Stage 4 Planning Proposal Flood Assessment

Westmead Private Hospital

59919071

Prepared for
Erilyan

25 February 2021

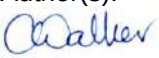
Contact Information

Cardno (NSW/ACT) Pty Ltd
ABN 95 001 145 035

Level 9 - The Forum
203 Pacific Highway
St Leonards NSW 2065
Australia

www.cardno.com
Phone +61 2 9496 7700
Fax +61 2 9439 5170

Author(s):



Catherine Walker
Senior Water Engineer

Venus Jofreh
Water Engineer

Approved By:

Stuart McTaggart
Transport Drainage Lead

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1 Introduction

This report details a flood assessment undertaken to support a planning proposal for the proposed extension (Stage 4) of Westmead Private Hospital (WPH) being prepared Ramsay Health Care. The flood assessment includes hydraulic modelling of the proposed development to determine flood impacts, and assesses the proposed development's consistency with Parramatta City Council flood planning objectives.

Westmead Private Hospital is located on the corner of Darcy Road and Mons Road and adjacent to Milsons Creek as shown in **Figure 1-1**. The site is currently occupied by the existing private hospital which was originally built over a major concrete channel. There is a substantial inlet structure on the northern side of Darcy Road to collect and convey overland flows into the concrete channel.

The proposed Stage 4 works include expansion of the existing hospital to incorporate an emergency department attached to the eastern edge of the existing main building. This is shown in drawings prepared by Silver Thomas Hanley (STH) architects (included as **Appendix A**) and an extract is included in **Figure 1-2**.

Figure 1-1 Locality Plan (SIX maps)

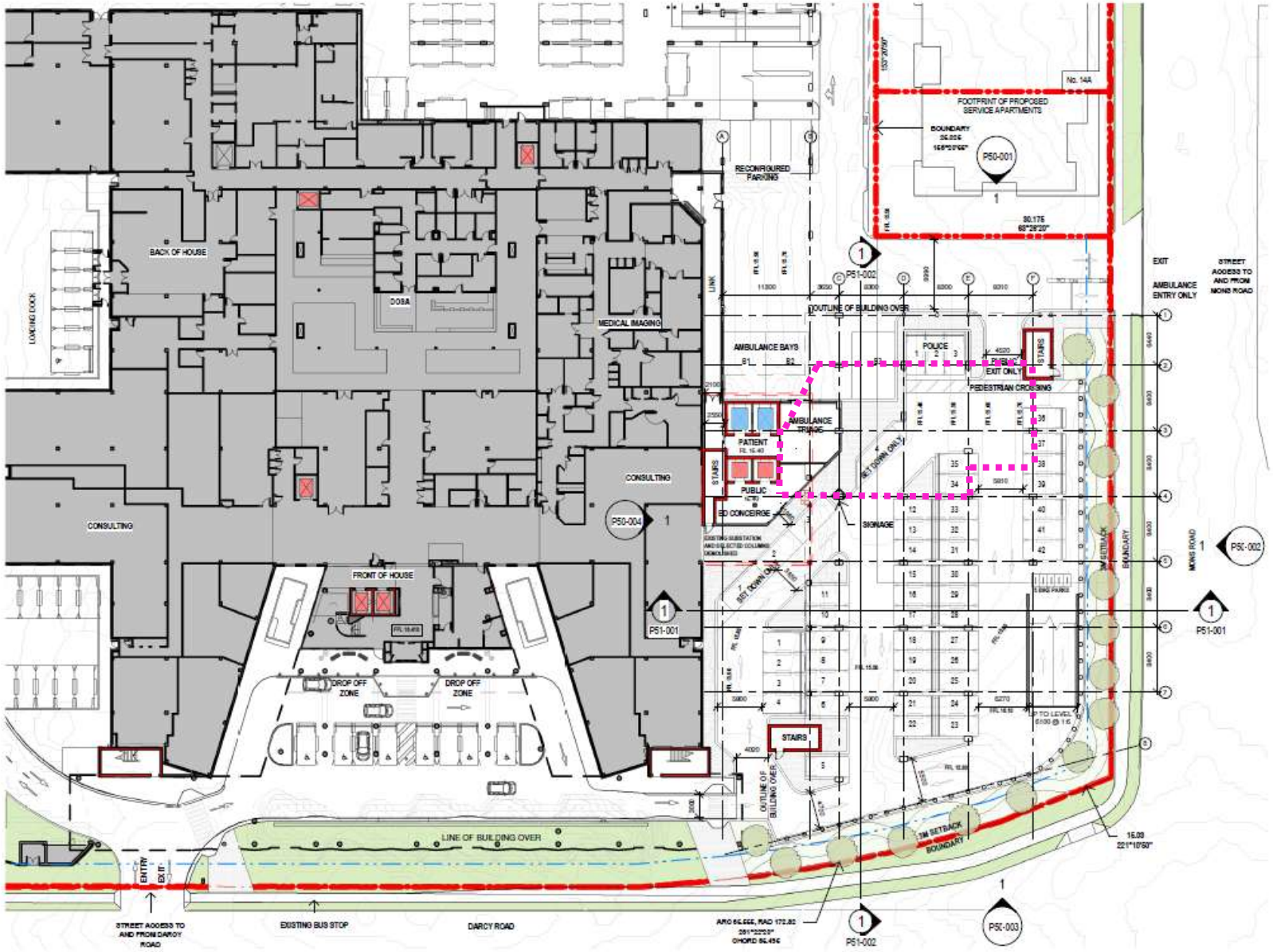

Figure 1-2 Ground Floor Plan with Proposed First Floor Emergency Department Extents (marked in magenta

2 Council Flood Information

Parramatta City Council's Flood Map for the area (refer **Figure 2-1**) shows flood extents derived from the detailed MIKE-11 model of the Upper Parramatta River floodplain and the floodplains of tributary watercourses. This map indicates partial inundation of the site by mainstream overland flooding in a 1% (Annual Exceedance Probability (AEP). event. In a Probable Maximum Flood (PMF) event the site is inundated by flooding from Toongabbie Creek and its tributaries.

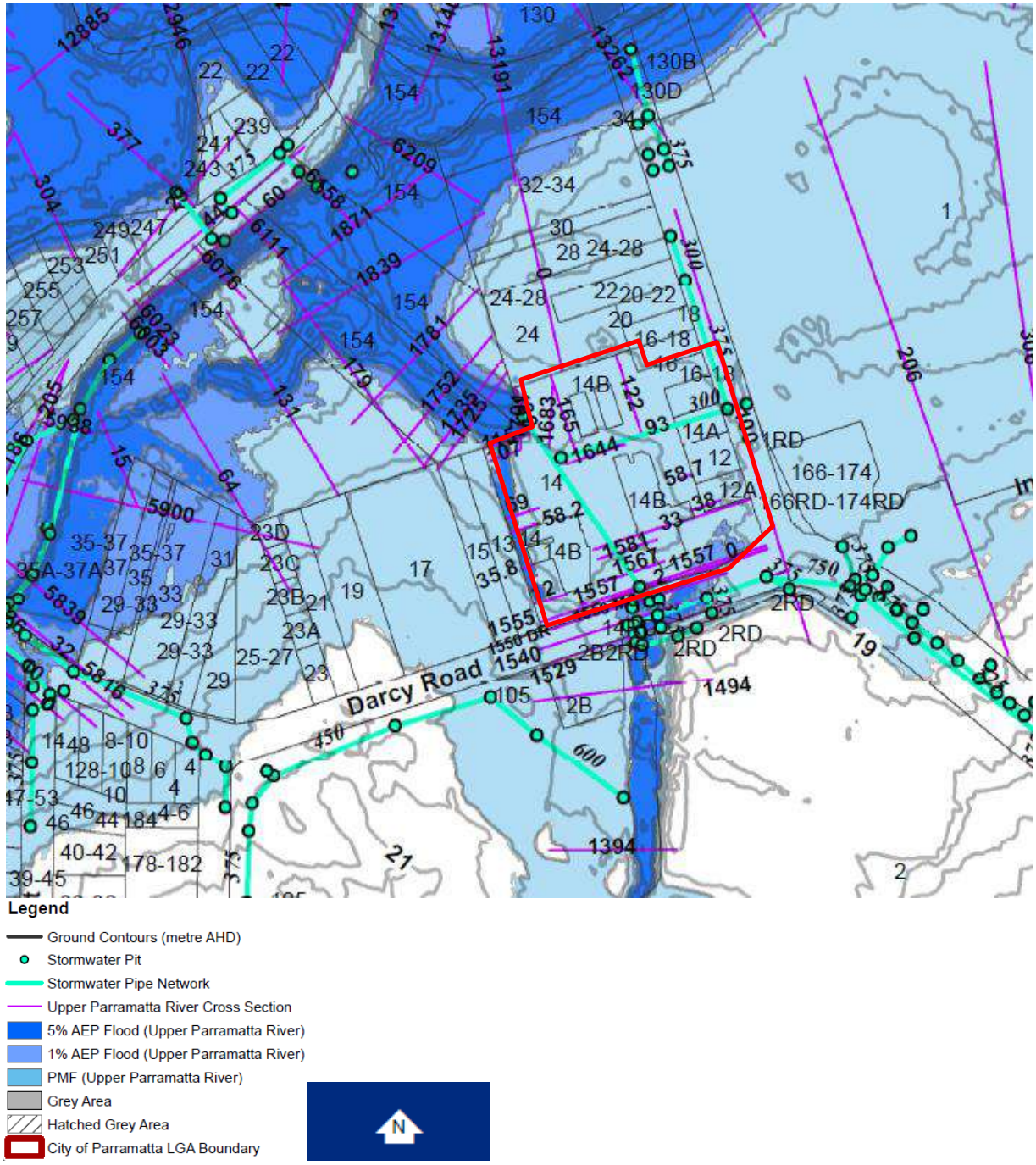

Figure 2-1 Parramatta City Council Flood Map Extract

3 Flood Assessment

3.1 Overview

Council's Flood Map (refer **Figure 2-1**) shows the extent of inundation due to mainstream flooding at the site. Additional flood modelling has been undertaken by Cardno to investigate flood behaviour specifically at the Westmead Private Hospital site. The approach and results are described below.

3.2 Methodology

A local TUFLOW 1D/2D model was established to estimate flow behaviour in the Westmead Private Hospital site for 1% AEP and PMF events. This model was used for the assessment of Stage 3 works as reported in the Westmead Private Hospital Stage 3 Flood Assessment Report (Cardno, 2019). A summary of the model build approach is provided below.

The direct rainfall (rainfall-on-grid) hydrology methodology was used to estimate runoff from the catchment.

The terrain was developed based on supplied topographical survey data, architectural plans and 1 m resolution Digital Elevation Model (DEM). The DEM data was provided by NSW Department of Finance, Services and Innovation Spatial Services (2013) and obtained from Geoscience Australia's Elevation Information System (ELVIS) for areas outside the site boundary. A grid size of 3m x 3m was adopted. The flood model extent is shown in **Figure 3-1**.

