

Infrastructure NSW

Powerhouse Ultimo Renewal

Stormwater and Flooding, Response to State Significant Development Comments

Reference: PU2-REP-CI-00X03

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1. Introduction

Arup prepared the Stormwater and Flooding Report (PUR-ARP-REP-CI-000001, Rev 4, 5 April 2024) in support of the State Significant Development application (SSD-67588459) for Powerhouse Ultimo Revitalisation Project. This report has been prepared to address responses to submissions received in relation to the Stormwater and Flooding Report.

The comments received and responses are outlined in Table 1.

Table 1 – Agency Comments

Item	Agency Comment	Response
City of Sydney		
3.3 Stormwater and Flooding	The site is identified as flood affected and flood modelling has been undertaken. The modelling shows significant ponding within the terrace area at the southeast corner of the site and some of the proposed new entries do not meet the requirement for 1% AEP + 0.5m - although a merit-based approach has been requested given the heritage significance of the existing building. No objection is raised given that the basement is protected up to the probable maximal flood level (PMF).	Response with respect to previous report (PUR-ARP-REP-CI-000001): - The basement entry adjacent to the Gathering Terrace is not protected in the Probable Maximum Flood (PMF). (See Table 16 of Section 7.4) - Table 18 of the report provides an assessment based on City of Sydney's acknowledgement for the need of a merit-based approach in assessing flood impacts to heritage buildings. This table notes that the adjacent finished floor levels (FFLs) of the building remain above the 1% AEP event and the 1% AEP including climate change. The adjacent building FFL is below the 1% AEP + 500mm and the PMF levels which is a typical requirement for threshold levels to buildings with basement connections (applicable to Powerhouse Ultimo at this location). The proposed development is applying for dispensation from the typical FPL criteria on the basis of heritage considerations. The flood assessment results have been prepared to inform a merits-based approach. For additional clarity regarding FFLs and flood levels, flood modelling has been completed and a figure has been prepared indicating the current architectural ground level plan, the entry threshold levels, the 1% AEP flood level and the PMF level in Appendix A.4. This figure can be viewed in conjunction with Table 3 which provides a summary of flood planning compliance.
3.3 Stormwater and Flooding	The MUSIC-Link report does not comply with the City's targets. An amended report should be provided.	Updated water quality modelling has been undertaken. Refer to Section 3 for details of updates made and Appendix B for updated MUSIC-Link report.
Biodiversity, Conservation and Science		
1	The proposal includes demolition of existing buildings and construction of new museum spaces and public open spaces. The potential flood impact caused by these changes remains unclear in the absence of flood modelling. All changes such as topography, building footprints and any other potential obstructions to flooding should be presented on a plan to undertake an initial qualitative assessment of whether flood impact modelling is necessary. BCS raised concerns on the potential for flood impacts for a previous SSD proposal at this site (SSD-32927319). The EIS for	Flood modelling has been undertaken based on the Council-adopted flood study model (City of Sydney Darling Harbour Catchment). Updates to the model have been made for both the existing and design case scenarios to incorporate detailed site survey, building footprints, obstructions, design surfaces and updates to the stormwater network where applicable. Refer to Section 2.1 for a description of the updates made to the Council flood model for the purpose of this assessment. Refer to Appendix A for flood mapping.

Item	Agency Comment	Response
	SSD32927319 did not provide a Flood Impact and Risk Assessment (FIRA) and the RtS provided an unsatisfactory FIRA. Please refer to previous EHG submissions on the EIS (DOC22/479653) and RtS (DOC22/878399) for this previous SSD.	
2.1	The Stormwater and Flooding Report has used a stormwater model and other calculations to estimate flood levels and flood planning levels. Given the shallow depth of flow, this approach may not be unreasonable for Harris Street and Macarthur Street. However, further information is required. The cross-sections used should be presented. Using the Manning's equation is not able to take account of areas with varying terrain. Varying flood depths in the flood model results presented indicate that this approach may not be accurate. BCS raises particular concern that flood levels at the Gathering Terrace may not be properly represented in the stormwater model. BCS recommends further information be provided to address these concerns, including:	Flood modelling has been undertaken based on the Council-adopted flood study model (City of Sydney Darling Harbour Catchment). Flood planning level compliance checks have been undertaken based on the modelling results and supersede the Manning's equation analysis presented in the Stormwater and Flooding Report. Refer to Section 2.2 and Appendix A.4 for the updated flood level planning compliance assessment.
2.2	The water surface levels and depths used to determine flood planning levels should be reviewed against flood depths and levels from a flood model including scrutiny of flood levels adjacent to any new basement entries	Flood modelling has been undertaken based on the Council-adopted flood study model (City of Sydney Darling Harbour Catchment). Flood planning level compliance checks have been undertaken based on the flood modelling results and supersede the Manning's equation analysis presented in the Stormwater and Flooding Report. Refer to Section 2.2 (Table 3) and Appendix A.4 for the updated flood level planning compliance assessment.
2.3	A plan clearly showing the relevant building entrances together with "flood planning level check locations" shown on Figure 17.	Refer to Section 2.2 (Table 3) and Appendix A.4 for the updated flood level planning compliance assessment.
2.4	A description of each location in Tables 15 and 16.	Refer to Section 2.2 (Table 3) and Appendix A.4 for the updated flood level planning compliance assessment.
3.1	The approach to the basement entries needs further clarification. The following should be provided: A plan showing basement entry location and whether these are existing or proposed.	Refer to Section 2.2 (Table 3) and Appendix A.4 for an illustration of the basement entrance locations and updated flood level planning compliance assessment.
3.2	Clarification on which basement entries are above the Probable Maximum Flood (PMF) and how much freeboard to the 1% Annual Exceedance Probability (AEP) can be provided where 500 mm cannot be reached. Preferably the existing tables would be amended to provide this information.	Refer to Section 2.2 (Table 3) and Appendix A.4 for the updated flood level planning compliance assessment.

Item	Agency Comment	Response
3.3	Consideration of the flood risk should form part of the justification for a lower level, e.g., depth and duration of flooding. Where protection to the PMF level cannot be reached, calculations can be made to estimate the maximum volume of water likely to enter the basement. The resultant maximum depth can inform a risk assessment.	A review of the risks associated with flood water entering the building has been provided, including the depth of inundation (including in basement areas, the consequences (hydraulic hazard, damage to artifacts, etc), Refer to Section 2.2.2.
3.4	It may be preferable to revise Tables 15 and 16 or produce an alternate table to focus only on flood planning level compliance for the purpose of clarity.	Refer to Section 2.2 (Table 3) and Appendix A.4 for the updated flood level planning compliance assessment.

1.1 Acronym Definition

Acronym	Definition
AEP	Annual Exceedance Probability
ARI	Average Recurrence Interval
ARR	Australian Rainfall and Runoff
BoM	Bureau of Meteorology
CoS	City of Sydney
CL	Continuing Loss
DCP	Development Control Plan
DDA	Disability Discrimination Act
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
FPL	Flood Planning Level
GPT	Gross Pollutant Trap
IL	Initial Loss
INSW	Infrastructure NSW
LEP	Local Environment Plan
LGA	Local Government Area
mAHD	Metres above Australian Height Datum
NSW	New South Wales
OSD	On-Site Detention
PMF	Probable Maximum Flood

Acronym	Definition
PUR	Powerhouse Ultimo Revitalisation
RUSLE	Revised Universal Soil Loss Equation
SEARs	Secretary's Environmental Assessment Requirements
SIP	Shelter In Place
SQID	Stormwater Quality Improvement Device
SSD	State Significant Development
SSDA	State Significant Development Application
SWC	Sydney Water Corporation
TN	Total Nitrogen
TP	Total Phosphorous
TSS	Total Suspended Solids
WQT	Water Quality Treatment
WSUD	Water Sensitive Urban Design

2. Flooding

2.1 Flood modelling

In response to the agency comments, the TUFLOW model utilised for the Darling Harbour Catchment Flood Study (BMT WBM, 2014) was requested from the City of Sydney and has been utilised to undertake further flood modelling of the proposed Powerhouse Ultimo Renewal. This section outlines the updates made the TUFLOW model to inform the updated flooding assessment.

The TUFLOW model was run for the 18.1% AEP, 5% AEP, 1% AEP, 1% AEP + climate change (20% rainfall increase), 0.2% AEP and PMF events for this assessment. Flood mapping is presented in Appendix A.

Key site features are indicated in the existing site plan and proposed general arrangement shown in Figure 1 and Figure 2.

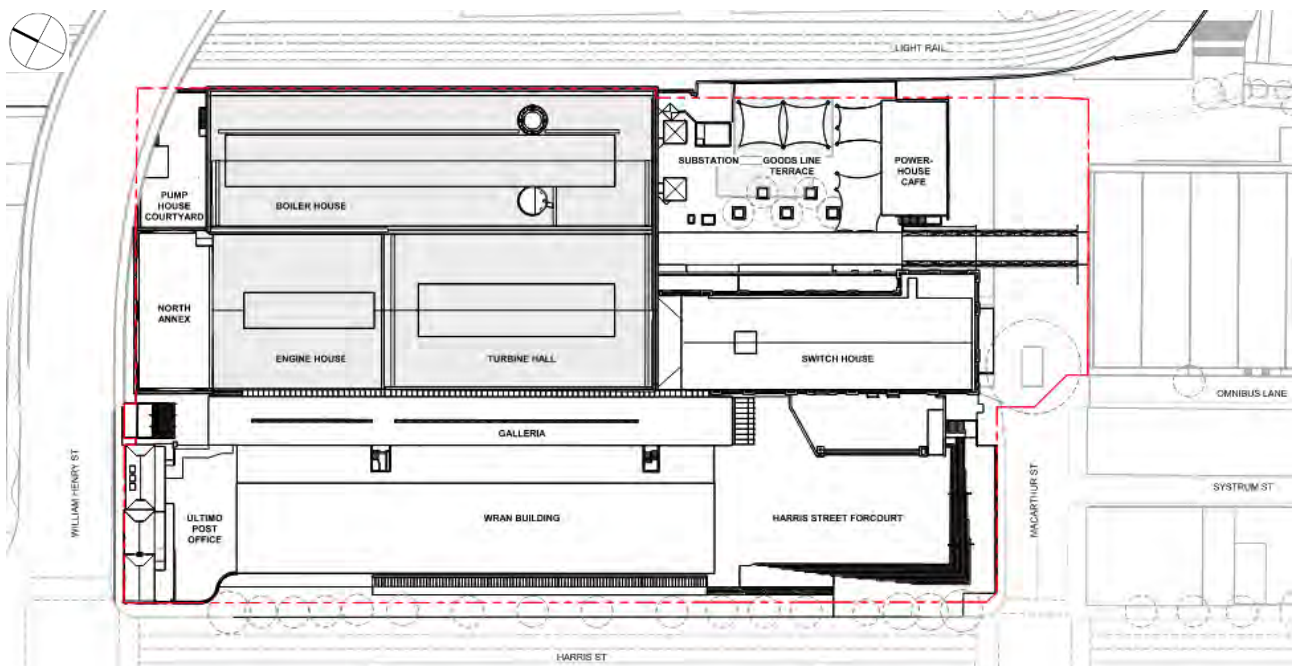


Figure 1 – Existing Site Plan

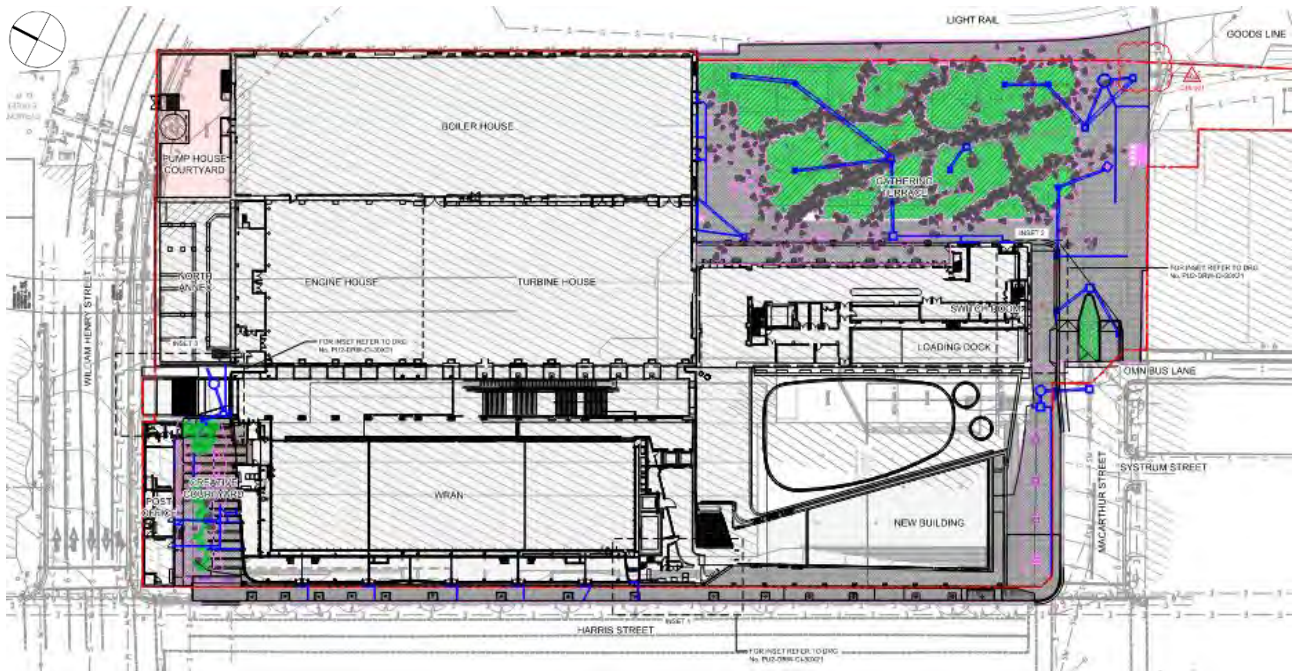


Figure 2 – Proposed General Arrangement

2.1.1 Updates to Baseline Model

The following updates have been made to the TUFLOW model received from the City of Sydney:

- A topographic survey surface has been incorporated into the TUFLOW model, based on information received from LTS Lockley (Revision J, received on 04/07/2024). The key features of this survey include:
 - The updated surface, covering the William Henry Street, Macarthur Street and Omnibus Lane carriageways, the eastern side of Harris Street carriageway, the Gathering Terrace and The Goods Line adjacent to the Harwood Building.
 - Barrier walls at the following locations:
 - Along the eastern side of the Gathering Terrace, from the south-east corner of the Boiler House Building, towards the stairs linking The Goods Line to Darling Drive. An existing gate near the Boiler House building has been incorporated into the model to allow some water to drain from the Gathering Terrace into the light rail corridor.
 - Along the eastern side of the Post Office Courtyard, separating the Post Office Courtyard from the lower courtyard near North Annex.
 - At the north-east corner of the site, bounding the Pump House courtyard area between the Boiler House building and the North Annex.
 - Along the southern edge of the Harris Street Forecourt
 - Stormwater pits and pipes internal to the Powerhouse Museum site, including within the Gathering Terrace.
- Building footprints were modified to represent the existing buildings within the Powerhouse Precinct more accurately. This included removing the building polygon covering the south-western courtyard and removing the shade cloth areas digitised as building footprints at Gathering Terrace.
- Omnibus Lane has been incorporated to the TUFLOW model by modifying a building footprint previously preventing surface flows draining from Macarthur Street into Omnibus Lane.

Updates to the TUFLOW model geometry from the Council model are shown in Figure 3.

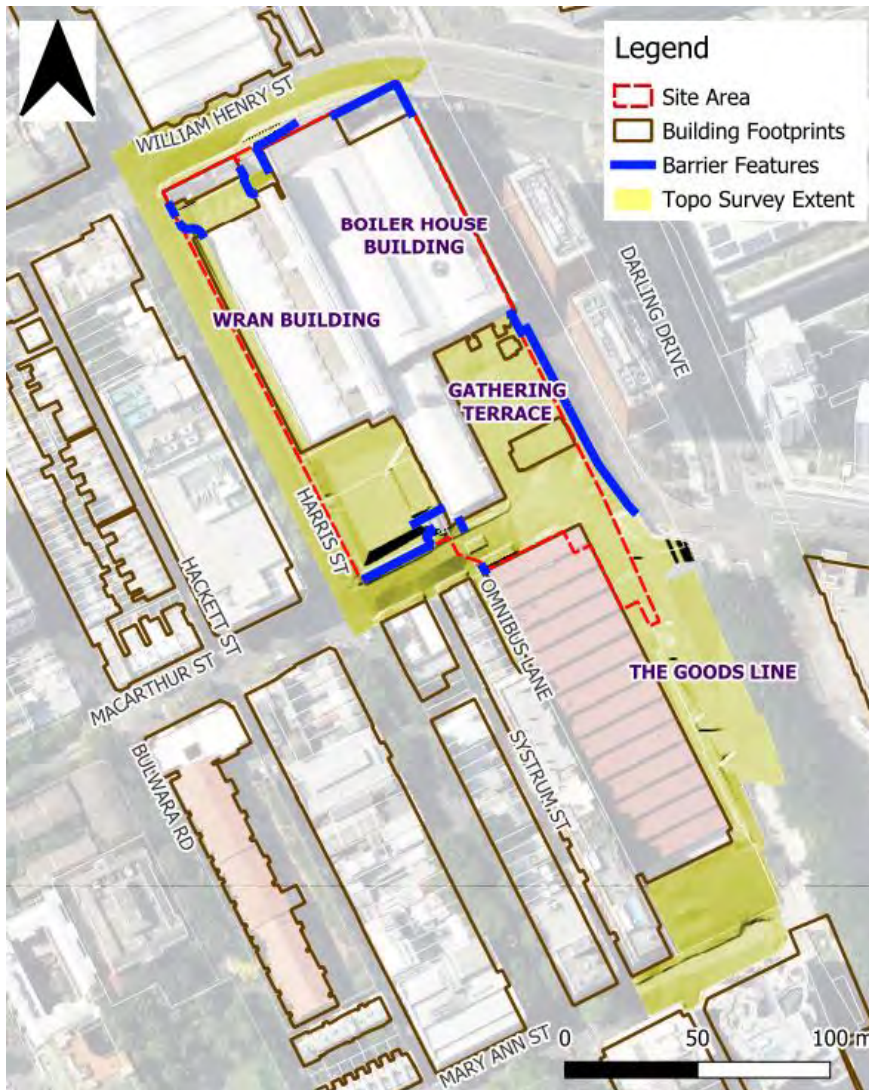


Figure 3 – Geometric inputs from topographical survey

- In addition to the stormwater network updates based on the survey information, the following updates to the stormwater network have been incorporated based on information available in historical Powerhouse Museum design drawings (dated 1983 – 1987). This is consistent with the assumptions noted in the building hydraulic services design.
 - Stormwater grates draining the Post Office courtyard, assumed to ultimately drain to the sea water chamber and out to Darling Harbour, have been added to the model to allow rainfall inflows within the courtyard to drain out. Surface grates picked up in the site survey are assumed to be drained by 150 mm pipes as illustrated on the drawings.
 - A grated inlet drain adjacent to the North Annex building has been incorporated to collect rainfall inflows within the lower courtyard between the Post Office Courtyard and the North Annex. This drain is also assumed to drain to the sea water chamber.
 - A grated inlet (denoted in the survey information) has been added at the southern end of Omnibus Lane to allow water to drain away from the trapped sag. A 150 mm diameter pipe has been assumed to drain the water from this inlet to the south, connecting into the Council network at Mary Ann Street.
 - Stormwater inlets and pipes have been incorporated within the Harris Street Forecourt, connecting to the Council stormwater network at Macarthur Street.

