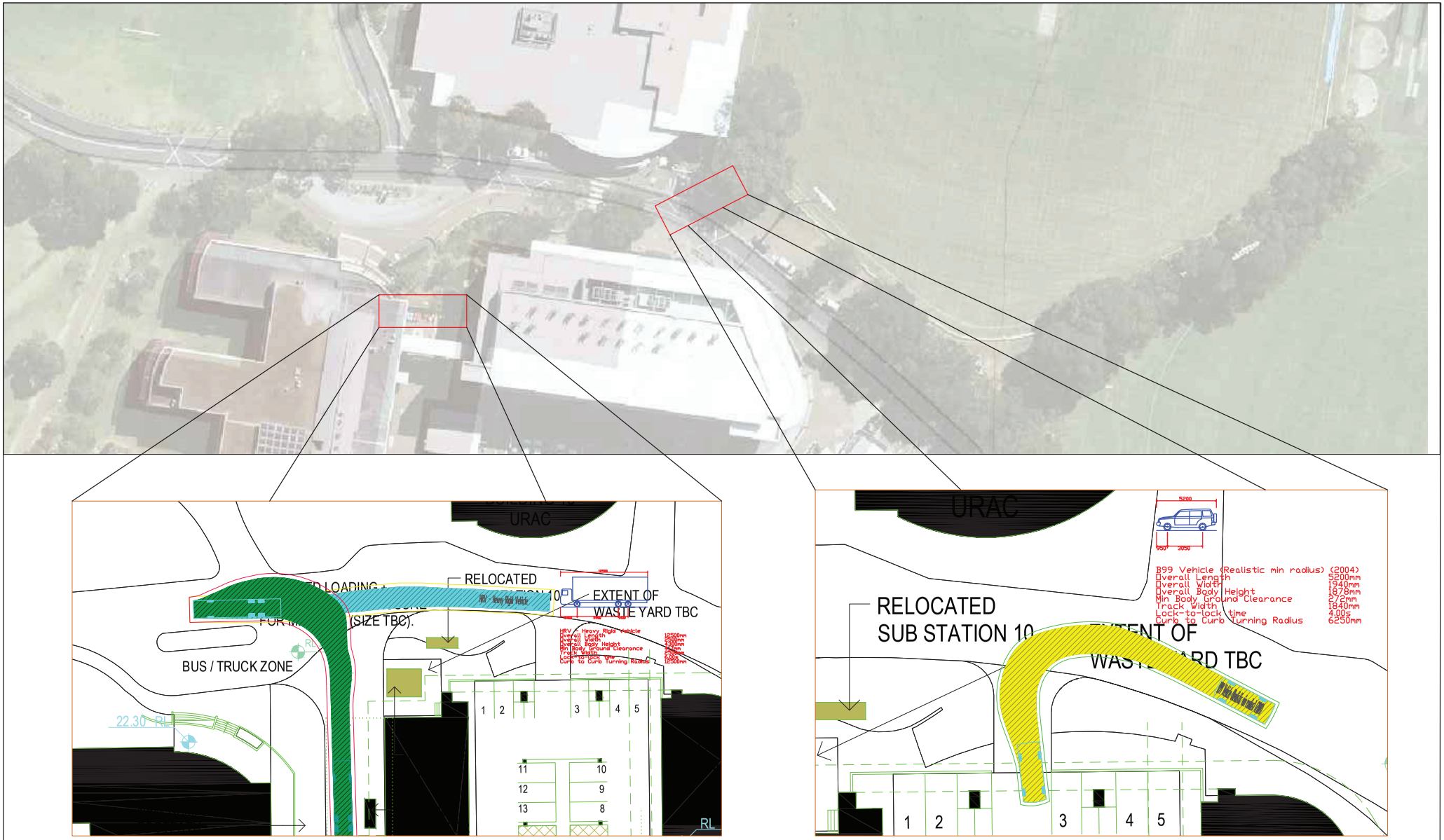

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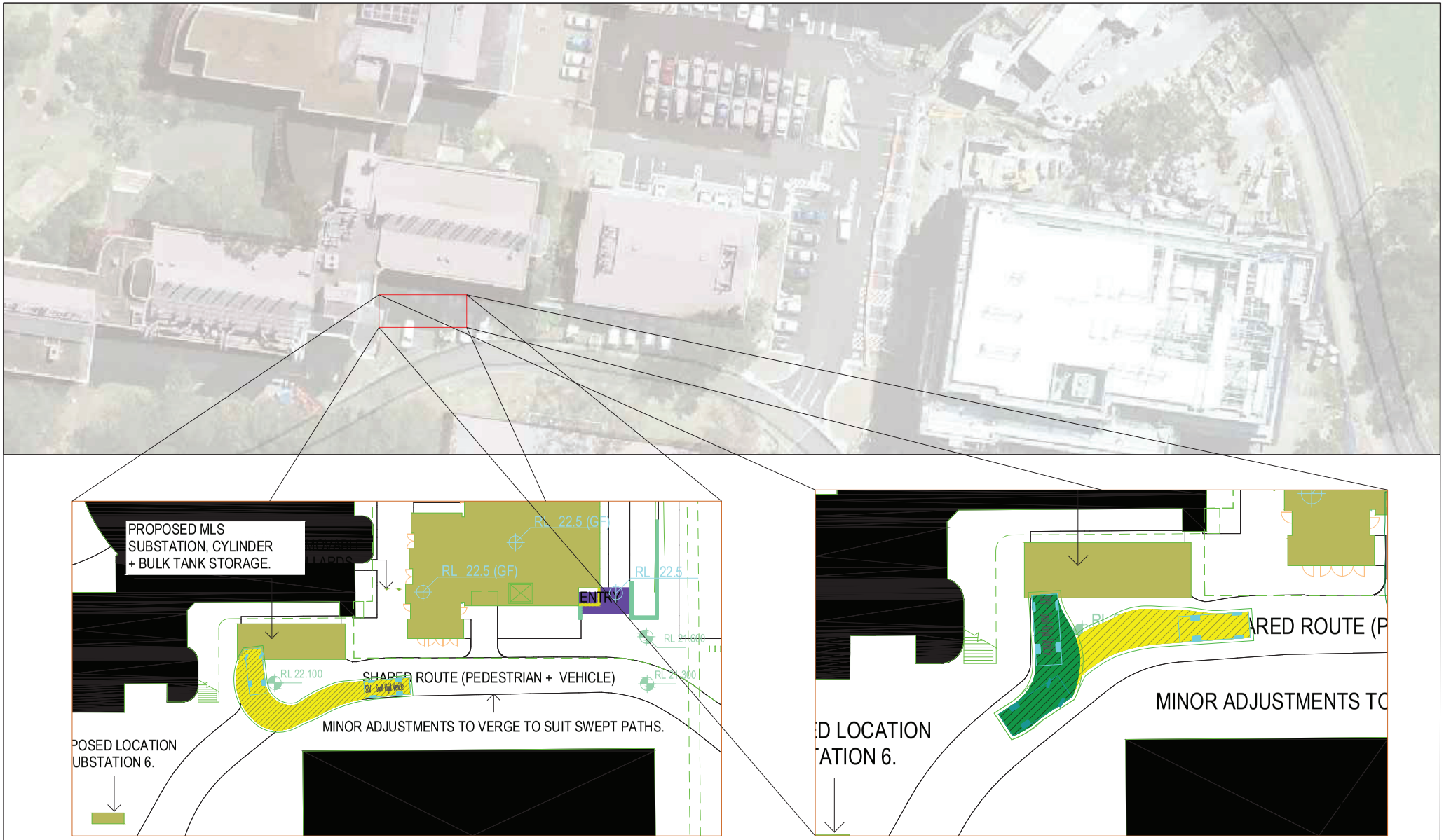

N	Caldwell & Kent CONSULTING	DRAWING TITLE- SWEPT PATH ASSESSMENT	PROJECT NO - CKC UOW01	SCALE - NTS
		CLIENT- UNIVERSITY OF WOLLONGONG	DRAWING NO - CKC UOWV05	DATE - 26/05/2017
		PROJECT ADDRESS - MOLECULAR BUILDING	NOTES -	