NORTHROP

CIVIL

# Flood Impact Assessment

*for*

# 17-23 Talavera Road, Macquarie Park

*for* Macquarie Telecom Pty. Ltd.

Level 1, 215 Pacific Highway
Charlestown NSW 2290
02 4943 1777
newcastle@northrop.com.au
ABN 81 094 433 100

# Contents

# Acronyms

| | |
|---|---|
| 12D | 3D Civil Design Software |
| AEP | Annual Exceedance Probability |
| AHD | Australian Height Datum |
| ARI | Average Recurrence Interval |
| AR&R 2019 | Australian Rainfall and Runoff 2019 |
| CoRC | City of Ryde Council |
| DA | Development Application |
| DCP | Development Control Plan |
| DP | Deposited Plan |
| DIPNR | Department of Infrastructure, Planning and Natural Resources |
| DTM | Digital Terrain Model |
| FFL | Finished Floor Level |
| FPL | Flood Planning Level |
| FRMS&P | Flood Risk Management Study and Plan |
| Ha | Hectares – Measure of Area |
| Km | Kilometres – Measure of length |
| LGA | Local Government Area |
| LiDAR | Light Detection and Ranging Terrain Data (also see ALS) |
| m | Measure of length / height / distance (metres) |
| m AHD | Meters above Australian High Datum |
| $m^3/s$ | Measure of flow rate (cubic metres per second) |
| NSW | New South Wales |
| PMF | Probable Maximum Flood |
| SEARs | Secretary's Environmental Assessment Requirements |
| SSDA | State Significant Development Application |
| TUFLOW | A 1D and 2D hydraulic modelling software |

# Introduction

Northrop Consulting Engineers have been engaged by Macquarie Telecom Pty. Ltd. to prepare a Flood Impact Assessment for the proposed development of the Macquarie Park Data Centre Campus IC3 Super West site at 17-23 Talavera Road, Macquarie Park, herein referred to as the subject site.

This flood impact assessment serves to support the State Significant Development Application (SSDA) relating to the proposed development. It has been prepared with consideration to the following Policies, Guidelines and Plans.

- City of Ryde Council Local Environmental Plan (2014).
- City of Ryde Council Development Control Plan (2014).
- City of Ryde Council Stormwater Management Technical Manual (2014)
- Australian Rainfall and Runoff 2019 (AR&R 2019).
- Australian Rainfall and Runoff 1987 (ARR1987).
- NSW Flood Prone Land Policy.
- NSW Floodplain Development Manual (DIPNR, 2005).
- Water Management Act 2000 (NSW Government, 2016).

This Flood Assessment has been prepared by Northrop Consulting Engineers on behalf of Macquarie Data Centres (MDC) care of GIDDIS Project Management and has been produced to support the Environmental Impact Statement (EIS) prepared by Willowtree Planning PTY Ltd (Willowtree Planning).

The EIS has been submitted to the New South Wales (NSW) Department of Planning, Industry and Environment (DPIE), in support of an application for State Significant Development (SSD), for the construction and operation of a data centre, involving earth works, provision of infrastructure and expansion of an existing data centre at 17 – 23 Talavera Road, Macquarie Park (Lot 527 DP 752035).

## Background

A flood investigation has been performed for the subject site for the purposes of a previous Development Application (DA) (LDA 2018/0322). The previous flood investigation was prepared by Northrop Consulting Engineers Pty. Ltd. and was titled:

> *"17-23 Talavera Road, Macquarie Park – Updates to Previously Submitted Flood Impact Assessment" dated the 28th of June 2019, herein referred to as the "Previous DA Investigation (Northrop, 2019)".*

The modelling prepared as part of the Previous DA Investigation (Northrop, 2019) has been used as the basis for this investigation.

Following initial submission of this Flood Impact Assessment, a Request for additional Information (RFI) was received from the City of Ryde Council (CoRC), dated the 16th of May 2022. The RFI requested amendments to the Previous DA Investigation (Northrop, 2019) flood model to enable a more detailed review of the proposed development.

As a result, additional design storm return intervals have been included herein while, a reduced grid size has been considered, enabling review of the proposed structural columns located within the proposed under croft area.

An additional meeting was held with Council Officers on the 27th of June 2022 to discuss the proposed updates to the TUFLOW model, with generally agreement achieved during the meeting with respect to the proposed modelling methodology (pending review of the information presented herein and the associated model and figure files).

Contained herein is an outline of the methodology used in undertaking this assessment, a description of the subject site and the proposed development, a summary of the updates made to the previously approved modelling, and a discussion of the results.

# Methodology

This flood impact assessment has been undertaken generally using the following procedure:

- Desktop review of previous investigations including a review of the Macquarie Park Flood Risk Management Study and Plan (Macquarie Park FRMS&P) completed by Bewsher Consulting in 2011 and the Previous DA Investigation (Northrop, 2019).
- Update previous Developed Case TUFLOW model prepared as part of the Previous DA Investigation (Northrop, 2019) to create the base case or Existing Case model for the purposes of this investigation. Updates to the base case were made based on Council RFI (dated; 16/05/2022) and generally includes:
    - Updates to the TUFLOW model to use latest TUFLOW version (i.e. TUFLOW version 2020-10-AD).
    - Reduced grid size to enable review of any changes in flow behaviour created by the proposed structural columns on the subject site.
- Run the updated Existing Case Model for the 20%, 5%, 1% AEP and PMF design storm events.
- Modify the updated Existing Case TUFLOW hydraulic model to include the proposed development layout, terrain, and proposed pipe diversion, creating the Developed Case scenario.
- Run the Developed Case model for the 20%, 5%, 1% AEP and PMF design storm events.
- Compare the Existing and Developed case results to review the impact the proposed development has on the existing flood behaviour on-site and in adjacent properties.
- Review of the anticipated site flood behaviour with respect to the relevant development controls.

This study has been prepared with consideration to the following plans and reports:

- The Previous DA Investigation prepared by Northrop and dated the 28th of June 2019.
- The previous Flood Impact Assessment Letter for IC3 Super West prepared by Northrop and titled: *"17-23 Talavera Road, Macquarie Park – IC3 Super West Development Application – Flood Assessment"* and dated the 14th of October 2021.
- Architectural Drawings prepared by HDR and dated 27th of September 2022.
- Civil Drawings and Report prepared by Northrop Consulting Engineers.

This report has been prepared for State Significant Development (SSD) application to the NSW Department of Planning and Environment.

# Subject Site and Proposed Development

## Subject Site

The site is described as Lot 527 DP 752035, commonly known as 17 – 23 Talavera Road, Macquarie Park. The site has a total area of approximately 20,000m$^2$, with access achieved via Talavera Road.

The site forms part of the Macquarie Park Corridor, which is the strategic centre of Macquarie Park, being a health and education precinct and an important economic and employment powerhouse in Sydney's North District.

The site is described through its current commercial setting as an existing Data Centre (LDA/2018/0322), adjoining surrounding commercial premises along Talavera Road, and forming part of the wider Macquarie Park Corridor.

Site topography generally falls in a northerly direction with an average grade in the order of two percent. Steeper topography, in the order of eighteen percent, is observed in the north-western corner of the site, adjacent to the driveway entrance to Talavera Road.

The site is situated approximately 12.5 km northwest of the Sydney CBD and 11.3 km northeast of Parramatta. It is within close proximity to transport infrastructure routes (predominantly the bus and rail networks), as well as sharing direct links with the wider regional road network, including Talavera Road, Lane Cove Road, Epping Road and the M2 Motorway.

These road networks provide enhanced connectivity to the subject site and wider locality. Additionally, the site is located within close proximity to active transport links, such as bicycle routes, providing an additional mode of accessible transport available to the subject site.


**Figure 1 - Subject Site**

The catchment upstream of the subject site is approximately 40.5ha in size and consists primarily of commercial and residential land-use. The catchment topography is moderately sloped in the upper and lower reaches with slopes in the order of one to five percent.

Flows from the upstream catchment enter the site from the southern corner and cross the site via the circulation driveway before discharging downstream onto Talavera Road.

## Proposed Development

The proposal represents an extension to the approved data centre (LDA/2018/0322) to allow for additional data storage capacity at the subject site, improving the overall operational efficiencies and provision of technology services to customers and the wider locality. The proposal generally comprises of the following:

- A seven-storey (7) building plus ground floor.
- Ancillary office space and staff amenities.
- A back-up power system.
- Associated infrastructure, car parking, loading docks and landscaping.

The subject site is located within the City of Ryde Council Local Government Area (LGA). The proposal seeks to operate 24 hours per day, seven (7) days per week.

The particulars of this proposal are summarised below:

- Minor earthworks involving cut and fill works.
- Infrastructure comprising civil works and utilities servicing.
- Construction of a seven (7) storey building plus ground floor extension, comprising up to:
    - 15 data halls.
    - 20 backup generators.
- Fit out of the building for use as a data centre (on an as-needs basis).

Further information is presented in the Architectural Drawings prepared by HDR Pty Ltd and Civil Drawings prepared by Northrop Consulting Engineers.

# Secretary's Environmental Assessment Requirements

This Flood Assessment has been prepared generally in accordance with the Secretary's Environmental Assessment Requirements (SEARs). The flood related SEARs Key Issues are presented in the below Table 1, with a response to each item also provided.

**Table 1 - SEARS Flooding Related General Requirements**

| SEARs Key Issue | Secretary's Environmental Assessment Requirements | Response |
|---|---|---|
| Flood Risk | Identification of any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any relevant provisions of the NSW Floodplain Development Manual (DIPNR, 2005) | Council's adopted flood study has been used as a basis for the flood investigation including an analysis of flood risk in accordance with the latest ARR 2019 hazard categories.<br>Flood risk across the site is outlined in the Results and Discussion sections of this report while, flood hazard conditions across the subject site are presented in Attachment A.<br>As the proposed FFLs are sited at or above the Probable Maximum Flood (PMF) event, increased rainfall intensities as a result of climate change are not expected to affect the proposed development. |
| Flood Risk | An assessment of the impacts of the development, including any changes to flood risk on-site or off-site (including the existing overland flow route), and detail design solutions and operational procedures to mitigate flood risk where required. | Flood impacts of the proposed development are discussed in the Flood Impacts Section of this report.<br>Changes in flood risk are presented and discussed in the results and discussion sections of this report.<br>Mitigation measures are presented in the Figures provided in Attachment A and discussed in the Developed Case Model section of this report. |

A reply to Council's specific flood related SEARS response items is also presented in the below Discussion section of this report.

# Model Parameters

Detailed two-dimensional hydraulic modelling was undertaken using the TUFLOW hydrodynamic modelling software. As mentioned above, modelling prepared as part of this study was based on the modelling prepared as part of the Previous DA Investigation (Northrop, 2019).

Updates to the hydrological and hydraulic models are outlined below.

## Hydrological Model

The hydrological model used in the updated TUFLOW model is consistent with the hydrology used in the Previous DA Investigation (Northrop, 2019) and Council's adopted flood study (i.e. the Macquarie Park Flood Risk Management Study and Plan (FRMS&P) TUFLOW model (Bewsher, 2011)).

This approach was discussed and agreed with by Council Officers.

## Hydraulic Model

The hydraulic model used for this study is the combined one-dimensional/ two-dimensional (1D/2D) TUFLOW hydrodynamic engine.

For this study, the latest TUFLOW version 2020-10-AD with HPC GPU module has been used. The original TUFLOW version used in the Previous DA Investigation (Northrop, 2019) was the TUFLOW version 2018-03-AA and CPU solver.

This approach was discussed and agreed with by Council Officers.

### Two-Dimensional Grid Extent and Size

A grid size of 1m was adopted for the two-dimensional model to adequately represent flows across the site and around structural columns. This was reduced from the previous 3m grid size considered by the Previous DA Investigation (Northrop, 2019) and Council's adopted flood study (i.e. the Macquarie Park Flood Risk Management Study and Plan (FRMS&P) TUFLOW model (Bewsher, 2011))

The two-dimensional grid extent is shown in Figure 2. The grid extent considered in the Previous DA Investigation (Northrop, 2019) was reduced for the purposes of this investigation. This was performed to reduce the potential for model instabilities (due to the reduced model grid size) and to reduce model run time.

The grid extends to North Ryde to the south of the subject site, and downstream of the M2 to the north, and east. The extent was determined based on review of the existing pit and pipe network, terrain and flood extents for events up to and including the PMF.

### Boundary Conditions

The model setup is presented in Figure 2 overleaf. Inflows to the model remain generally unchanged when compared to the Previous DA Investigation (Northrop, 2019) with the exception of the reduced grid size. Inflows outside the extent of the reduced grid extent were clipped from the model.

As shown in Figure 2, two outlet head boundaries were entered into the model, one in the northern extent of the model and a second at the eastern extent. For both outlets, a “free outfall” tailwater condition was considered. This corresponds to an outflow tailwater condition of RL. 27.5m AHD at the northern outlet and 34.7m AHD at the eastern outlet.

These tailwater conditions are expected to be far enough downstream as to not influence subject site flood levels or any potential downstream flood impacts created by the proposed development.

HERRING ROAD
HERRING ROAD
LANE COVE ROAD
M2 MOTORWAY
TALAVERA ROAD
KHARTOUM ROAD
M2 MOTORWAY
MACQUARIE PARK
WATERLOO ROAD
EPPING ROAD
EPPING ROAD
EPPING ROAD
EPPING ROAD
NORTH RYDE
KENT ROAD
EPPING ROAD
WICKS ROAD

## Legend

- Subject Site
- Model Extent
- Inflow Locations
- 1D Outflows
- Downstream Boundary
- 1D Stormwater Pipes
- Pits / Headwalls

0 100 200 Metres

1:6,500

# Figure 2 [A]

**2D Model Setup**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP

29/6/2022 A3 Y:\SYDNEY 2017\SY170095 - Talavera Rd, Mac Park\O - Drawings\MAP\220627 - Updated SSDA\SY170095-02_ Figures_1m_Grid.qgz

Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial

### Catchment Roughness

Catchment roughness was based on the Previous DA Investigation (Northrop, 2019) for both the existing and developed case scenarios as presented in the following **Figure 3** and **Figure 4** respectively.

The following Table 2 presents the surface roughness values adopted for each land use.

**Table 2 – Land use Roughness (Manning's)**

| Land use | Roughness (Manning's) |
|---|---|
| Roads | 0.020 |
| Short Grass | 0.030 |
| Buildings | 20.000 |
| Landscaping | 0.025 |

Existing case boundary fences and site louvres remain unchanged when compared to the Previous DA Investigation (Northrop, 2019).

During the developed case, structural columns and solid shear walls have been fully blocked out of the flood model representing 100% flow obstructions. Columns and shear walls have been modelled with a minimum 2-meter width (i.e. 2x the grid size) to ensure they are recognised by the two-dimensional model. It is noted, many of the structural columns are expected to be less than approximately 1 meter in size, and as such blockage created by the columns may be considered conservative.

Terrain levels over building floor levels have been raised to FFL levels with a high roughness as presented in Table 2 above. Open shear walls within the under-croft area have also been modelled with a blockage of 50%.

Additional louvres across the front of the site, in the vicinity of IC2 have also been included in the model with an assumed 50% blockage.

### Terrain

Terrain data used in the development of the model includes a combination of LiDAR elevation data, the original terrain (DEM_Z) used for the Previous DA Investigation (Northrop, 2019), detailed survey and design surfaces created for the previous and latest proposed developments. With the reduced model grid size (i.e. 3m to 1m), the DEM_Z file was used as 1d elements (e.g. stormwater elements) no longer aligned with the 1d_zpts.