Stormwater updates incorporated into the TUFLOW model are shown in Figure 4.

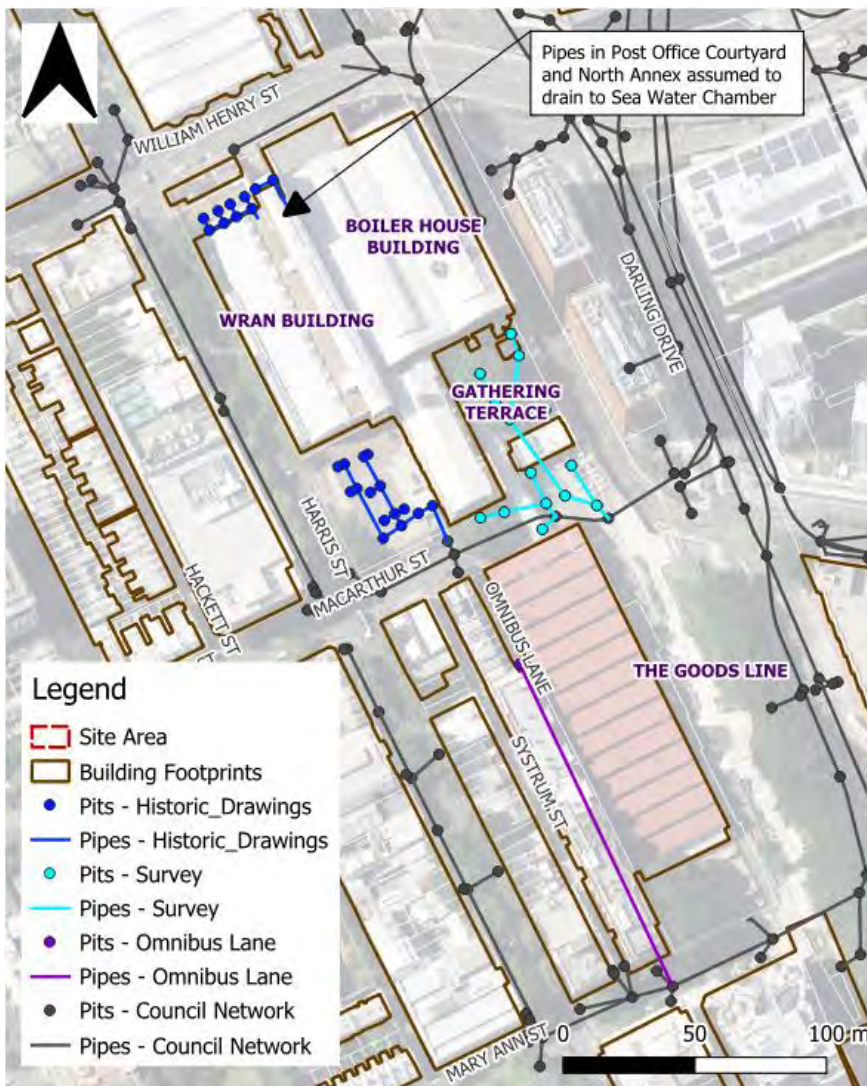


Figure 4 – Stormwater inputs from topographical survey/historical drawings

- Catchment inflows within the site area have been updated in the TUFLOW model to be in line with the assumptions adopted for the civil drainage design. That is:
 - The roof catchment from the Wran Building, plus the stormwater network draining the Post Office Courtyard and the Lower Courtyard (adjacent to the North Annex), are assumed to drain to the sea water chamber located in the basement of the existing building, via the internal stormwater network.
 - In the PMF, the western portion of the roof of the Wran building is assumed to drain to Harris Street (as opposed to the sea water chamber) as the internal building stormwater network is assumed to be at capacity.
- The Boiler House Building and the Gathering Terrace catchments have been assumed to drain into the Council stormwater network at Macarthur Street. Down pipes from this catchment connect into the stormwater network beneath the Gathering Terrace and then into the Council network at the south-east corner of the site
- The Entrance Courtyard (at the south-west of the site area) drains via the internal drainage network into the Council Network at Macarthur Street, with the pipe connection from the site located opposite Omnibus Lane. Once the internal stormwater network is at capacity, overland flows discharge from the courtyard to Harris Street.

Approximate catchment areas are illustrated in Figure 5 .

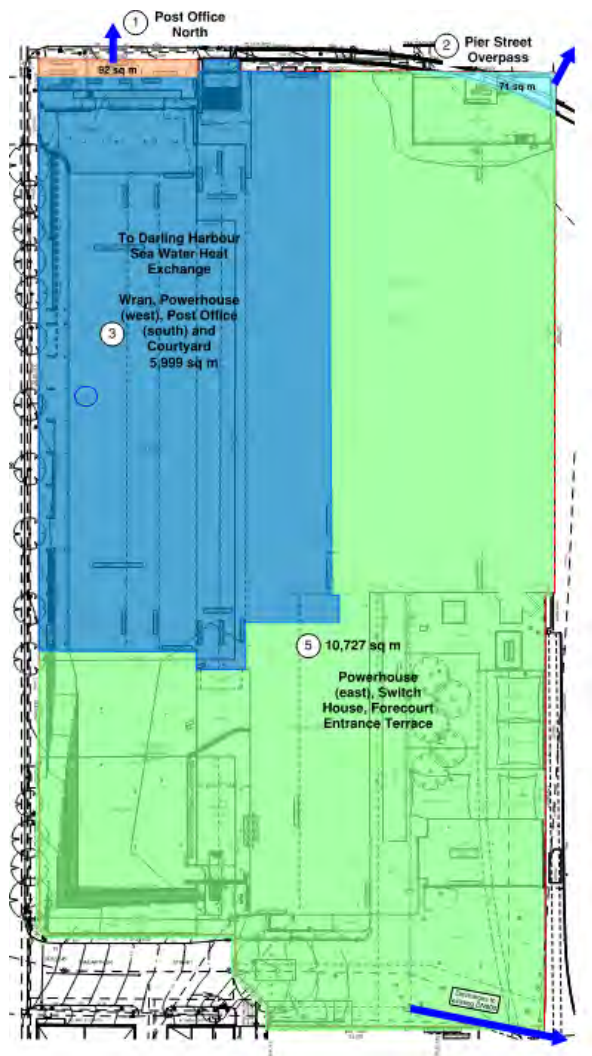


Figure 5 – Existing Catchment Plan

2.1.2 Inputs to the Design Case Scenario

The following updates have been incorporated into the TUFLOW model to simulate the design case scenario:

- The design surface illustrated on the Powerhouse Ultimo Revitalisation civil design drawings (Interim Tender submission dated 15/07/2024).
- Alterations to the building footprints within the site (where applicable), including the new building at the south-west corner of the site and the removal of the existing café and substation buildings within Gathering Terrace.
- Alterations to the existing stormwater network based on the Powerhouse Ultimo Revitalisation civil design drawings (Tender submission dated 9/08/2024). This includes:
 - Updates to the drainage network within Macarthur Street and Gathering Terrace
 - Inclusion of the grated pit within the lower courtyard (adjacent to North Annex)
- A design surface within the Level 1 Courtyard, which has been schematised in the TUFLOW model as 2D Z-Shape elements based on the Landscape Design drawings (Interim Tender submission dated 12/07/2024)
- Stormwater draining the Level 1 Courtyard, based on Hydraulic Services drawings (Interim Tender submission dated 12/07/2024)

Catchment inflows have been updated in line with the assumptions adopted for the civil drainage design. The main assumptions regarding the catchment inflows in the design case are:

- The respective roof catchment areas for the Wran Building (draining to the Sea Water Chamber) and the Boiler House buildings (draining into the Council network at Gathering Terrace) remain unchanged from the existing conditions.
- The impervious fraction of the site remains unchanged from the existing conditions.

Minor updates have been made to the rainfall polygons applied to the remaining building areas where building envelopes are updated as part of the design case.

Approximate catchment areas are illustrated in Figure 6.

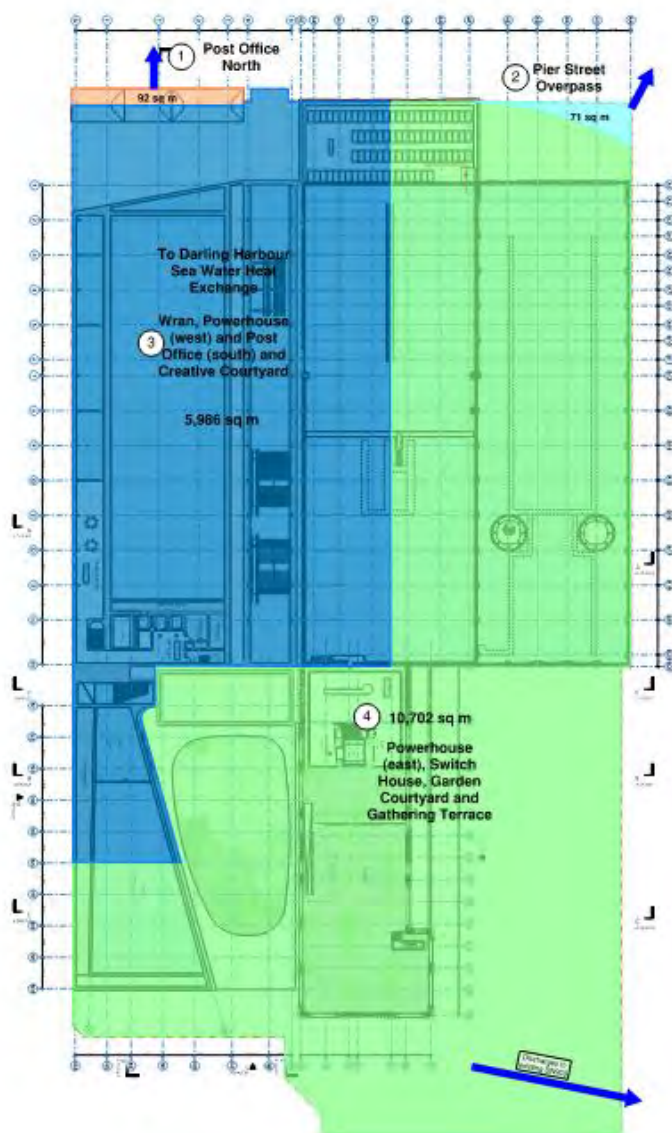


Figure 6 – Proposed Catchment Plan

2.1.3 Flood Modelling Results

Flood maps illustrating the results of the flood modelling have been prepared for the following scenarios:

- Existing Case Scenario – Appendix A.1
- Design Case Scenario (Unmitigated) – Appendix A.2
- Design Case Scenario (Mitigated) – Appendix A.3

Based on the design inputs listed in Section 2.1.2 (the “unmitigated” design scenario), it was noted there is a material increase in the peak flood levels from the existing conditions within Omnibus Lane in the 5% AEP event. This afflux is due to raised design surface levels (from existing) in Macarthur Street immediately downstream of Omnibus Lane. This results in an increase in the surface flows being diverted down Omnibus Lane, as opposed to flowing east along Macarthur Street towards the Gathering Terrace.

The afflux in Omnibus Lane for the unmitigated design scenario in the 5% AEP event is shown in Figure 7. It is noted that flood level impacts within Omnibus Lane do not vary significantly from existing conditions (that is, peak flood levels do not change by more than +/- 10 mm) in all other events assessed.

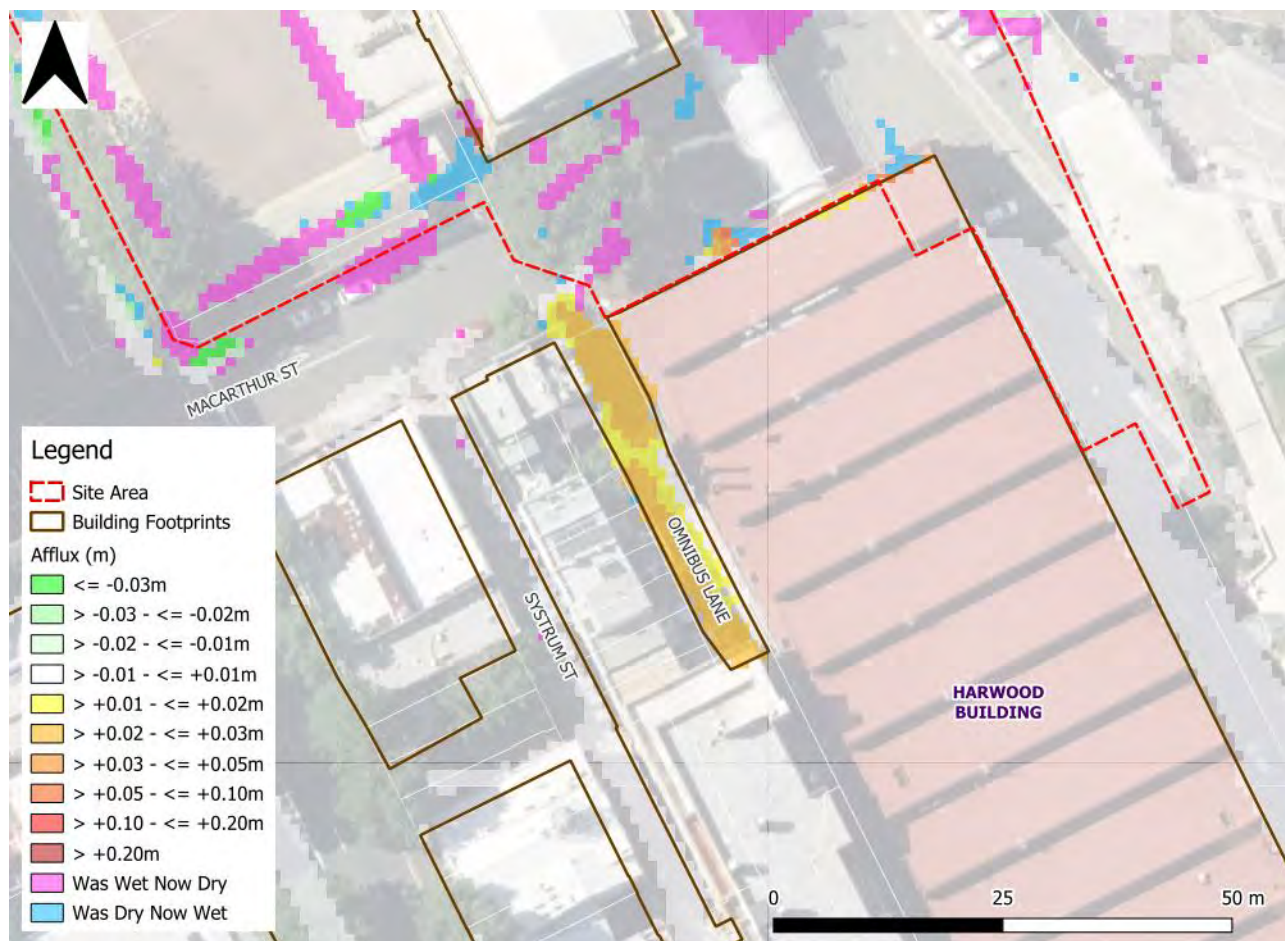


Figure 7 – Afflux at Omnibus Lane, Unmitigated Design Scenario, 5% AEP Event

A mitigated design case option was also modelled, with a portion of the raised section of Macarthur Street downstream of Omnibus Lane removed (effectively assuming existing surface levels apply). This alleviates the afflux within Omnibus Lane predicted in the 5% AEP event for the unmitigated design scenario. The afflux for the mitigated design at Omnibus Lane in the 5% AEP is shown in Figure 8.

Alternative design mitigation measures to achieve a compliant afflux at Omnibus Lane may be considered at later design stages if required. This may include measures such as augmenting the upstream stormwater network to capture more surface flows upstream of Omnibus Lane.



Figure 8 – Afflux at Omnibus Lane, Mitigated Design Scenario, 5% AEP Event

Velocity and hydraulic hazard mapping are illustrated in Appendix A for the existing and design cases.

Flow velocities do not materially change in the design case scenario (either unmitigated or mitigated) compared with existing conditions. As the proposal mainly involves the reconfiguration of the existing Powerhouse Museum building, plus some minor regrading of Macarthur Street, Gathering Terrace and the existing footpaths on Harris Street, the impact of the development on flow velocities within the external overland flow paths is minimal.

The provisional hydraulic hazard is categorised as H1 (generally safe for people, vehicles and buildings) around the proposed development in all flood events up to and including the 0.2% AEP, including within the Gathering Terrace.

In the PMF, the provisional hydraulic hazard is predicted to be up to H3 over the sag points within Gathering Terrace and H2 elsewhere. There is a small increase in the extent of the H3 hydraulic hazard area under the design case scenario, which is primarily due to localised re-grading of the surface levels from existing plus an increase in predicted flood levels of approximately 40 mm compared to the existing case (triggering the H3 threshold when peak flood depths exceed 0.5 m). However, this area is not required to be traversed by people either evacuating or sheltering within the building in the event of a flood emergency..

Figure 9 illustrates the combined flood hazard curves presented in Australian Rainfall and Runoff 2019.