A channel beneath the existing hospital conveys flows from south to north. Flows enter this channel through two inlets: one south of Darcy Road, where a densely vegetated open channel is culverted beneath the road, and the second on the northern side of Darcy Road, where a vertically grated inlet pit allows overland flow to drain from Darcy Road into the channel beneath the hospital. Following previous assessments and discussion with Council, it was determined that the application of 100% blockage factor to both of these inlets would be an appropriate and conservative assumption. Therefore, for the purpose of this assessment, the Darcy Road culvert and the channel were omitted from the flood model.

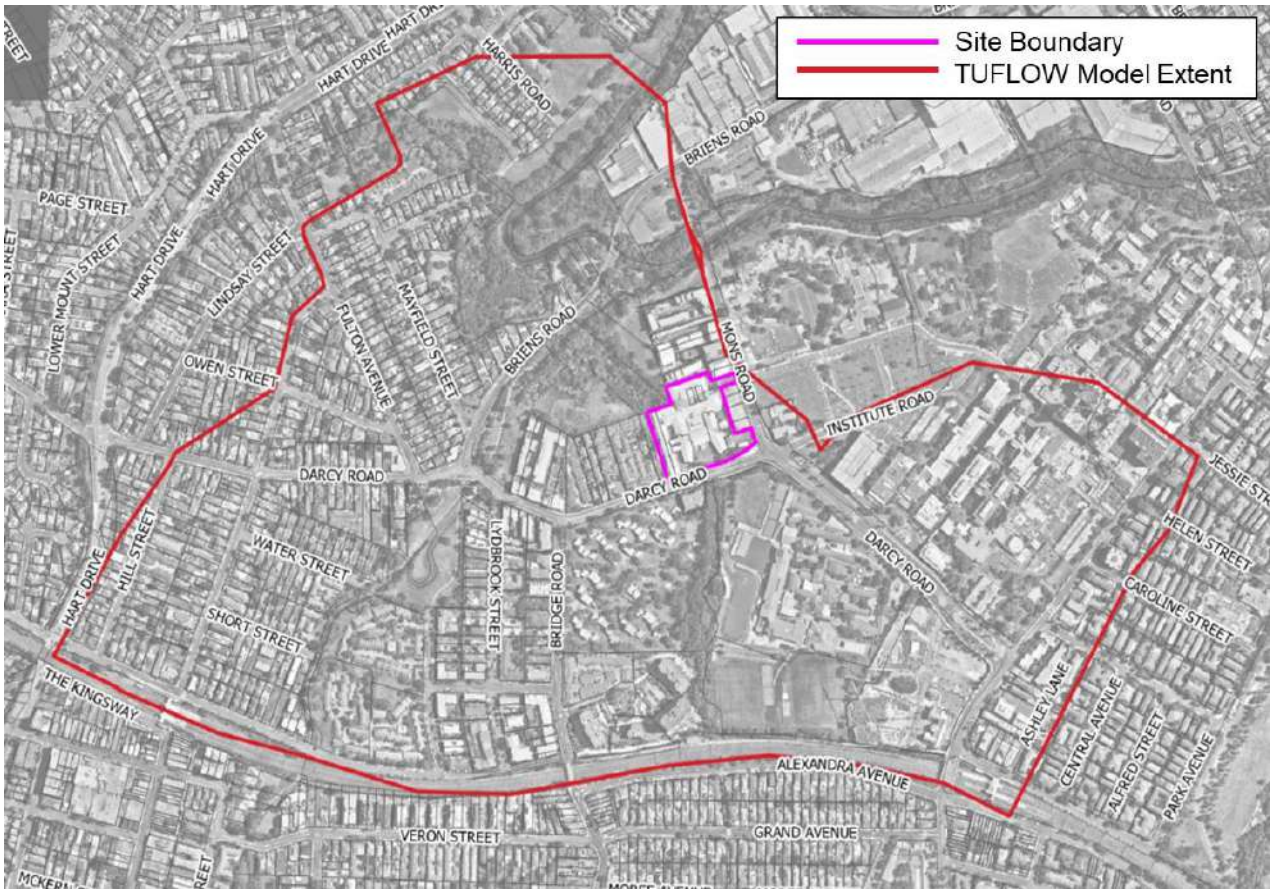

Figure 3-1 TUFLOW Model Extent (red) and Site Boundary (magenta)

3.3 Existing Development

The Existing Conditions model assumes that the Stage 3 works (currently under construction) have been completed, and the Stage 3 TUFLOW model was adopted as the base case for the purpose of this assessment. The model was modified to ensure the local features and existing conditions of the site are presented accurately.

The Existing Conditions model (updated Stage 3 model) was run for the 1% AEP and PMF events.

3.4 Proposed Development

The Existing Conditions model (updated Stage 3 model) was modified with the following changes to represent the Stage 4 development works:

- Proposed Stage 4 building footprints at ground level were “nulled out” of the model to represent the obstruction caused by the walls at ground level. This includes the proposed ambulance triage lobby and two fire-stairs;
- Ramp to the upper carpark is modelled as an area of high roughness; and,
- The proposed terrain grading at the southern side of the carpark to convey flows toward the carpark is included. The proposed grading was introduced to offset the flood impacts caused by the staircase.

Figure 3-2 shows the changes applied into the Stage 4 TUFLOW model.

The Stage 4 model was run for the 1% AEP and PMF events.

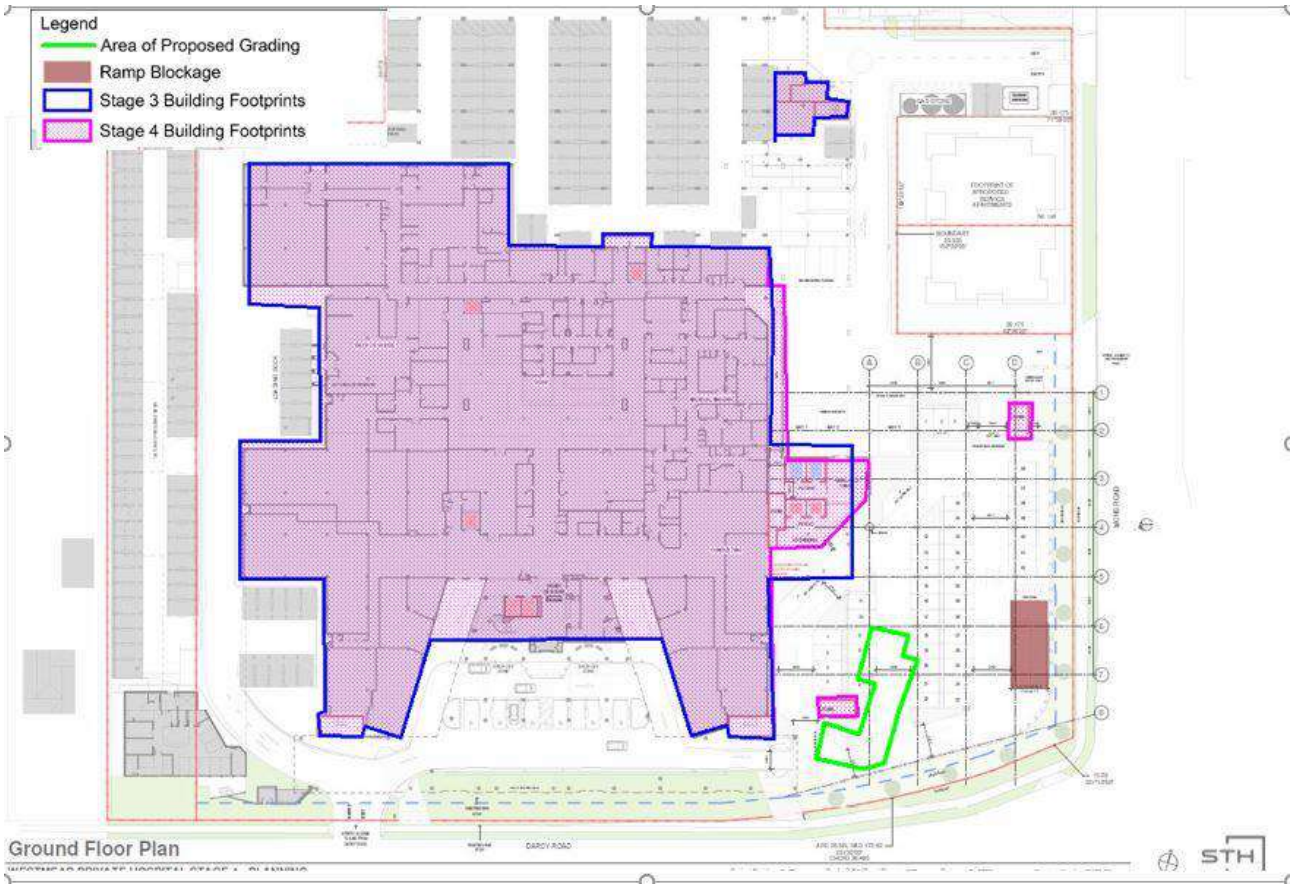

Figure 3-2 Updates Included into Stage 4 Model (Compared to Stage 3)

4 Results

4.1 Existing (Stage 3 Conditions)

The flood behaviour under existing conditions, assuming Stage 3 works are complete, are provided in Appendix B, as set out in **Table 4-1**.

Table 4-1 Existing Conditions Flood Results

Figure No.	Event	Title
B1	1% AEP	Peak Flood Depths and Level Contours
B2	1% AEP	Peak Flood Velocity
B3	1% AEP	Hazard Classifications (H1-H6)
B4	PMF	Peak Flood Depths and Level Contours
B5	PMF	Peak Flood Velocity
B6	PMF	Hazard Classifications (H1-H6)

4.1.2 Peak Flood Levels and Depths

The estimated 1%AEP and PMF flood levels, extents and depth are presented in **Figure B1** and **Figure B4** (**Appendix B)**. In the 1% AEP flood event, the western side of the site is almost flood free with minor flood extents on the western building boundary. However, significant flood extents (with depth of more than 0.6m) is observed elsewhere on the study site. 1% AEP flood levels vary from 16.2 mAHD on Darcy Road to 14.6 mAHD downstream of the study site.

In the PMF event the study site is totally flooded with flood depth of up to 4m. A constant flood level of 18.6 mAHD is observed across the study site.

4.1.3 Velocity and Hazard

Under existing conditions (Stage 3 completed), flood velocities in the 1% AEP are generally low with the exception of a relatively high-velocity flow (up to 2.0 m/s) which traverses the carpark at the eastern side of the study site (**Figure B2**). In the PMF event, low velocities are observed across the site (**Figure B5**).

