

Stormwater Management Plan & Utilities Management Plan (Rev. 1)

**Macquarie University,
Macquarie Park, NSW**

Prepared for Macquarie University / 16 June 2017

131406 P

Contents

1.0	Introduction	3
1.1	Macquarie University	3
1.2	Relevant Documents	9
2.0	Riparian Zone, Flooding and Stormwater	10
2.1	Stormwater Drainage	10
2.1.1	Design Criteria	10
2.2	Water Sensitive Urban Design	10
2.2.1	Rainwater Reuse	10
2.3	Flooding	11
2.3.1	University Creek	11
2.3.2	Mars Creek	13
2.3.3	Flooding Controls	14
2.4	Construction Phase Stormwater Management	14
3.0	Roadworks	15
4.0	Utilities	15
5.0	Hydraulic Services	15
5.1	Existing Potable Water and Fire Hydrant Services	15
5.1.1	Masterplanning Potable Water and Fire Hydrant Services	16
5.2	Existing Sewer	16
5.3	Masterplanning Sewer	16
5.4	Existing Natural Gas Services	16
5.5	Masterplanning Natural Gas Services	17
6.0	ELECTRICAL SERVICES	18
6.1	Existing Electrical Services	18
6.2	Masterplanning Electrical Services	18
6.3	Existing Telecommunications	18
6.4	Masterplanning Telecommunications	18
Appendix A – Flood Maps		
Appendix B – Hydraulic Services		
Appendix C – Electrical Services		

1.0 Introduction

Macquarie University is planning to develop parcels of land within the campus for commercial, research and University use.

This report has been prepared to summarise the utilities, stormwater design and flooding constraints present at Macquarie University, in Macquarie Park, for master-planning purposes.

TTW have prepared the stormwater and flooding strategy. David Buckle and Associates have prepared servicing strategy for water, sewer and gas. JDG Consulting have prepared electrical and communications servicing strategy.

1.1 Macquarie University

The University is bound by Culloden Road to the west, Talavera Road to the north, Herring Road to the east and Epping Road to the south.

Mars Creek and University Creek run through the University in a north easterly direction. The location plan, aerial image, Master Plan and precinct plan are shown in Figures 1 to 4 respectively.