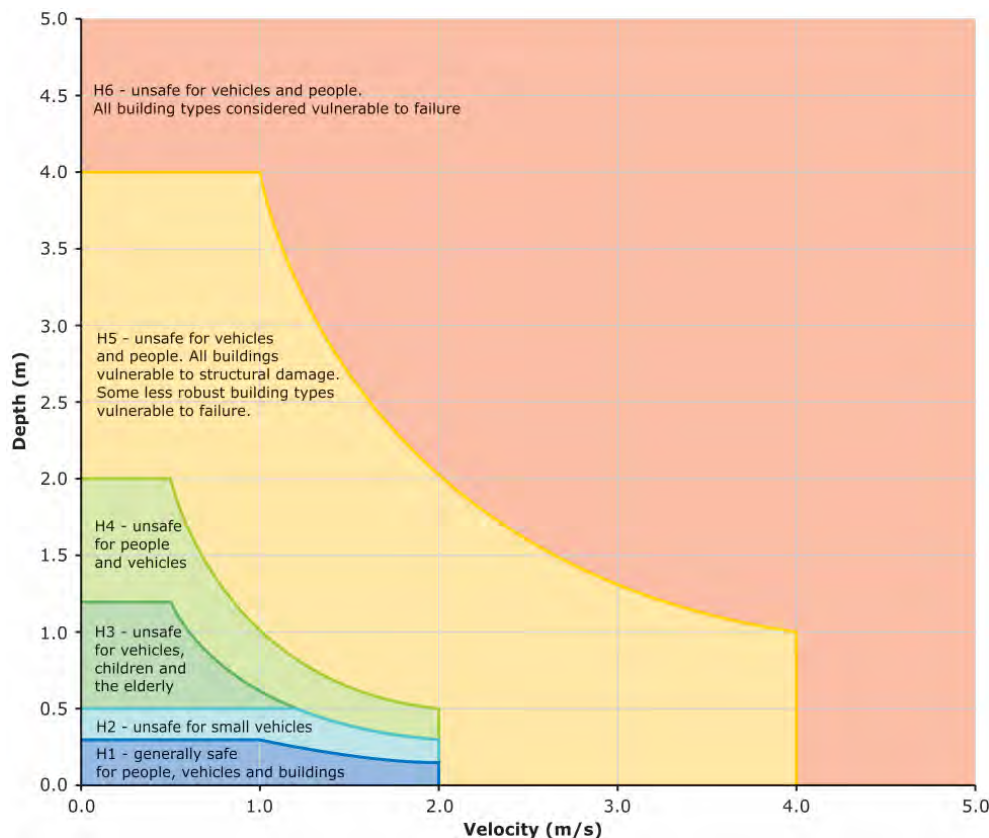


Figure 9 – Combined Flood Hazard Curves (Smith et al, 2014)

2.2 Updates to Previous Flood Advice

In response to comments provided by BCS (listed in Table 1), an updated flood level compliance table (Table 3) has been provided to present flood planning level compliance at entrance locations to the Powerhouse Museum building. Table 3 should be read in conjunction with the figures presented in Appendix A.4, which illustrate the locations of the building entrances.

2.2.1 Flood Planning Levels

Based on the updated TUFLOW modelling undertaken, the site boundary adjacent to the Harris Street mid-block and south is encroached in the PMF. Therefore, the CoS planning criteria of 1% AEP + 0.5 m or PMF (whichever greater) is applicable to Harris Street mid-block and south basement thresholds, (Entrances 7, 8 and 9) (as per the City of Sydney Interim Floodplain Management Policy).

Entrance 7 achieves compliance with the flood planning level (1% AEP + 500 mm). Whilst Entrances 8 and 9 do not comply with the flood planning level (1% AEP + 0.5 m), the risk of these entrances being subject to flooding is low noting there is a continuous downhill grade along Harris Street (and Macarthur Street) which will allow any overland flow to drain away from these entrances. Flood modelling undertaken indicates these entrances will have some freeboard in the PMF.

Entrances 16-24 to the proposed Powerhouse Museum building (which are all located within the Gathering Terrace at the south-east of the site) do not achieve the flood planning criteria (the greater of the 1% AEP + 0.5 m or PMF). This result is consistent with the previous Stormwater and Flooding Report (PUR-ARP-REP-CI-000001, Rev 4, 5 April 2024), although the predicted PMF flood levels from the TUFLOW model are higher than those previously reported.

The Gathering Terrace is an existing trapped low point, and the existing Powerhouse buildings adjacent to the Gathering Terrace have heritage significance. The terrace is constrained by the adjacent light rail retaining wall and The Goods Line, which are both elevated above the terrace, plus the existing floor level of the Powerhouse buildings (6.18 m AHD).

The existing floor level is above the flood level predicted in all events up to and including the 0.2% AEP (1 in 500 year) event, however the building remains subject to flooding in extreme flood events up to the PMF.

The City's Interim Floodplain Management Policy provides acknowledgement of the need for a merit-based approach in assessing flood impacts to heritage buildings. An updated assessment against the relevant criteria in Section 3.3 of the City's policy is provided in Table 2.

Table 2 – Assessment of CoS's Policy

Policy Requirements (Section 3.3)	Assessment
i. Expert assessment has identified the structure or development as having heritage conservation value;	The buildings are noted as heritage items on the State Heritage Register and the Sydney LEP 2012.
ii. Planning instruments have specifically identified the existing development as having heritage conservation value and provide the appropriate level of statutory protection;	The buildings are noted as heritage items on the State Heritage Register and the Sydney LEP 2012.
iii. The highest practical level of flood protection is provided while maintaining an appropriate balance with heritage conservation;	The finished floor levels of the building remain above the 1%AEP event, and modelling undertaken indicates the finished floor levels are above the 0.2% AEP (1 in 500 Year) flood level. Adjustment of the floor levels and/or entrances to the buildings to provide a greater level of flood protection beyond the 1%AEP event would have a significant and irreparable impact on the heritage significance of these structures.
iv. The proposed development will not be subject to frequent flooding risk that may jeopardise the long term viability or heritage conservation of the development. Comprehensive assessment would be required where the development is subject to flooding in storms more frequent than the 5% AEP flood;	The finished floor levels of the building remain above the 1% AEP event and the 1% AEP including climate change (as well as the 0.2% AEP (1 in 500 Year) event. As such the building is not subject to frequent flooding risk.
v. A restriction shall be placed on the property title, identifying the flooding risk and requiring conservation of heritage values.	The flood risk is acknowledged, and it is a matter for the authority to place a restriction on the title..

2.2.2 Gathering Terrace – Flood Risk Assessment

Table 3 indicates the existing Powerhouse Building adjacent to the Gathering Terrace is subject to flooding in extreme flood events, such as the PMF. The consequences of an extreme flood event occurring at Gathering Terrace include:

- Potential risk to life of building occupants (staff/visitors), plus occupants of the Gathering Terrace
- Damage to the Powerhouse Museum building and any exhibits/artefacts stored on the ground floor (or in the basement floor) of the existing building.

The flood risk at Gathering Terrace is an existing risk. Results from the Design Case scenario flood modelling runs provide the following insights with regard to the flood risk at the existing Powerhouse Building:

- The proposed floor levels of the existing Powerhouse Building are above the predicted 1% AEP and 1% AEP plus climate change events. In addition, flood model results indicate the floor level (6.18 m AHD) is above the 0.2% AEP (1 in 500 year) flood level (approximately 6.14 m AHD) predicted within Gathering Terrace.
- The provisional hydraulic hazard for the flooding within Gathering Terrace is categorised as H1 (generally safe for people, vehicles and buildings) all flood events up to and including the 0.2% AEP event.
- The peak flood depth predicted within the existing Powerhouse building in the PMF is approximately 0.39 m. Given Gathering Terrace is a trapped sag and the hydraulic hazard is driven by flood depth (as opposed to velocity), the flood depth within the powerhouse building would not exceed 0.5 m, which would not exceed the H2 category within the Powerhouse Building..

- The time to peak flood level within the Gathering Terrace in the PMF remains relatively short, being reached within 15 minutes of the onset of the storm event for the critical duration storm.
- The duration of inundation at Gathering Terrace is similar to the duration of the rainfall event (that is, the Gathering Terrace drains out relatively quickly once rainfall has ceased in the catchment).
- Provisional hydraulic hazard in the PMF is categorised as a mixture of H2 (unsafe for small vehicles) in the Gathering Terrace, with some areas of H3 hazard (unsafe for vehicles, children and the elderly) directly over the sag points.

Given the low probability of flooding affecting the Powerhouse Building (requires a flood in exceedance of the 0.2% AEP event) and that the hydraulic hazard does not constitute a significant risk to building occupants, it is anticipated that flood risks can be addressed through the operational and emergency risk management plans for the building. This plan will consider evacuation to higher floor levels within the building, and restrictions on what can be stored on the lower levels.

Table 3 – Flood planning level compliance summary

Loc.	Location Description	Basement Entrance or Ground floor entrance?	Existing or Proposed?	Applicable Flood Planning Criteria	Proposed Floor Level (m AHD)	1% AEP Level (m AHD)	1% AEP + CC Level (m AHD)	PMF Level (m AHD)	Applicable Flood Planning Level (m AHD)	Planning Criteria Met?	Basement Entrances Freeboard to 1% AEP Flood Level (m)	Basement Entrances Freeboard to PMF Flood Level (m)
1	Harris Street	Basement Entrance	Proposed	0.3m above surrounding Ground level	15.29 ^{^1}	15.57	15.57	15.66	15.72 ^{^1}	Yes ^{^1}	0.15 ^{^1}	0.06 ^{^1}
2	Harris Street	Ground Floor	Proposed	1% AEP flood level	15.54	15.39	15.40	15.52	15.39	Yes	N/A	N/A
3	Harris Street	Ground Floor	Proposed	1% AEP flood level	15.37	15.27	15.28	15.37	15.27	Yes	N/A	N/A
4	Harris Street	Ground Floor	Proposed	1% AEP flood level	15.21	15.08	15.09	15.17	15.08	Yes	N/A	N/A
5	Harris Street	Ground Floor	Proposed	1% AEP flood level	15.03	14.93	14.94	15.05	14.93	Yes	N/A	N/A
6	Harris Street	Ground Floor	Proposed	1% AEP flood level	14.84	14.82	14.83	14.91	14.82	Yes	N/A	N/A
7	Harris Street	Basement Entrance	Proposed	1% AEP flood level + 0.5m or PMF (whichever is higher)	15.29	14.70	14.71	14.80	15.20	Yes	0.59	0.49
8	Harris Street	Basement Entrance	Proposed	1% AEP flood level + 0.5m or PMF (whichever is higher)	14.60	14.42	14.43	14.54	14.92	No	0.18	0.06
9	Harris Street	Basement Entrance	Proposed	1% AEP flood level + 0.5m or PMF (whichever is higher)	14.60	14.32	14.34	14.45	14.82	No	0.28	0.15
10	Level 1 Courtyard	Basement Entrance	Proposed	0.3m above surrounding Ground level	11.40	8.82	8.83	8.84	9.12	Yes	2.58	2.56
11	Macarthur Street - Loading Dock	Basement Entrance	Proposed	0.3m above surrounding Ground level	8.30	7.96	7.97	8.00	8.24	Yes	0.34	0.30

Loc.	Location Description	Basement Entrance or Ground floor entrance?	Existing or Proposed?	Applicable Flood Planning Criteria	Proposed Floor Level (m AHD)	1% AEP Level (m AHD)	1% AEP + CC Level (m AHD)	PMF Level (m AHD)	Applicable Flood Planning Level (m AHD)	Planning Criteria Met?	Basement Entrances Freeboard to 1% AEP Flood Level (m)	Basement Entrances Freeboard to PMF Flood Level (m)
11a	Macarthur Street	Basement Entrance	Proposed	0.3m above surrounding Ground level	7.89	7.81	7.82	7.84	8.02	No ²	0.08	0.05
12	Macarthur Street	Basement Entrance	Proposed	0.3m above surrounding Ground level	7.64	7.00	7.00	7.02	7.25	Yes	0.64	0.62
13	Macarthur Street	Basement Entrance	Proposed	0.3m above surrounding Ground level	6.89	6.57	6.58	6.65	6.86	Yes	0.32	0.23
14	Macarthur Street	Basement Entrance	Proposed	0.3m above surrounding Ground level	6.89	6.34	6.34	6.57	6.52	Yes	0.55	0.32
15	Macarthur Street	Basement Entrance	Proposed	0.3m above surrounding Ground level	6.89	6.09	6.13	6.56	6.33	Yes	0.80	0.33
16	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.09	6.13	6.56	6.59	No	0.09	-0.38
17	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.05	6.12	6.57	6.57	No	0.13	-0.39
18	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.05	6.12	6.57	6.57	No	0.13	-0.39
19	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.06	6.12	6.57	6.57	No	0.12	-0.39
20	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.04	6.12	6.57	6.57	No	0.14	-0.39
21	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.04	6.12	6.57	6.57	No	0.14	-0.39
22	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.04	6.12	6.57	6.57	No	0.14	-0.39

Loc.	Location Description	Basement Entrance or Ground floor entrance?	Existing or Proposed?	Applicable Flood Planning Criteria	Proposed Floor Level (m AHD)	1% AEP Level (m AHD)	1% AEP + CC Level (m AHD)	PMF Level (m AHD)	Applicable Flood Planning Level (m AHD)	Planning Criteria Met?	Basement Entrances Freeboard to 1% AEP Flood Level (m)	Basement Entrances Freeboard to PMF Flood Level (m)
23	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.04	6.12	6.57	6.57	No	0.14	-0.39
24	Gathering Terrace	Basement Entrance	Existing	1% AEP flood level + 0.5m or PMF (whichever is higher)	6.18	6.04	6.12	6.57	6.57	No	0.14	-0.39

^1 Ground surface levels are raised 0.3 m above adjacent gutter invert level between Harris Street and the Courtyard Entrances, protecting this entrance from flooding in the Harris Street corridor

^2 Current threshold level at building alignment is raised 0.27 m above adjacent gutter invert level. Internal steps to be provided to achieve 0.3 m in future design stages to achieve compliance

3. Water Quality Modelling

The MUSIC model for the site has been updated to address the comments raised by the City of Sydney and to include Design Development (DD) updates that have occurred post-SSDA. Key changes made during DD, include:

1. The MUSIC model targets City of Sydney pollutant reduction targets and Greenstar 'credit' achievement targets which are consistent. The previous 'exceptional' Greenstar requirements are no longer being targeted.
2. The consolidation of the two rainwater tanks into one 90kL tank;
3. Redistribution of roof catchments in the stormwater network to reflect updated hydraulic DD; and
4. Removal of the 'reflecting pool'.

The updated MUSIC link report is included in Appendix B.

The additional comments below address the remaining 'failing parameters' in the updated MUSIC-link report:

- SF Chamber notional detention time is less than the minimum; and total nitrogen, phosphorus and total suspended solids k values are less than minimum specified values as they are not representative of traditional 'sedimentation' chambers. These are supplier (Ocean Protect) provided nodes.
- C** for threshold hydraulic loading, total nitrogen, phosphorus and total suspended solids are not applicable to rainwater tanks. MUSIC report incorrectly stating values as they cannot be adjusted in the Rainwater tank node.

Appendix A

Flood Modelling Results

A.1 Flood Maps – Existing Case Scenario

Figure No.	Title
A1.1	Powerhouse Ultimo - Existing Case 18.1% AEP Flood Depths and Levels
A1.2	Powerhouse Ultimo - Existing Case 5% AEP Flood Depths and Levels
A1.3	Powerhouse Ultimo - Existing Case 1% AEP Flood Depths and Levels
A1.4	Powerhouse Ultimo - Existing Case 1% AEP + Climate Change Flood Depths and Levels
A1.5	Powerhouse Ultimo - Existing Case 0.2% AEP Flood Depths and Levels
A1.6	Powerhouse Ultimo - Existing Case PMF Flood Depths and Levels
A1.7	Powerhouse Ultimo - Existing Case 18.1% AEP Flood Velocity
A1.8	Powerhouse Ultimo - Existing Case 5% AEP Flood Velocity
A1.9	Powerhouse Ultimo - Existing Case 1% AEP Flood Velocity
A1.10	Powerhouse Ultimo - Existing Case 1% AEP + Climate Change Flood Velocity
A1.11	Powerhouse Ultimo - Existing Case 0.2% AEP Flood Velocity
A1.12	Powerhouse Ultimo - Existing Case PMF Flood Velocity
A1.13	Powerhouse Ultimo - Existing Case 18.1% AEP Flood Hazard
A1.14	Powerhouse Ultimo - Existing Case 5% AEP Flood Hazard
A1.15	Powerhouse Ultimo - Existing Case 1% AEP Flood Hazard
A1.16	Powerhouse Ultimo - Existing Case 1% AEP + Climate Change Flood Hazard
A1.17	Powerhouse Ultimo - Existing Case 0.2% AEP Flood Hazard
A1.18	Powerhouse Ultimo - Existing Case PMF Flood Hazard



Legend

Project Boundary

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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Client
INSW

Job Title
Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A1.2
Powerhouse Ultimo - Existing
Case 5% AEP Flood Depths
and Levels

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

Project Boundary

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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Scale at A3 1:1,000

Figure No. A1.3
**Powerhouse Ultimo - Existing
Case 1% AEP Flood Depths
and Levels**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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Scale at A3 1:1,000



Figure No. A1.4

Powerhouse Ultimo - Existing
Case 1% AEP+Climate Change
Flood Depths and Levels

Job No.
293558

Figure Status
DRAFT



Legend

— Project Boundary

— Water Level Contours (m AHD)

Peak Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.50
	0.50 - 0.75
	0.75 - 1.00
	1.00 - 1.50
	> 1.50

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Job Title
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1000

0

10

20 m

Scale at A3 1:1,000

Figure No. A1.5
**Powerhouse Ultimo - Existing
Case 0.2% AEP Flood Depths
and Levels**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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Job Title
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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A1.7
Powerhouse Ultimo - Existing
Case 18.1% AEP Flood Velocity

Job No. 293558	Figure Status DRAFT
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Legend