Combined hazard categories were adopted to assess the flood hazard at and around the study site. A general classification of flood hazard on a floodplain and also vulnerability curves are presented in Error! Reference source not found. (source: Technical flood risk management guideline: Flood hazard, Australian Institute for Disaster Resilience, 2012). The combined curves are divided into hazard classifications that relate to specific vulnerability thresholds as described below:

- **H1:** Generally safe for vehicles, people and buildings.
- **H2:** Unsafe for small vehicles.
- **H3:** Unsafe for vehicles, children and the elderly.
- **H4:** Unsafe for vehicles and people.
- **H5:** Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure.
- **H6:** Unsafe for vehicles and people. All building types considered vulnerable to failure.

According to the results, in the 1% AEP event high hazard areas for people and vehicles (H4 hazard category) occur on Darcy Road and also at the carpark at the eastern side of the study site (**Figure B3**). This can be related to the 100% blockage of underground pipes and inlet which has been adopted in this

assessment. To manage this circumstances, an evacuation strategy from this carpark area has been developed as part of the Stage 3 of this development in the “Westmead Private Hospital Flood Emergency Detailed Response Plan” (Cardno, 2021).

In the PMF event due to the high depth of flood the site is generally within the high hazard area (category H5).

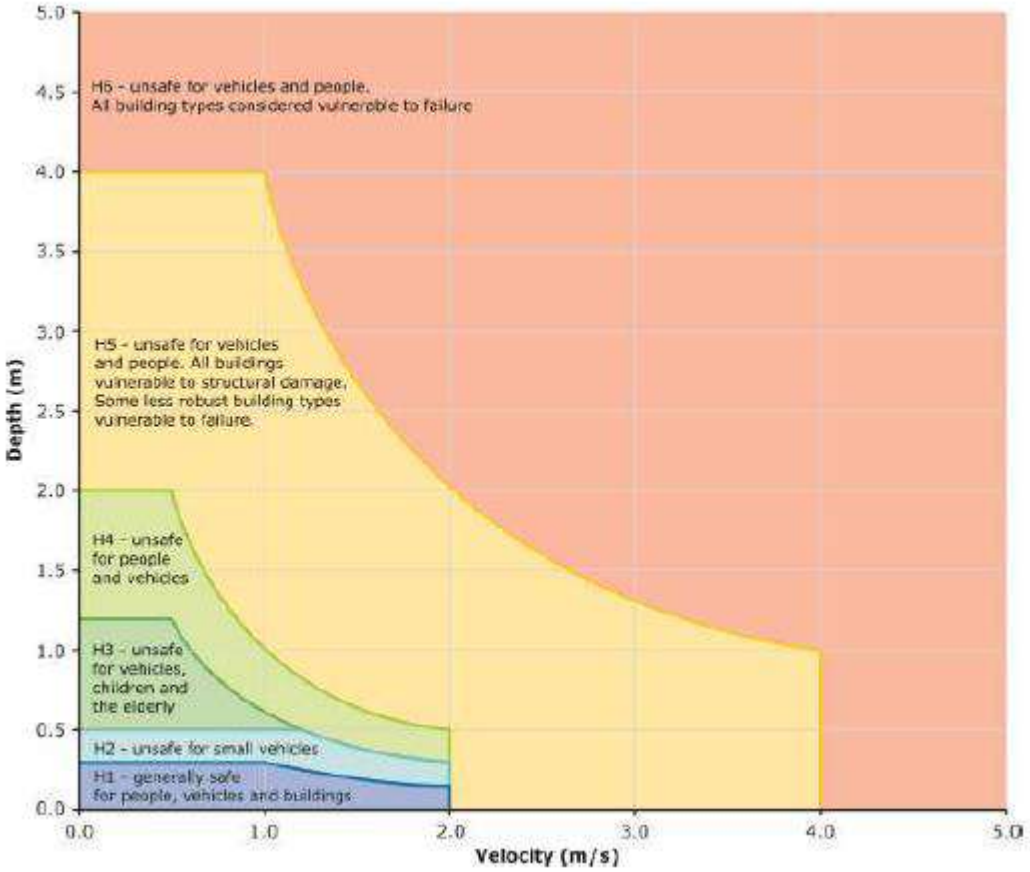

Figure 4-1 Hazard Category Definitions (Source: Technical flood risk management guideline: Flood hazard, Australian Institute for Disaster Resilience, 2012)

4.2 Proposed Development

The flood behaviour under proposed conditions (Stage 4 works) are provided in Appendix B, as set out in Table 4-2.

Table 4-2 Proposed Conditions Flood Results

Figure No.	Event	Title
C1	1% AEP	Peak Flood Depths and Level Contours
C2	1% AEP	Peak Flood Velocity
C3	1% AEP	Hazard Classifications (H1-H6)
C4	1% AEP	Flood Impacts
C5	PMF	Peak Flood Depths and Level Contours
C6	PMF	Peak Flood Velocity
C7	PMF	Hazard Classifications (H1-H6)
C8	PMF	Flood Impacts

4.2.2 Peak Flood levels and Depth

Similar to the existing conditions, significant 1% AEP flooding is observed at the eastern side of the study site and also on Darcy Road. 1% AEP flood levels vary from 16.2 mAHD on Darcy Road to 14.6 mAHD downstream of the study site (**Figure C1**).

In the PMF event, similar to the existing conditions the study site is totally flooded with flood depth of up to 4 m. A constant flood level of 18.6 mAHD is observed across the study site (**Figure C5**).

4.2.3 Velocity and Combined Hazard

1% AEP flood velocities in the proposed conditions remain similar to existing, the only difference is that the stair case at the south-eastern corner of the building will act as a blockage to flow and therefore the flood velocities immediately upstream of it will decrease. The velocity around the staircase will increase as a result of the proposed grading. High hazard areas on Darcy Road and within the carpark will remain the same (**Figure C2** and **Figure C3**).

PMF flood velocities remain low while hazard will be high all across the site as in the existing condition (**Figure C6** and **Figure C7**).

4.3 Impact Assessment

A comparison of the 1% AEP flood levels under the existing (inclusive of Stage 3) and Stage 4 conditions reveals that the flood levels will generally remain unchanged. Increased flood levels of up to 25 mm are observed at the north-east corner of the site however the impacts are contained within study site boundary and are not affecting any adjacent properties or roads. Localised decreases of flood levels (up to 35 mm) are observed within the carpark. A 1% AEP difference plot representing Proposed flood levels less Existing levels is presented in **Figure C4**.

In the PMF event differences between the existing and proposed flood levels are negligible (**Figure C8**) as the soffit of the first floor is proposed to be 19.45 mAHD, which is above the PMF level of 18.6 mAHD.

5 Consistency with Council Flood Planning Policies

Ramsay Health Care is in the process of preparing a Planning Proposal for submission to Parramatta City Council (Council) for the development an extension to Westmead Private Hospital ('Stage 4'). The proposed development site is subject to flood risk, and as such, Council requires the proponent to submit a Flood Report that demonstrates consistency with the objectives of its various planning policies, including Direction 9.1(2) Section 4.3: Flood Prone Land,

5.1 Environmental Planning and Assessment Act 1979, Direction 9.1(2) Section 4.3: Flood Prone Land

5.1.1 Objectives

The objectives of this direction area:

a) To ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005, and
b) To ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.

5.1.2 Consistency with Direction 9.1(2) Section 4.3: Flood Prone Land

This Flood Impact Assessment report sets out the impact of the proposed development on existing flood behaviour, both on and off the subject land. The assessment concludes that localised changes in flood behaviour in the 1% AEP event are contained within the site boundary, and that there are no changes to flood behaviour in the PMF. The assessment has been undertaken in accordance with industry best practice and the principles of the Floodplain Development Manual 2005.

5.2 Parramatta LEP Clause 6.3: Flood Planning

5.2.1 Objectives

The objectives of this clause are as follows—

a) to minimise the flood risk to life and property associated with the use of land,
b) to allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change,
c) to avoid significant adverse impacts on flood behaviour and the environment.

5.2.2 Consistency with Parramatta LEP Clause 6.3

The Emergency Department constructed as part of the Stage 4 development at Westmead Private Hospital is proposed to be located on the first floor of the building, above the PMF peak flood level, meaning that safe shelter-in-place can be readily facilitated during a flood event. Emergency management will be governed by the Westmead Private Hospital Flood Emergency Detailed Response Plan. As above, the flood impact assessment has demonstrated that the proposed development has localised impacts in the 1% AEP event, contained within the site boundary, and negligible impacts in the PMF event.

5.3 Parramatta DCP 2011, Section 2.4.2.1: Flooding

5.3.1 Objectives

O.1 To ensure the proponents of development and the community in general are aware of the potential flood hazard and consequent risk and liability associated with the use and development of flood liable land.

O.2 To manage flood liable land in an economically, environmentally and socially sustainable manner.

O.3 To ensure that developments with high sensitivity to flood risk (e.g. critical public utilities) are sited and designed to provide reliable access and minimise risk from flooding.

O.4 To allow development with a lower sensitivity to the flood hazard to be located within the floodplain, subject to appropriate design and siting controls and provided that the potential consequences that could still arise from flooding remain acceptable.

O.5 To prevent any intensification of the development and use of High Flood Risk Precinct or floodways, and wherever appropriate and feasible, allow for their conversion to natural waterway corridors.

O.6 To ensure that the proposed development does not expose existing development to increased risks associated with flooding.

O.7 To ensure building design and location address flood hazard and do not result in adverse flood impact and unreasonable impacts upon the amenity or ecology of an area.

O.8 To minimise the risk to life by ensuring the provision of appropriate access from areas affected by flooding up to extreme events.

O.9 To minimise the damage to property, including motor vehicles, arising from flooding.

O.10 To incorporate the principles of Ecologically Sustainable Development (ESD).

The objectives of the DCP are implemented through the controls contained in Section 2 of the Parramatta DCP 2011.

5.3.2 Consistency with the objectives of Parramatta DCP 2011, Section 2.

The following statements are made in response to Section 2 of the Parramatta DCP 2011:

5.3.2.1 Floor Levels

The proposed Emergency Department on the first floor has a finished floor level of 20.45 mAHD which is well above the PMF level (18.6 mAHD).

The ground floor facilities, which include the proposed Ambulance Triage and lifts to higher levels, has a proposed finished floor level of 16.4 mAHD, and is approximately 0.4 m above the 1% AEP level at this location.

5.3.2.2 Flood Affectation

Detailed flood modelling has shown that there is minimal change in flood storage, flood levels, flows or velocities in events up to the 1% AEP flood because the development. In the PMF event the site is subject to backwater flooding as indicated by the flat PMF flood gradient.

Cumulative development of local properties within the catchment is expected to have limited or nil impact on flooding in the vicinity as flows are generally conveyed in Milsons Creek and Toongabbie Creek. Thus similar developments would not affect the passage of flood flows. It is noted that requirements to implement OSD in accordance with the fourth edition of the UPRCT OSD Handbook would control the impact of any new development on peak runoff to watercourses.