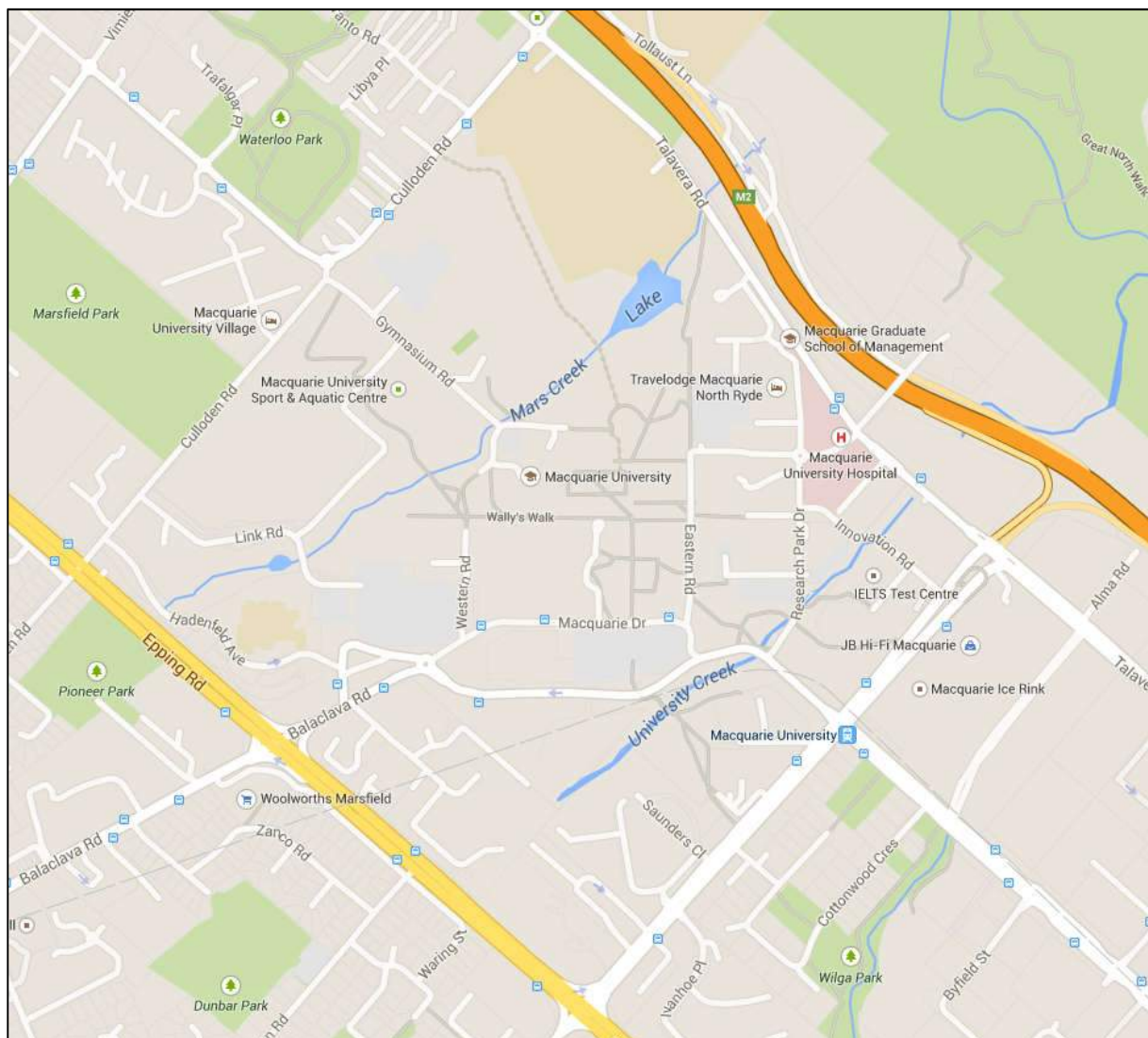


Figure 1 Locality Plan (source: Google)