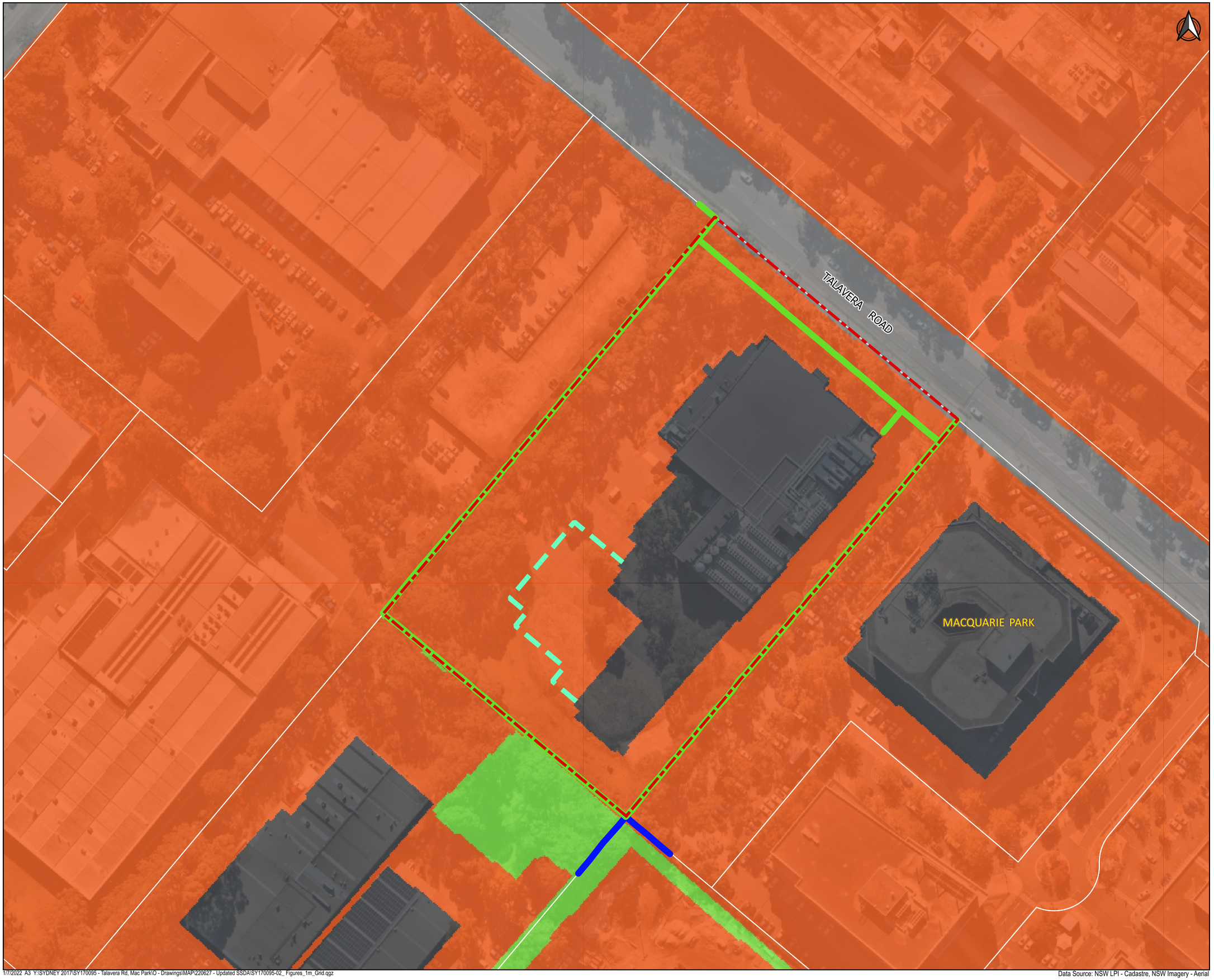
Some minor manual amendments were then entered into the flood model at locations where headwall invert levels didn't match terrain levels. In these scenarios, terrain levels were lowered to match headwall invert levels. These amendments were not expected to create significant changes to the original flood behaviour observed at the subject site.

Terrain data for the Existing and Developed Case Scenarios are presented in **Figure 5** and **Figure 6** respectively.

### Hydraulic Structures

Existing hydraulic structures are based on the Previous DA Investigation (Northrop, 2019) and are presented in the following **Figure 5**. During the developed case scenario, a diversion of the existing Trunk 1800mm RCP is proposed as shown in **Figure 6**. This line is proposed to be diverted around the southern and western boundaries and upgraded to a 2100mm RCP.

Refer to the Civil Drawings prepared by Northrop Consulting Engineers for further details.




## Legend

- Subject Site

**Fences**

- 20% Blockage
- 60% Blockage
- Louvers

**Roughness (Manning's)**

- Roads (0.020)
- Short Grass (0.030)
- Buildings (20)
- Landscaping (0.025)

0 20 40 Metres

1:1,200

# Figure 3 [A]

**Existing Case Model Landuse and Roughness**

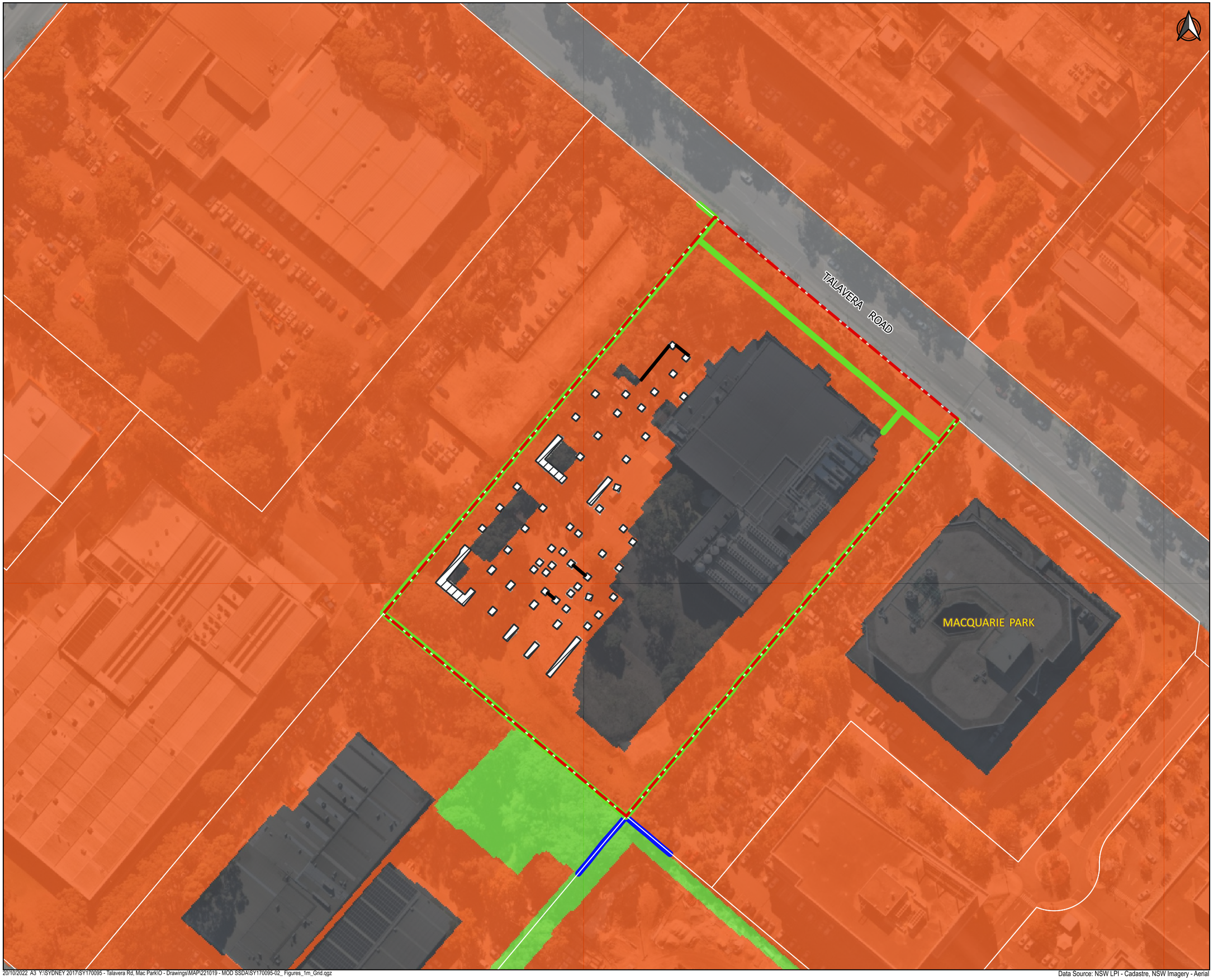
17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial




## Legend

- Subject Site
- Columns and Walls
- Open Shear Walls

**Fences**

- 20% Blockage
- 60% Blockage

**Roughness (Manning's)**

- Roads (0.020)
- Short Grass (0.030)
- Buildings (20)
- Landscaping (0.025)

0 20 40 Metres

1:1,200

# Figure 4 [B]

**Developed Case Model Landuse and Roughness**

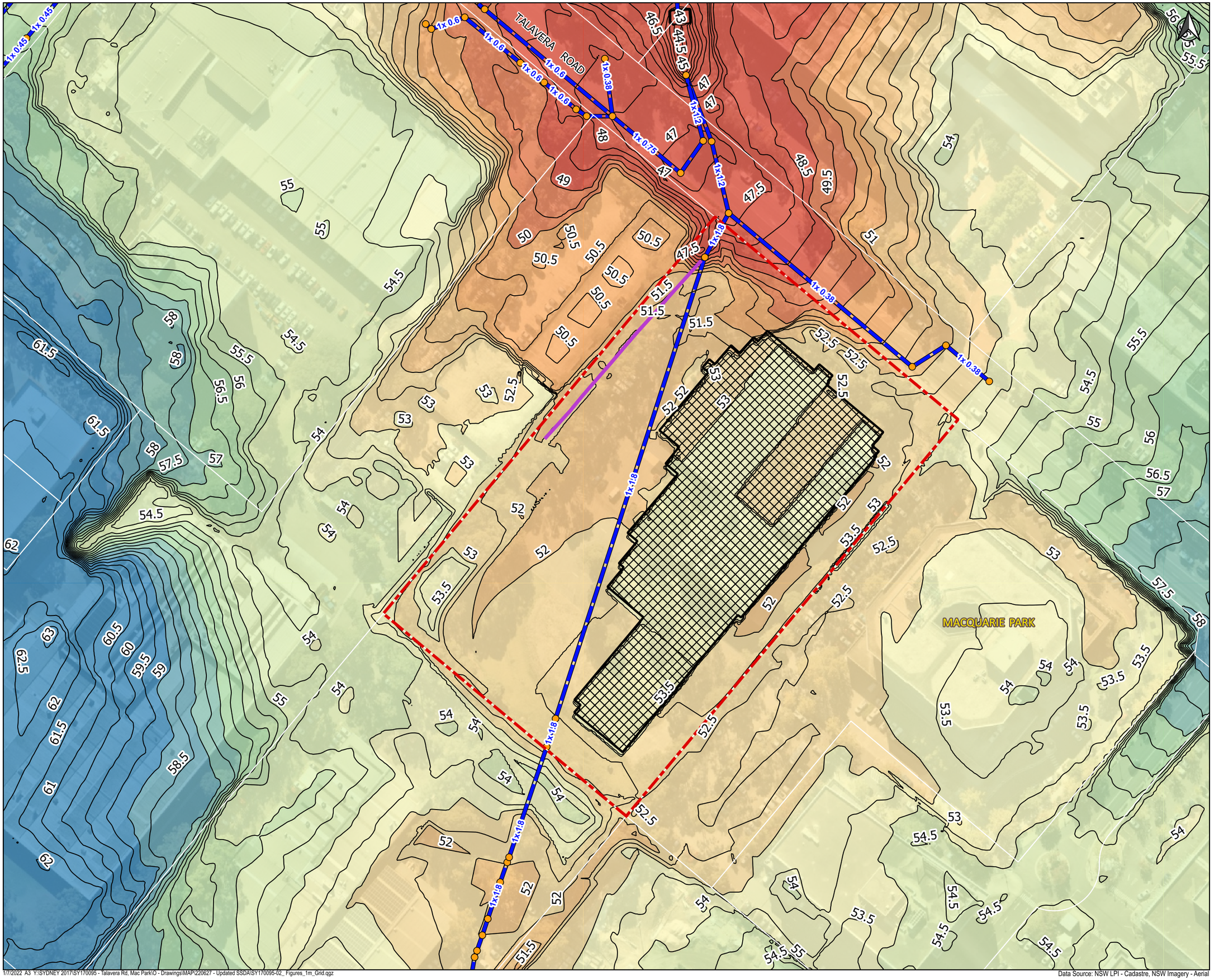
17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial




## Legend

- Pits
- Pipes
- Bund
- 0.5m Contours
- Subject Site
- Buildings

**Terrain (m AHD)**

- <= 49.00
- 49.00 - 50.00
- 50.00 - 51.00
- 51.00 - 52.00
- 52.00 - 53.00
- 53.00 - 54.00
- 54.00 - 55.00
- 55.00 - 56.00
- 56.00 - 57.00
- 57.00 - 58.00
- 58.00 - 59.00
- > 59.00

0 20 40 Metres

1:1,200

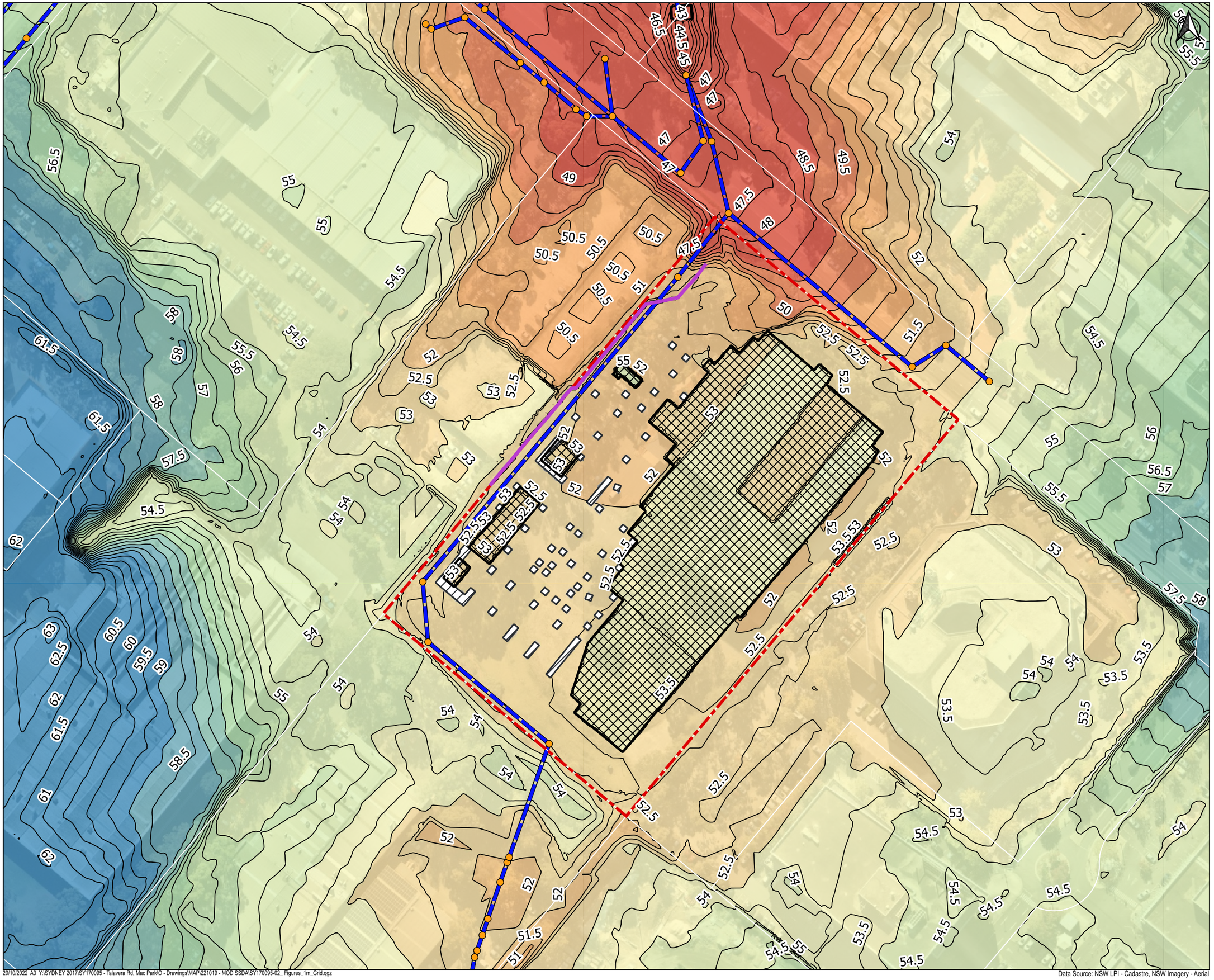
# Figure 5 [A]

**Existing Case Model Terrain and Infrastructure**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




# Figure 6 [B]

**Developed Case Model Terrain and Infrastructure**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial

# Results

## Model Verification

To review the updated model's consistency with the Previous DA Investigation (Northrop, 2019), a comparison of the latest base case scenario, with the developed case scenario for the Previous DA Investigation (Northrop, 2019) has been prepared. A comparison of the 1% AEP design storm event is presented in the following Figure 7.