5.3.2.3 Car Parking and Driveway Access

The existing ground floor carpark is proposed to be retained as part of the Stage 4 development, with no additional basement carparking proposed.

Bollards, flood warning systems, signage, exits and evacuation routes will be incorporated into the Flood Emergency Detailed Response Plan.

5.3.2.4 Evacuation

The Emergency Department is proposed to be on the first floor, where staff and patients will be able to shelter in place above the PMF level. Reliable access for pedestrians will be provided to access the first floor in case of a flood event. Necessary signage for both the carpark and first floor is specified in the Flood Emergency Detailed Response Plan.

This approach is consistent with the Parramatta Disaster Plan (DISPLAN) 2010, which details arrangements for preparing for, responding to and recovering from emergencies within the City of Parramatta. It is noted also that the 2010 Parramatta DISPLAN, states in part that:

- the intent is to minimise the area of the CBD that is evacuated, noting that some emergencies may require the evacuation of some sections or large sections, if not all of the CBD; and
- shelter in place is used when it is assessed that for safety of the occupants of a building(s) or for control reasons that it is safer for occupants to remain in the building than to be on the streets.

It is expected that this is also the intent for the all other areas within the LGA outside the CBD. The Flood Emergency Detailed Response Plan discussed the proposed actions for the site in a flood event. The FEDRP will be updated to include the specific requirements of the proposed emergency department.

6 Conclusion

This flooding assessment was undertaken to assess the potential impacts of the Stage 4 Westmead Private Hospital development on flooding in the area. The TUFLOW model developed to assess the Stage 3 development was adopted for use in this assessment. The base case assumes that Stage 3 works (currently under construction) are complete.

The Stage 4 (Proposed Conditions) model was developed through inclusion of the following modifications:

- Proposed Stage 4 building footprints at ground level (including the proposed ambulance triage lobby and two fire-stairs;
- Ramp to the upper carpark (modelled as an area of high roughness); and
- The terrain grading at the southern side of the carpark.

The Existing and Proposed Conditions models were run for the 1% AEP and PMF flood events and the results show that:

- The proposed Stage 4 development does not affect flood behaviour outside the site boundary in the 1% AEP event; and
- Proposed first floor levels are higher than estimated PMF levels. The proposed ground floor levels (similar to the existing hospital ground level), are above the 1% AEP level;
- Emergency management will be guided by the Flood Emergency Detailed Response Plan
- The proposed development demonstrates consistency with Council's flood related planning policies.

7 References

Westmead Private Hospital Flood Assessment Report (Cardno, 2019)

Westmead Private Hospital Flood Emergency Detailed Response Plan (Cardno, 2021)

Environmental Planning and Assessment Act (Department of Planning and Environment, 1979)

Floodplain Development Manual (New South Wales Government, 2005)

Technical Flood Risk Management Guideline 7-3: Flood Hazard, Australian Institute of Disaster Resilience, 2017

APPENDIX

A

ARCHITECTURAL PLANS


SITE BOUNDARY
78.03
63°26'00"
OUTLINE OF BUILDING OVER
EXISTING UNDERCROFT PARKING
EXISTING STAIR
WESTMEAD SPECIALIST CENTRE
30.175
333°20'50"
30.005
63°26'20"
EXISTING STAIR
EXIT
ENTRY
GAS STORE
PAD MOUNT SUBSTATION
30.175
71°59'20"
153°20'50"
FOOTPRINT OF APROPOSED SERVICE APARTMENTS
No. 14A
BOUNDARY
25.025
153°20'55"
RECONFIGURED PARKING
30.175
63°26'20"
BACK OF HOUSE
KITCHEN EXPANSION
LOADING DOCK
OUTLINE OF BUILDING OVER
DOSA
MEDICAL IMAGING
LINK
A
B
C
D
STREET ACCESS TO AND FROM MONS ROAD
AMBULANCE ENTRY ONLY
AMBULANCE BAYS
BAY 1
BAY 2
BAY 3
STAIRS
POLICE
PUBLIC EXIT ONLY
PEDESTRIAN CROSSING
AMBULANCE TRIAGE
PATIENT
STAIRS
PUBLIC
ED CONCIERGE
CONSULTING
EXISTING SUBSTATION AND SELECTED COLUMNS DEMOLISHED
MONS ROAD
1
2
3
4
5
6
7
8
FRONT OF HOUSE
DROP OFF ZONE
DROP OFF ZONE
STAIRS
UP TO LEVEL 1
15.03
221°10'50"
ENTRY
EXIT
EXISTING BUS STOP
STREET ACCESS TO AND FROM DARCY ROAD
EXISTING BUS STOP
DARCY ROAD
ARC 36.565, RAD 172.82
231°22'20"
CHORD 36.495

Ground Floor Plan

WESTMEAD PRIVATE HOSPITAL STAGE 4 - PLANNING

Project Number **10487** Scale @ A0 Sheet Size **1 : 200** Date **14/01/2020** Drawing Number:**SK20-001**

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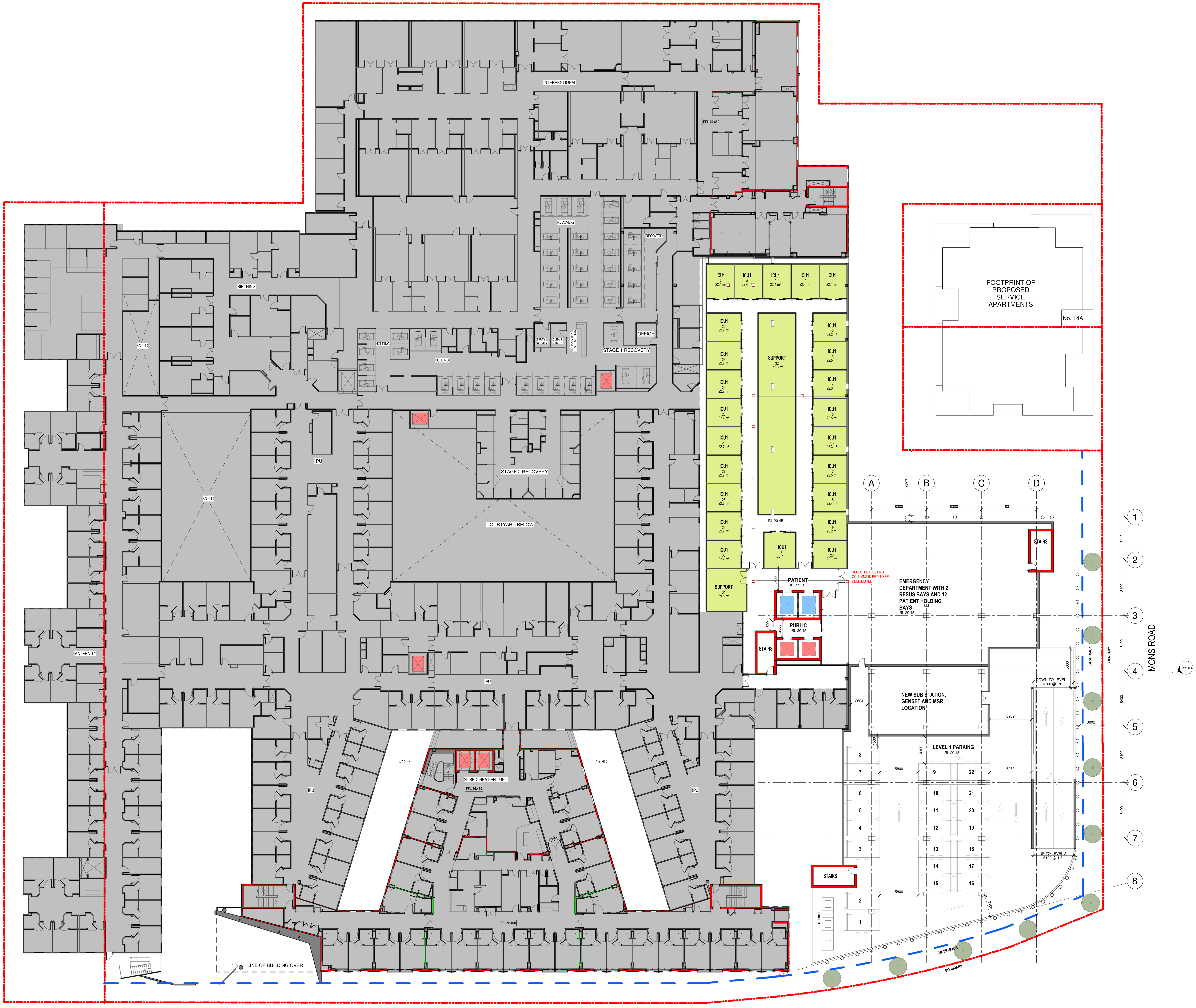

Level 1 Floor Plan

WESTMEAD PRIVATE HOSPITAL STAGE 4 - PLANNING

Project Number 10487 | Scale @ A0 Sheet Size 1 : 200 | Date 14/01/2020 | Drawing Number: SK20-002

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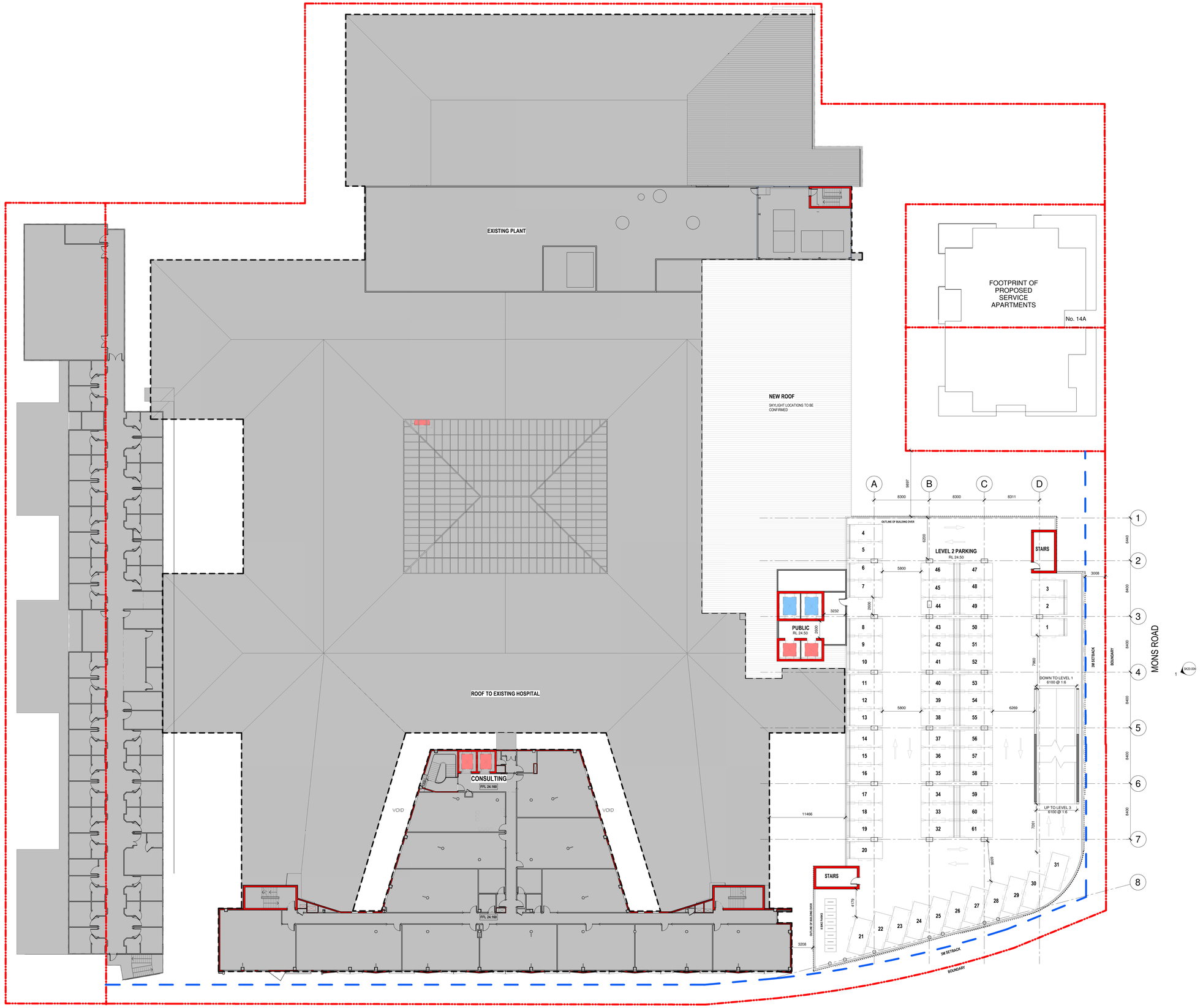