Figure 2 Aerial Photo

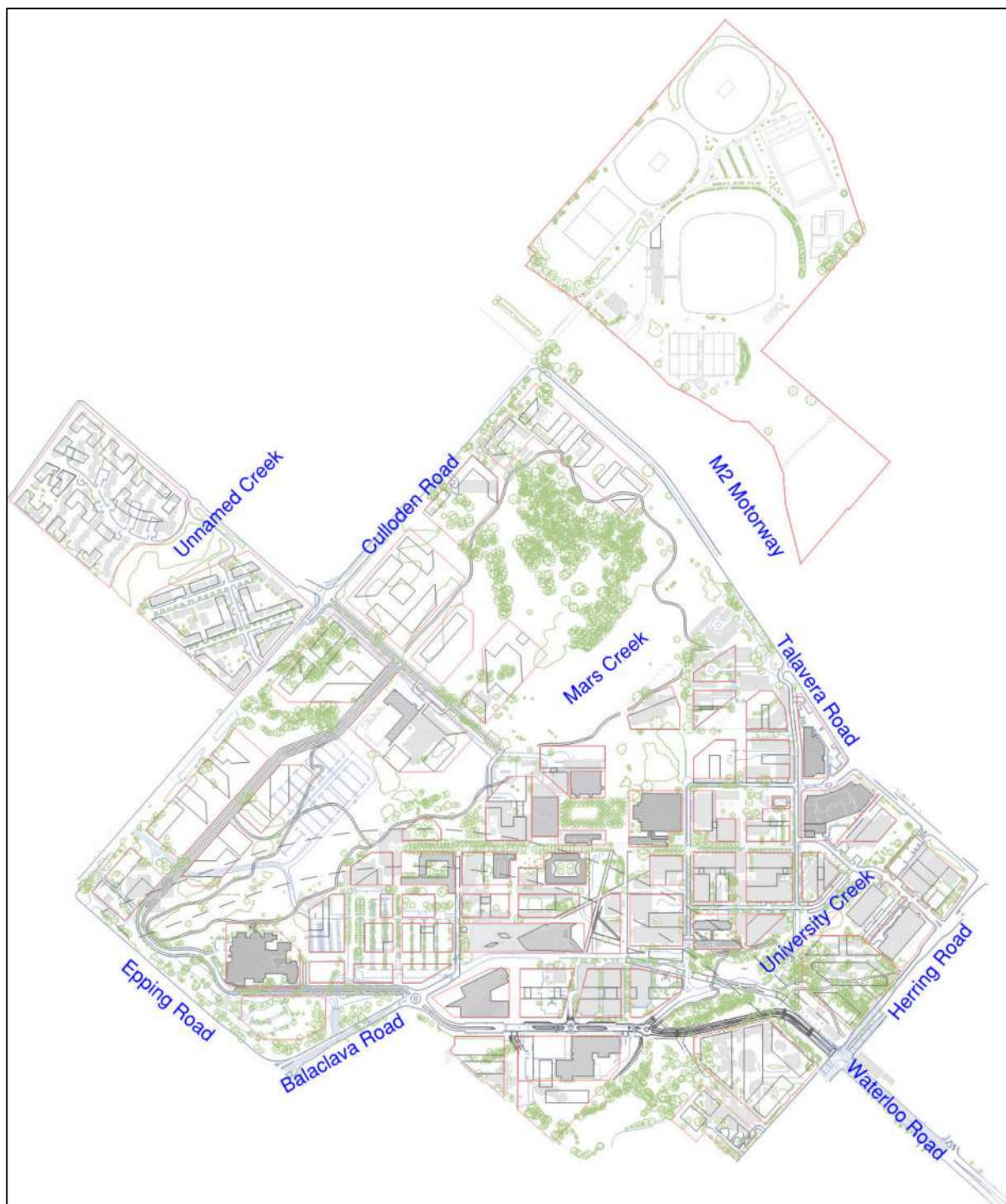


Figure 3 Macquarie University Master Plan

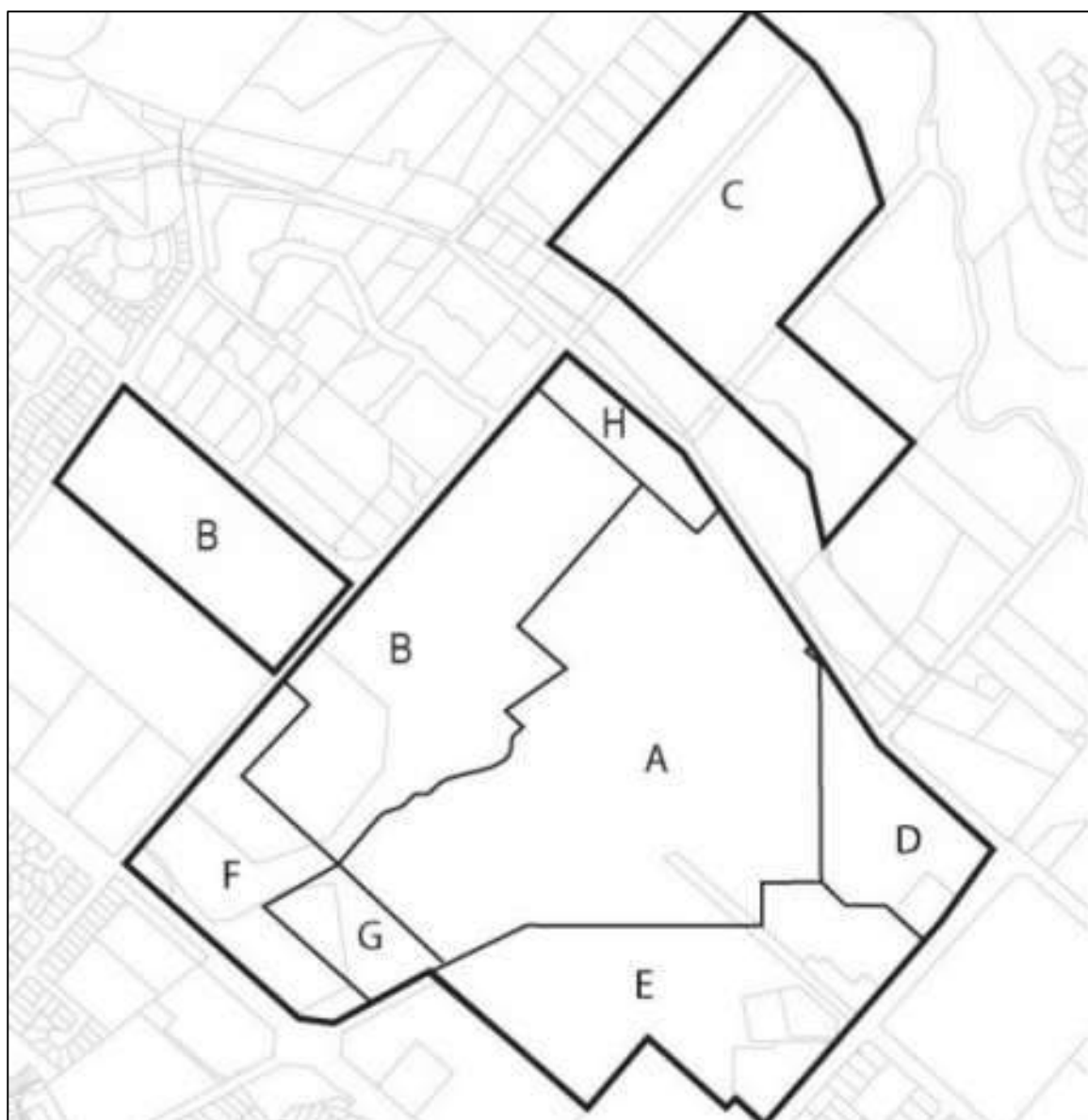


Figure 4 Precinct Layout (Source Cox Design Excellence Strategy and Urban Design Guidelines)

Table 1 University Precincts

Precinct A	Academic Core
Precinct B	University Housing
Precinct C	University Open Space and Playing Fields
Precinct D	Macquarie University Research Park (MURP) and Private Hospital
Precinct E	Station South
Precinct F	Epping Road West
Precinct G	Epping Road Precinct Expansion
Precinct H	Talavera Road North

Under the Concept Plan, the maximum additional GFA across the campus is limited by precinct as per Table 2. Under the master plan, this represents a vision for growth over the next 50 years.

Minor changes to the Concept Plan precinct boundaries are proposed due to the adjustments, upgrades and development under the Master Plan. Changes to these boundaries are shown in Figure 5.