A relatively good correlation is observed between the two models both upstream and across the subject site, with generally a change of less than +/- 25mm observed. An exception is observed in the property to the east of the subject site with of up to 37mm observed in the area.

Downstream of the subject site, larger changes are observed in Talavera Road with a decrease of up to approximately 260mm observed in the vicinity of the Talavera Road sag. This decrease is expected to be the result of an improved definition of the terrain at the spill crest in the sag (due to the reduced grid size) and improved model stability with the use of the latest HPC GPU solver.

The lower flood levels observed in Talavera Road are not expected to significantly alter Flood Planning Levels on the subject site as flood levels on the subject site are much higher than those observed at the Talavera Road sag. Similarly, a lower existing case water level in the Talavera Road sag has the potential to exacerbate any downstream impacts created by the proposed development.

Furthermore, it is important to recognise that a like for like assessment has been performed for purposes of the Flood Impact Assessment. As such, the changes created by the updated modelling methodology are expected to be observed in both the existing and developed case scenarios.

Therefore, the differences in water level observed between the two models are considered acceptable for the purposes this investigation.

## Existing Case Behaviour

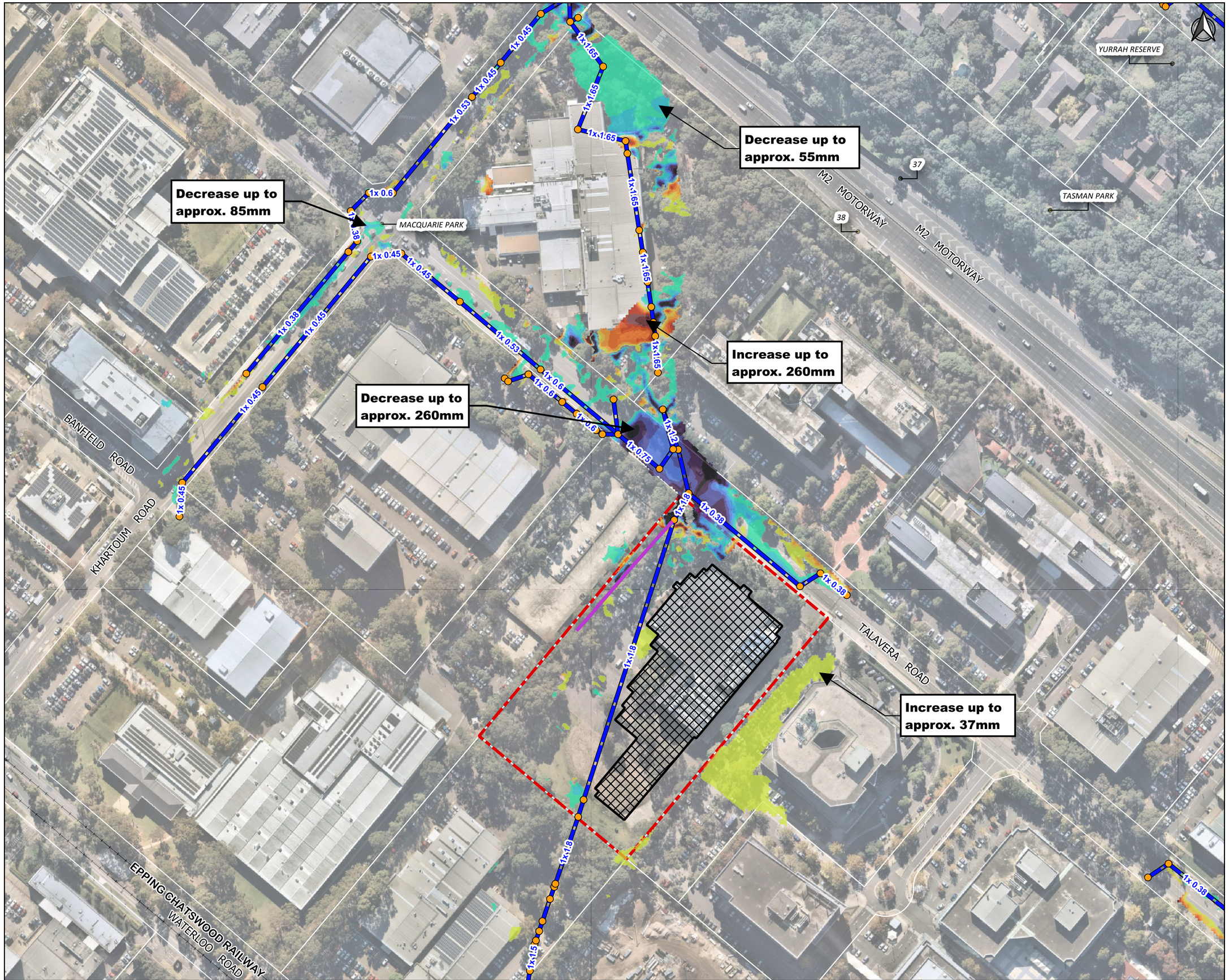
During the existing case, overland flow enters the subject site from the southern corner, where flood water initially divides between entering the subject site and filling up the flood storage area located within the property adjacent to the south-eastern boundary. Once this flood storage area is filled, additional flows are forced onto the subject site via a low point near the southern corner. Once flows enter the subject site, they continue overland in a north-westerly then north-easterly direction, over the existing driveway and carpark, before discharging to Talavera Road in the northern corner of the subject site.

The 20%, 5%, 1% and PMF flood depth and elevation contours for the existing case scenario are presented in the attached Figures A1-A3 & A5 of Attachment A respectively.

Figure A1 shows the subject site is generally flood free during the 5% AEP design storm event while, Figure A2 shows overland flow crossing the subject site during the 5% AEP. Figure A3 shows flood depths across the subject site during the 1% AEP range from approximately, 0.1 - 0.3m in the driveway and carpark adjacent to the south-western and north-western boundaries while the driveway along the south-eastern boundary remains largely flood free.

Similarly, during the PMF design storm event flood depths range from approximately 0.1 - 0.5m in the driveway and carpark along the south-western and north-western boundaries while, depths in excess of 1.0m are observed along the south-eastern boundary

Flood elevations in the property adjacent to the south-eastern boundary are shown in Figures A3 and A5 as 52.81m AHD and 53.20m AHD during the 1% AEP and PMF design storm events respectively.




## Legend

- Subject Site
- Building Extent
- Pits / Headwalls
- Pipes / Culverts
- Bund

**Elevation Difference (m)**

- < -0.200
- -0.200 - -0.175
- -0.175 - -0.150
- -0.150 - -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- 0.125 - 0.150
- 0.150 - 0.175
- 0.175 - 0.200
- > 0.200

0 30 60 Metres

1:2,000

# Figure 7 [A]

**Existing Case Updated (1m) Minus Original (3m) 1% AEP Flood Event**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP

Similarly, flood levels at the southern corner during the 1% AEP and PMF design storm events range from 52.78m AHD to 53.12m AHD during the 1% AEP and PMF design storm events respectively.

Flood elevations at the existing IC2 Loading Dock (FFL of ~52.5m AHD) during the 1% AEP and PMF are 52.02m AHD and 52.23m AHD respectively.

Flood hazard has also been considered for the existing and developed scenarios using the latest AR&R 2019 hazard categories. A summary of these categories is presented in Figure 8 below.

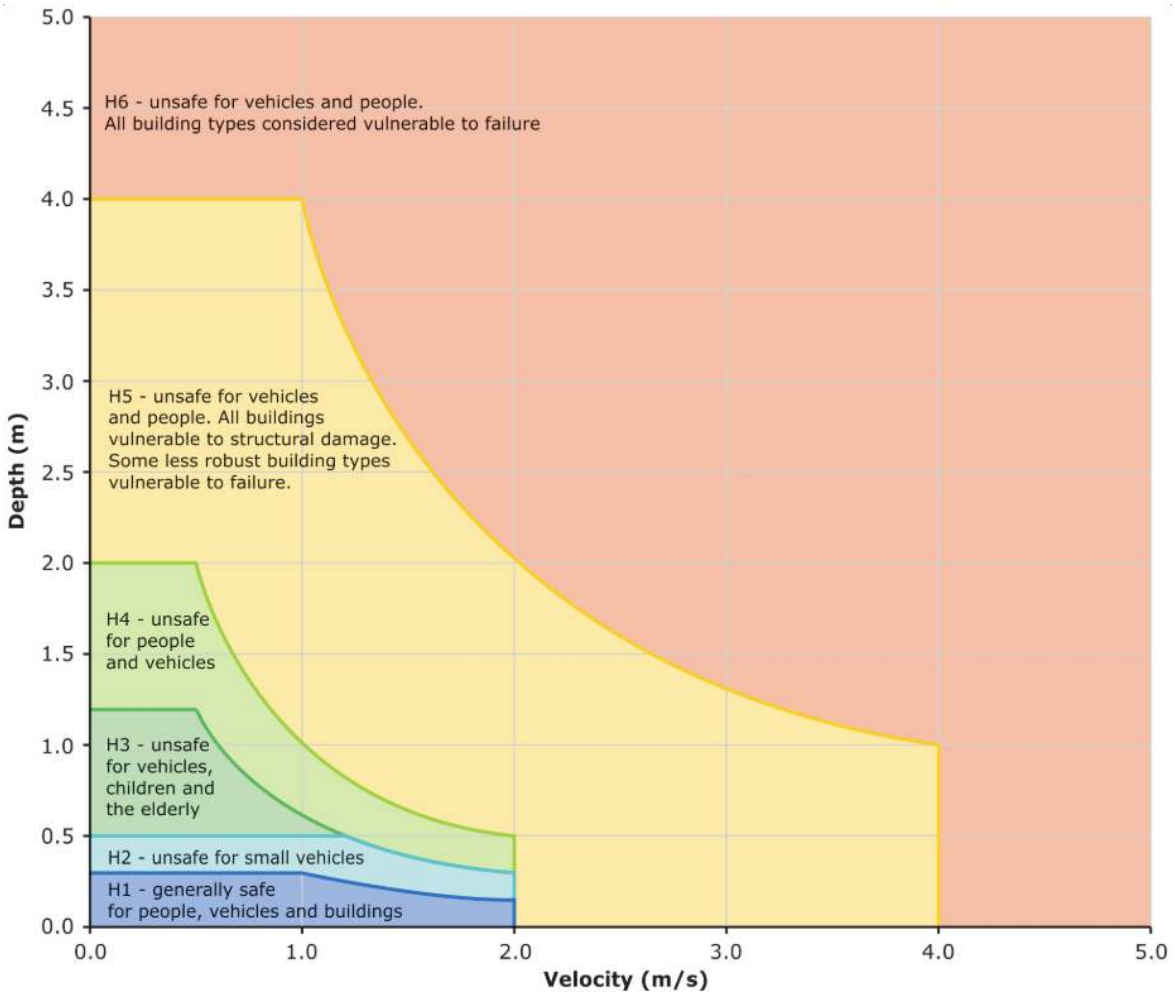



**Figure 8 - Australian Rainfall and Runoff (2019) Hazard Categories**

Figure A4 of Attachment A shows the existing flood hazard in the driveway during the 1% AEP is largely H1 with a patch of H2 along the south-western boundary. During the PMF, Figure A6 of Attachment A shows H5 hazard flow at the southern corner and along the south-eastern side of the building. A maximum of H4 is observed in the driveway and carpark along the north-western boundary which increases to H5 as flows continues down the driveway towards Talavera Road at the northern corner of the subject site.

## Developed Flood Behaviour

The 20%, 5%, 1% AEP and PMF flood depth and elevation contours for the developed case scenario are presented in the attached Figures B1-B3 & B5 of Attachment A respectively.

During the developed case, flows enter the subject site from the southern corner and continue overland in a north-westerly direction then north-easterly direction over the existing driveway and carpark before discharging to Talavera Road in the northern corner of the subject site.

Figure B1 of Appendix A shows the site is largely flood free during the 20% AEP while, flood water is observed across the site in Figure B2 during the 5% AEP design storm event.

During the 1% AEP, adjustments have been made to the design surface within the under-croft area and adjacent to existing IC2 loading dock, in an attempt to reduce the flood levels and hazard conditions in the driveway and carpark and to lower the flood levels around the existing loading dock where possible.

Figures B3 and B5 show the 1% AEP and PMF flood depths and elevation for the developed case scenario. The results show a slight reduction in flood elevations in the property adjacent to the south-eastern boundary. A slight increase in flood depth is observed at the existing IC2 loading dock with a flood level of 52.04m AHD during the 1% AEP (increased from 52.02m AHD) and 52.47m AHD (increased from 52.23m AHD) during the PMF. It is noted, although increases are observed, the existing FFL remains above the required FPL (i.e. 1% AEP + 300mm) and PMF flood levels.

Figures B4 and B6 of Attachment A shows maximum flood hazard conditions during the 1% AEP and PMF design storm events across the subject. Hazard conditions during the 1% AEP remain similar to the existing case while, the extent of H4 hazard during the PMF has decreased when compared to the existing case with H3 and H2 now largely observed through the under-croft area.

Hazard conditions in Talavera Road, adjacent to the subject site during the 1% AEP design storm event are up to H5, decreasing to H3 in the sag located adjacent to the northern corner of the site. H5 hazard conditions are expected to be due to the relatively steep grade and high velocity in the road carriageway. If required, access and egress from the subject site may be possible during the 1% AEP via the access driveway in the eastern corner of the site.

The extent of H5 in Talavera Road increases during the PMF with patches of H6 also observed. It is expected that in a rare or extreme event such as the PMF, staff and visitors will evacuate prior to the event or seek refuge within the building until floodwaters subside. This is reflected in the Flood Emergency Response Plan prepared for the site as part of the previous DA.

### Development Impact

The development impact on the existing 20%, 5%, 1% AEP and PMF design storm events is presented in Figures C1 to C4 of Attachment A.

Figures C1 to C3 show a decrease in flood depth in the properties adjacent to the southern and eastern boundaries. This is expected to be due to the increased capacity of the below ground network across the subject site, drawing down the existing flood levels upstream.

During the 1% AEP and PMF design storms events, Figures C3 and C4 show a decrease in the property to the west of the subject site. This is expected to be the result of updating the height of the bund / wall along the boundary in attempt to improve flood conditions in adjacent properties.

A localised increase is observed in Talavera Road during the PMF of up to 250mm. Comparing Figures A6 and B6 in Attachment A, this increase is not expected to affect the trafficability in Talavera Road with H5 and H6 hazard conditions already observed in the area (i.e. the increase does not result in the introduction of a new hazard category).