Project Boundary

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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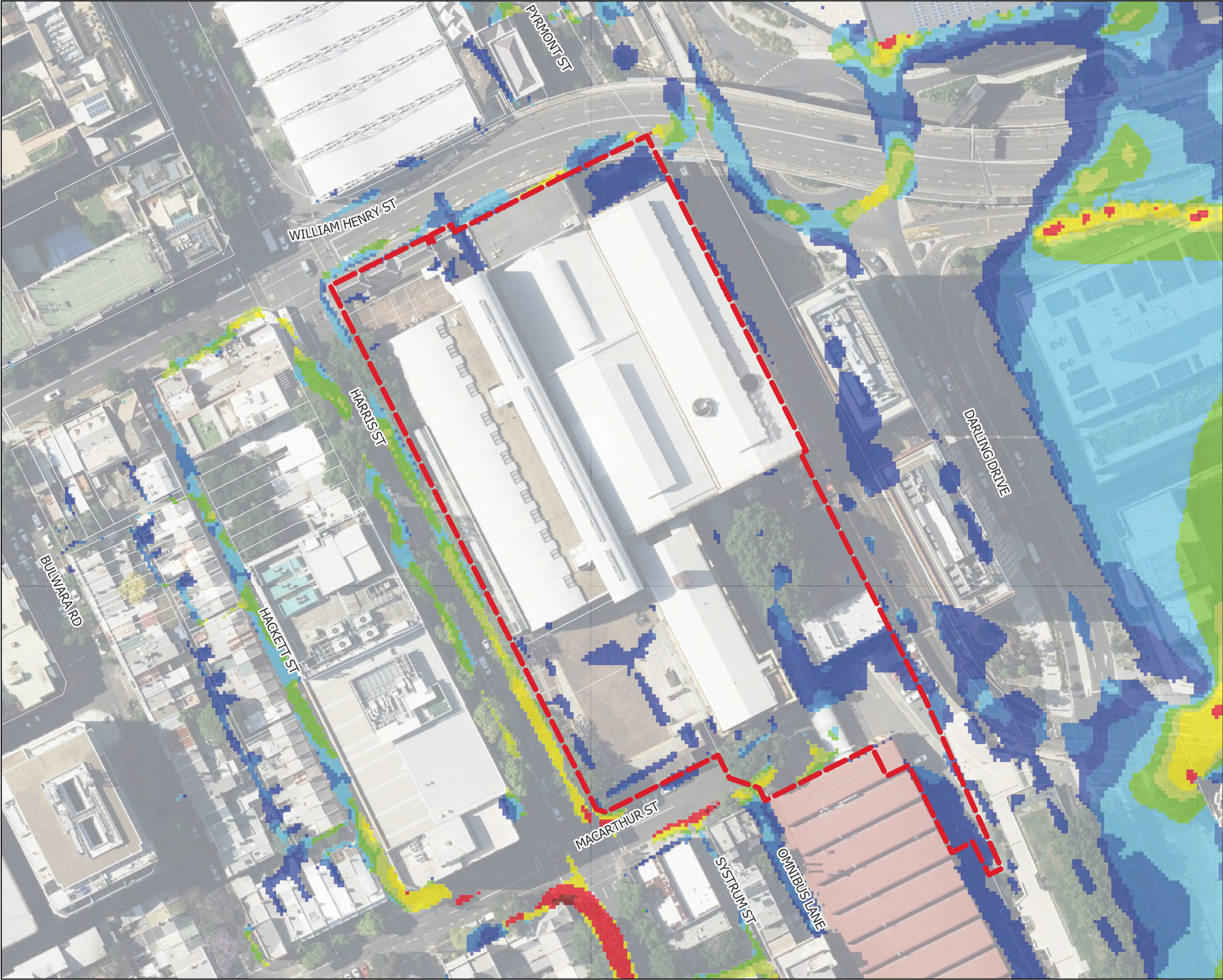
Job Title
Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A1.8
Powerhouse Ultimo - Existing
Case 5% AEP Flood Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

Project Boundary

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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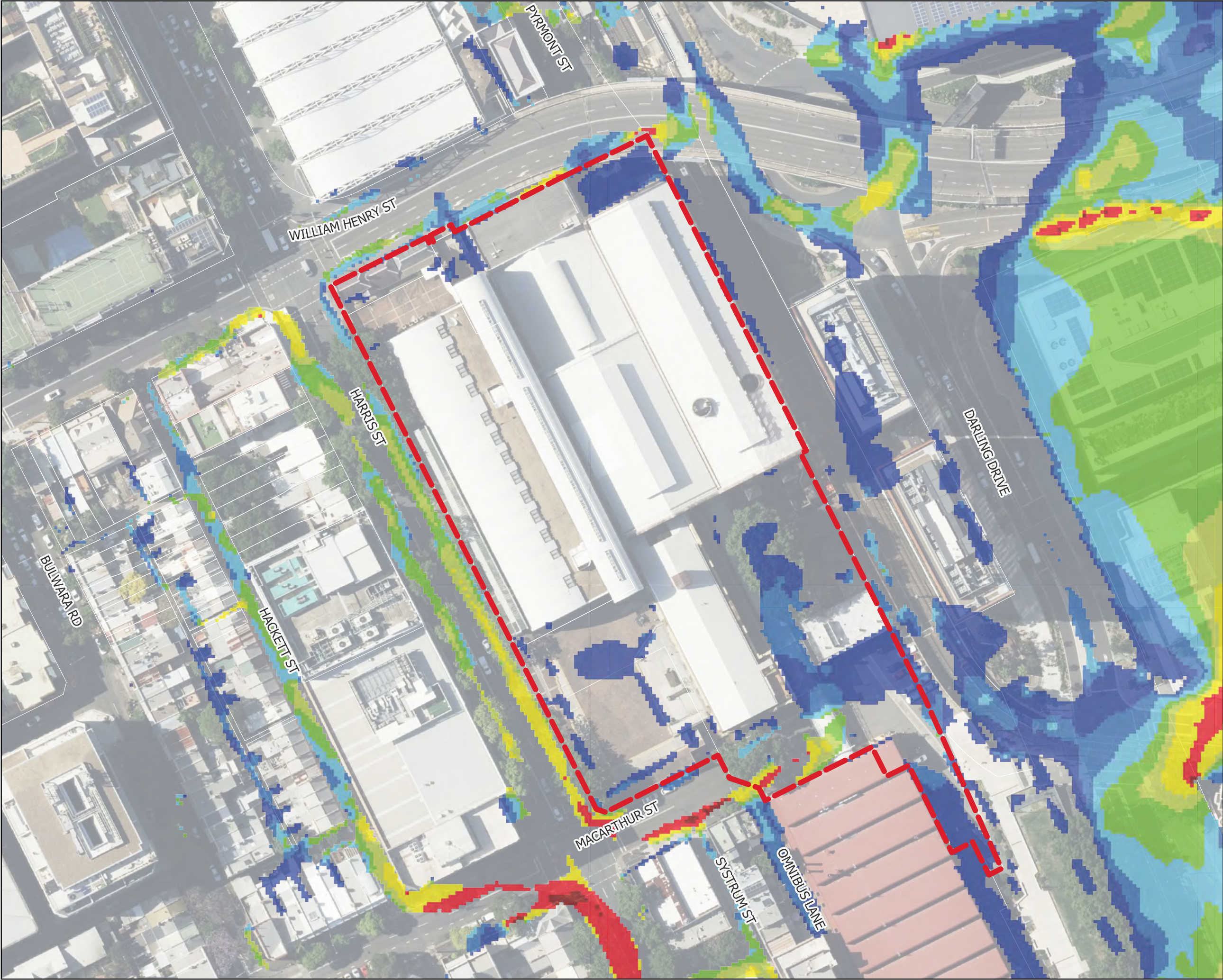
Job Title
Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A1.9
Powerhouse Ultimo - Existing
Case 1% AEP Flood Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

Project Boundary

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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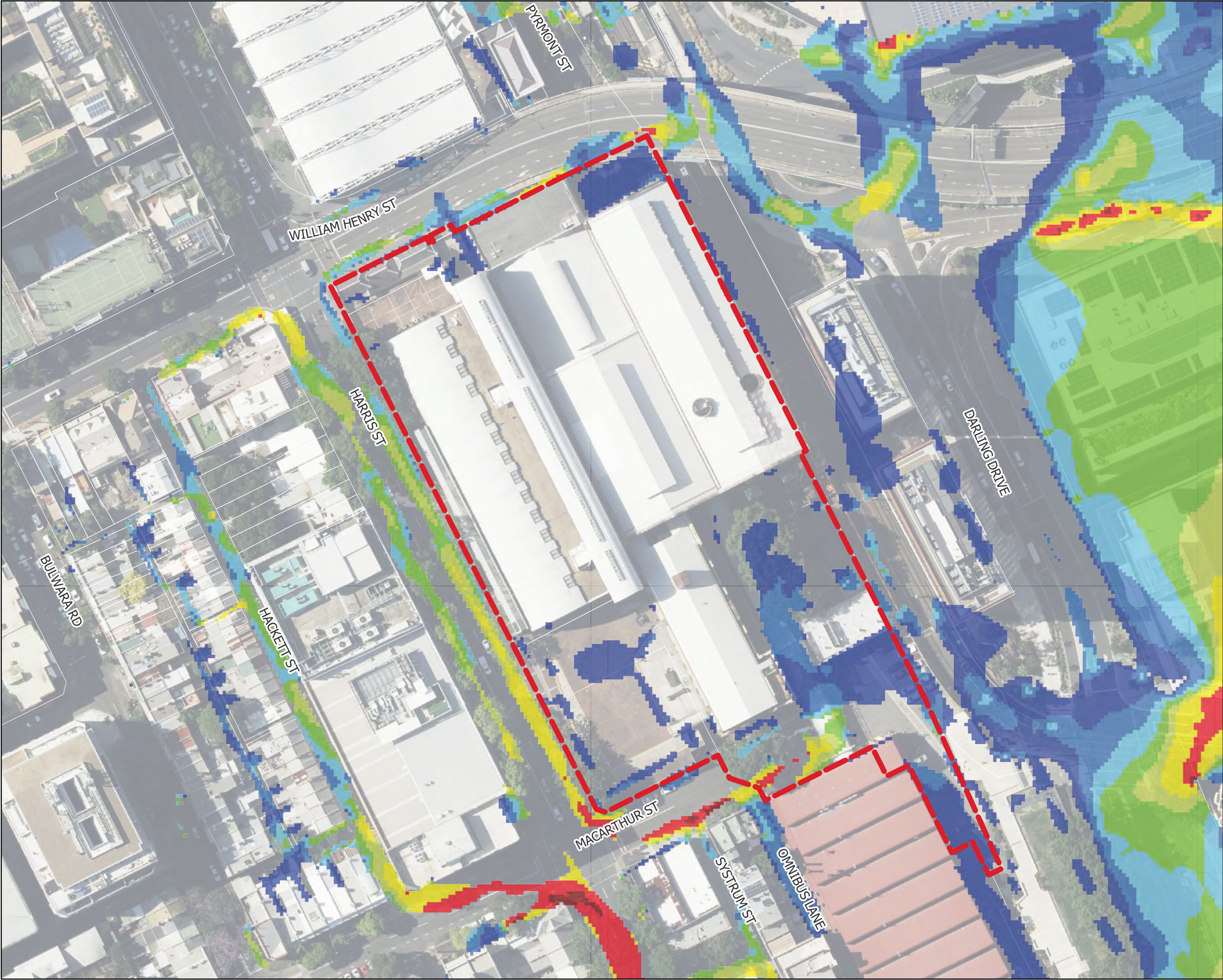
Job Title
Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A1.10
Powerhouse Ultimo - Existing
Case 1% AEP+Climate Change
Flood Velocity

Job No. 293558	Figure Status DRAFT
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Legend

Project Boundary

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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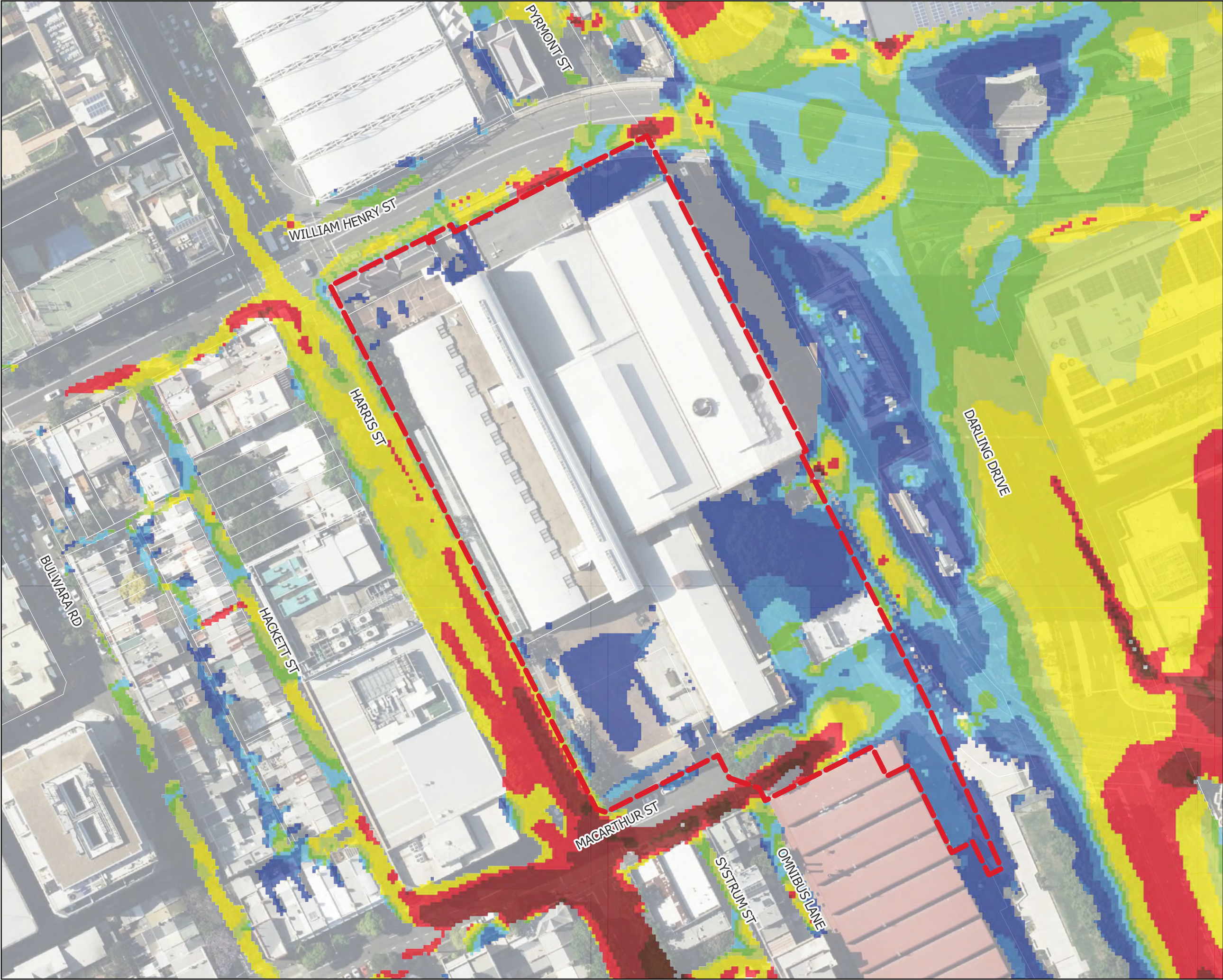
Job Title
Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A1.11
Powerhouse Ultimo - Existing
Case 0.2% AEP Flood Velocity

Job No. 293558	Figure Status DRAFT
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Legend

Project Boundary

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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Job Title
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Scale at A3 1:1,000

Figure No. A1.12
**Powerhouse Ultimo - Existing
Case PMF Flood Velocity**

Job No. 293558	Figure Status DRAFT
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Legend

— Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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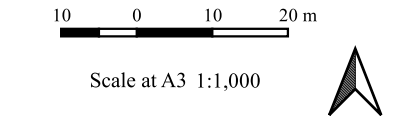


Figure No. A1.13
**Powerhouse Ultimo - Existing
Case 18.1% AEP Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

— Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Job Title
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Scale at A3 1:1,000

Figure No. A1.14
**Powerhouse Ultimo - Existing
Case 5% AEP Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Scale at A3 1:1,000

Figure No. A1.15
**Powerhouse Ultimo - Existing
Case 1% AEP Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

— Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Job Title
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1000

0

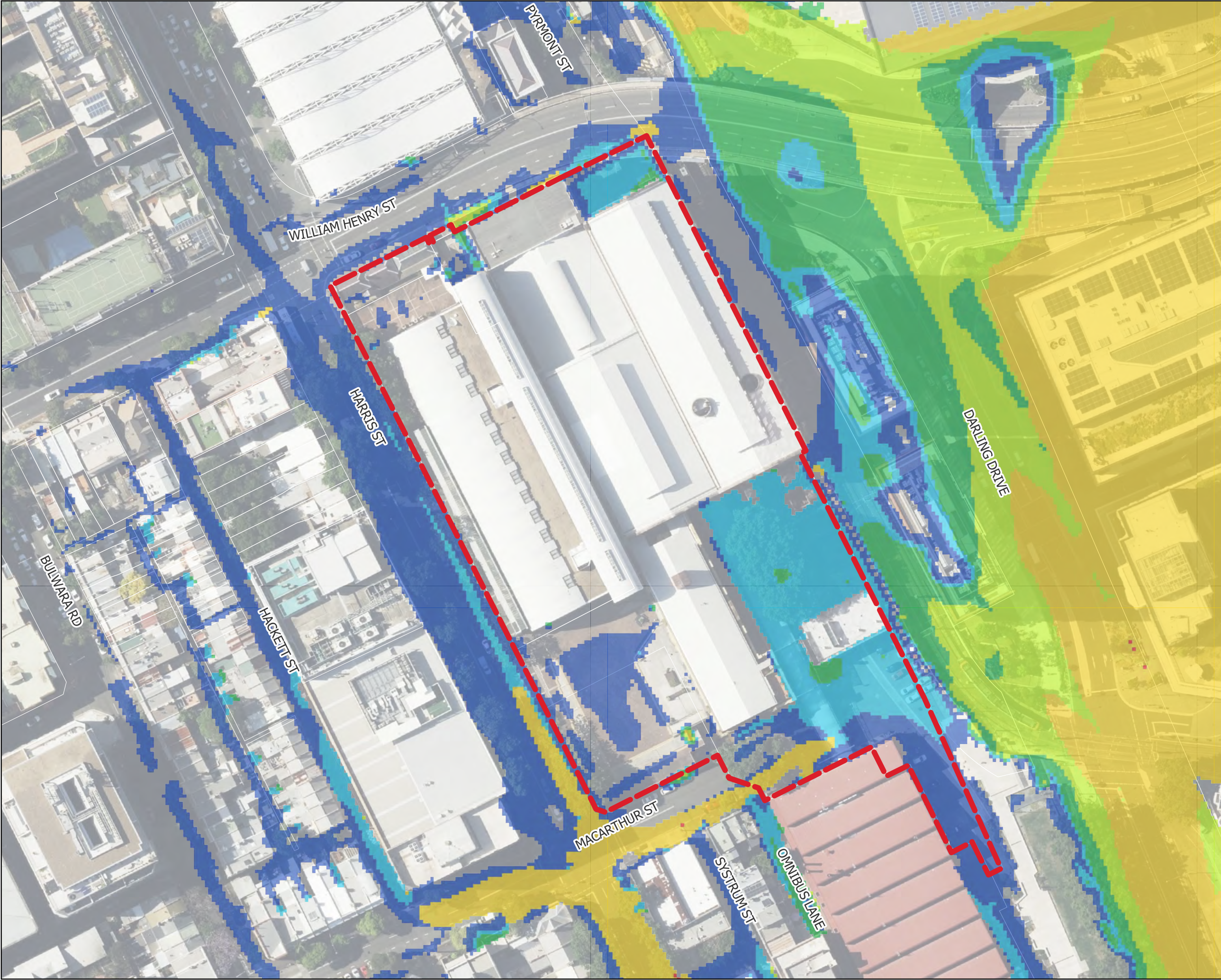
10

20 m

Scale at A3 1:1,000

Figure No. A1.17
**Powerhouse Ultimo - Existing
Case 0.2% AEP Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

--- Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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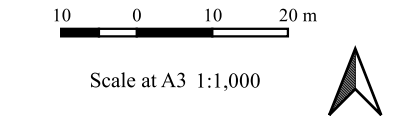


Figure No. A1.18
**Powerhouse Ultimo - Existing
Case PMF Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------

A.2 Flood Maps – Unmitigated Design Case Scenario

Figure No.	Title
A2.1	Powerhouse Ultimo - Unmitigated Design Case 18.1% AEP Flood Depths and Levels
A2.2	Powerhouse Ultimo - Unmitigated Design Case 5% AEP Flood Depths and Levels
A2.3	Powerhouse Ultimo - Unmitigated Design Case 1% AEP Flood Depths and Levels
A2.4	Powerhouse Ultimo - Unmitigated Design Case 1% AEP + Climate Change Flood Depths and Levels
A2.5	Powerhouse Ultimo - Unmitigated Design Case 0.2% AEP Flood Depths and Levels
A2.6	Powerhouse Ultimo - Unmitigated Design Case PMF Flood Depths and Levels
A2.7	Powerhouse Ultimo - Unmitigated Design Case 18.1% AEP Flood Velocity
A2.8	Powerhouse Ultimo - Unmitigated Design Case 5% AEP Flood Velocity
A2.9	Powerhouse Ultimo - Unmitigated Design Case 1% AEP Flood Velocity
A2.10	Powerhouse Ultimo - Unmitigated Design Case 1% AEP + Climate Change Flood Velocity
A2.11	Powerhouse Ultimo - Unmitigated Design Case 0.2% AEP Flood Velocity
A2.12	Powerhouse Ultimo - Unmitigated Design Case PMF Flood Velocity
A2.13	Powerhouse Ultimo - Unmitigated Design Case 18.1% AEP Flood Hazard
A2.14	Powerhouse Ultimo - Unmitigated Design Case 5% AEP Flood Hazard
A2.15	Powerhouse Ultimo - Unmitigated Design Case 1% AEP Flood Hazard
A2.16	Powerhouse Ultimo - Unmitigated Design Case 1% AEP + Climate Change Flood Hazard
A2.17	Powerhouse Ultimo - Unmitigated Design Case 0.2% AEP Flood Hazard
A2.18	Powerhouse Ultimo - Unmitigated Design Case PMF Flood Hazard
A2.19	Powerhouse Ultimo - Unmitigated Design Case 18.1% AEP Afflux
A2.20	Powerhouse Ultimo - Unmitigated Design Case 5% AEP Afflux
A2.21	Powerhouse Ultimo - Unmitigated Design Case 1% AEP Afflux
A2.22	Powerhouse Ultimo - Unmitigated Design Case 1% AEP + Climate Change Afflux
A2.23	Powerhouse Ultimo - Unmitigated Design Case 0.2% AEP Afflux
A2.24	Powerhouse Ultimo - Unmitigated Design Case PMF Afflux



Legend

Project Boundary

Cadastre

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A2.1
**Powerhouse Ultimo -
Unmitigated Design Case
18.1% AEP Flood Depths and
Levels**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

— Project Boundary

Cadastre

— Water Level Contours (m AHD)

Peak Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.50
	0.50 - 0.75
	0.75 - 1.00
	1.00 - 1.50
	> 1.50

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Job Title

Powerhouse Ultimo Renewal



Scale at A3 1:1,000



Figure No. A2.2

**Powerhouse Ultimo -
Unmitigated Design Case 5%
AEP Flood Depths and Levels**

Job No.
293558

Figure Status
DRAFT



Legend

--- Project Boundary

Cadastre

--- Water Level Contours (m AHD)

Peak Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.50
	0.50 - 0.75
	0.75 - 1.00
	1.00 - 1.50
	> 1.50

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INSW

Job Title
Powerhouse Ultimo Renewal



Scale at A3 1:1,000



Figure No. A2.3
**Powerhouse Ultimo -
Unmitigated Design Case 1%
AEP Flood Depths and Levels**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Water Level Contours (m AHD)

Peak Flood Depth (m)

<= 0.05

0.05 - 0.10

0.10 - 0.25

0.25 - 0.50

0.50 - 0.75

0.75 - 1.00

1.00 - 1.50

> 1.50

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Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000



Figure No. A2.4

Powerhouse Ultimo -
Unmitigated Design Case 1%
AEP+Climate Change Flood
Depths and Levels

Job No.
293558

Figure Status
DRAFT



Legend

Project Boundary

Cadastre

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000



Figure No. A2.5

Powerhouse Ultimo -
Unmitigated Design Case 0.2%
AEP Flood Depths and Levels

Job No.
293558

Figure Status
DRAFT



Legend

--- Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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Job Title

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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A2.7

**Powerhouse Ultimo -
Unmitigated Design Case
18.1% AEP Flood Velocity**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

--- Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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Job Title
Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A2.8
**Powerhouse Ultimo -
Unmitigated Design Case 5%
AEP Flood Velocity**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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Job Title
Powerhouse Ultimo Renewal

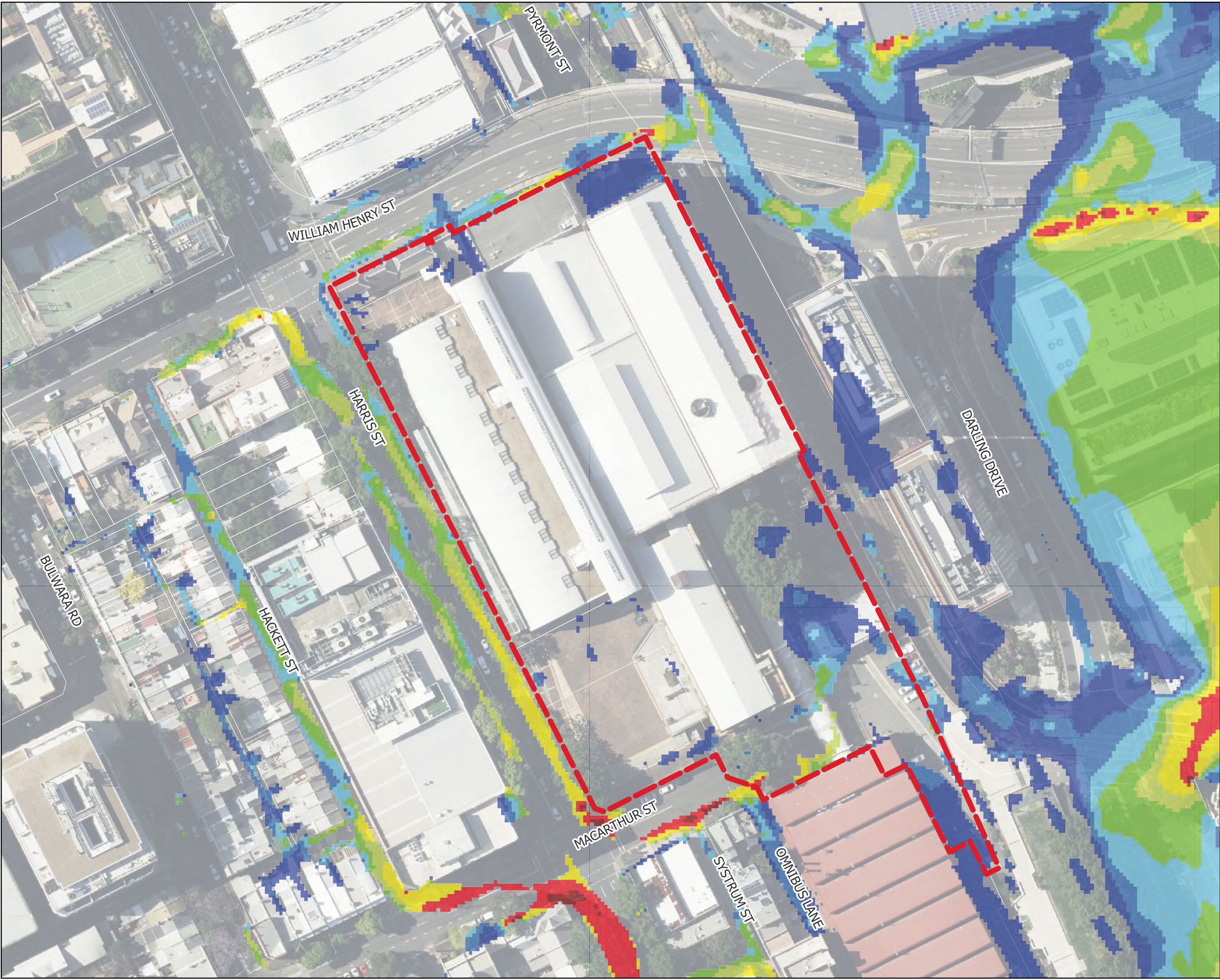


Scale at A3 1:1,000



Figure No. A2.9
Powerhouse Ultimo -
Unmitigated Design Case 1%
AEP Flood Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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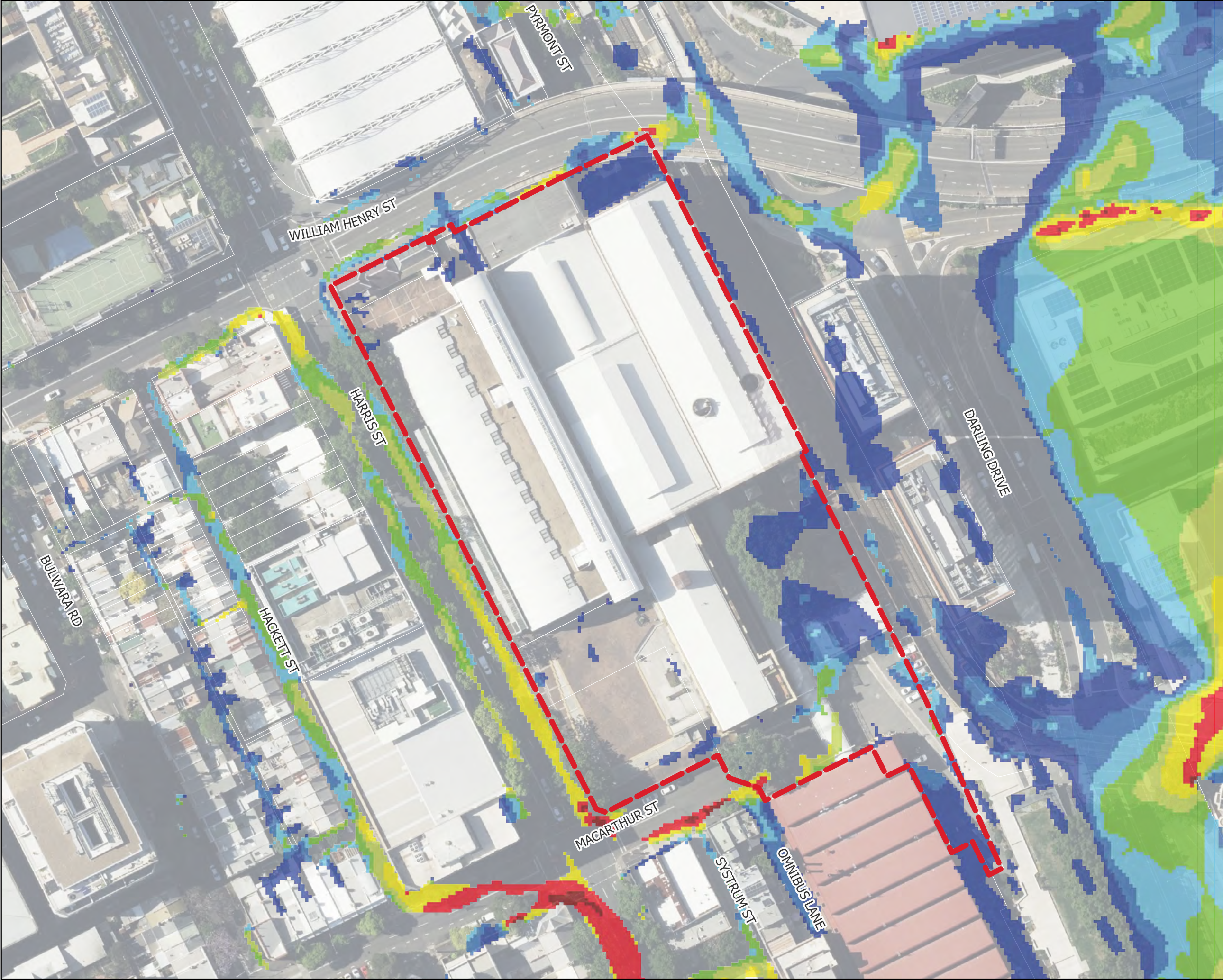


Scale at A3 1:1,000



Figure No. A2.10
Powerhouse Ultimo -
Unmitigated Design Case 1%
AEP+Climate Change Flood
Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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Job Title
Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A2.11
Powerhouse Ultimo -
Unmitigated Design Case 0.2%
AEP Flood Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

— Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Job Title
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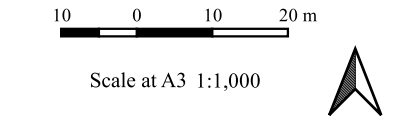


Figure No. A2.13
**Powerhouse Ultimo -
Unmitigated Design Case
18.1% AEP Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

— Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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1000

01020

m

Scale at A3 1:1,000

Figure No. A2.14
**Powerhouse Ultimo -
Unmitigated Design Case 5%
AEP Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

— Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Job Title

Powerhouse Ultimo Renewal

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Scale at A3 1:1,000



Figure No. A2.16

**Powerhouse Ultimo -
Unmitigated Design Case 1%
AEP+Climate Change Flood
Hazard**

Job No.
293558

Figure Status
DRAFT



Legend

— Project Boundary

Cadastre

Provisional Hydraulic Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Job Title
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1000

0

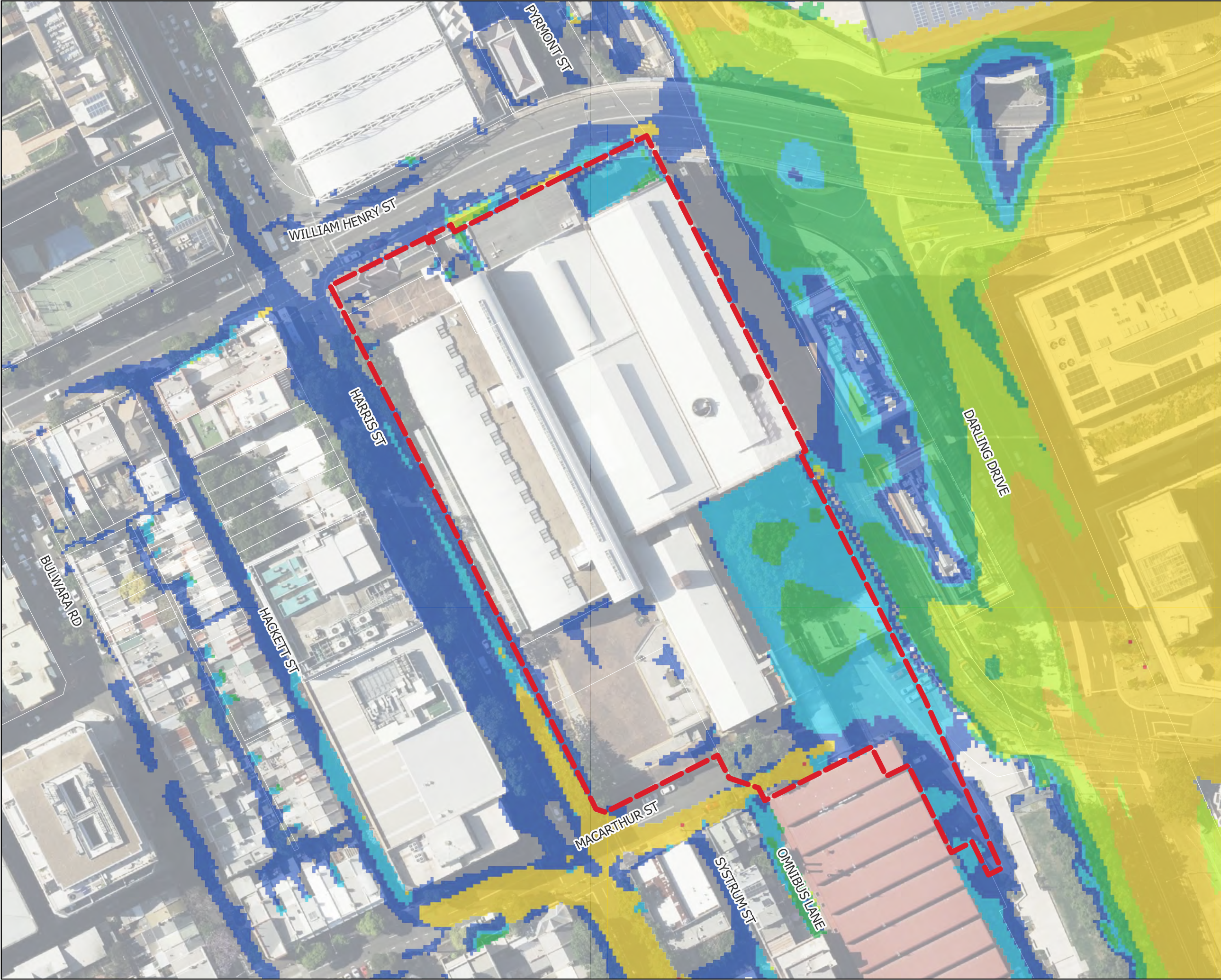
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20 m

Scale at A3 1:1,000

Figure No. A2.17
**Powerhouse Ultimo -
Unmitigated Design Case 0.2%
AEP Flood Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



- Legend
- Project Boundary
 - Cadastre
 - Provisional Hydraulic Hazard
 - H1 - Generally safe for people, vehicles and buildings
 - H2 - Unsafe for small vehicles
 - H3 - Unsafe for vehicles, children and the elderly
 - H4 - Unsafe for people and vehicles
 - H5 - Unsafe for vehicles and people. All buildings 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