Table 2 Maximum additional GFA

Precinct D	136,000 m ²
Precinct E (Station North)	90,000 m ²
Precinct E (Station South)	85,000 m ²
Precinct E (Triangle South of University Avenue)	155,000 m ²
Precinct F	70,000 m ²
Precinct A	61,200 m ²
Other	Not nominated

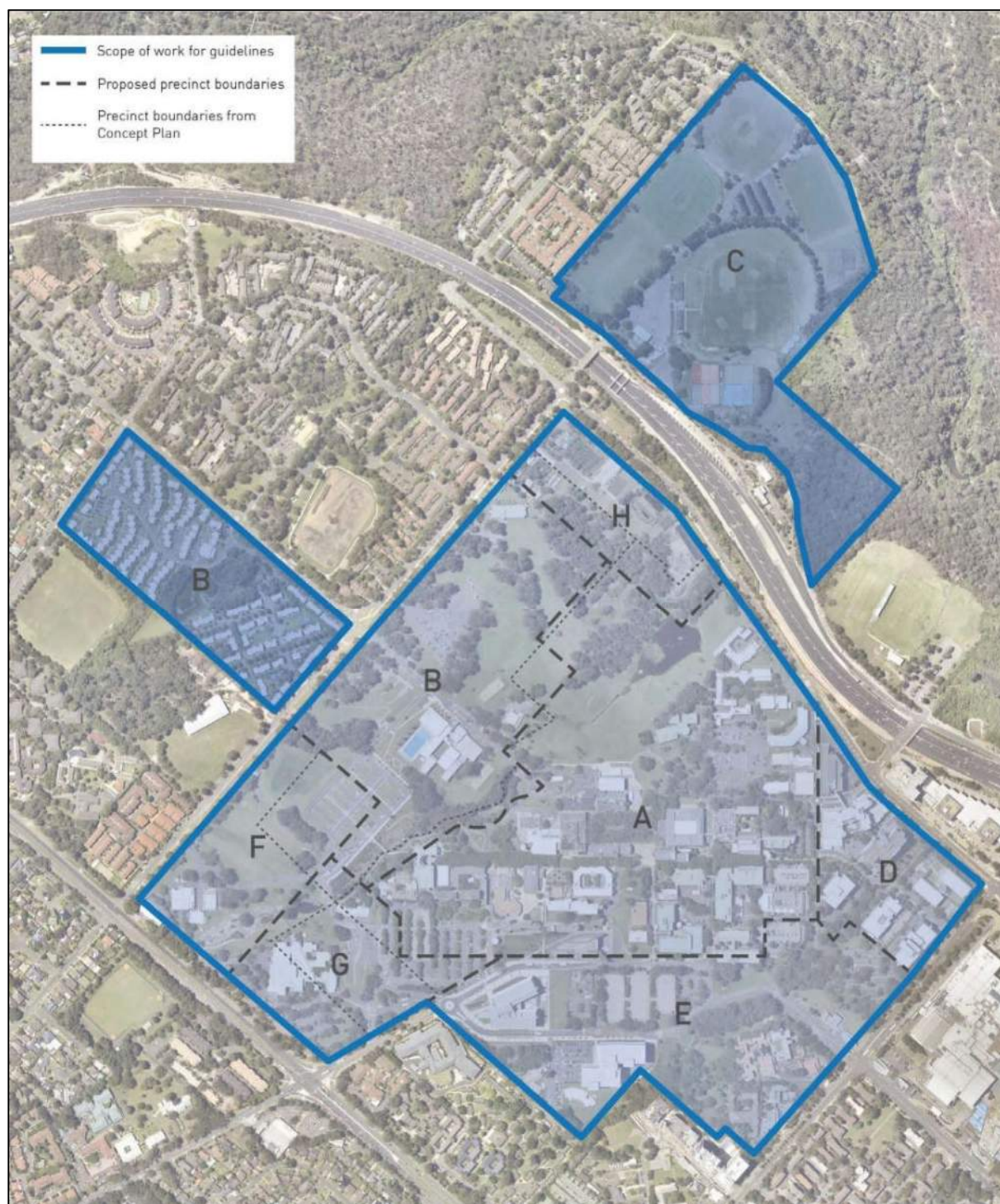


Figure 5 Proposed Precinct Boundaries (Source Cox Design Excellence Strategy)

1.2 Relevant Documents

The following documents have been reviewed in preparing this document:

- City of Ryde Development Control Plan 2014 (DCP)
- University Creek Stormwater Management Plan (TTW, December 2014)
- Macquarie Park Floodplain Risk Management Study & Plan (Bewsher, 2010)
- Mars Creek Catchment Environmental Plan (Storm Consulting)
- Civil Engineering plans prepared by TTW
- Architectural plans (Cox Richardson)
- Macquarie University Design Excellence Strategy and Urban Design Guidelines draft 6 (Cox Richardson)
- Macquarie University Infrastructure Plan

2.0 Riparian Zone, Flooding and Stormwater

C4 – Riparian Zone, Flooding and Stormwater	Preparation of a Stormwater Management Plan, incorporating a Vegetation and Threatened Species Plan (on a precinct basis as required via C3).	Landscape Rehabilitation Plan and Vegetation Management Plan Stormwater Management Plan Utilities Management Plan	Previous studies expanded to include the remainder of the main campus.
--	---	---	--

2.1 Stormwater Drainage

2.1.1 Design Criteria

Drainage designs for future works will follow the requirements set out in the DCP. Subsurface systems will be designed to capture and convey a 20-year storm event. Overland flow paths will be designed to convey flows from a 100-year storm event.

The IFD extracted from the Bureau of Meteorology's IFD tool and presented in Table 3 will be used for future design development.