# Discussion

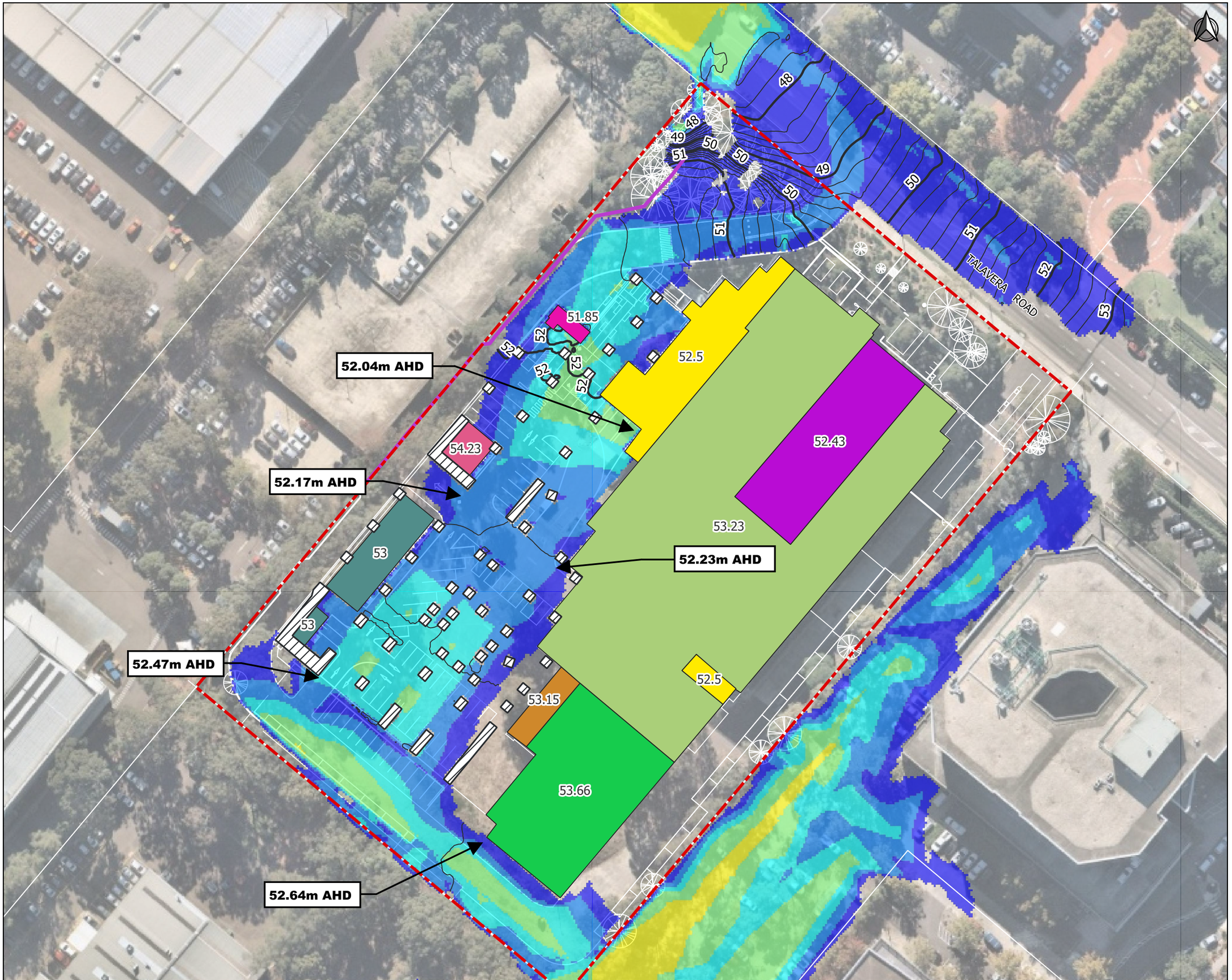
## Finished Floor Levels

City of Ryde Council Development Control Plan (DCP), Part: 8.2 – Stormwater Management Technical Manual suggests Finished Floor Level (FFLs) for Industrial / Commercial facilities are required to be sited at a minimum of the 1% AEP + 300mm.

The following Figure 9 and Figure 10 present the developed case flood behaviour with respect to the existing and proposed ground floor level finished floor levels during both the 1% AEP and PMF design storm events respectively.

Review of Figure 9 shows that all proposed habitable finished floor levels are positioned above the required 1% AEP + 300mm. Similarly, a heightened level of flood immunity is provided following review of Figure 10 with FFLs also sited above the PMF.

A proposed fire stair is located in the north-western portion of the development and is sited at ground level to enable access from the carpark. This area is not considered habitable and needs to be positioned at ground level to enable pedestrian access. It is recommended this area be constructed using flood compatible materials.




## Legend

- Subject Site
- Building
- Wall / Bund
- Contours (1m)
- Contours (200mm)

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

**Finished Floor Levels**

- 52.43
- 52.50
- 53.15
- 53.23
- 53.66
- 53.50
- 51.85
- 53.00
- 54.23

0 10 20 Metres

1:800

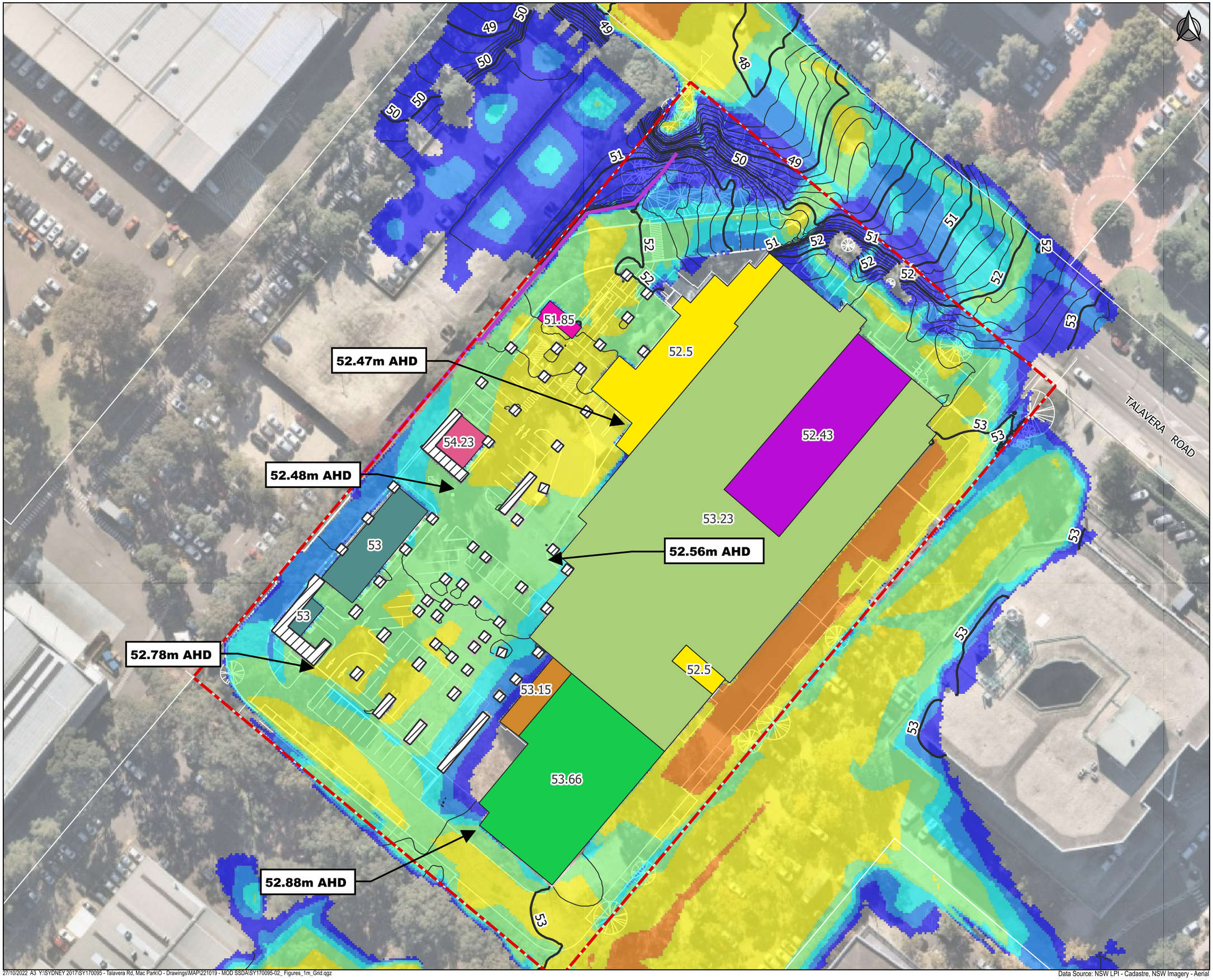
# Figure 9 [E]

**Developed Case 1% AEP Flood Depth and Elevation and Finished Floor Levels**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




## Legend

- Subject Site
- Building
- Wall / Bund
- Contours (1m)
- Contours (200mm)

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

**Finished Floor Levels**

- 52.43
- 52.50
- 53.15
- 53.23
- 53.66
- 53.50
- 51.85
- 53.00
- 54.23

0 10 20 Metres

1:800

# Figure 10 [C]

**Developed Case PMF Flood Depth and Elevation and Finished Floor Levels**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP

## Development Control Plan Requirements

The proposed development has been assessed with respect to Council's flooding related requirements in particular, Part 8.2 Stormwater and Floodplain Management – Section 4.4.6 Commercial and Industrial.

A summary of the assessment is presented in the following Table 3.

**Table 3 - Council Requirements Summary Table**

| Reference Clause | Development Control | Response |
|---|---|---|
| (a) | Commercial development on land subject to flood risk categorised as high will not be permitted unless it can be clearly demonstrated that development under this section can be undertaken on the land without jeopardising public safety and access, property damage or adverse ramifications of the pre-developed flood regime by means of a Flood Impact Statement | The subject site is classified as a low to medium flood risk as shown in the Macquarie Park FRMS&P and as such this item is not applicable.<br>In addition, the proposed development presents improved flood conditions when compared to the existing case. A reduction in flood elevations in adjacent properties and reduced flood hazard conditions during the PMF are observed on the subject site. |
| (b) | Floor levels of habitable and non-habitable areas must comply with the freeboard requirements as stated in Table 2.1 of the Stormwater Technical Manual. If these levels cannot be practically achieved for the entire floor area (e.g., for reasons of accessibility from a public space) then a lesser level may be considered subject to consideration of the extent or scale of property damage and risk to public safety. | Table 2.1 of the Stormwater Technical Manual suggests a FFL for industrial / commercial facilities of the 1% AEP + 300mm.<br>The proposed habitable FFLs are sited above the 1% AEP + 300mm or the PMF, whichever is greater. This exceeds the FFL requirements set out by Council's Stormwater Technical Manual.<br>A proposed fire stair is located in the north-western portion of the development and is sited at ground level to enable access from the carpark. This area is not considered habitable and needs to be positioned at ground level to enable pedestrian access. It is recommended this area be constructed using flood compatible materials. |
| (c) | New structures subject to flooding and overland flow (excluding those sites located in Overland Flow Precincts) must be designed and constructed to withstand the anticipated hydrostatic forces. For all parts of the development potentially exposed to floodwater, below the minimum freeboard requirement, the development structure must: | External walls subject to loading from overland flows will be designed to be flood proof and will to have the structurally capability to withstand the hydrostatic forces of floodwater, debris, buoyancy, etc.<br>It is expected this will be reviewed at detailed design phase. |

| Reference Clause | Development Control | Response |
|---|---|---|
| | i. Be constructed of flood compatible building components in accordance with the Stormwater and Floodplain Management Technical Manual. Stormwater and Floodplain Management 8.2 Development Control Plan 2014 Final Adopted 21<br>ii. A structural engineer must certify that the completed works are designed and capable of withstanding forces subject to forces of floodwater, debris, buoyancy forces anticipated by the 100yr ARI flood event. | |
| (d) | Development must not divert major overland flows or reduce flood storage such to adversely impact the neighbouring property or surrounding area. It must be demonstrated the development does not:<br>i. Reduce the pre-developed level of flood storage.<br>ii. Increase flood levels or velocities such to adversely impact adjoining dwellings. | As discussed in the Development Impact section of this report, a review of the flood behaviour has been performed and the proposed development is not expected to have a significant adverse impact in adjacent properties. |
| (e) | If the development under this development type category involves subdivision of the land, it must be demonstrated that potential development of this newly created allotment can comply with controls under this section. | The proposed development does not propose to subdivide land. |
| (f) | A restrictive covenant must be placed on the title of the land to ensure there are no further significant works and alterations to the landform or development are undertaken without the approval of Council such to impact on flooding. | Noted. It is expected the previously imposed restrictive covenant will be updated to suit the latest flood extents. |

## Council's Technical Specification Requirements (Part 2.2.2)

Commentary with respect to the Flooding and Overland Flow Planning Considerations presented in Council's Stormwater Management Technical Manual Part 2.2.2 are summarised in the below Table 4.

**Table 4 - Response to Planning Considerations in Council's Technical Manual Part 2.2.2.**

| Planning Considerations | Response |
|---|---|
| Flood Regime | A description of the existing and developed case flood regime is provided in the Existing and Developed Case Flood Behaviour sections of this report. |
| Floor Levels | Existing and proposed FFLs have been assessed in the Flood Planning Levels section of this report. |
| Building Components | External walls subject to loading from overland flows will be designed to be flood proof and will to have the structurally capability to withstand the hydrostatic forces of floodwater, debris, buoyancy, etc. as mentioned above. |
| Structural Soundness | Given the subject site may be used as a last resort temporary refuge facility during a flood event, it is recommended that the proposed development be designed to withstand flood forces for events up to and including the PMF. This requirement is consistent with the consent conditions provided for the previous DA. |
| Flood Affects | The impact of the proposed development on the existing flood behaviour, both within external properties and for the subject site has been presented in the Developed Case flood behaviour, Development Impact and Flood Planning Levels sections of this correspondence.<br>The results presented herein suggests the proposed development is not expected to have a significant adverse flood impact on the subject site or in adjacent properties. |
| Evacuation | Commentary with respect to Evacuation from the subject site is provided in the Developed Case Flood Behaviour section of this correspondence.<br>It is recommended that the existing Flood Emergency Response Plan, prepared for the subject site be updated to include the latest development. |
| Management and Design | A hydrologic and hydraulic assessment is presented herein. The comparison of the pre-developed and post-development results suggests the proposed development is not expected to have a significant adverse impact on the subject site or in adjacent properties. Improvements to the existing flood behaviour are observed on the subject site when compared to the existing case. |

It is noted that this investigation has been prepared using Council's adopted flood study and as such, the hydrological, hydraulic modelling requirements presented in Parts 4 and 5 of presented in Council's Stormwater Management Technical Manual are not expected to be applicable.

Based on previous and more recent consultation with Council, we expect this approach is the most suitable modelling methodology for the purposes of the investigation.

## Secretary's Environmental Assessment Requirements

Additional flooding related Secretary Environmental Assessment Requirements (SEARs) have been received for consideration during the design of the proposed development. The below Table 5 presents a summary of the requirements and a response to each item.