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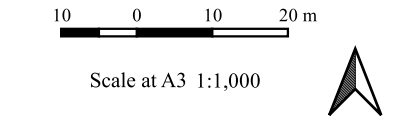


Figure No. A2.18
Powerhouse Ultimo -
Unmitigated Design Case PMF
Flood Hazard

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

— Project Boundary

Cadastre

Afflux (m)

- $\leq -0.03\text{m}$
- $> -0.03 - \leq -0.02\text{m}$
- $> -0.02 - \leq -0.01\text{m}$
- $> -0.01 - \leq +0.01\text{m}$
- $> +0.01 - \leq +0.02\text{m}$
- $> +0.02 - \leq +0.03\text{m}$
- $> +0.03 - \leq +0.05\text{m}$
- $> +0.05 - \leq +0.10\text{m}$
- $> +0.10 - \leq +0.20\text{m}$
- $> +0.20\text{m}$
- Was Wet Now Dry
- Was Dry Now Wet

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Scale at A3 1:1,000



Figure No. A2.19
Powerhouse Ultimo -
Unmitigated Design Case
18.1% AEP Afflux

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

— Project Boundary

Cadastre

Afflux (m)

- $\leq -0.03\text{m}$
- $> -0.03 - \leq -0.02\text{m}$
- $> -0.02 - \leq -0.01\text{m}$
- $> -0.01 - \leq +0.01\text{m}$
- $> +0.01 - \leq +0.02\text{m}$
- $> +0.02 - \leq +0.03\text{m}$
- $> +0.03 - \leq +0.05\text{m}$
- $> +0.05 - \leq +0.10\text{m}$
- $> +0.10 - \leq +0.20\text{m}$
- $> +0.20\text{m}$

■ Was Dry Now Wet

■ Was Wet Now Dry

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Powerhouse Ultimo Renewal

10 0 10 20 m

Scale at A3 1:1,000

Figure No. A2.20
**Powerhouse Ultimo -
Unmitigated Design Case 5%
AEP Afflux**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Afflux (m)

- <= -0.03m
- > -0.03 - <= -0.02m
- > -0.02 - <= -0.01m
- > -0.01 - <= +0.01m
- > +0.01 - <= +0.02m
- > +0.02 - <= +0.03m
- > +0.03 - <= +0.05m
- > +0.05 - <= +0.10m
- > +0.10 - <= +0.20m
- > +0.20m

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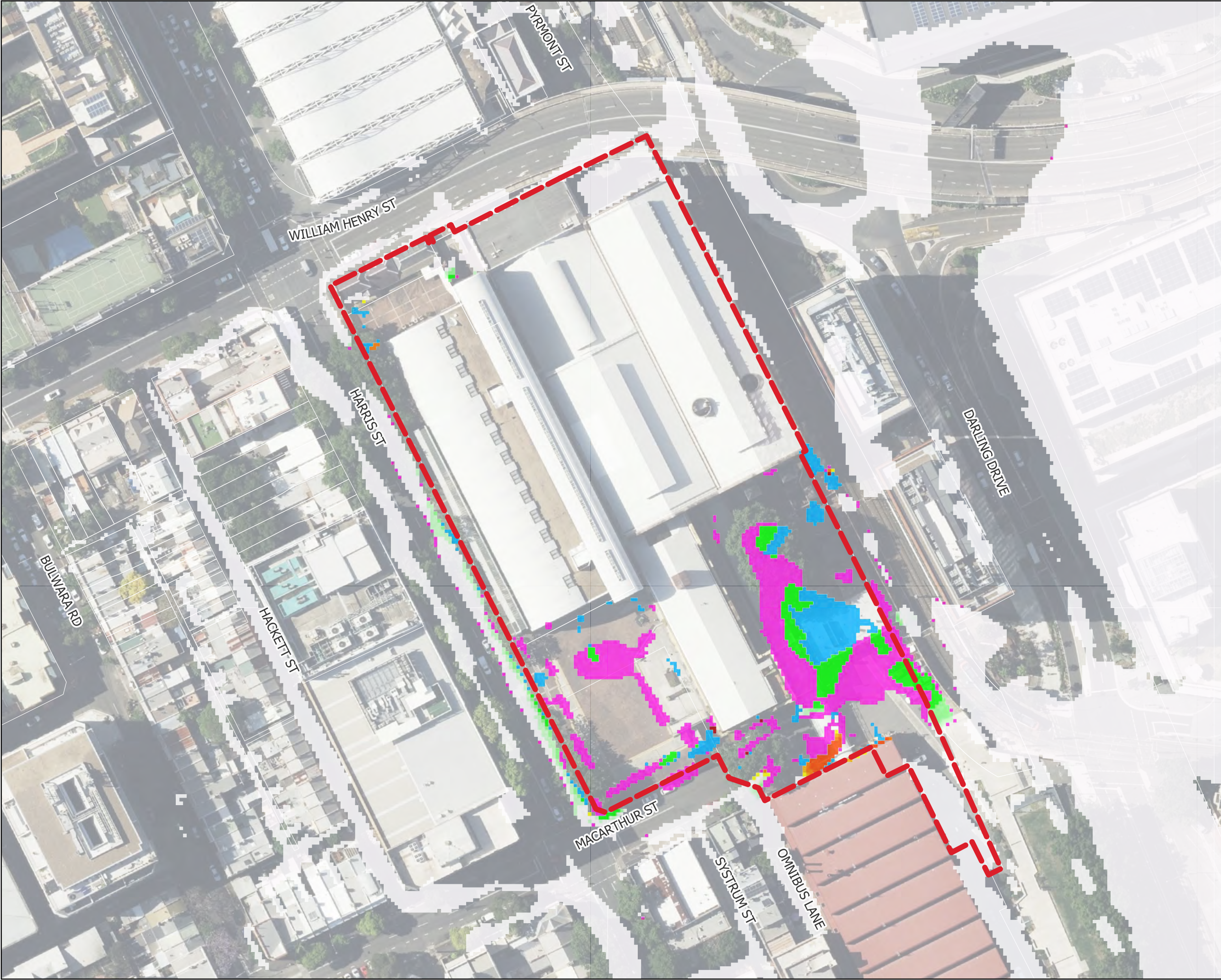


Scale at A3 1:1,000



Figure No. A2.21
Powerhouse Ultimo -
Unmitigated Design Case 1%
AEP Afflux

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

— Project Boundary

Cadastre

Afflux (m)

- $\leq -0.03\text{m}$
- $> -0.03 - \leq -0.02\text{m}$
- $> -0.02 - \leq -0.01\text{m}$
- $> -0.01 - \leq +0.01\text{m}$
- $> +0.01 - \leq +0.02\text{m}$
- $> +0.02 - \leq +0.03\text{m}$
- $> +0.03 - \leq +0.05\text{m}$
- $> +0.05 - \leq +0.10\text{m}$
- $> +0.10 - \leq +0.20\text{m}$
- Was Wet Now Dry
- Was Dry Now Wet

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1000

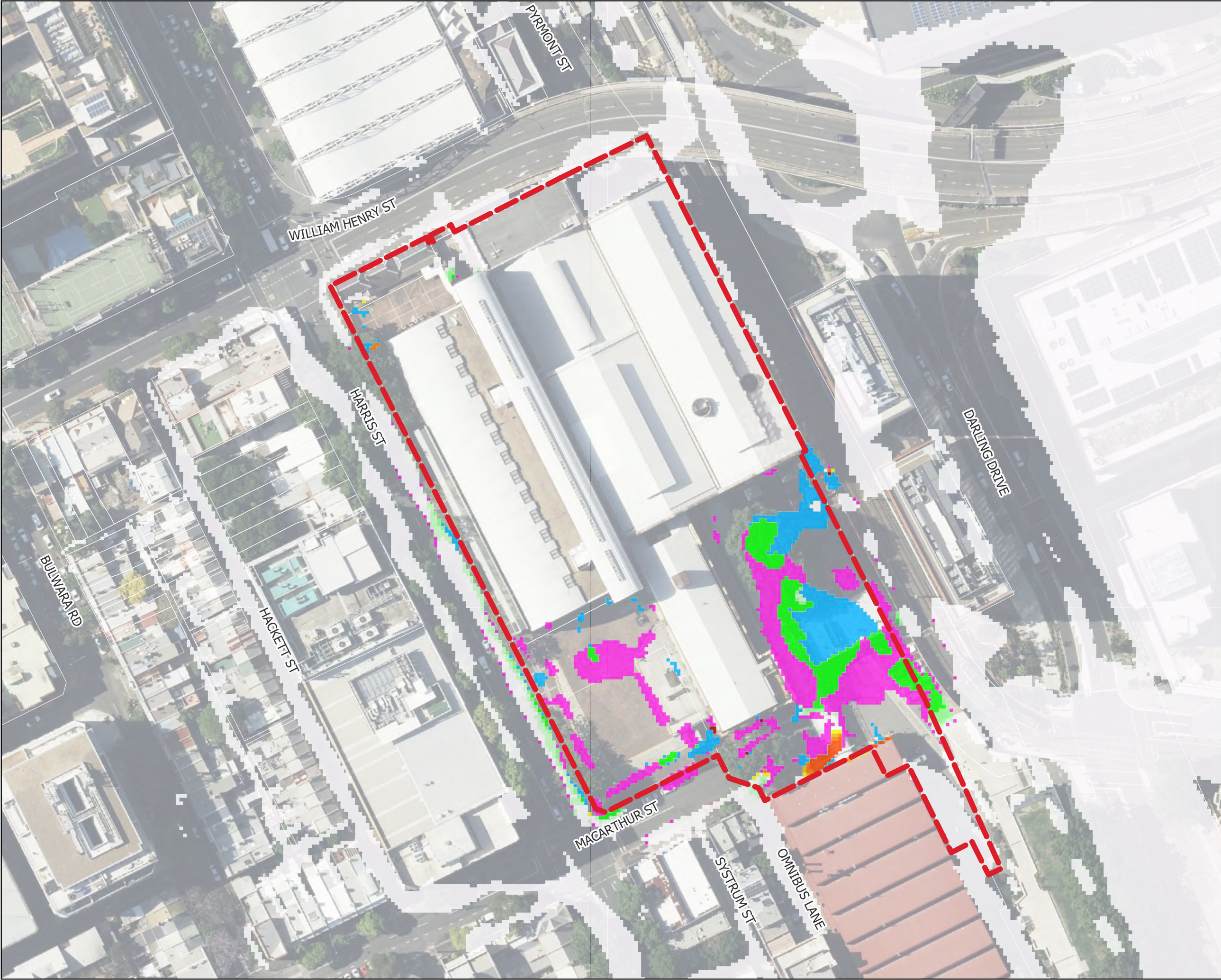
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m

Scale at A3 1:1,000

Figure No. A2.22
**Powerhouse Ultimo -
Unmitigated Design Case 1%
AEP+Climate Change Afflux**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Afflux (m)

<= -0.03m

> -0.03 - <= -0.02m

> -0.02 - <= -0.01m

> -0.01 - <= +0.01m

> +0.01 - <= +0.02m

> +0.02 - <= +0.03m

> +0.03 - <= +0.05m

> +0.05 - <= +0.10m

> +0.10 - <= +0.20m

> +0.20m

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1000

0

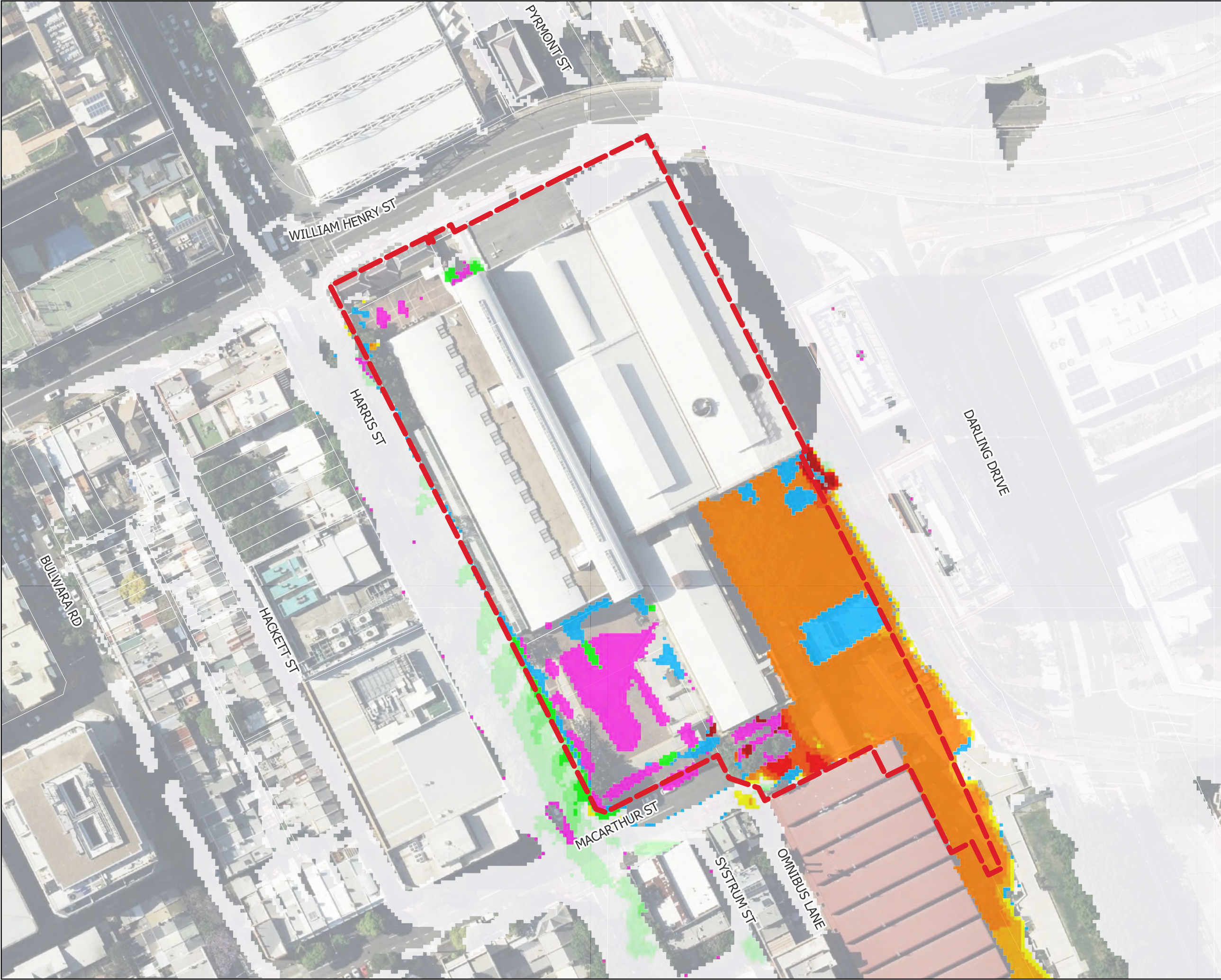
10

20 m

Scale at A3 1:1,000

Figure No. A2.23
Powerhouse Ultimo -
Unmitigated Design Case 0.2%
AEP Afflux

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

Project Boundary

Cadastre

Afflux (m)

- <= -0.03m
- > -0.03 - <= -0.02m
- > -0.02 - <= -0.01m
- > -0.01 - <= +0.01m
- > +0.01 - <= +0.02m
- > +0.02 - <= +0.03m
- > +0.03 - <= +0.05m
- > +0.05 - <= +0.10m
- > +0.10 - <= +0.20m
- > +0.20m

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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A2.24
Powerhouse Ultimo -
Unmitigated Design Case PMF
Afflux

Job No. 293558	Figure Status DRAFT
-------------------	------------------------

A.3 Flood Maps – Mitigated Design Case Scenario

Figure No.	Title
A3.1	Powerhouse Ultimo - Mitigated Design Case 18.1% AEP Flood Depths and Levels
A3.2	Powerhouse Ultimo - Mitigated Design Case 5% AEP Flood Depths and Levels
A3.3	Powerhouse Ultimo - Mitigated Design Case 1% AEP Flood Depths and Levels
A3.4	Powerhouse Ultimo - Mitigated Design Case 1% AEP + Climate Change Flood Depths and Levels
A3.5	Powerhouse Ultimo - Mitigated Design Case 0.2% AEP Flood Depths and Levels
A3.6	Powerhouse Ultimo - Mitigated Design Case PMF Flood Depths and Levels
A3.7	Powerhouse Ultimo - Mitigated Design Case 18.1% AEP Flood Velocity
A3.8	Powerhouse Ultimo - Mitigated Design Case 5% AEP Flood Velocity
A3.9	Powerhouse Ultimo - Mitigated Design Case 1% AEP Flood Velocity
A3.10	Powerhouse Ultimo - Mitigated Design Case 1% AEP + Climate Change Flood Velocity
A3.11	Powerhouse Ultimo - Mitigated Design Case 0.2% AEP Flood Velocity
A3.12	Powerhouse Ultimo - Mitigated Design Case PMF Flood Velocity
A3.13	Powerhouse Ultimo - Mitigated Design Case 18.1% AEP Flood Hazard
A3.14	Powerhouse Ultimo - Mitigated Design Case 5% AEP Flood Hazard
A3.15	Powerhouse Ultimo - Mitigated Design Case 1% AEP Flood Hazard
A3.16	Powerhouse Ultimo - Mitigated Design Case 1% AEP + Climate Change Flood Hazard
A3.17	Powerhouse Ultimo - Mitigated Design Case 0.2% AEP Flood Hazard
A3.18	Powerhouse Ultimo - Mitigated Design Case PMF Flood Hazard
A3.19	Powerhouse Ultimo - Mitigated Design Case 18.1% AEP Afflux
A3.20	Powerhouse Ultimo - Mitigated Design Case 5% AEP Afflux
A3.21	Powerhouse Ultimo - Mitigated Design Case 1% AEP Afflux
A3.22	Powerhouse Ultimo - Mitigated Design Case 1% AEP + Climate Change Afflux
A3.23	Powerhouse Ultimo - Mitigated Design Case 0.2% AEP Afflux
A3.24	Powerhouse Ultimo - Mitigated Design Case PMF Afflux



Legend

— Project Boundary

Cadastre

— Water Level Contours (m AHD)

Peak Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.50
	0.50 - 0.75
	0.75 - 1.00
	1.00 - 1.50
	> 1.50

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Powerhouse Ultimo Renewal

10

0

10

20 m

Scale at A3 1:1,000

Figure No. A3.1

**Powerhouse Ultimo - Mitigated
Design Case 18.1% AEP Flood
Depths and Levels**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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Scale at A3 1:1,000



Figure No. A3.2
Powerhouse Ultimo - Mitigated
Design Case 5% AEP Flood
Depths and Levels