Level 2-7 Floor Plan

WESTMEAD PRIVATE HOSPITAL STAGE 4 - PLANNING

Project Number **10487** | Scale @ A0 Sheet Size **1 : 200** | Date **14/01/2020** | Drawing Number: **SK20-003**

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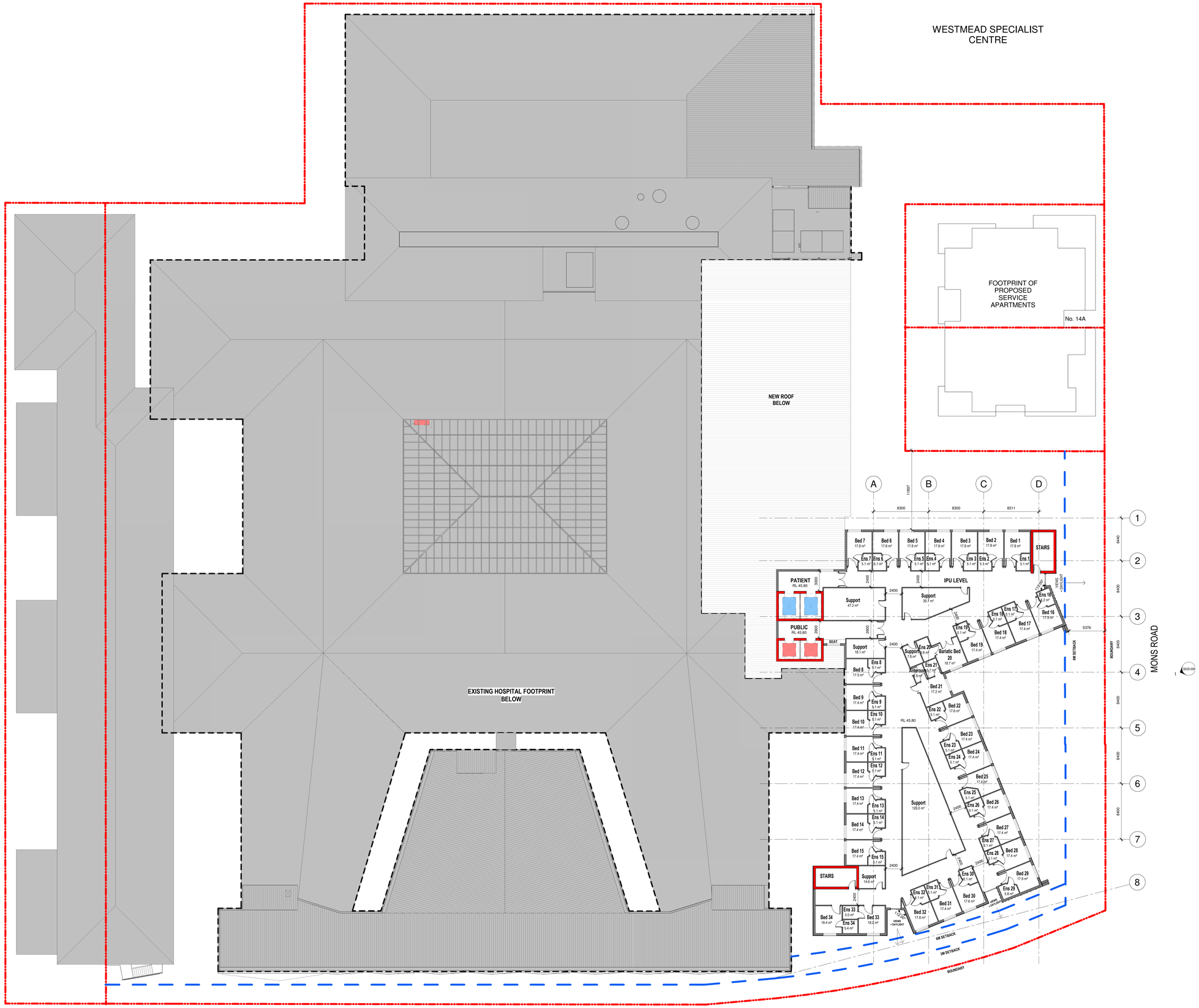

Level 8-16 Floor Plan

WESTMEAD PRIVATE HOSPITAL STAGE 4 - PLANNING

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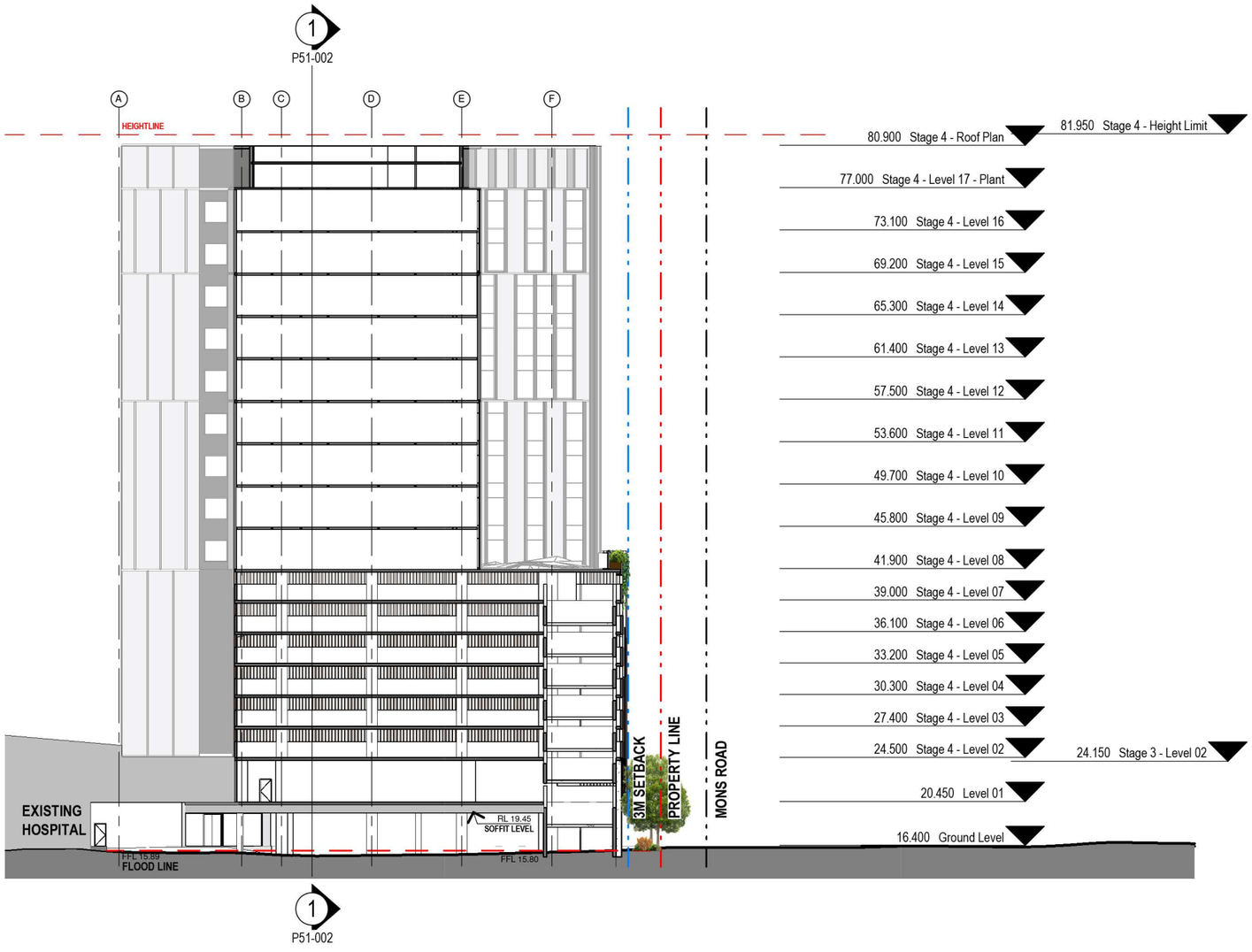

CLIENT:
RAMSAY HEALTH CARE
PROJECT MANAGER:
ERILYAN

PROJECT NAME:
WESTMEAD PRIVATE HOSPITAL
STAGE 4 PLANNING PROPOSAL

SHEET NAME:
CONCEPTUAL SECTION E-W

DRAWING NUMBER	P51-001
PROJECT NUMBER	10487
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DATE	19/02/2021
DRAWN	CT
CHECKED	BR

REVISION	DESCRIPTION	DATE	ISSUED
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B	Issued for Information	CT	19/02/2021

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APPENDIX

B

FLOOD MODELLING RESULTS – EXISTING CONDITIONS

Stage 4 Planning Proposal Flood Assessment

Existing Conditions
1% AEP
Flood Depth & Water Level Contours

Legend

- Site Boundary
- Existing Hospital (Assume Stage 3 Development Complete)
- 0.2m Water Level Contour