**Table 5 - Secretary's Environmental Assessment Requirements and Response**

| Reference Clause / Document | Requirement | Response |
|---|---|---|
| Item 1.5 | The applicants proposed flood and overland flow strategy nominates floodwaters to disperse over and through the parking area in the under croft so as to reduce the concentration of flow through the site. This does not comply with Council's DCP Part 8.2 (Stormwater and Floodplain Management) Section 4.4.2 which stipulates open parking areas are to be no less than the 100yr ARI event. Notably vehicles are able to float in floodwaters of some 200mm and allowing flow through a carpark would present a significant concern in relation to not only private property damage but potential flood debris (floating vehicles) blocking the flow path downstream. | It is recognised that the existing and proposed carpark is located below the 1% AEP design storm event. As this is an existing issue, we are seeking a merits-based assessment with an aim to improve these existing conditions where possible by widening the flow path, therefore reducing the extent of the unfavourable hazard conditions where possible.<br>Figure B4 of Attachment A presents the developed case flood hazard through the under-croft car park during the 1% AEP. The results demonstrate H1 hazard across the majority of the carpark, with a small patch of H2 adjacent to the existing loading dock & entrance. The above Figure 8 suggests H1 hazard flow behaviour is safe for both pedestrians and vehicles and H2 is safe for pedestrians and large vehicles. It is also noted that the H2 hazard observed in the carpark, is surrounded by H1 flow conditions with any small vehicles that may become buoyant in this area, unlikely to continue downstream.<br>During the PMF design storm event, a large proportion of the flood hazard conditions in the under-croft area have been reduced from up to H4 to a maximum of H3 when compared to the existing case. As a result, hazard conditions during this event are considered an improvement when compared to the existing case with lower potential for vehicles to become unstable and float downstream. |

| Reference Clause / Document | Requirement | Response |
|---|---|---|
| | | The development also proposes to reduce the number of available parking spaces from 110 to 71 therefore reducing the risk across the subject site.<br>In addition, a steel palisade fence is located around the subject site which is expected to reduce the potential for vehicles that may become buoyant on the subject site from floating further downstream during a major or significant event. |
| Item 1.7 | The proposed expansion is considered to conflict with a number of requirements of the DCP and Council's Technical Manual. | A response to the relevant flood related DCP items as outlined in Part 8.2 – Stormwater and Floodplain Management - Section 4 are presented above. Commentary with respect to the Flood Regime, Floor Levels, Building Components, Structural Soundness, Flood Affects, Evacuation and Management & Design have also been included herein generally in accordance with Council's Technical Manual Part 2.2.2.<br>In addition, a response to the DCP requirements for carparks (Section 4.4.2 of Part 8.2 of the DCP) has also been presented in the above Item 1.5. |
| Item 1.10 | The existing pipeline reduces the diameter from 1800mm to 1200mm. It is expected that the new development will possibly divert flows to adjacent properties and increase the flood levels and runoff as well. The existing pipeline in Talavera Road may not have the capacity to convey additional flows. The subject property is located in the 1 in 100 year overland flow path therefore the detailed flood study must assess the pipe system and overland flow path for the existing and post-developed situations. The developer must consider providing on site underground flood storage and release a little volume of water into the trunk drainage system. | The below ground network presented in **Figure 5** and **Figure 6** and overland flow path through the subject site have been assessed herein. The below ground network is based on the data presented in Council's adopted flood study namely the Macquarie Park Flood Risk Management Study and Plan (Bewsher, 2011) while, the overland flow path has been designed using 12D software.<br>It is proposed to divert the existing 1800mm RCP around the subject site and at the same time, upgrade the trunk pipeline to a 2100mm RCP. The results presented herein suggests the diversion and the proposed development are not expected to result in a significant adverse flood impact on the subject site or in adjacent properties. |

| Reference Clause / Document | Requirement | Response |
|---|---|---|
| Item 3.1 | New detailed flood study with data files: The subject site is subject to flooding, therefore the applicant must submit a new detailed flood study as part of this planning proposal. The revised flood study shall be prepared in accordance with Council's stormwater and Floodplain Technical Manual and shall demonstrate that the proposed works will not worsen the flooding situation in the area. | A detailed flood study has been prepared and is presented herein. The study has been prepared based on a previous approved development assessment using Council's adopted flood study – namely the Macquarie Catchment Flood Risk Management Study and Plan (Bewsher, 2011).<br>Amendments to the model are presented herein and have been previously discussed with Council.<br>The results presented herein suggests the proposed development is not expected to have a significant adverse flood impact on the subject site or in adjacent properties. |
| Item 4.2 | Flood Impact: The site is noted to be impacted by flooding and over land flow and therefore will warrant a flood impact assessment to be provided. The flood impact statement must address the requirements in Section 4 of councils DCP part 8.2 (stormwater and floodplain management) and any modelling required by this study must be submitted for review. | A review of the proposed development with respect to Council's DCP Part 8.2 – Stormwater and Floodplain Management - Section 4 has been performed as presented above. The modelling methodology and results are presented herein. |

# Conclusion

A flood impact assessment has been undertaken for the proposed extension of the existing data centre located at 17-23 Talavera Road, Macquarie Park. Flood modelling has been prepared based on a previous investigation performed for the subject site.

A review of the proposed development has been performed with respect to Council's Development Control Plan, Technical Specification and the Council's SEARs items.

We commend our findings to Council and the Department for their review. Should you have any queries regarding this correspondence, please feel free to contact the undersigned on (02) 4943 1777.

Prepared by

**Laurence Gitzel**
Associate | Flood Engineer
BEng (Environmental) MIEAust CPEng

## Limitation Statement

Northrop Consulting Engineers Pty Ltd (Northrop) has been retained to prepare this report based on specific instructions, scope of work and purpose pursuant to a contract with its client. It has been prepared in accordance with the usual care and thoroughness of the consulting profession for the use by Macquarie Telecom Pty. Ltd.. The report is based on generally accepted practices and standards applicable to the scope of work at the time it was prepared. No other warranty, express or implied, is made as to the professional advice included in this report.

Except where expressly permitted in writing or required by law, no third party may use or rely on this report unless otherwise agreed in writing by Northrop.

Where this report indicates that information has been provided to Northrop by third parties, Northrop has made no independent verification of this information except as expressly stated in the report. Northrop is not liable for any inaccuracies in or omissions to that information.

The report was prepared on the dates shown and is based on the conditions and information received at the time of preparation.

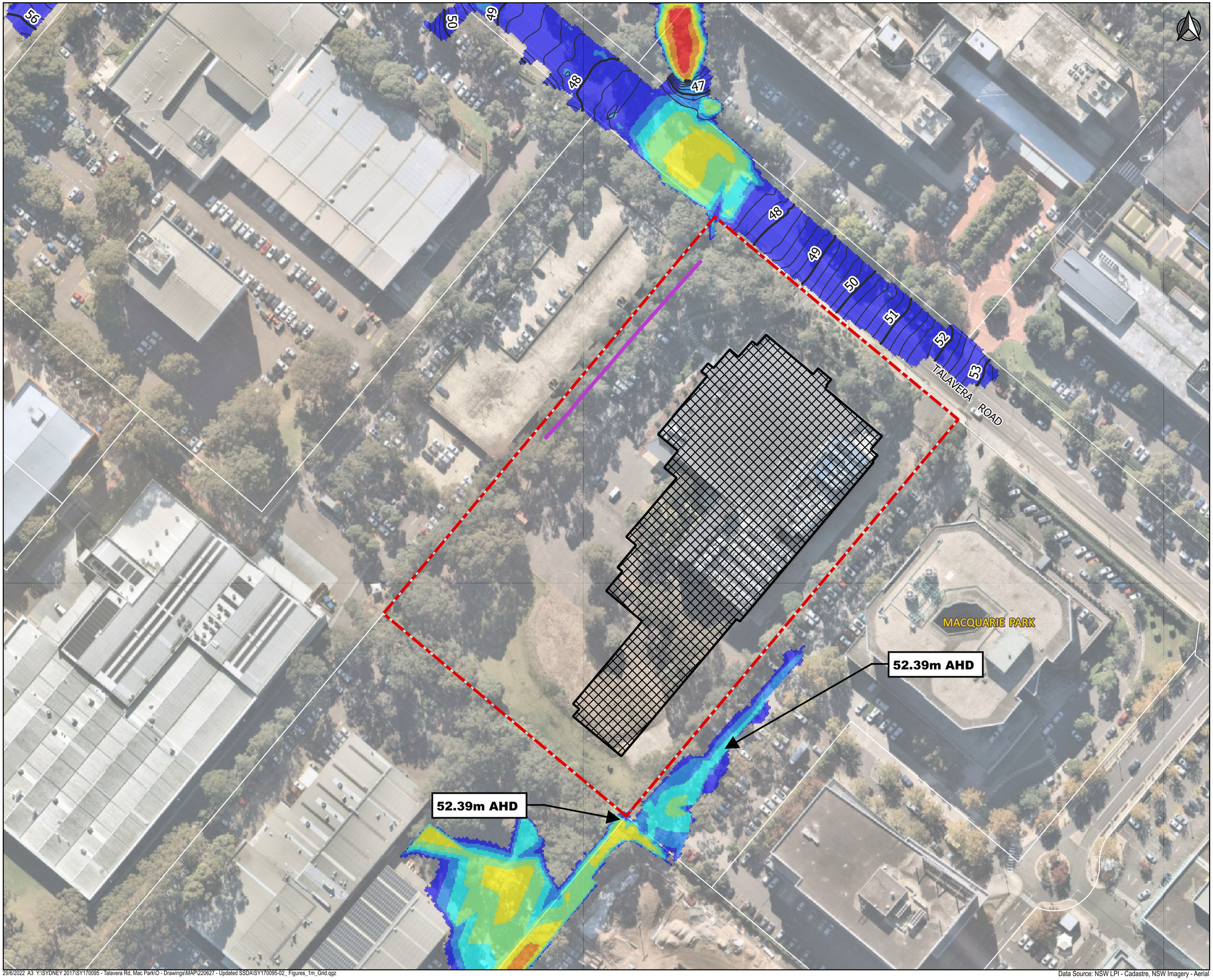
This report should be read in full, with reference made to all sources. No responsibility is accepted for use of any part of this report in any other context or for any other purpose. Northrop does not purport to give legal advice or financial advice. Appropriate specialist advice should be obtained where required.

To the extent permitted by law, Northrop expressly excludes any liability for any loss, damage, cost, or expenses suffered by any third party relating to or resulting from the use of, or reliance on, any information contained in this report.

## Document Register

| Rev | Status | Prepared | Approved | Date |
|---|---|---|---|---|
| **A** | Approval | DN | LG | 15/07/2022 |
| **B** | Modified Layout | DN | LG | 25/10/2022 |
| **C** | Modified Layout | DN | LG | 27/10/2022 |

# Appendix A – Flood Figures




## Legend

- Subject Site
- Building
- Bund
- Contours (1m)
- Contours (200mm)

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

1:1,200

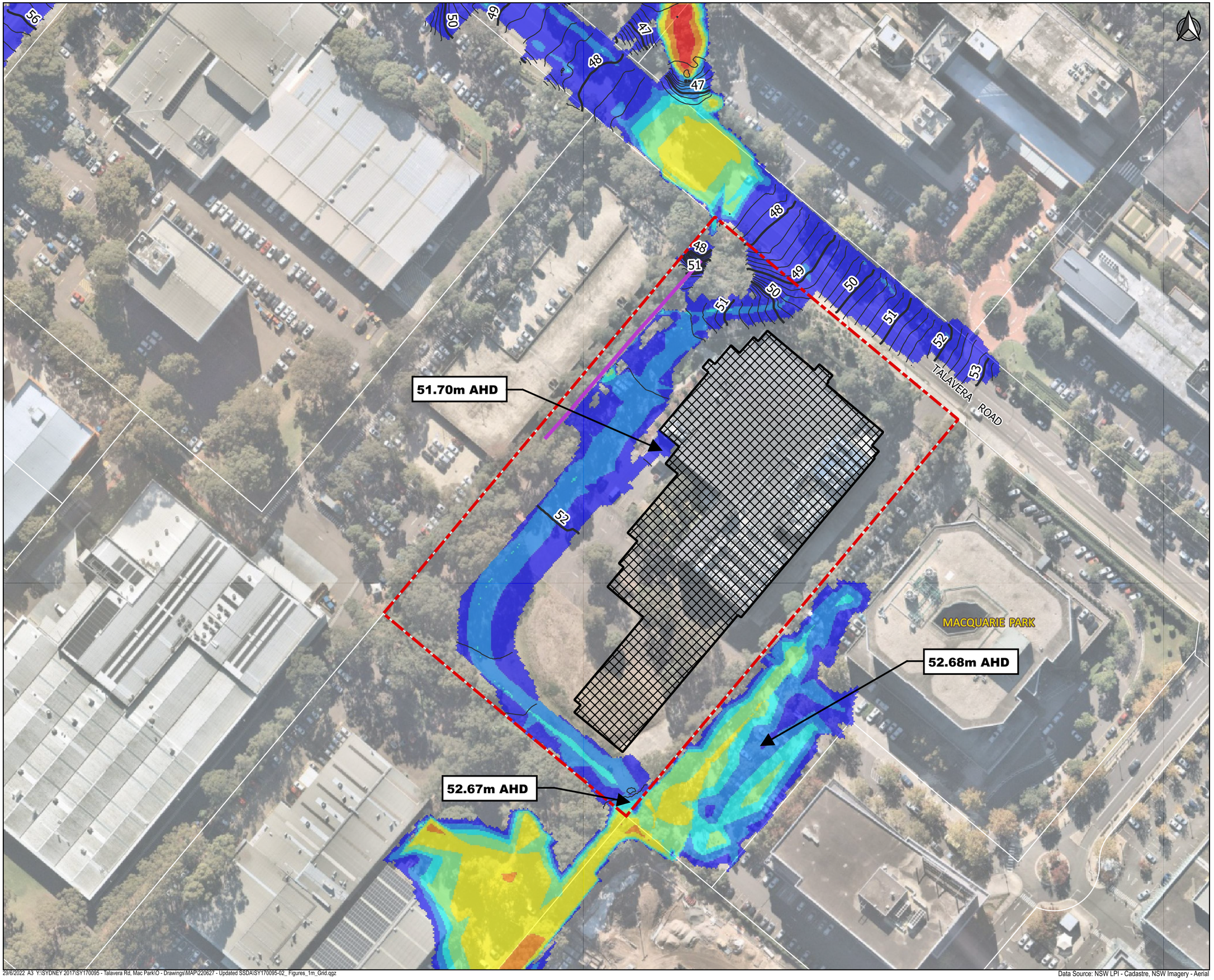
# Figure A1 [A]

**Existing Case**
**20% AEP Flood Depth and Elevation**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




## Legend

- Subject Site
- Building
- Bund
- Contours (1m)
- Contours (200mm)

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

1:1,200

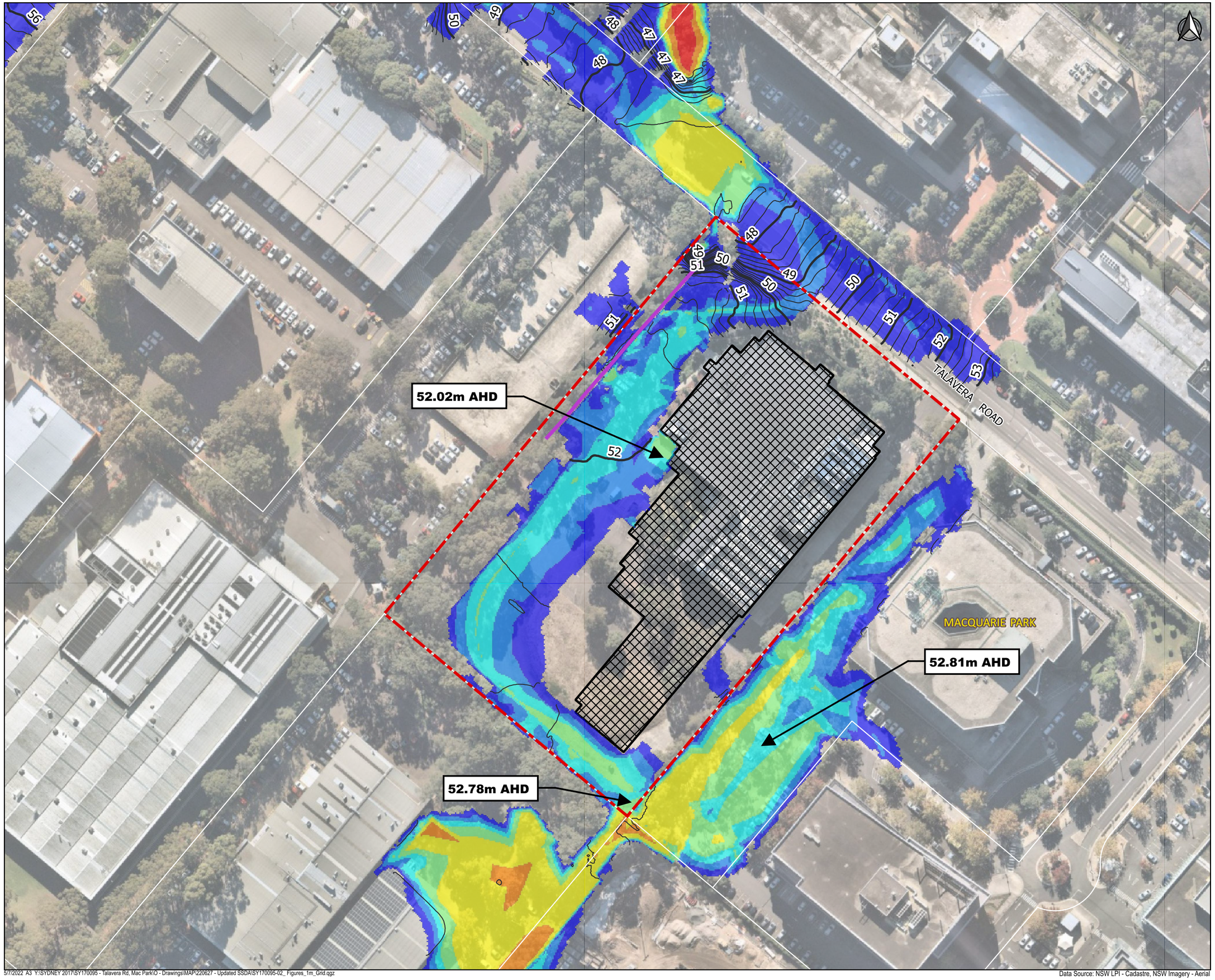
# Figure A2 [A]