Job No.
293558

Figure Status
DRAFT



Legend

— Project Boundary

— Cadastre

— Water Level Contours (m AHD)

Peak Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.50
	0.50 - 0.75
	0.75 - 1.00
	1.00 - 1.50
	> 1.50

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Powerhouse Ultimo Renewal



Scale at A3 1:1,000



Figure No. A3.3
**Powerhouse Ultimo - Mitigated
Design Case 1% AEP Flood
Depths and Levels**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

--- Project Boundary

--- Cadastre

--- Water Level Contours (m AHD)

Peak Flood Depth (m)

	<= 0.05
	0.05 - 0.10
	0.10 - 0.25
	0.25 - 0.50
	0.50 - 0.75
	0.75 - 1.00
	1.00 - 1.50
	> 1.50

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Client
INSW

Job Title
Powerhouse Ultimo Renewal

10

0

10

20 m

Scale at A3 1:1,000

Figure No. A3.4 Powerhouse Ultimo - Mitigated Design Case 1% AEP+Climate Change Flood Depths and Levels	
Job No. 293558	Figure Status DRAFT



Legend

Project Boundary

Cadastre

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A3.5
**Powerhouse Ultimo - Mitigated
Design Case 0.2% AEP Flood
Depths and Levels**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Water Level Contours (m AHD)

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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Scale at A3 1:1,000



Figure No. A3.6

Powerhouse Ultimo - Mitigated
Design Case PMF Flood Depths
and Levels

Job No.
293558

Figure Status
DRAFT



Legend

Project Boundary

Cadastre

Velocity (m/s)

0.0 - 0.2

0.2 - 0.4

0.4 - 0.6

0.6 - 0.8

0.8 - 1.0

1.0 - 1.5

1.5 - 2.0

2.0 - 3.0

3.0 - 4.0

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Job Title
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1000

0

10

20 m

Scale at A3 1:1,000

Figure No. A3.8
Powerhouse Ultimo - Mitigated
Design Case 5% AEP Flood
Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

--- Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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1000

0

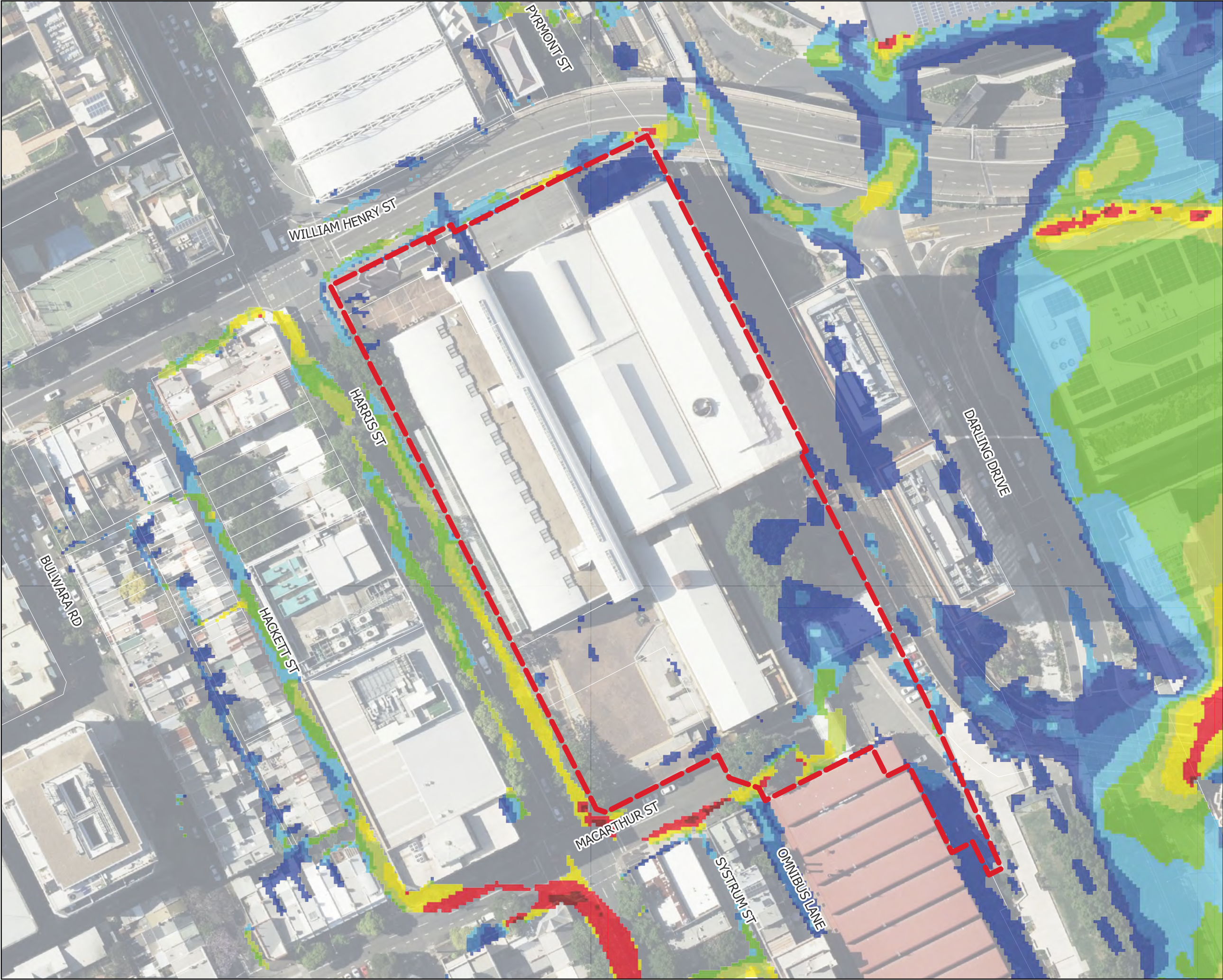
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20

Scale at A3 1:1,000

Figure No. A3.9
Powerhouse Ultimo - Mitigated
Design Case 1% AEP Flood
Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

--- Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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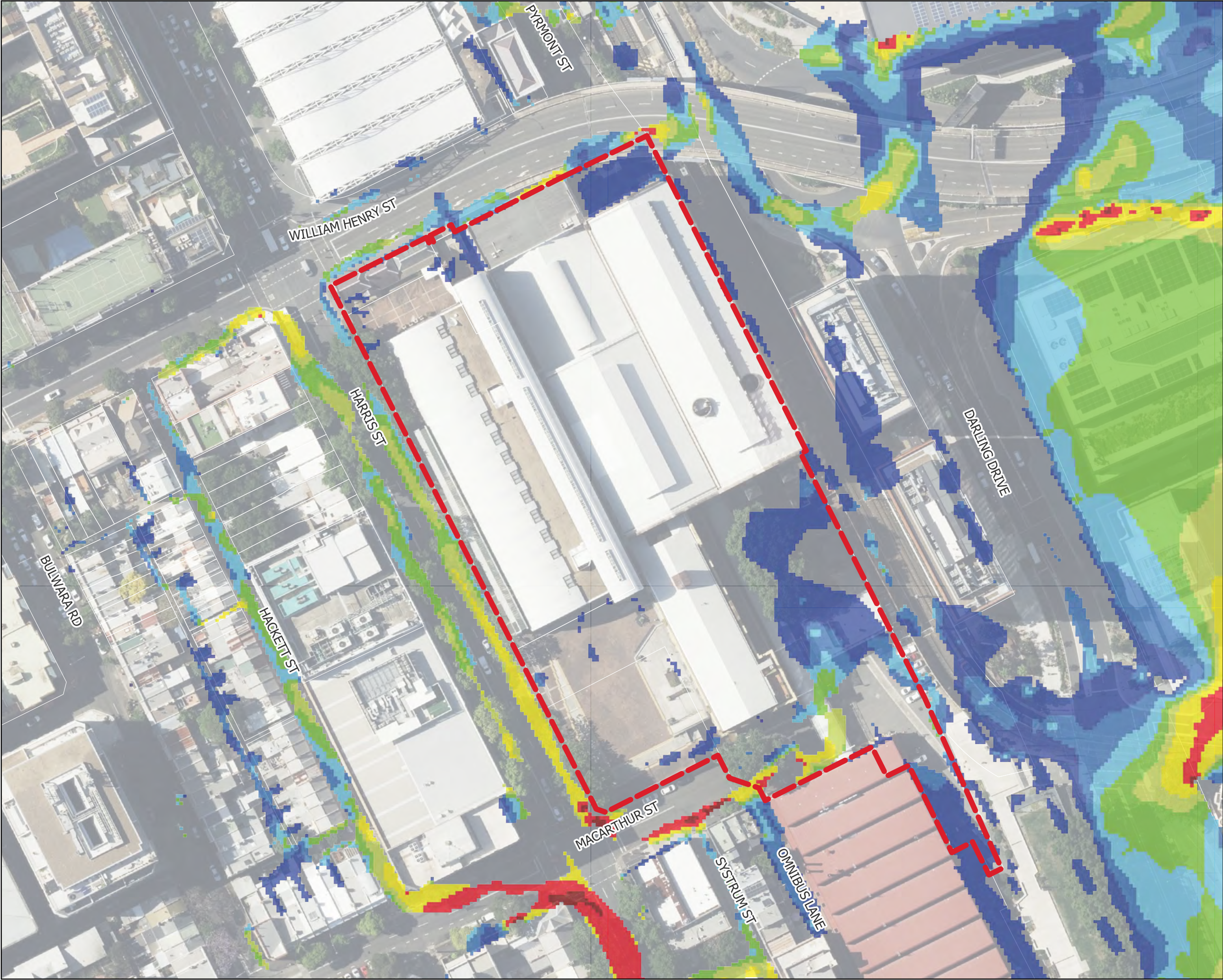
Job Title
Powerhouse Ultimo Renewal

100020

Scale at A3 1:1,000

Figure No. A3.10
**Powerhouse Ultimo - Mitigated
Design Case 1% AEP+Climate
Change Flood Velocity**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Velocity (m/s)

- 0.0 - 0.2
- 0.2 - 0.4
- 0.4 - 0.6
- 0.6 - 0.8
- 0.8 - 1.0
- 1.0 - 1.5
- 1.5 - 2.0
- 2.0 - 3.0
- 3.0 - 4.0

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Job Title
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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A3.11
Powerhouse Ultimo - Mitigated
Design Case 0.2% AEP Flood
Velocity

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

--- Project Boundary

Cadastre

Provisional Hydraulic Flood Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A3.13
Powerhouse Ultimo - Mitigated Design Case 18.1% AEP Flood Hazard

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Provisional Hydraulic Flood Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Job Title
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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A3.14
**Powerhouse Ultimo - Mitigated
Design Case 5% AEP Flood
Hazard**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Provisional Hydraulic Flood Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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Scale at A3 1:1,000



Figure No. A3.16

Powerhouse Ultimo - Mitigated
Design Case 1% AEP+Climate
Change Flood Hazard

Job No.
293558

Figure Status
DRAFT



Legend

Project Boundary

Cadastre

Provisional Hydraulic Flood Hazard

- H1 - Generally safe for people, vehicles and buildings
- H2 - Unsafe for small vehicles
- H3 - Unsafe for vehicles, children and the elderly
- H4 - Unsafe for people and vehicles
- H5 - Unsafe for vehicles and people. All buildings 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

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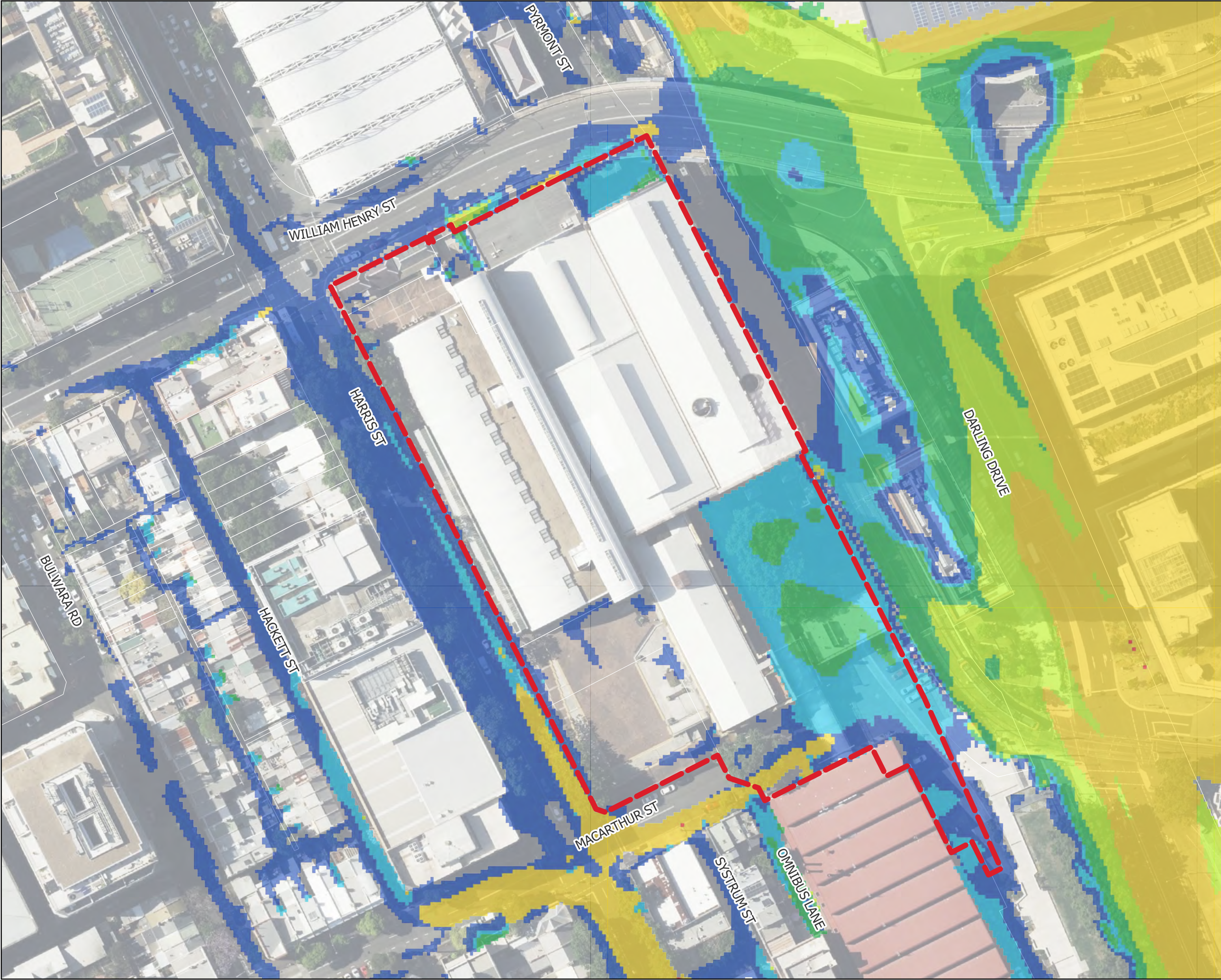
Scale at A3 1:1,000



Figure No. A3.17
Powerhouse Ultimo - Mitigated
Design Case 0.2% AEP Flood
Hazard

Job No.
293558

Figure Status
DRAFT



- Legend
- Project Boundary
 - Cadastre
 - Provisional Hydraulic Flood Hazard
 - H1 - Generally safe for people, vehicles and buildings
 - H2 - Unsafe for small vehicles
 - H3 - Unsafe for vehicles, children and the elderly
 - H4 - Unsafe for people and vehicles
 - H5 - Unsafe for vehicles and people. All buildings 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

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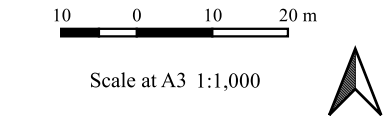


Figure No. A3.18
Powerhouse Ultimo - Mitigated
Design Case PMF Flood
Hazard

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

--- Project Boundary

Cadastre

Afflux (m)

- $\leq -0.03\text{m}$
- $> -0.03 - \leq -0.02\text{m}$
- $> -0.02 - \leq -0.01\text{m}$
- $> -0.01 - \leq +0.01\text{m}$
- $> +0.01 - \leq +0.02\text{m}$
- $> +0.02 - \leq +0.03\text{m}$
- $> +0.03 - \leq +0.05\text{m}$
- $> +0.05 - \leq +0.10\text{m}$
- $> +0.10 - \leq +0.20\text{m}$
- $> +0.20\text{m}$

■ Was Wet Now Dry

■ Was Dry Now Wet

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1000

01020

m

Scale at A3 1:1,000

Figure No. A3.19
**Powerhouse Ultimo - Mitigated
Design Case 18.1% AEP Afflux**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Afflux (m)

- <= -0.03m
- > -0.03 - <= -0.02m
- > -0.02 - <= -0.01m
- > -0.01 - <= +0.01m
- > +0.01 - <= +0.02m
- > +0.02 - <= +0.03m
- > +0.03 - <= +0.05m
- > +0.05 - <= +0.10m
- > +0.10 - <= +0.20m
- > +0.20m
- Was Wet Now Dry
- Was Dry Now Wet

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10 0 10 20 m

Scale at A3 1:1,000

Figure No. A3.20
**Powerhouse Ultimo - Mitigated
Design Case 5% AEP Afflux**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

--- Project Boundary

Cadastre

Afflux (m)

- $\leq -0.03\text{m}$
- $> -0.03 - \leq -0.02\text{m}$
- $> -0.02 - \leq -0.01\text{m}$
- $> -0.01 - \leq +0.01\text{m}$
- $> +0.01 - \leq +0.02\text{m}$
- $> +0.02 - \leq +0.03\text{m}$
- $> +0.03 - \leq +0.05\text{m}$
- $> +0.05 - \leq +0.10\text{m}$
- $> +0.10 - \leq +0.20\text{m}$
- $> +0.20\text{m}$