Table 3 IFD data

	2-YEAR	50-YEAR
1 hour	36.27 mm/hr	70.83 mm/hr
12 hour	8.21 mm/hr	17.68 mm/hr
72 hour	2.61 mm/hr	5.89 mm/hr
Skew	0.00	
F2	4.3	
F50	15.85	

2.2 Water Sensitive Urban Design

The City of Ryde DCP 2014 Part 8.2 provides the following stormwater quality targets:

- b. WSUD measures incorporated into the development must satisfy the following pollutant target controls;**
- 90% reduction in the post development mean annual load of total pollutant loads (greater than 5mm)
 - 85% reduction in the post development mean annual load of Total Suspended Solids (TSS)
 - 60% reduction in the post development mean annual load of Total Phosphorous (TP)
 - 45% reduction in the post development mean annual load of Total Nitrogen (TN)

It is recommended that the above removal rates are incorporated to future developments at the University.

2.2.1 Rainwater Reuse

With extensive landscaped areas, Macquarie University is well placed to capture roof water for irrigation use. It is recommended that roof water capture is considered for future developments at the University

2.3 Flooding

Flood studies have been undertaken for both University Creek and Mars Creek.

2.3.1 University Creek

TTW has undertaken flood modelling for University Creek. Refer to University Creek Stormwater Management Plan (TTW, December 2014) for details of the flood modelling. Results of the analysis are presented in **Figure 6** and **Figure 7**. A more detailed map of the proposed flood levels is contained in Appendix A.