**Existing Case**
**5% AEP Flood Depth and Elevation**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




## Legend

- Subject Site
- Building
- Bund
- Contours (1m)
- Contours (200mm)

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

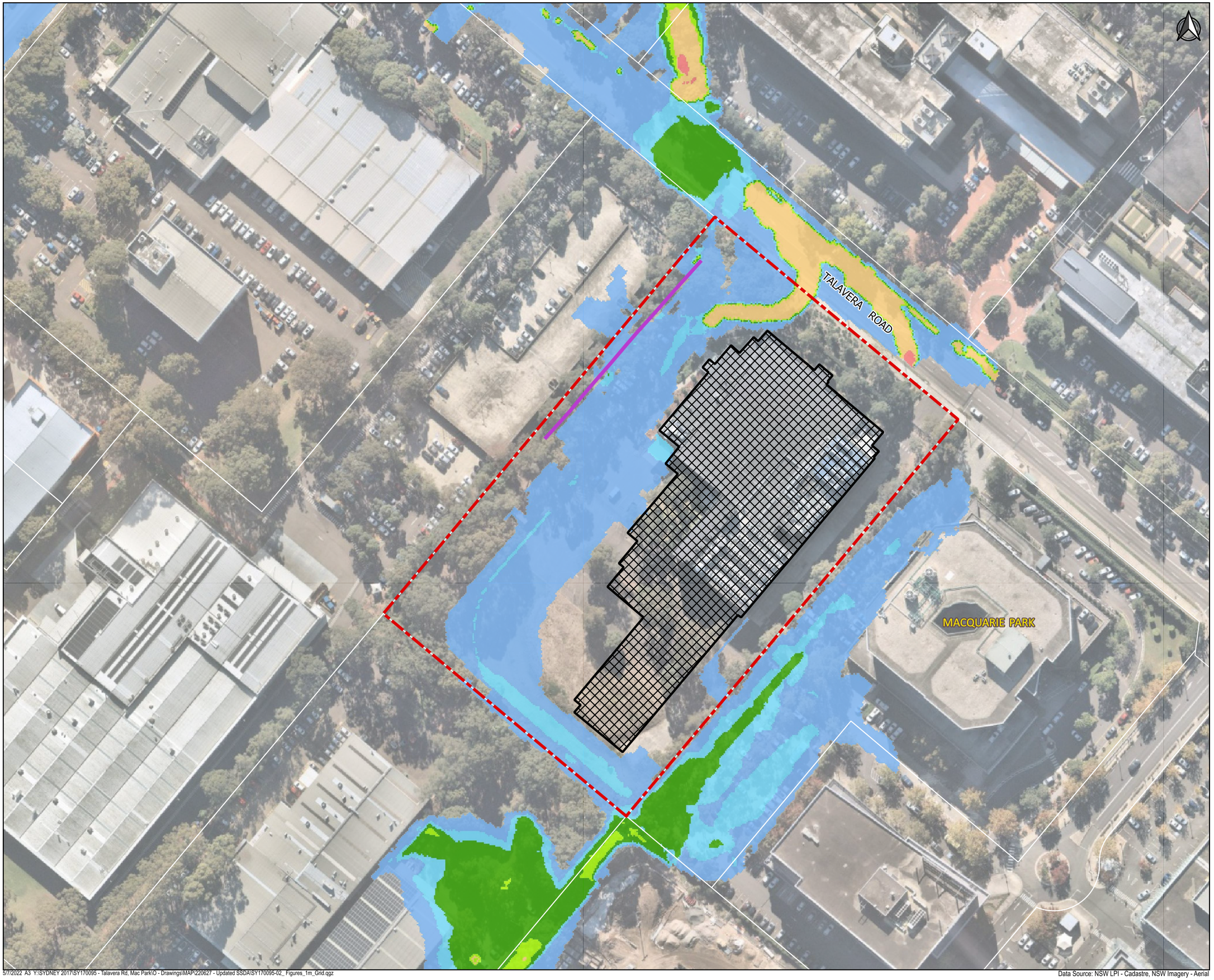
1:1,200

# Figure A3 [A]

**Existing Case**
**1% AEP Flood Depth and Elevation**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP




## Legend

- Subject Site
- Building
- Bund

**Hazard (ARR 2019)**

- H1
- H2
- H3
- H4
- H5
- H6

0 20 40 Metres

1:1,200

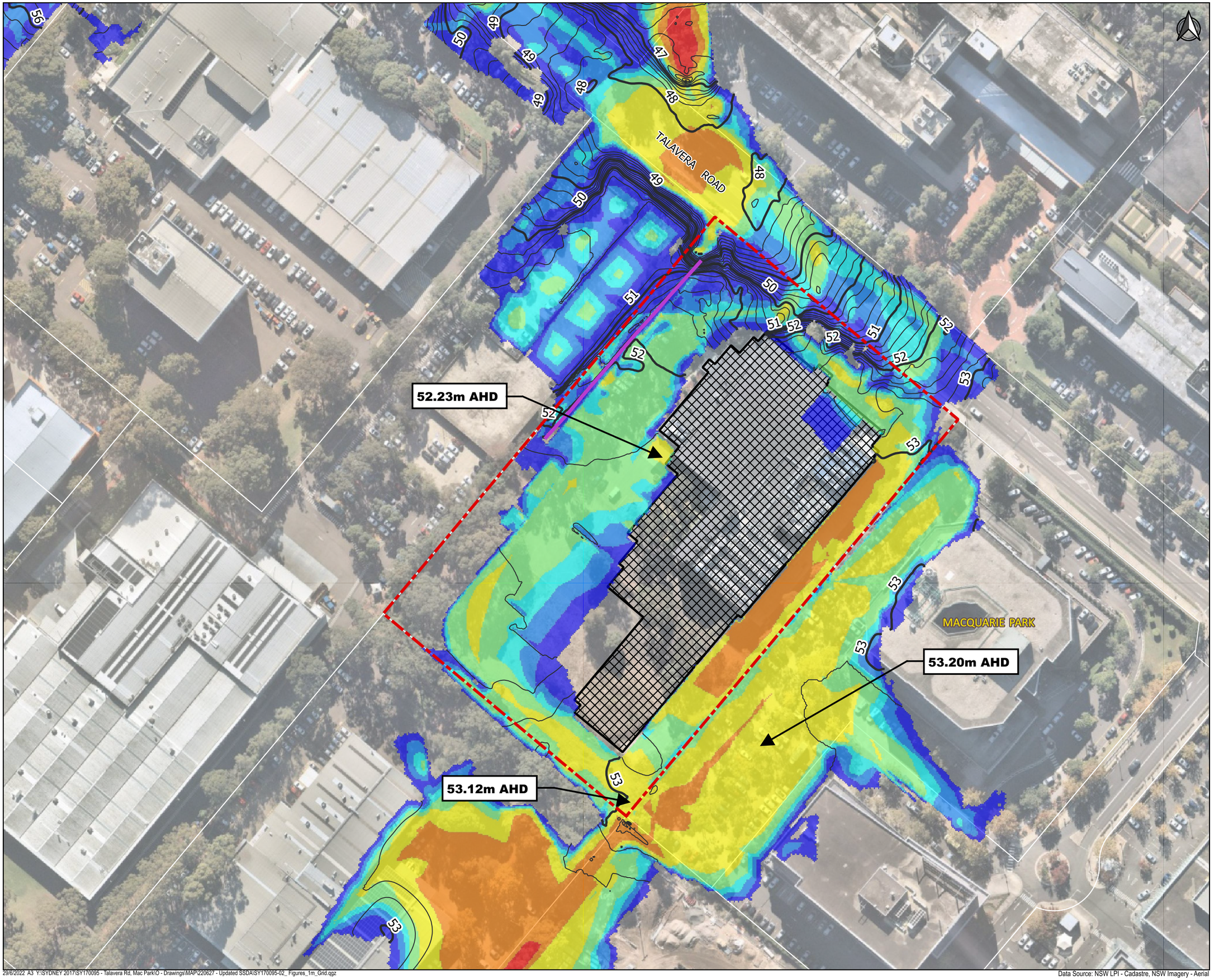
# Figure A4 [A]

**Existing Case**
**1% AEP Flood Hazard**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




## Legend

- Subject Site
- Building
- Bund
- Contours (1m)
- Contours (200mm)

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

1:1,200

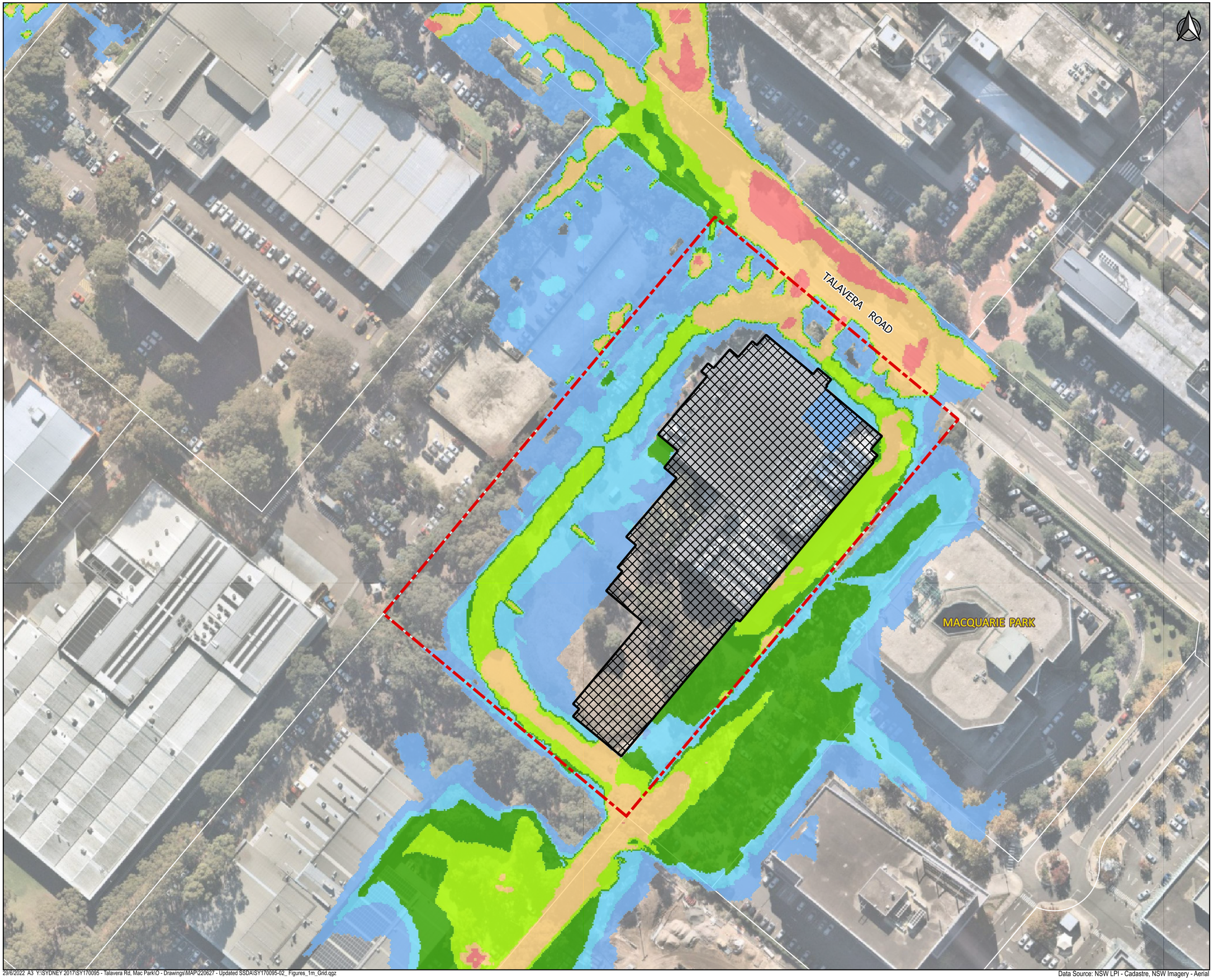
# Figure A5 [A]

**Existing Case PMF Flood Depth and Elevation**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




## Legend

- Subject Site
- Building

**Hazard (ARR 2019)**

- H1
- H2
- H3
- H4
- H5
- H6

0 20 40 Metres

1:1,200

# Figure A6 [A]

**Existing Case**
**PMF Flood Hazard**

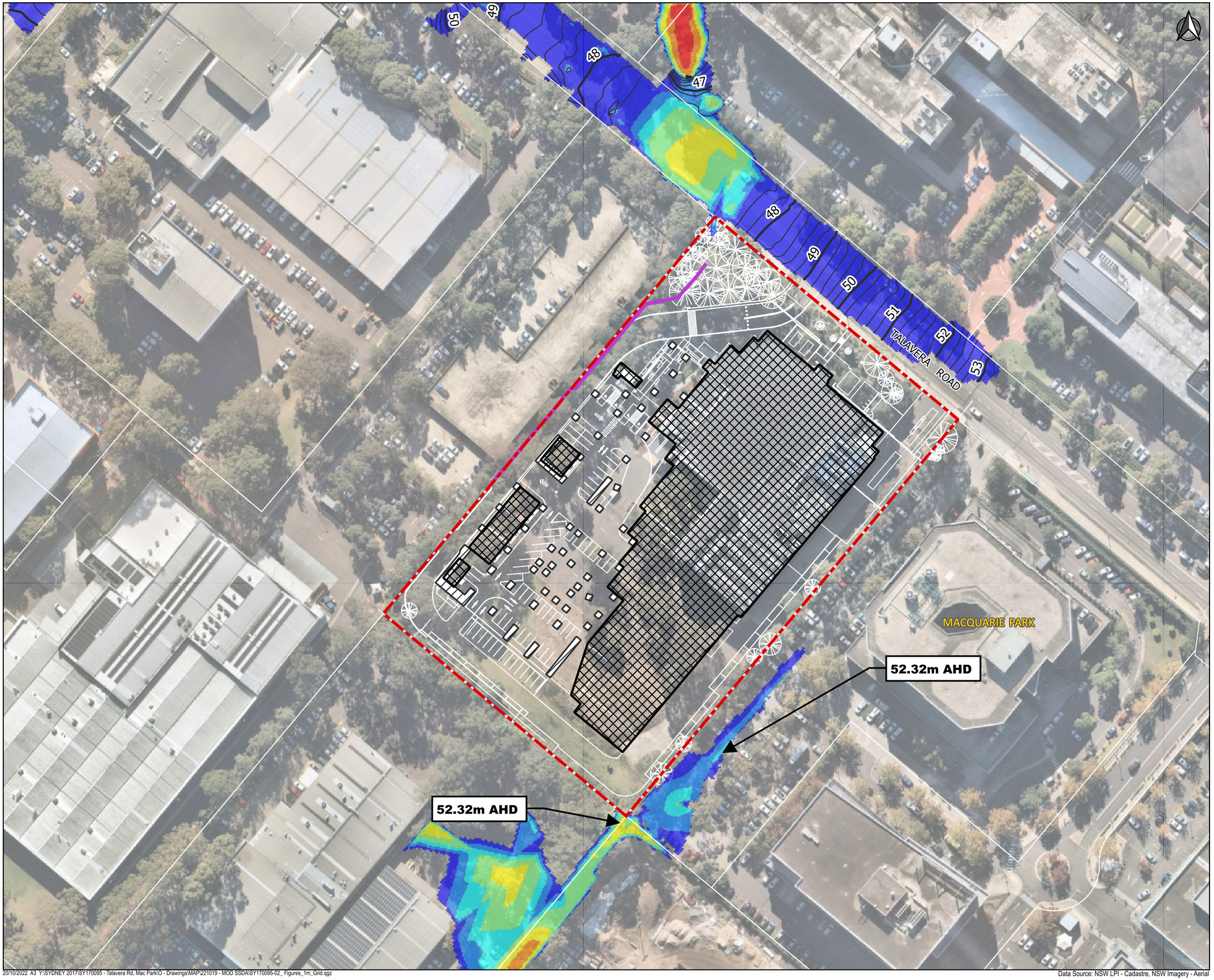
17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial