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

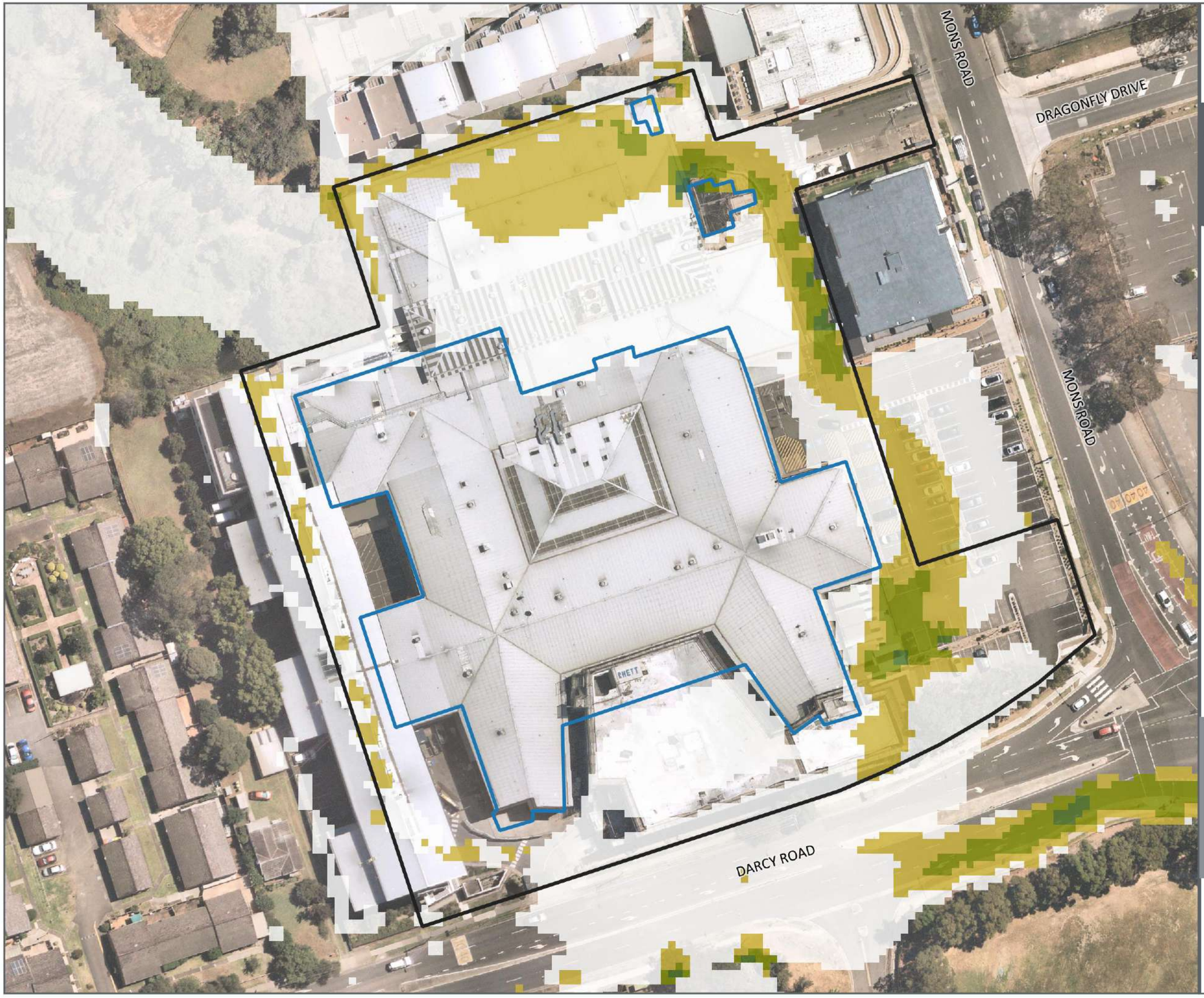
FIGURE B1

1:750 **Scale at A3**

0 8 16 24 32 40 m

Cardno

Map Produced by Cardno Water & Environment (AWE)
Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56



Stage 4 Planning Proposal Flood Assessment

Existing Conditions
1% AEP
Flood Velocities

Legend

- Site Boundary
- Existing Hospital (Assume Stage 3 Development Complete)

Flood Velocities (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE B2

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

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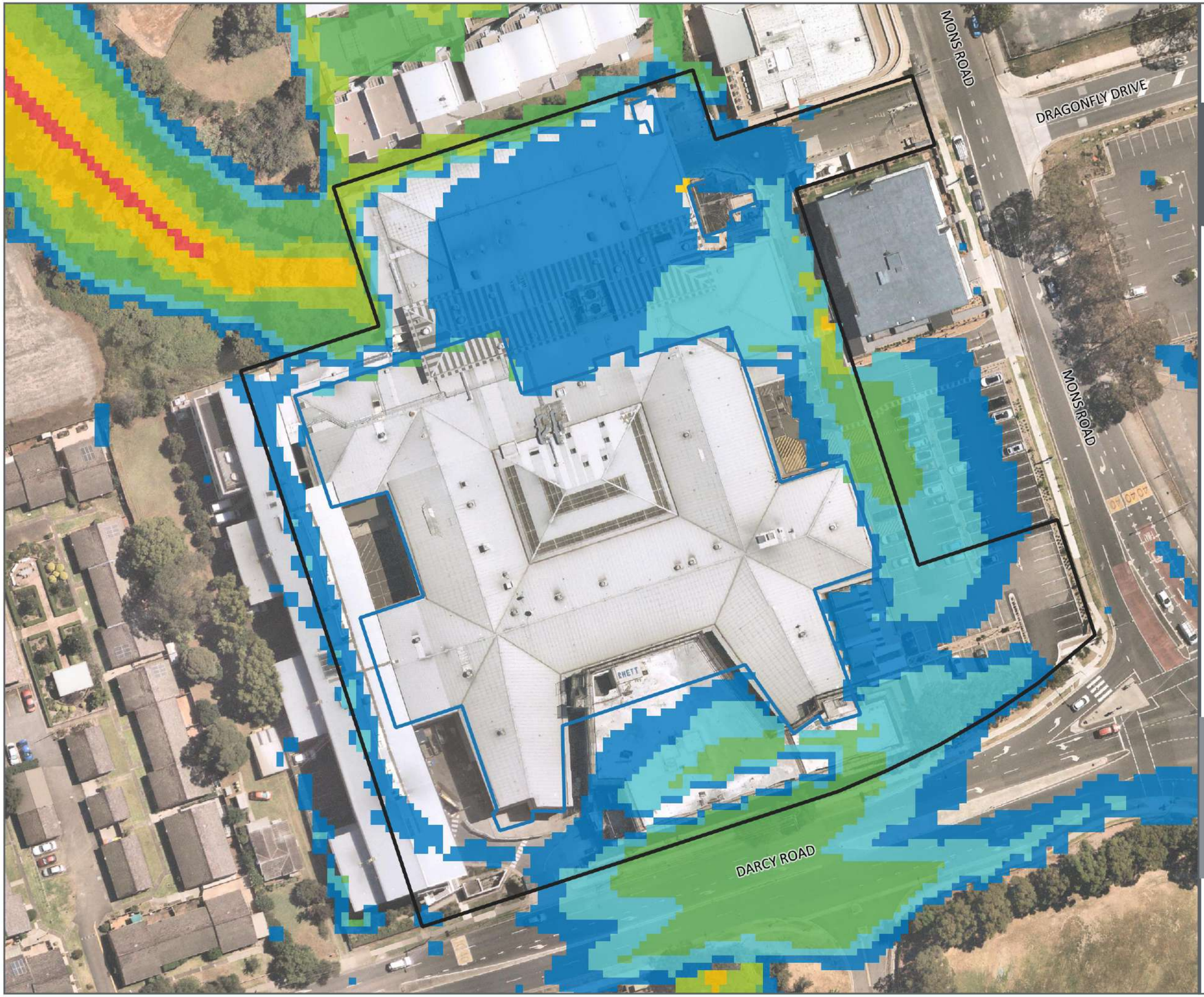
Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56



Stage 4 Planning Proposal Flood Assessment

Existing Conditions
1% AEP
Flood Hazard Categories (H1-H6)

Legend

- Site Boundary
- Existing Hospital (Assume Stage 3 Development Complete)

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE B3

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

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Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56

Stage 4 Planning Proposal Flood Assessment

Existing Conditions
PMF
Flood Depth & Water Level Height

MONS ROAD
DRAGONFLY DRIVE
MONS ROAD
DARCY ROAD

18.63 mAHD
18.62 mAHD
18.62 mAHD
18.63 mAHD
18.62 mAHD
18.63 mAHD
18.8
18.8
18.8
18.8
19.0

Legend

- Site Boundary
- Existing Hospital (Assume Stage 3 Development Complete)
- Spot Height
- 0.2m Water Level Contour