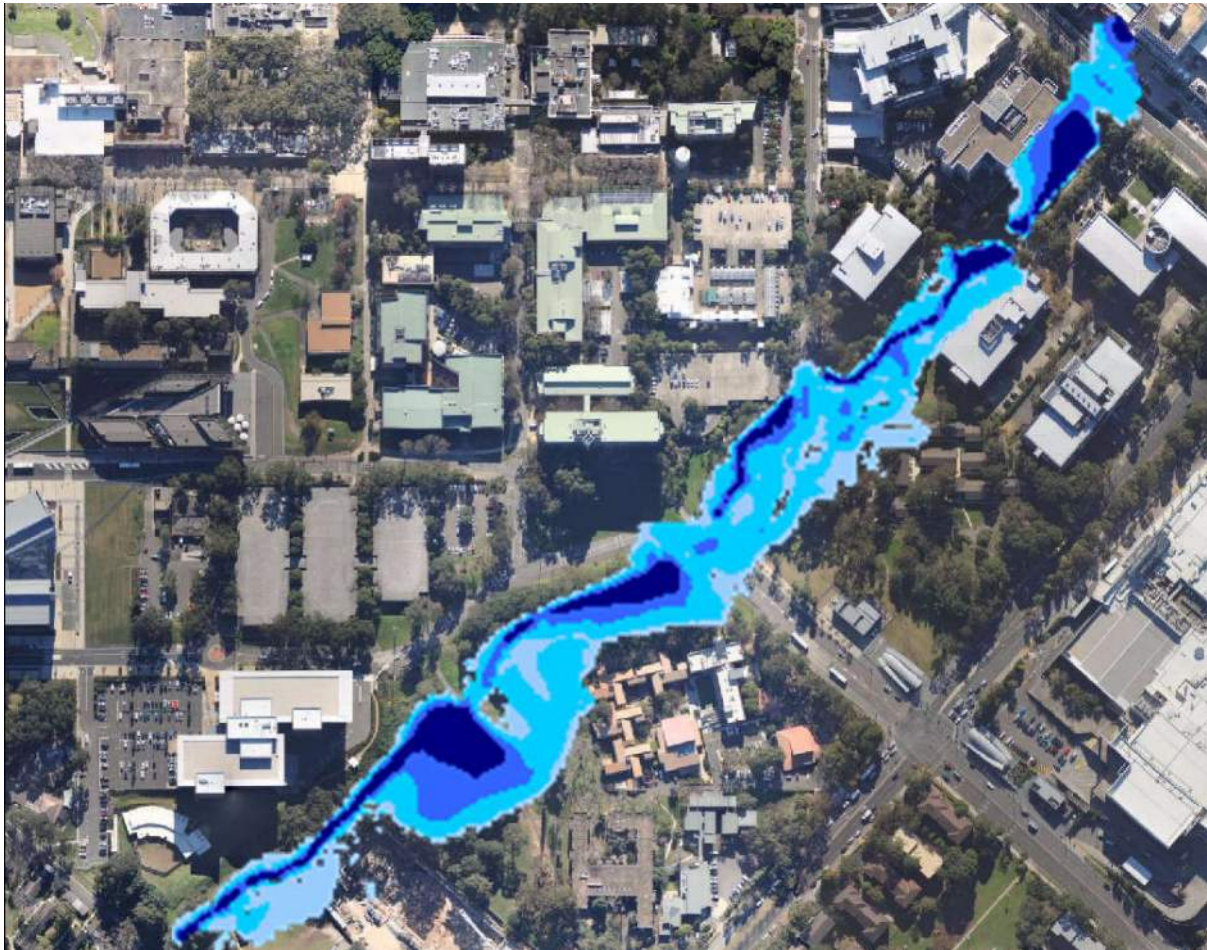


Figure 6 Pre-2013 100-year flood model results in University Creek

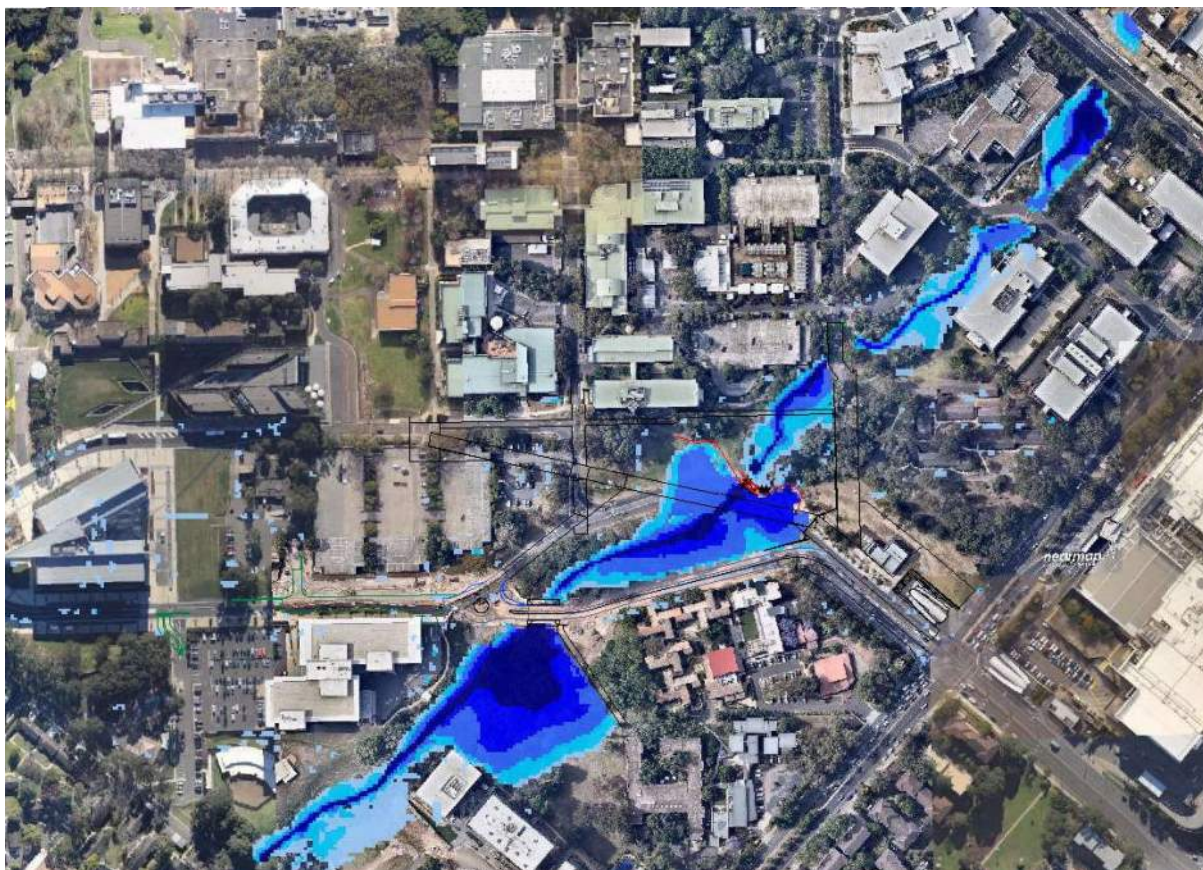


Figure 7 Proposed 100-year flood results in University Creek (Refer to Appendix A for detailed map)

2.3.2 Mars Creek

Bewsher prepared a flood study report covering Mars Creek in April 2010. The results from their 100-year flood modelling are presented in **Figure 8**.



Figure 8 Extract from Bewsher's report - 100 year flood modelling results in Mars Creek

Storm Consulting prepared a Catchment Environmental Plan for Mars Creek. The plan includes flood mapping and levels. Refer to Appendix A in this document for the full flood map with levels. Developments adjacent to the creek will consider flooding and riparian setbacks.

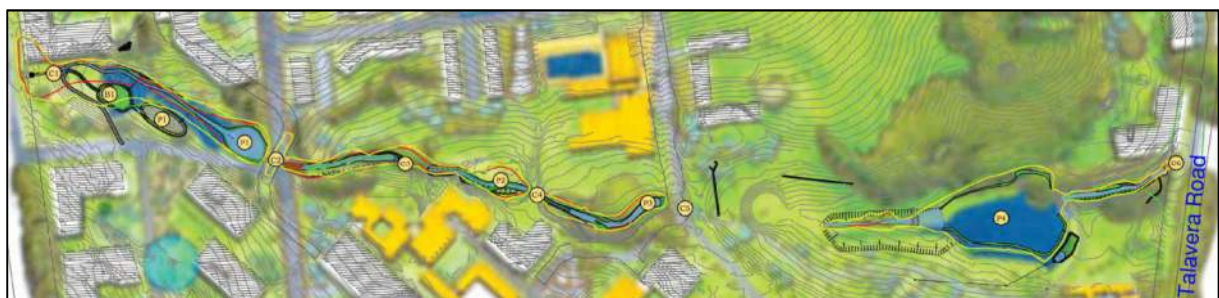


Figure 9 Extract from Storm Consulting's Mars Creek Catchment Environmental Plan

2.3.3 Flooding Controls

The Ryde Council DCP 2014 outlines the following controls for building adjacent to flood affected land:

- The level of habitable floor areas to be equal to or greater than the 100 year flood level plus freeboard of 500mm.
- Non-habitable floor levels to be equal to or greater than the 100 year flood level plus freeboard of 500mm where possible, or otherwise no lower than the 20 year flood level plus freeboard of 500mm unless justified by a site specific assessment.
- Habitable floor levels to be minimum 500mm above adjacent ground levels.
- Non-habitable floor levels to be minimum 300mm above adjacent ground levels.
- Garages capable of accommodating more than 3 motor vehicles on land zoned for urban purposes, or enclosed car parking, must be protected from inundation by floods equal to or greater than the 100 year flood.

The DCP 2014 (chapter 8.2, section 4.4.2) includes the requirement that the entrance to basement car parks is above the Probable Maximum Flood (PMF). Correspondence with Council has confirmed this requirement due to the risk of basement car park flooding.

- Basement parking or parking at levels below the adjacent flood levels, a bunded crest at the estimated PMF (probable maximum flood) level prior to descent into the parking area, must be provided such that inundation of the area is prevented.

Modelling of the PMF flood event will need to be undertaken for both Mars Creek and University Creek to inform constraints on future development.

2.4 Construction Phase Stormwater Management

During the construction, erosion and sediment control plans shall be implemented to prevent sediment laden stormwater from entering the council drainage network and the local watercourses. Stormwater controls on site will be detailed in an erosion and sediment control plan, generally in accordance with the "Blue Book" - Managing Urban Stormwater: Soils and Construction (Landcom NSW). The plan will vary based on construction staging and methodology, but will typically include:

- upstream clean water diversion;
- silt fences;
- sedimentation basin;
- dust control; and
- vehicle wash down.

The erosion and sediment control plan includes an inspection and maintenance schedule. The erosion and sediment control plan mitigates against sediment laden stormwater entering the council drainage system and the downstream environment.

3.0 Roadworks

The proposed road layout requires realignment and widening to accommodate the Concept Plan site layout required and the recently constructed Eastern Entry and Precinct E works. New roads are proposed in precincts B, F and G.

4.0 Utilities

C14 – Utilities	Preparation of: – A detailed water supply infrastructure analysis – Services masterplan – Water supply needs analysis. Prior to the submission of the first application for building works.	Utilities Management Plan	Previous study expanded to include the remainder of the main campus.
------------------------	---	---------------------------	--

Macquarie University has developed a campus wide Infrastructure Plan. This plan will be updated to incorporate future infrastructure changes due to the Masterplan development. Any proposed works must refer to the latest version of the Infrastructure Plan.

5.0 Hydraulic Services

David Buckle and Associates has prepared services plans for hydraulic servicing for the masterplan. Notes and overview plans have been included in Appendix B of this document.

The existing Macquarie University site has no stand-alone hydraulic services and relies entirely upon external authority infrastructure as its source of basic services. The authorities responsible for delivering these services have over the past several years been apprised of Macquarie University's expansion plans going forward and have augmented and or planned to augment their infrastructure to cater for the anticipated demands. Feasibility studies have been carried out to validate the assumptions made in projected loads.

5.1 Existing Potable Water and Fire Hydrant Services

Water supply is provided to the site by water mains surrounding the site which are controlled by Sydney Water. Previous studies have indicated that these mains are capable of supporting the proposed developments with some off site augmentation being required by Sydney Water to meet demand. This augmentation requirement is particularly relevant to the North Western segment of the core campus where this off site augmentation will need to have been completed prior to development.

The existing core campus site at Macquarie University has two connections to this Sydney Water infrastructure located within Balaclava Road (Figure 10) and Culloden Roads (Figure 11). These two points feed the privately owned internal water services infrastructure / ring mains that serve the internal development zones within the site. The layout of the existing Macquarie University potable water network is detailed in campus zone plans developed by David Buckle & Associates (NSW) P/L:



Figure 10 Balaclava Rd Main Meter



Figure 11 Culloden Road Main Meter

5.1.1 Masterplanning Potable Water and Fire Hydrant Services

Current masterplanning provides for all developments on the perimeter of the site to be supported by Sydney Water external infrastructure including the future residential expansion of residential (3,500 beds) on the western side of main campus. The masterplanning zones are shown on the accompanying drawing titled H01 Hydraulic Services Concept Plan Services Zoning (refer Appendix B).

All internal development sites will be supported by the Macquarie University internal water mains infrastructure. The internal water mains infrastructure which is monitored on behalf of the University by David Buckle & Associates (NSW) Pty. Ltd. has been interrogated by applying additional loads and has shown that the planned developments can be supported by installing the mains extensions shown on the accompanying drawing titled H02 Hydraulic Services Concept Plan Potable Water & Fire Hydrants (refer Appendix A).

This process of determining water demand analysis for each proposal and incorporating projected peak loads into the hydraulic model of the network is to be carried out for each development proposal prior to commencement to ensure that the existing campus local infrastructure is capable of supporting the projected load.