## Legend

- Subject Site
- Buildings
- Columns and Walls
- Contours (1m)
- Contours (200mm)
- Wall / Bund

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

1:1,200

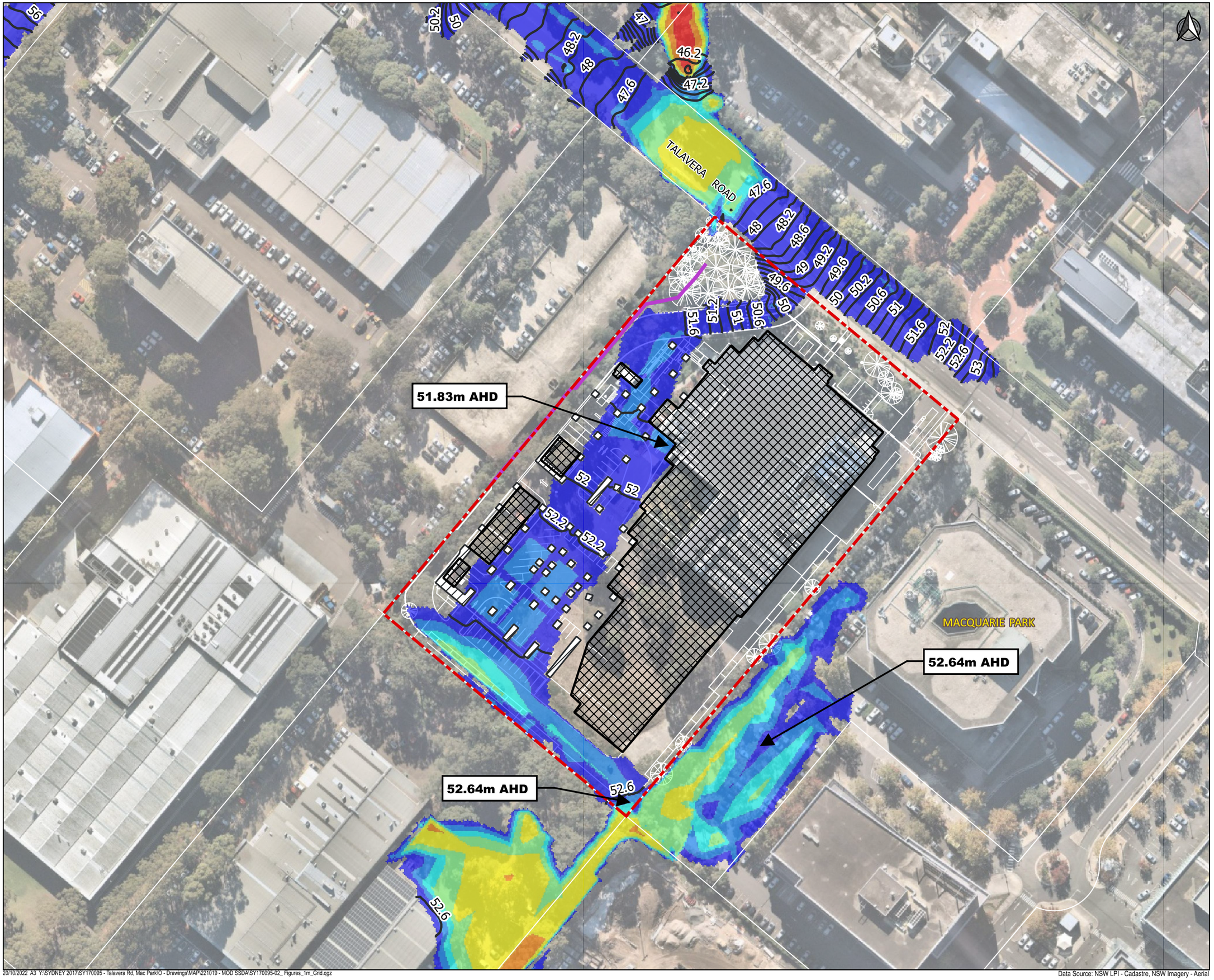
# Figure B1 [B]

**Developed Case**
**20% AEP Flood Depth and Elevation**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




## Legend

- Subject Site
- Buildings
- Columns and Walls
- Contours (1m)
- Contours (200mm)
- Wall / Bund

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

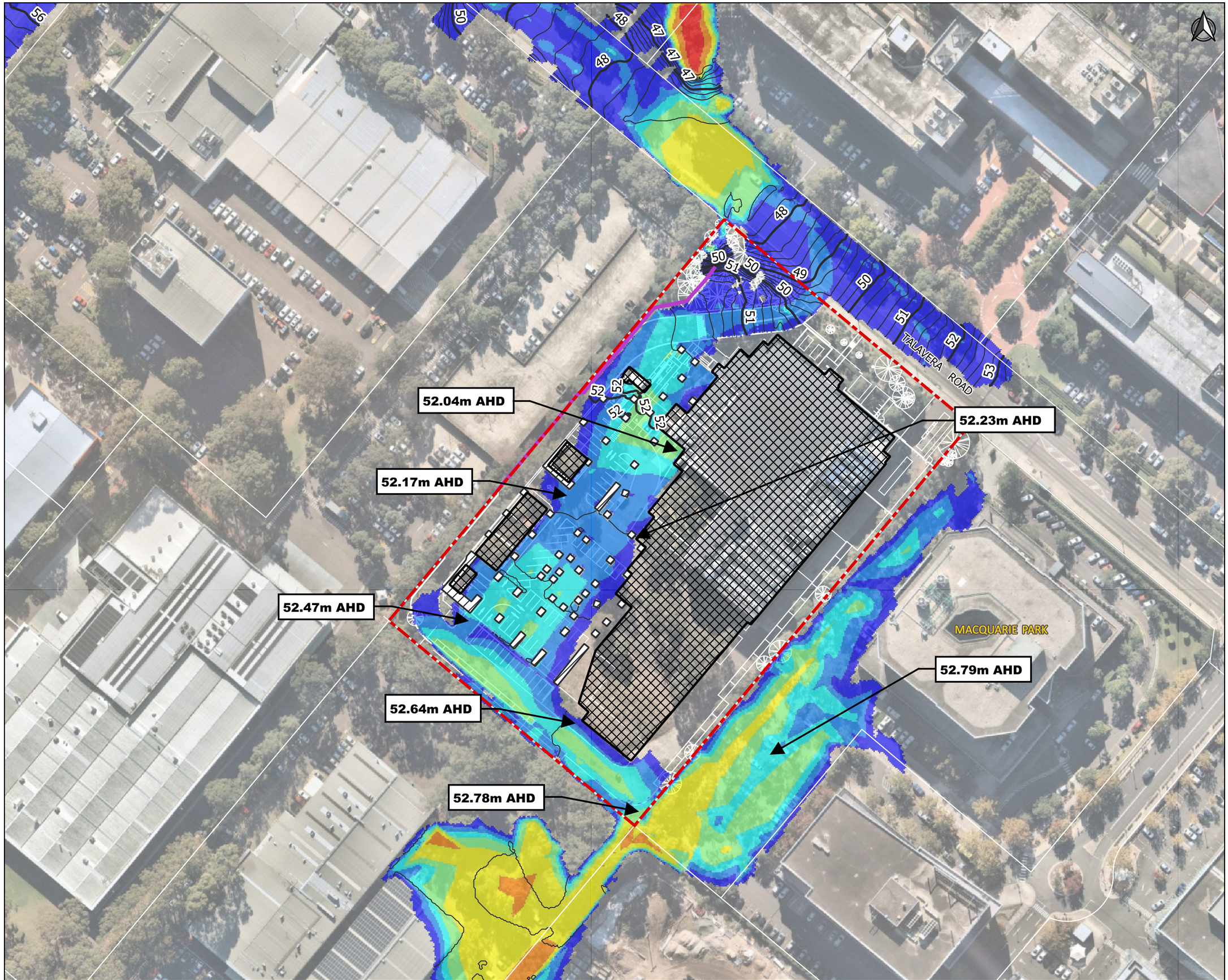
1:1,200

# Figure B2 [B]

**Developed Case**
**5% AEP Flood Depth and Elevation**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP




## Legend

- Subject Site
- Building
- Columns and Walls
- Contours (1m)
- Contours (200mm)
- Wall / Bund

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

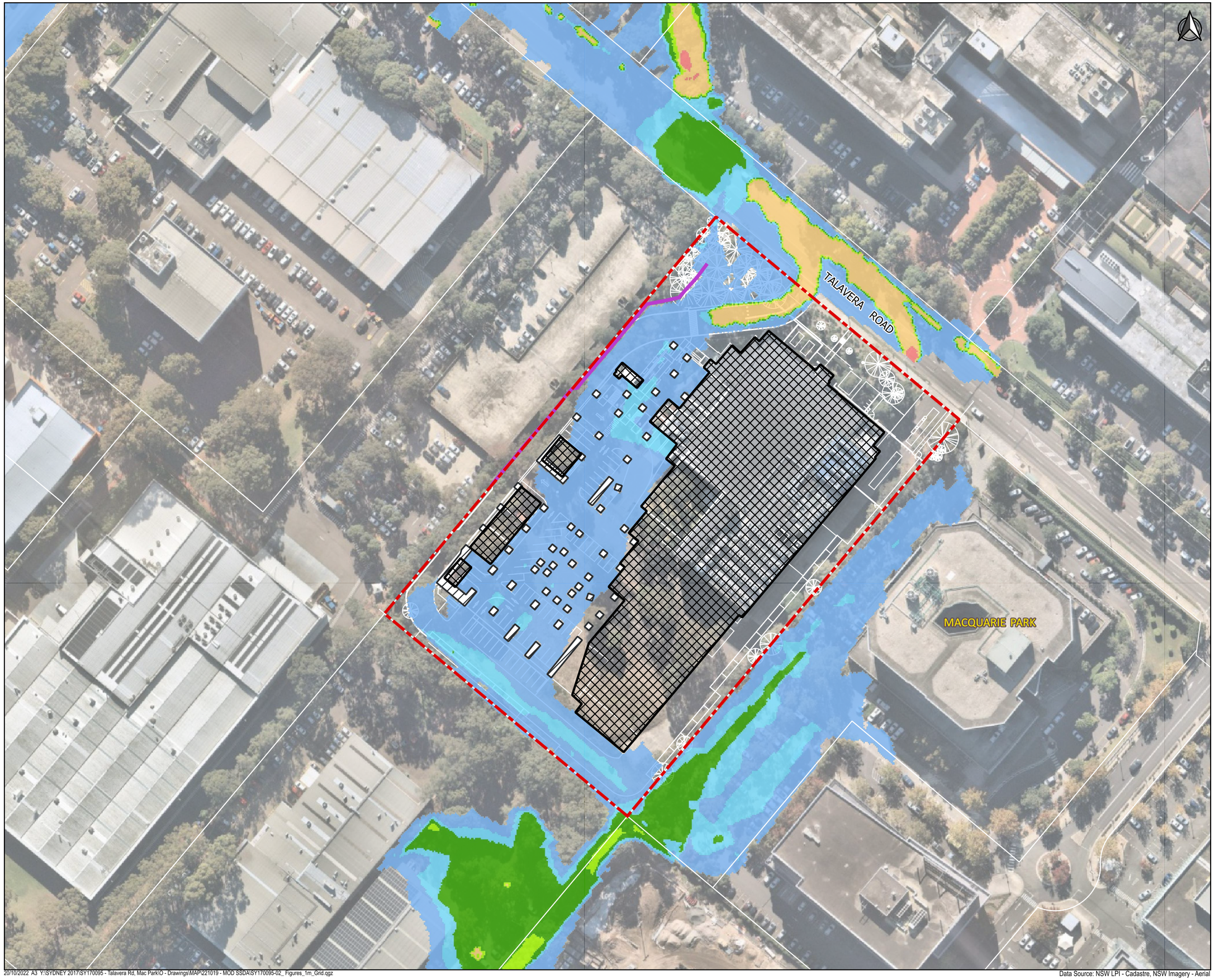
1:1,200

# Figure B3 [B]

**Developed Case**
**1% AEP Flood Depth and Elevation**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP




## Legend

- Subject Site
- Building
- Columns and Walls
- Walls / Bunds

**Hazard (ARR 2019)**

- H1
- H2
- H3
- H4
- H5
- H6

0 20 40 Metres

1:1,200

# Figure B4 [B]

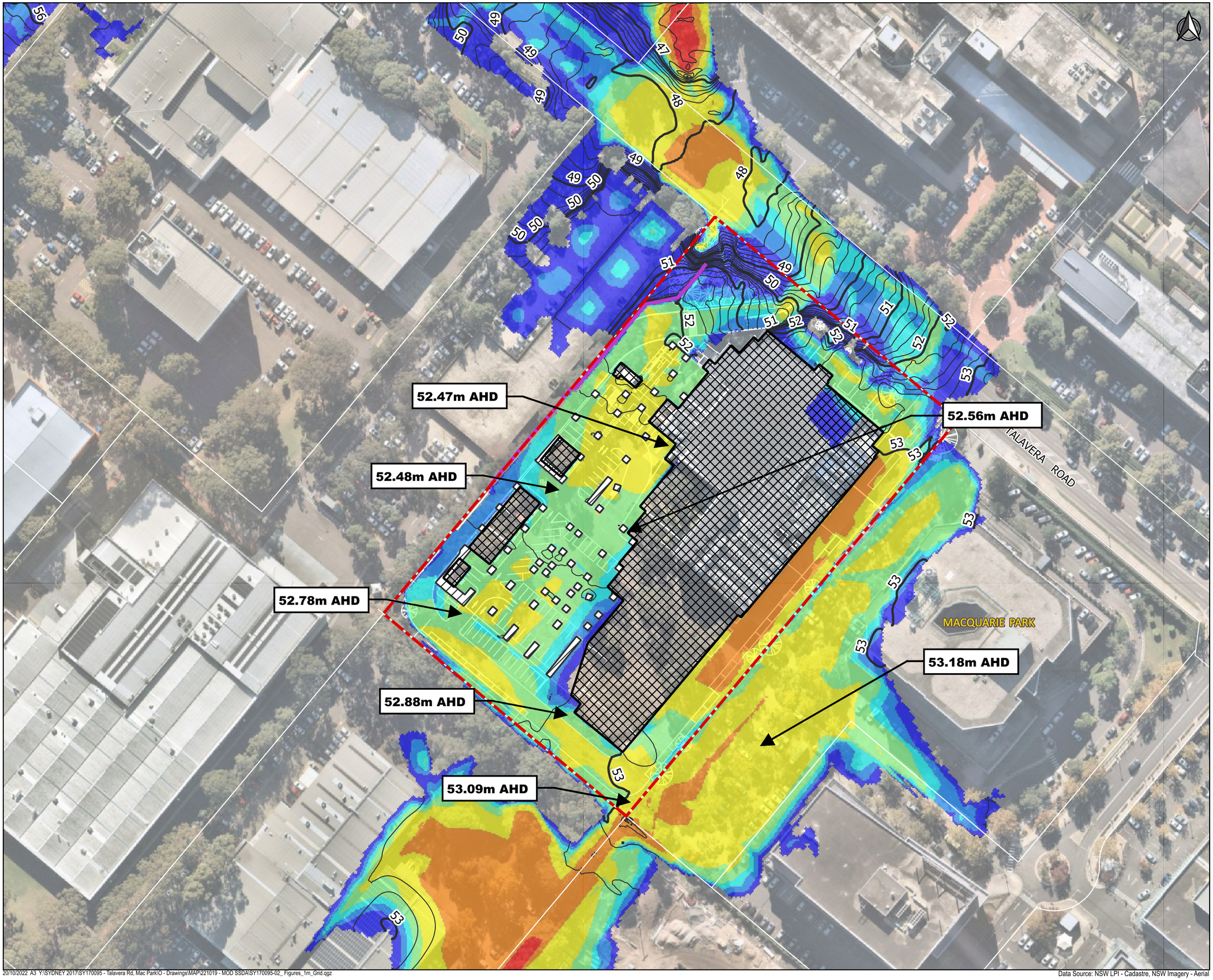
**Developed Case**
**1% AEP Flood Hazard**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial




## Legend

- Subject Site
- Building
- Columns and Walls
- Contours (1m)
- Contours (200mm)
- Walls / Bunds

**Depth (m)**

- Less than 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- Greater than 2.0

0 20 40 Metres

1:1,200

# Figure B5 [B]

**Developed Case PMF Flood Depth and Elevation**

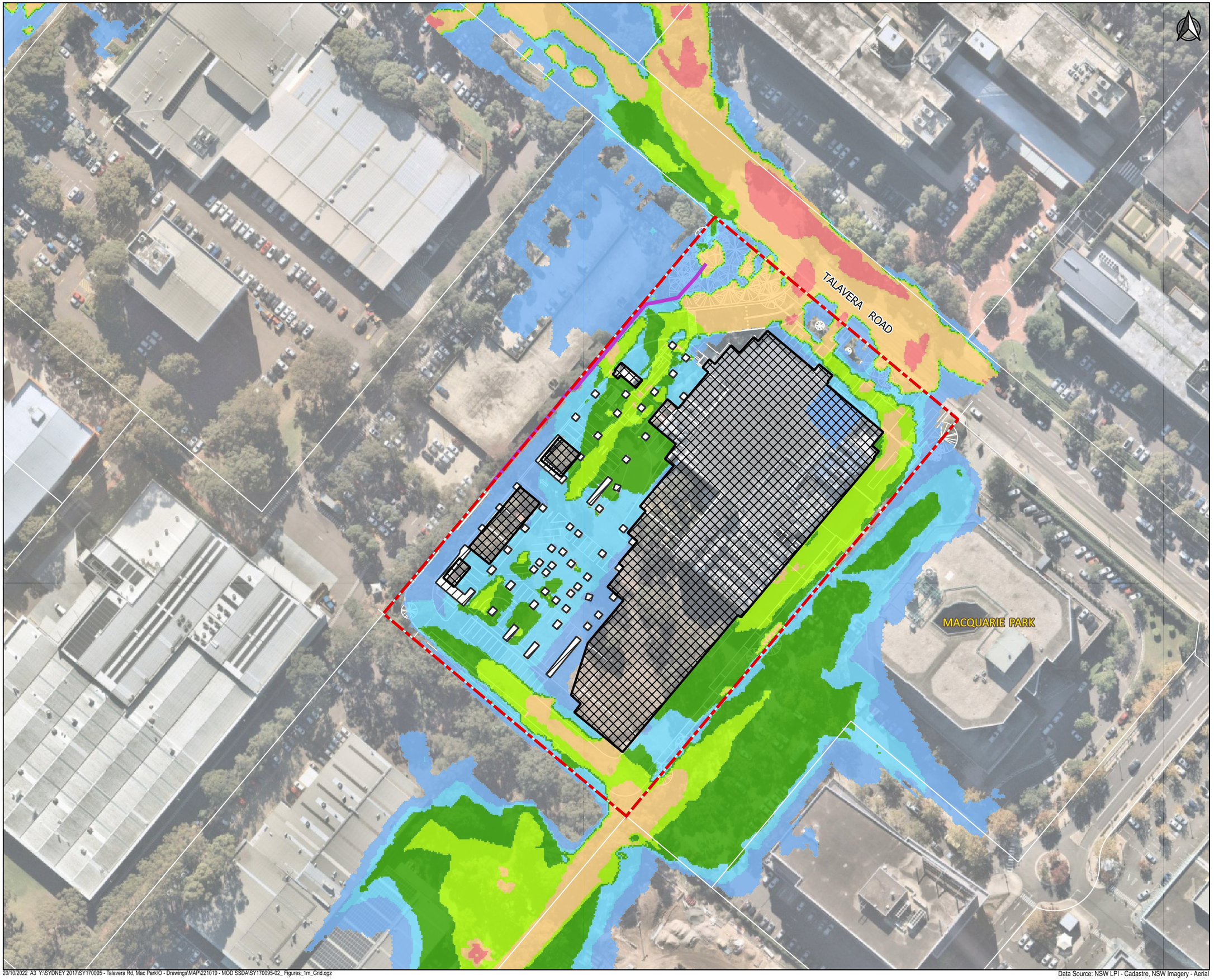
17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial




## Legend

- Subject Site
- Building
- Columns and Walls
- Walls / Bund

**Hazard (ARR 2019)**

- H1
- H2
- H3
- H4
- H5
- H6

0 20 40 Metres

1:1,200

# Figure B6 [B]

**Developed Case**
**PMF Flood Hazard**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT
NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial


## Legend

- Subject Site

**Depth Difference (m)**

- < -0.200
- -0.200 - -0.175
- -0.175 - -0.150
- -0.150 - -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- 0.125 - 0.150
- 0.150 - 0.175
- 0.175 - 0.200
- > 0.200

0 30 60 Metres

1:2,000

# Figure C1 [B]

**Development Impact**
**Depth Difference**
**20% AEP Flood Event**

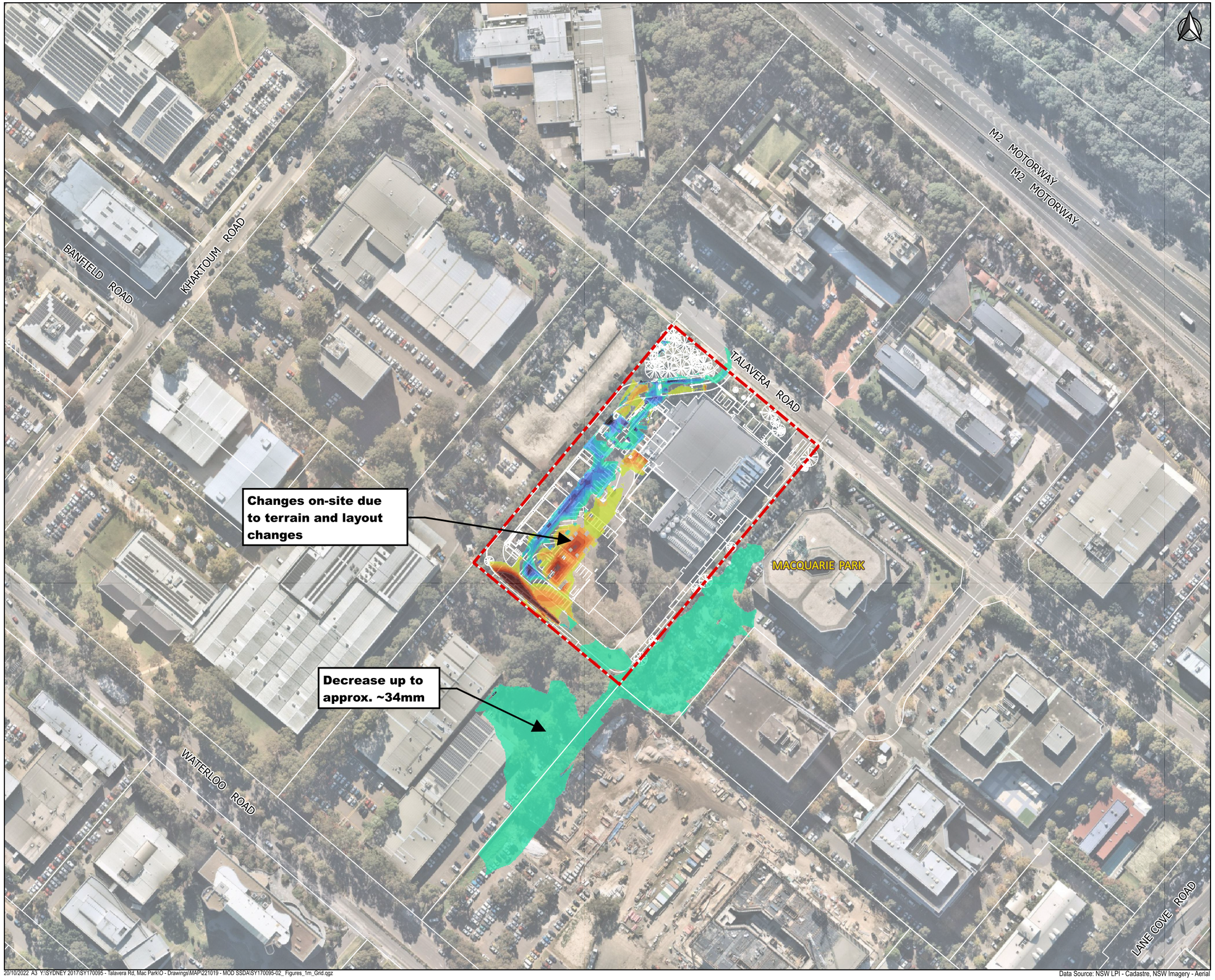
17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP



Data Source: NSW LPI - Cadastre, NSW Imagery - Aerial




## Legend

Subject Site

**Depth Difference (m)**

- < -0.200
- -0.200 - -0.175
- -0.175 - -0.150
- -0.150 - -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- 0.125 - 0.150
- 0.150 - 0.175
- 0.175 - 0.200
- > 0.200

0 30 60 Metres

1:2,000

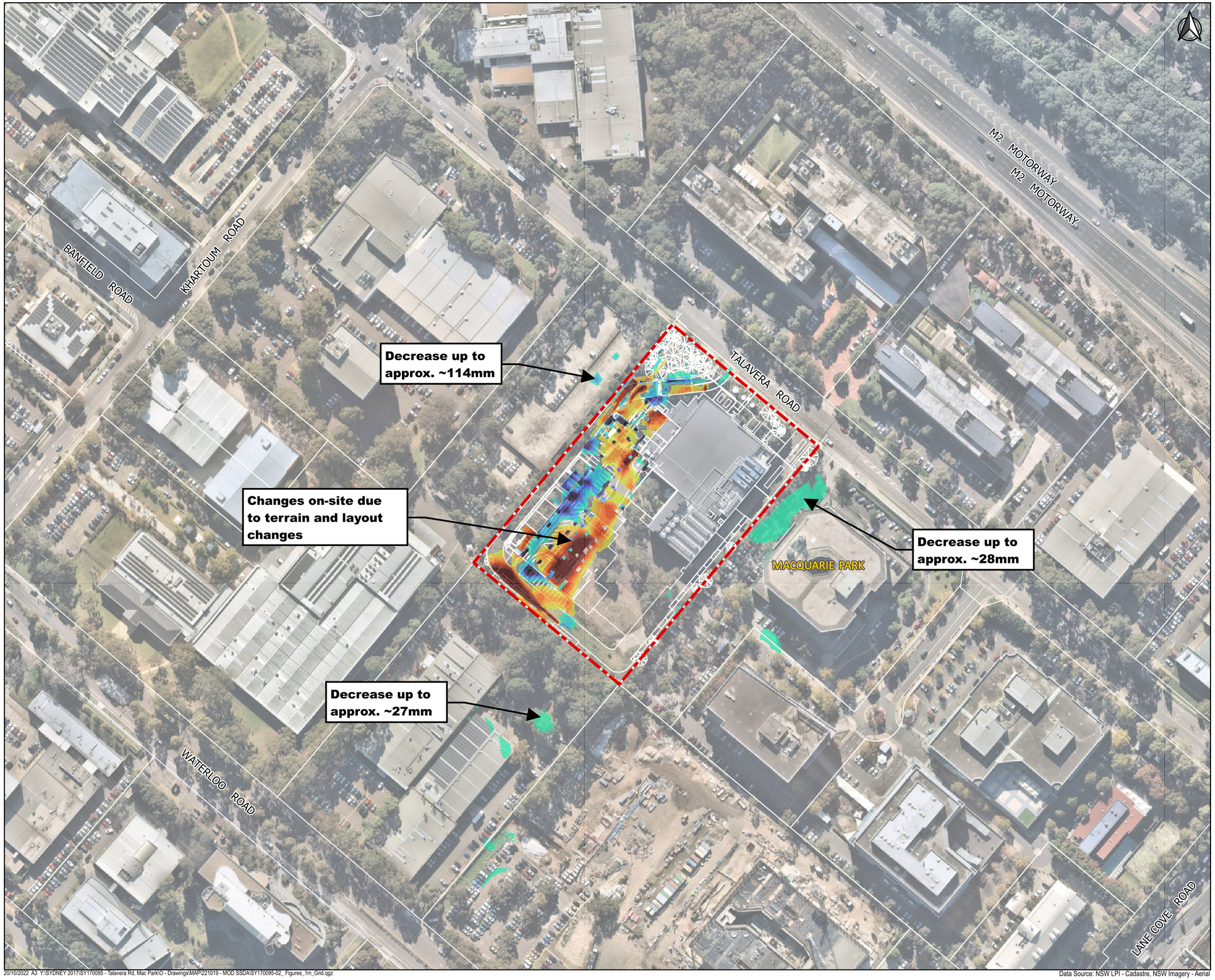
# Figure C2 [B]

**Development Impact**
**Depth Difference**
**5% AEP Flood Event**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP




## Legend

- Subject Site

**Depth Difference (m)**

- < -0.200
- -0.200 - -0.175
- -0.175 - -0.150
- -0.150 - -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- 0.125 - 0.150
- 0.150 - 0.175
- 0.175 - 0.200
- > 0.200

0 30 60 Metres

1:2,000

# Figure C3 [B]

**Development Impact**
**Depth Difference**
**1% AEP Flood Event**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP

Decrease up to approx. ~45mm

Increase up to approx. ~250mm

Decrease up to approx. 240mm

Changes on-site due to terrain and layout changes

BANFIELD ROAD

KHARTOUM ROAD

M2 MOTORWAY

M2 MOTORWAY

TALAVERA ROAD

MACQUARIE PARK

WATERLOO ROAD

LANE COVE ROAD

## Legend

Subject Site

**Depth Difference (m)**

- < -0.200
- -0.200 - -0.175
- -0.175 - -0.150
- -0.150 - -0.125
- -0.125 - -0.100
- -0.100 - -0.075
- -0.075 - -0.050
- -0.050 - -0.025
- -0.025 - 0.025
- 0.025 - 0.050
- 0.050 - 0.075
- 0.075 - 0.100
- 0.100 - 0.125
- 0.125 - 0.150
- 0.150 - 0.175
- 0.175 - 0.200
- > 0.200

0 30 60 Metres

1:2,000

# Figure C4 [B]

**Development Impact**
**Depth Difference**
**PMF Flood Event**

17-23 Talavera Road
Macquarie Park, NSW

GIDDIS PROJECT MANAGEMENT

NORTHROP