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE B4

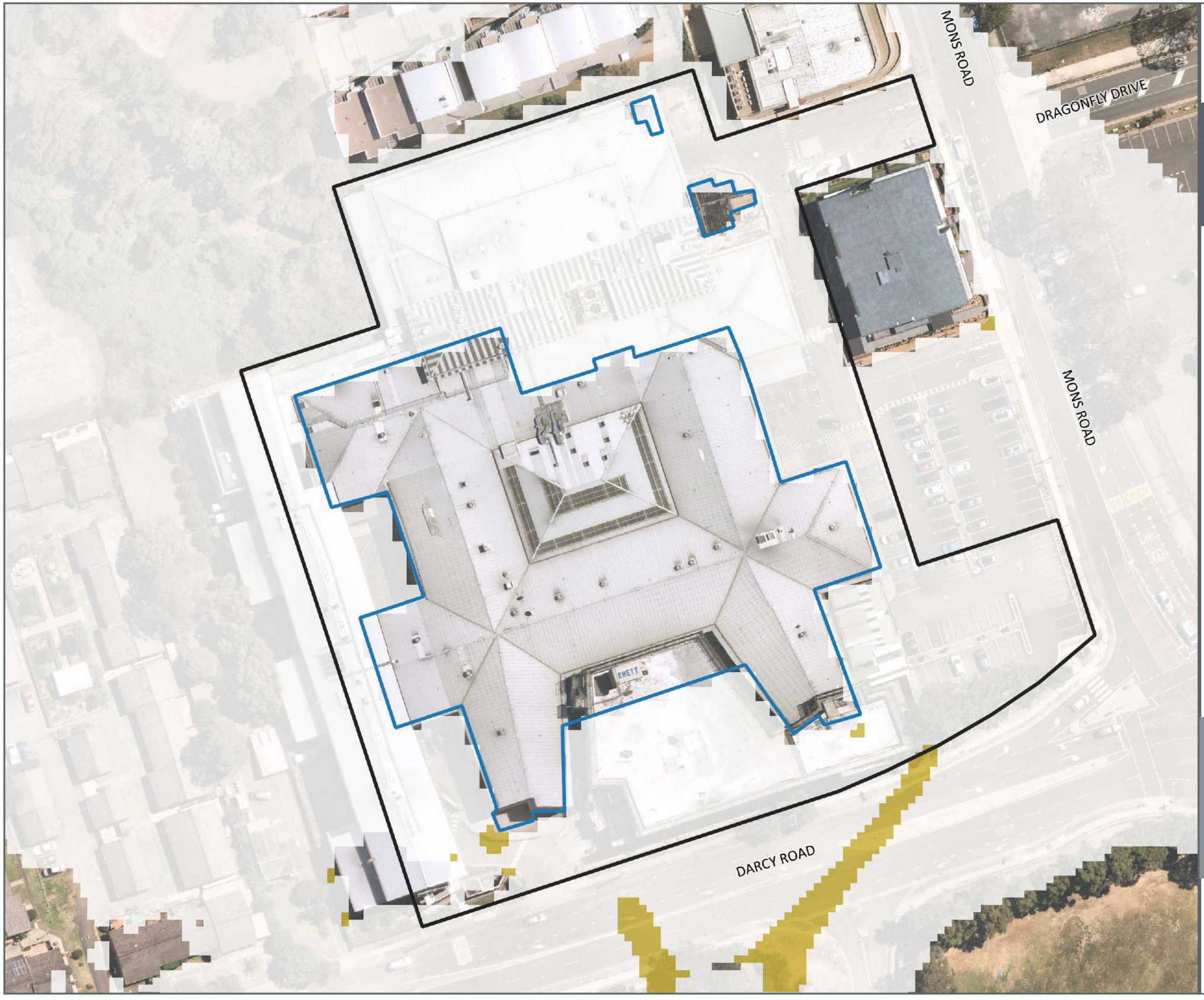
1:750 Scale at A3

0 8 16 24 32 40 m

N

Cardno

Map Produced by Cardno Water & Environment (AWE)
Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56



Stage 4 Planning Proposal Flood Assessment

Existing Conditions
PMF
Flood Velocities

Legend

- Site Boundary
- Existing Hospital (Assume Stage 3 Development Complete)

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE B5

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

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Date: 2021-2-25
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Coordinate System: MGA Zone 56

Stage 4 Planning Proposal Flood Assessment

Existing Conditions
PMF
Flood Hazard Categories (H1-H6)

MONS ROAD
DRAGONFLY DRIVE
MONS ROAD
DARCY ROAD

Legend

- Site Boundary
- Existing Hospital (Assume Stage 3 Development Complete)

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE B6

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

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Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56

APPENDIX

C

FLOOD MODELLING RESULTS – PROPOSED CONDITIONS

Stage 4 Planning Proposal Flood Assessment

Proposed Development
1% AEP
Flood Depth & Water Level Contours

Legend

- Site Boundary
- Proposed Development
- 0.2m Water Level Contour

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE C1

1:750 **Scale at A3**

0 8 16 24 32 40 m

Cardno

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Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56

Stage 4 Planning Proposal Flood Assessment

Proposed Development
1% AEP
Flood Velocities

Legend

- Site Boundary
- Proposed Development

Flood Velocity (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE C2

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

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Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56

Stage 4 Planning Proposal
Flood Assessment

Proposed Development
1% AEP
Flood Hazard Categories (H1-H6)

MONS ROAD

DRAGONFLY DRIVE

MONS ROAD

DARCY ROAD

Legend

- Site Boundary
- Proposed Development

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

FIGURE C3

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

Map Produced by Cardno Water & Environment (AWE)
Date: 2021-2-25
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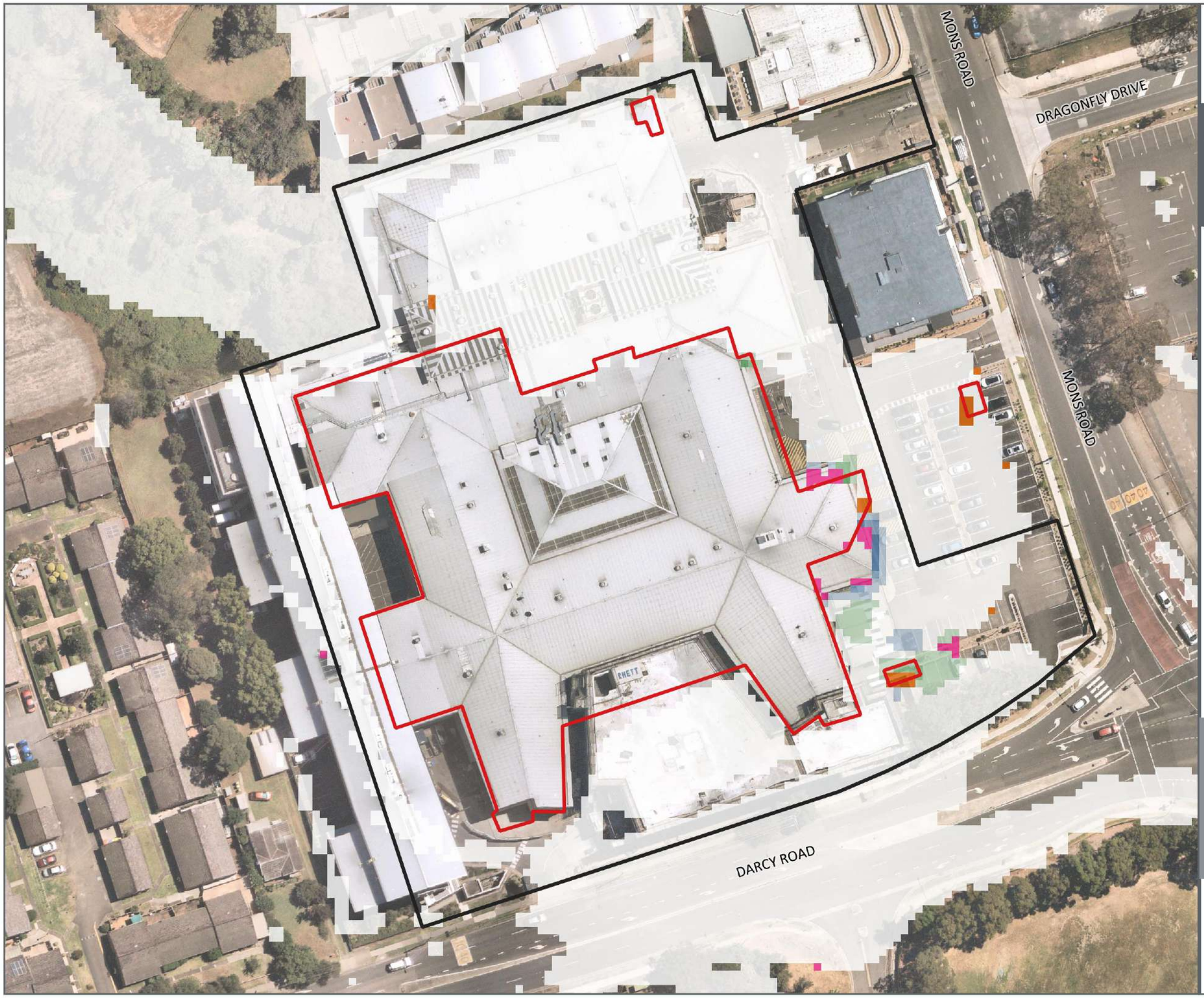
Coordinate System: MGA Zone 56



Stage 4 Planning Proposal Flood Assessment

Proposed Development
1% AEP
Flood Impact

Legend

- Site Boundary
- Proposed Development

Wet Dry Analysis
- Was Wet, Now Dry
- Was Dry, Now Wet

Flood Difference (m)
- < -0.50
- -0.50 to -0.20
- -0.20 to -0.10
- -0.10 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE C4

1:750 **Scale at A3**

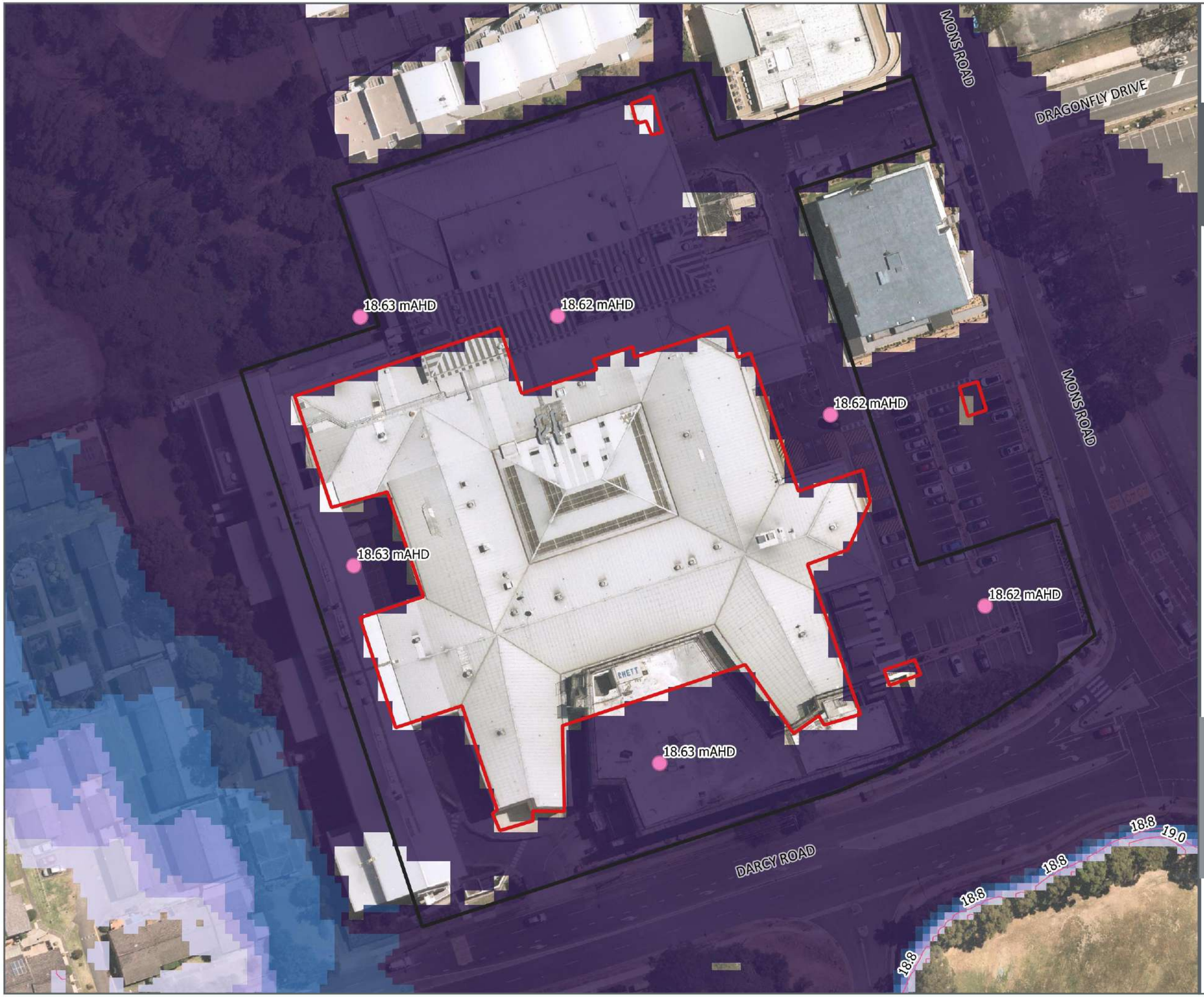
0 8 16 24 32 40 m

Cardno

Map Produced by Cardno Water & Environment (AWE)
Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56