There is a potential requirement for fire water storage on site to cope with water demand in the case of a fire on site during the domestic demand peak period

5.2 Existing Sewer

The main Campus is serviced by two sewer carriers known as the Mars Creek Carrier and the Balaclava Road Carrier, both of which are Sydney Water assets. Apart from the Sydney Water sewers, the Campus is serviced by a network of sewerage reticulation lines owned and maintained by the University.

5.3 Masterplanning Sewer

Future works will require extensions of the existing sewer network.

Discussion in 2008 with Sydney Water indicated future work planned for 2017 to 2067 would require amplification of the Balaclava Road Carrier beneath the M2 Motorway. Further studies will be required to determine the extent and staging of the augmentation.

5.4 Existing Natural Gas Services

Gas infrastructure to Macquarie University is provided by Jemena. This external infrastructure has recently been upgraded and is capable of supporting current projected loads with the possible exception of any large form of alternative energy scheme such as co-generation and or fuel cell technology adoption.

The Macquarie University campus is provided currently with three independent gas services feeding the internal gas networks. These networks consist of 1 x 100kPa service and 2 x 210kPa services. The layout of the existing Macquarie University natural gas network is detailed in campus zone plans developed by David Buckle & Associates (NSW) P/L:

5.5 Masterplanning Natural Gas Services

The 2 x 210kPa services have adequate capacity to serve projected loads as indicated by the Macquarie University Masterplan by installing the natural gas extensions shown on the accompanying drawing titled H03 Hydraulic Services Concept Plan Natural Gas (refer Appendix B).

The 100kPa service is currently stressed and requires monitoring of future load capacity. The system is capable of being augmented by increasing pressure through the network or be distressed by load shedding proposals.

As with the water services any proposed development fronting public roads on the perimeter of the site will be served with natural gas direct from the authority mains located within the street.

Any proposed development on the site will require the preparation of a gas load analysis for inclusion in the authority and or internal mains capacity models to ensure that the existing infrastructure is capable of supporting the proposed load.

6.0 ELECTRICAL SERVICES

JDG Consulting has prepared electrical and telecommunication servicing plans for the masterplan. Notes and overview plans have been included in Appendix C of this document

6.1 Existing Electrical Services

Ausgrid currently provide electricity supply to the Macquarie University site with High Voltage feeders from both Epping Zone Substation which is located to the West of the site and Macquarie Zone Substation to the East.

Ausgrid currently service the Precinct E Station South site via the Epping Zone Substation to the north-west of the University Campus.

New high voltage conduits run underground from the Macquarie Park Zone Substation along Waterloo Road have been installed to accommodate additional proposed HV augmentation cabling to service the proposed new developments. Internal to the University Campus new conduits run in easement allocations to Ausgrid requirements.

High voltage (HV) (Voltage 11kV) distribution cables run underground in conduit along Epping Road from the north-west to Herring Road then run on the north-west side of Herring Road to the north-east past Waterloo Road.

HV distribution cables also run underground in conduit along Balaclava Road from the north-west to University Ave then run both to the north along Western Road to the north of the Campus and on the south-east side of University Ave to the centre of the Campus.

Residential Colleges facing Herring Road are supplied via the existing HV distribution cables and kiosk substations that will eventually be decommissioned and removed from site.

6.2 Masterplanning Electrical Services

Development for the Macquarie University site within the long term will require augmentation of the current Ausgrid network.

All existing and new services will be run underground. Augmentation of the electricity supply inside the University is required to serve the demands anticipated in Precinct E.

It is proposed to secure an additional 2 off HV distribution feeders from Ausgrid by undertaking additional augmentation works with approval of Ausgrid.

As the masterplan development of the University progresses, the feasibility of establishing a new Ausgrid Zone Substation and the options available to the University in regard to electricity supply to meet all foreseeable future demands will need to be assessed.

In the longer term, utilisation of HV distribution from Ausgrid either from a new Campus Zone Substation or otherwise from an existing upgraded Zone Substation via augmentation works will be based on the options available at the time of construction.

6.3 Existing Telecommunications

Telstra Corporation currently serves the site via the local Telstra telephone exchange to the north-west of the University Campus. Residential Colleges are supplied via the existing telecommunication services running along Herring Road.

6.4 Masterplanning Telecommunications

It is important to note that at this stage no copper or fibre services have been set aside to accommodate the new developments.

New underground telecommunication conduits running from the Herring Road / Waterloo Road intersection will be installed to accommodate additional proposed telecommunication requirements of proposed new developments.

New Telecommunications conduits and pits will be required to be installed within the footpath of all new road infrastructure to provide the capacity for new development to connect copper and fibre services.

Prepared by
**TAYLOR THOMSON WHITTING
(NSW) PTY LTD**



EIRIAN CRABBE
SENIOR ENGINEER

Authorised By
**TAYLOR THOMSON WHITTING (NSW)
PTY LTD**



STEPHEN BRAIN
TECHNICAL DIRECTOR

\\ttw\dfs\Jobfiles\2013\1314\131406\Reports\TTW\170616 Stormwater and Utilities Managment Plan Rev. 1.docx