Stage 4 Planning Proposal
Flood Assessment

Proposed Development
PMF
Flood Depth & Water Level Height



Legend

- Site Boundary
- Proposed Development
- Spot Height
- 0.2m Water Level Contour

Flood Depth (m)

- 0.00 to 0.10
- 0.10 to 0.30
- 0.30 to 0.50
- 0.50 to 0.70
- 0.70 to 1.00
- 1.00 to 1.50
- > 1.50

FIGURE C5

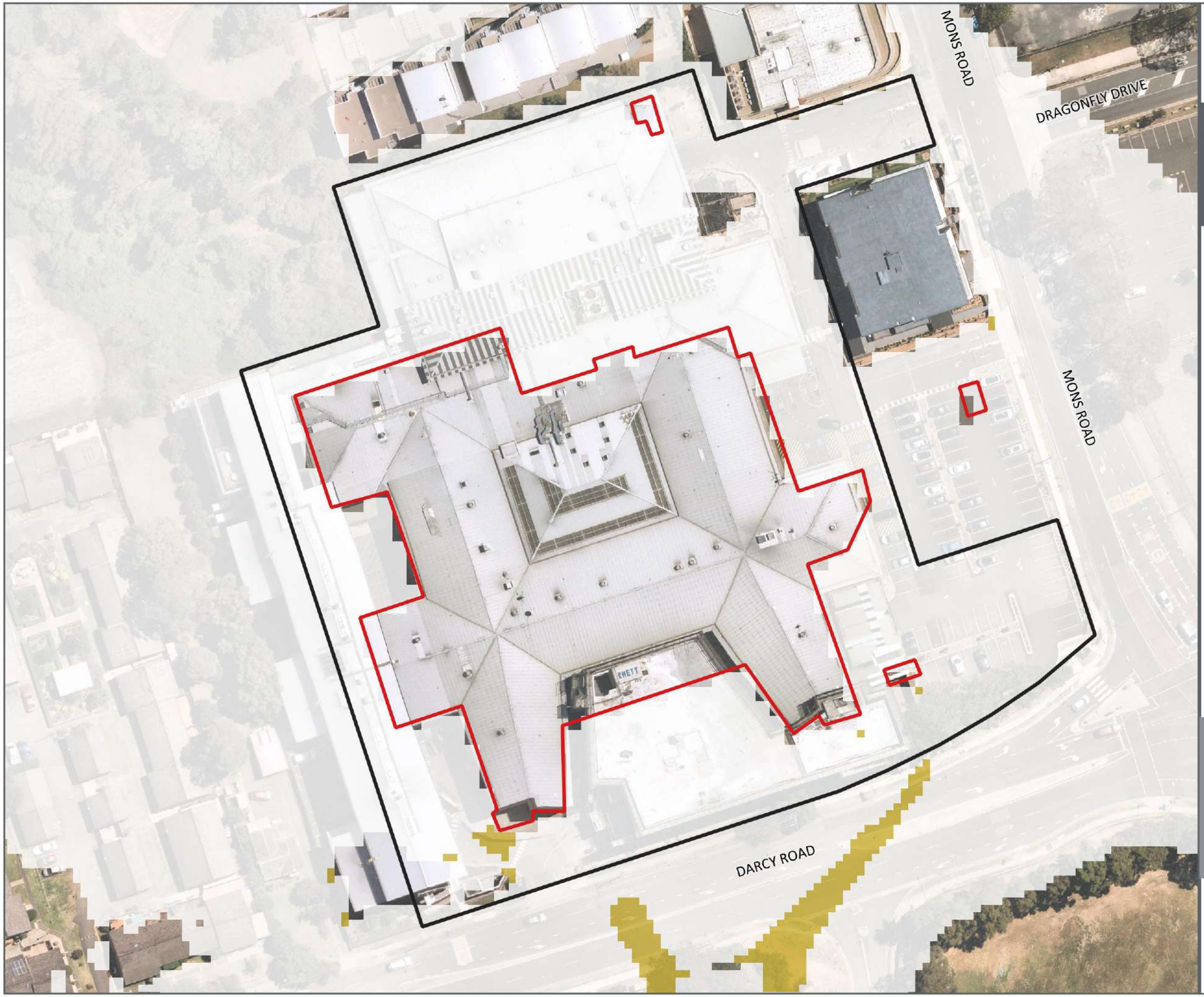
1:750 Scale at A3

0 8 16 24 32 40 m

N

Cardno

Map Produced by Cardno Water & Environment (AWE)
Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56



Stage 4 Planning Proposal Flood Assessment

Proposed Development
PMF
Flood Velocities

Legend

- Site Boundary
- Proposed Development

Flood Velocities (m/s)

- 0.00 to 0.50
- 0.50 to 1.00
- 1.00 to 1.50
- 1.50 to 2.00
- 2.00 to 3.00
- > 3.00

FIGURE C6

1:750 **Scale at A3**

0 8 16 24 32 40 m

Cardno

Map Produced by Cardno Water & Environment (AWE)
Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56

Stage 4 Planning Proposal Flood Assessment

Proposed Development
PMF
Flood Hazard Categories (H1-H6)

Legend

- Site Boundary
- Proposed Development

Flood Hazard Categories

- H1 - Generally safe for vehicles, people and buildings.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for vehicles, children and the elderly.
- H4 - Unsafe for vehicles and people.
- H5 - Unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust buildings subject to failure.
- H6 - Unsafe for vehicles and people. All building types considered vulnerable to failure.

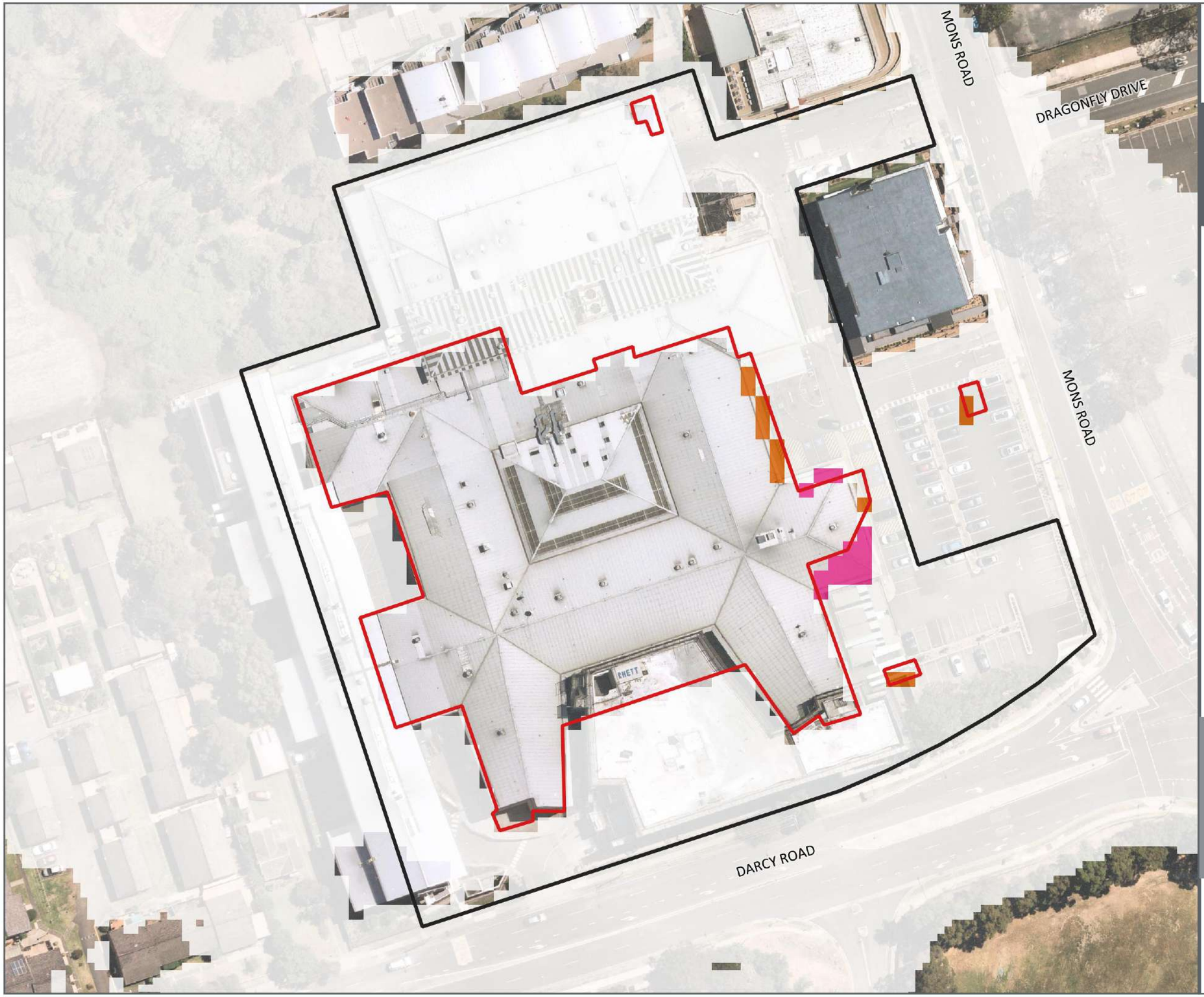
FIGURE C7

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

Map Produced by Cardno Water & Environment (AWE)
Date: 2021-2-25
Project: Stage 4 Planning Proposal Flood Assessment
Coordinate System: MGA Zone 56



Stage 4 Planning Proposal Flood Assessment

Proposed Development
PMF
Flood Impact

Legend

- Site Boundary
- Proposed Development

Wet Dry Analysis

- Was Wet, Now Dry
- Was Dry, Now Wet

Flood Difference (m)

- < -0.50
- -0.50 to -0.20
- -0.20 to -0.10
- -0.10 to -0.05
- -0.05 to -0.01
- -0.01 to 0.01
- 0.01 to 0.05
- 0.05 to 0.10
- 0.10 to 0.20
- 0.20 to 0.50
- > 0.50

FIGURE C8

1:750 Scale at A3

0 8 16 24 32 40 m

Cardno

Map Produced by Cardno Water & Environment (AWE)
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Coordinate System: MGA Zone 56