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1000

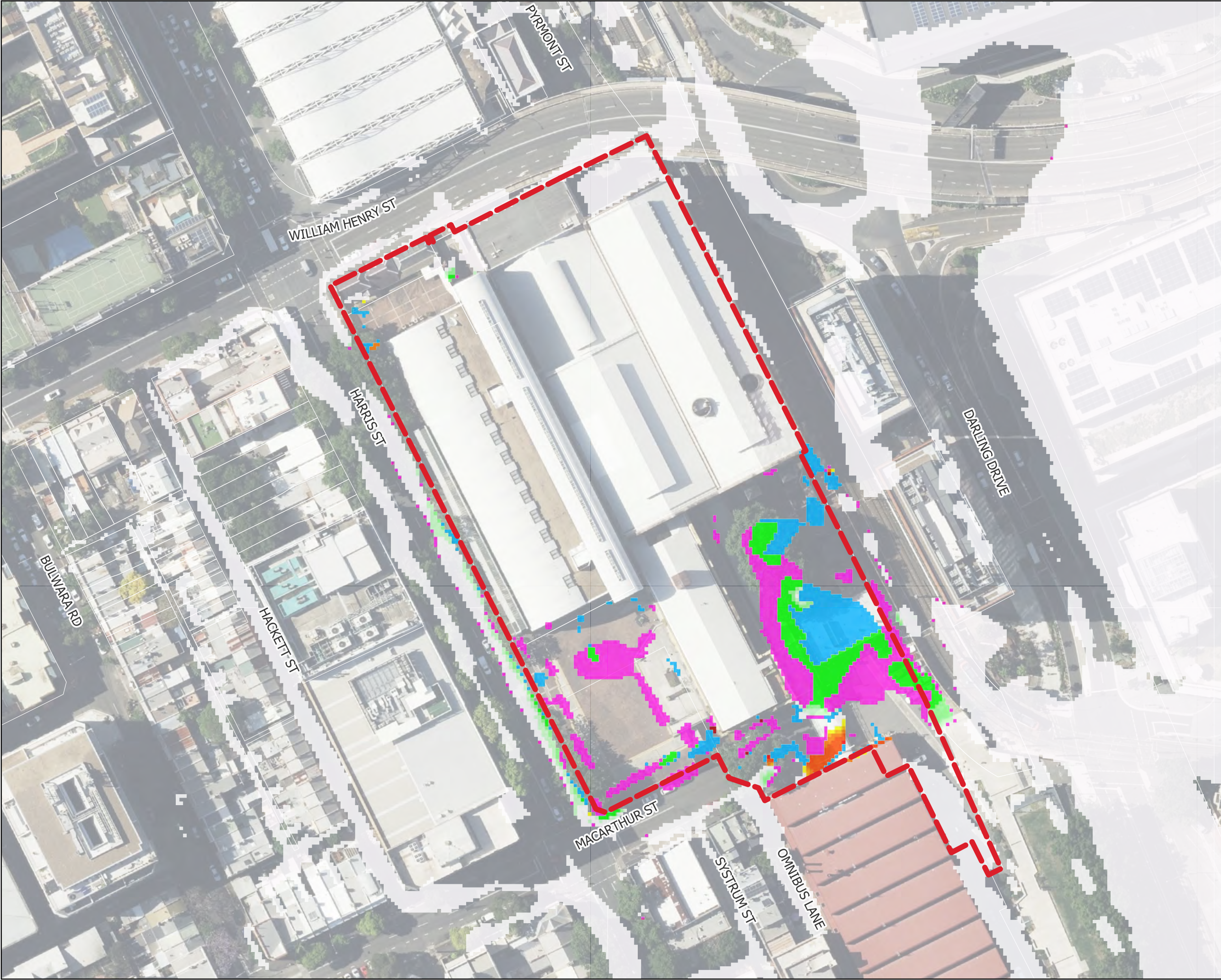
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m

Scale at A3 1:1,000

Figure No. A3.21
**Powerhouse Ultimo - Mitigated
Design Case 1% AEP Afflux**

Job No. 293558	Figure Status DRAFT
--------------------------	-------------------------------



Legend

Project Boundary

Cadastre

Afflux (m)

- <= -0.03m
- > -0.03 - <= -0.02m
- > -0.02 - <= -0.01m
- > -0.01 - <= +0.01m
- > +0.01 - <= +0.02m
- > +0.02 - <= +0.03m
- > +0.03 - <= +0.05m
- > +0.05 - <= +0.10m
- > +0.10 - <= +0.20m
- > +0.20m

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Was Dry Now Wet

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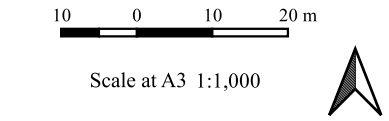


Figure No. A3.22
Powerhouse Ultimo - Mitigated
Design Case 1% AEP+Climate
Change Afflux

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

Project Boundary

Cadastre

Afflux (m)

- <= -0.03m
- > -0.03 - <= -0.02m
- > -0.02 - <= -0.01m
- > -0.01 - <= +0.01m
- > +0.01 - <= +0.02m
- > +0.02 - <= +0.03m
- > +0.03 - <= +0.05m
- > +0.05 - <= +0.10m
- > +0.10 - <= +0.20m
- > +0.20m
- Was Wet Now Dry
- Was Dry Now Wet

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Scale at A3 1:1,000



Figure No. A3.23
Powerhouse Ultimo - Mitigated
Design Case 0.2% AEP Afflux

Job No. 293558	Figure Status DRAFT
-------------------	------------------------



Legend

--- Project Boundary

Cadastre

Afflux (m)

- <= -0.03m
- > -0.03 - <= -0.02m
- > -0.02 - <= -0.01m
- > -0.01 - <= +0.01m
- > +0.01 - <= +0.02m
- > +0.02 - <= +0.03m
- > +0.03 - <= +0.05m
- > +0.05 - <= +0.10m
- > +0.10 - <= +0.20m
- > +0.20m
- Was Wet Now Dry
- Was Dry Now Wet

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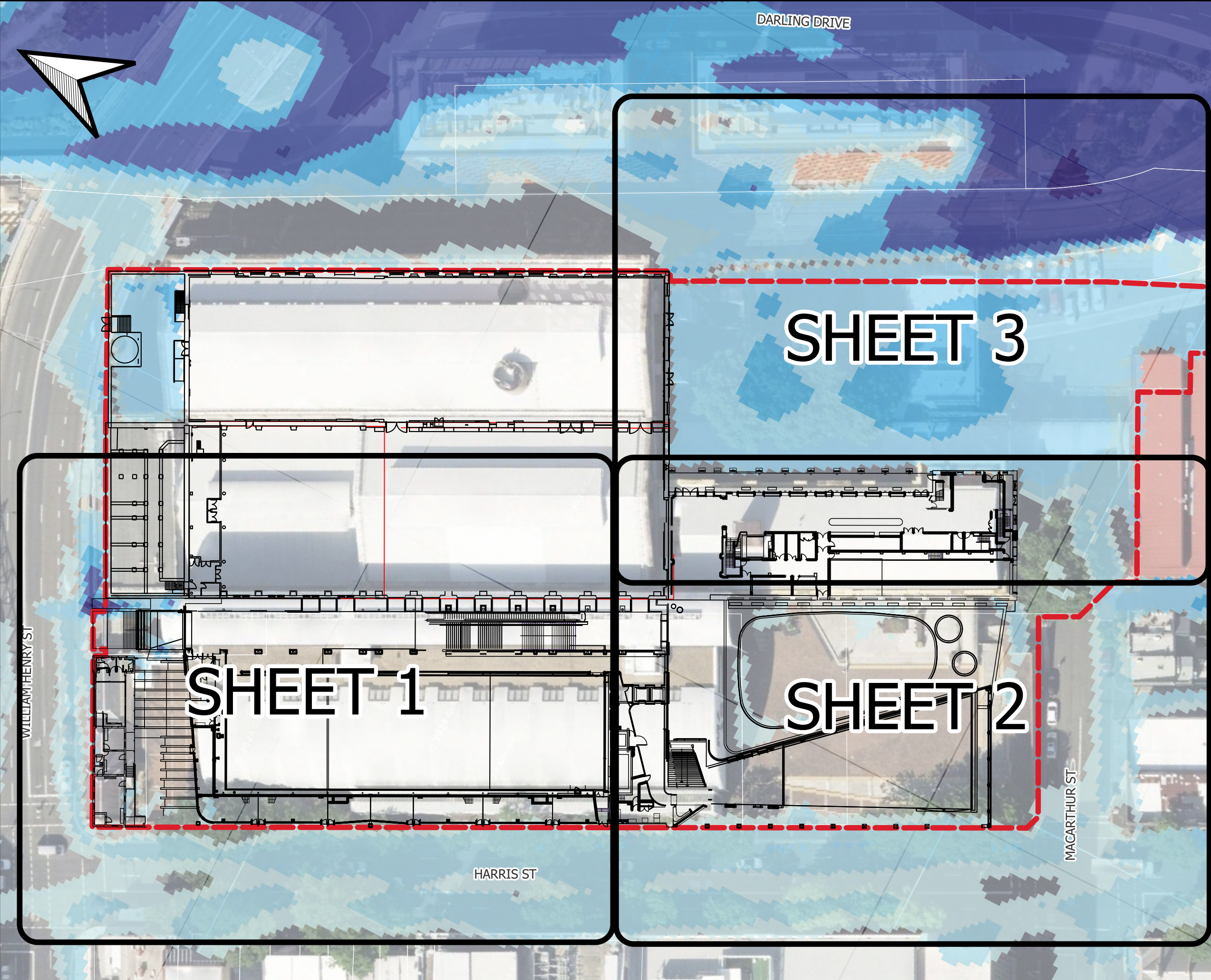
Figure No. A3.24

Powerhouse Ultimo - Mitigated
Design Case PMF Afflux

Job No.
293558

Figure Status
DRAFT

A.4 Flood Planning Level Figures



Legend

— Project Boundary

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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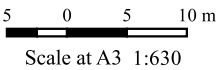
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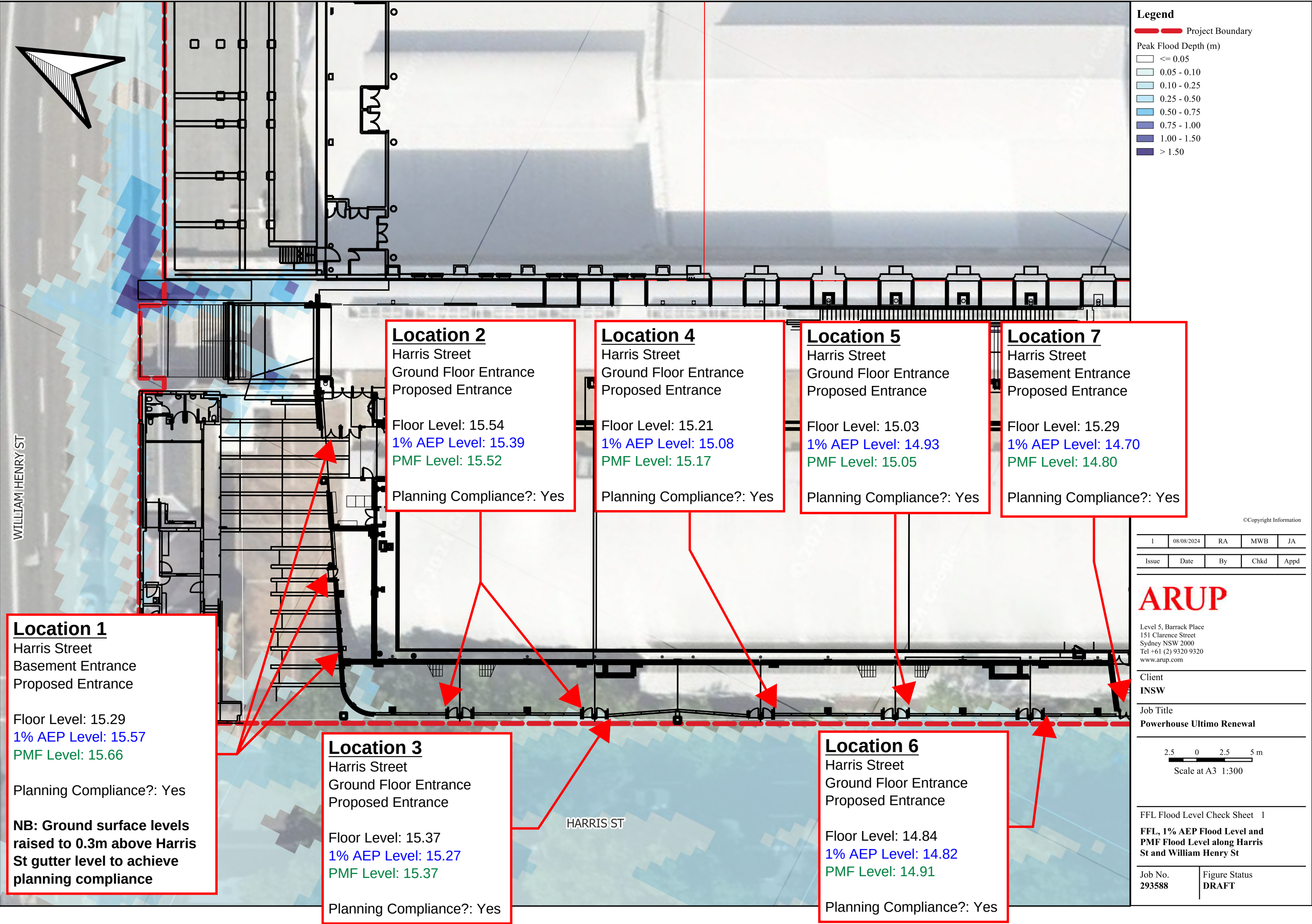
Client
INSW

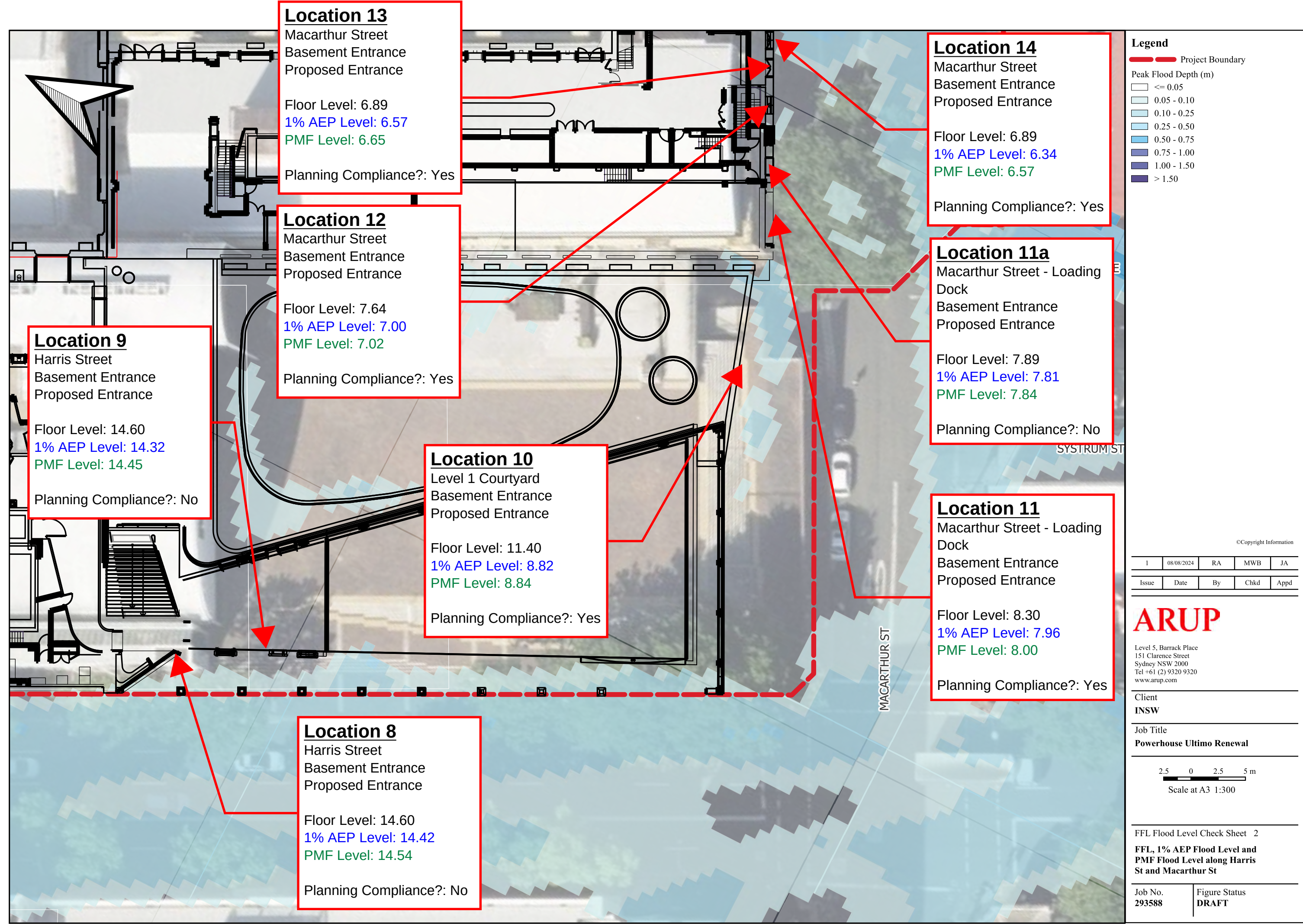
Job Title
Powerhouse Ultimo Renewal



FFL Flood Level Check Figure 0
**FFL, 1% AEP Flood Level and
PMF Flood Level Sheet
Overview**

Job No. 293588	Figure Status DRAFT
--------------------------	-------------------------------





Location 13
Macarthur Street
Basement Entrance
Proposed Entrance

Floor Level: 6.89
1% AEP Level: 6.57
PMF Level: 6.65

Planning Compliance?: Yes

Location 12
Macarthur Street
Basement Entrance
Proposed Entrance

Floor Level: 7.64
1% AEP Level: 7.00
PMF Level: 7.02

Planning Compliance?: Yes

Location 9
Harris Street
Basement Entrance
Proposed Entrance

Floor Level: 14.60
1% AEP Level: 14.32
PMF Level: 14.45

Planning Compliance?: No

Location 10
Level 1 Courtyard
Basement Entrance
Proposed Entrance

Floor Level: 11.40
1% AEP Level: 8.82
PMF Level: 8.84

Planning Compliance?: Yes

Location 8
Harris Street
Basement Entrance
Proposed Entrance

Floor Level: 14.60
1% AEP Level: 14.42
PMF Level: 14.54

Planning Compliance?: No

Location 14
Macarthur Street
Basement Entrance
Proposed Entrance

Floor Level: 6.89
1% AEP Level: 6.34
PMF Level: 6.57

Planning Compliance?: Yes

Location 11a
Macarthur Street - Loading
Dock
Basement Entrance
Proposed Entrance

Floor Level: 7.89
1% AEP Level: 7.81
PMF Level: 7.84

Planning Compliance?: No

Location 11
Macarthur Street - Loading
Dock
Basement Entrance
Proposed Entrance

Floor Level: 8.30
1% AEP Level: 7.96
PMF Level: 8.00

Planning Compliance?: Yes

Legend

Project Boundary

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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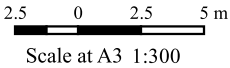
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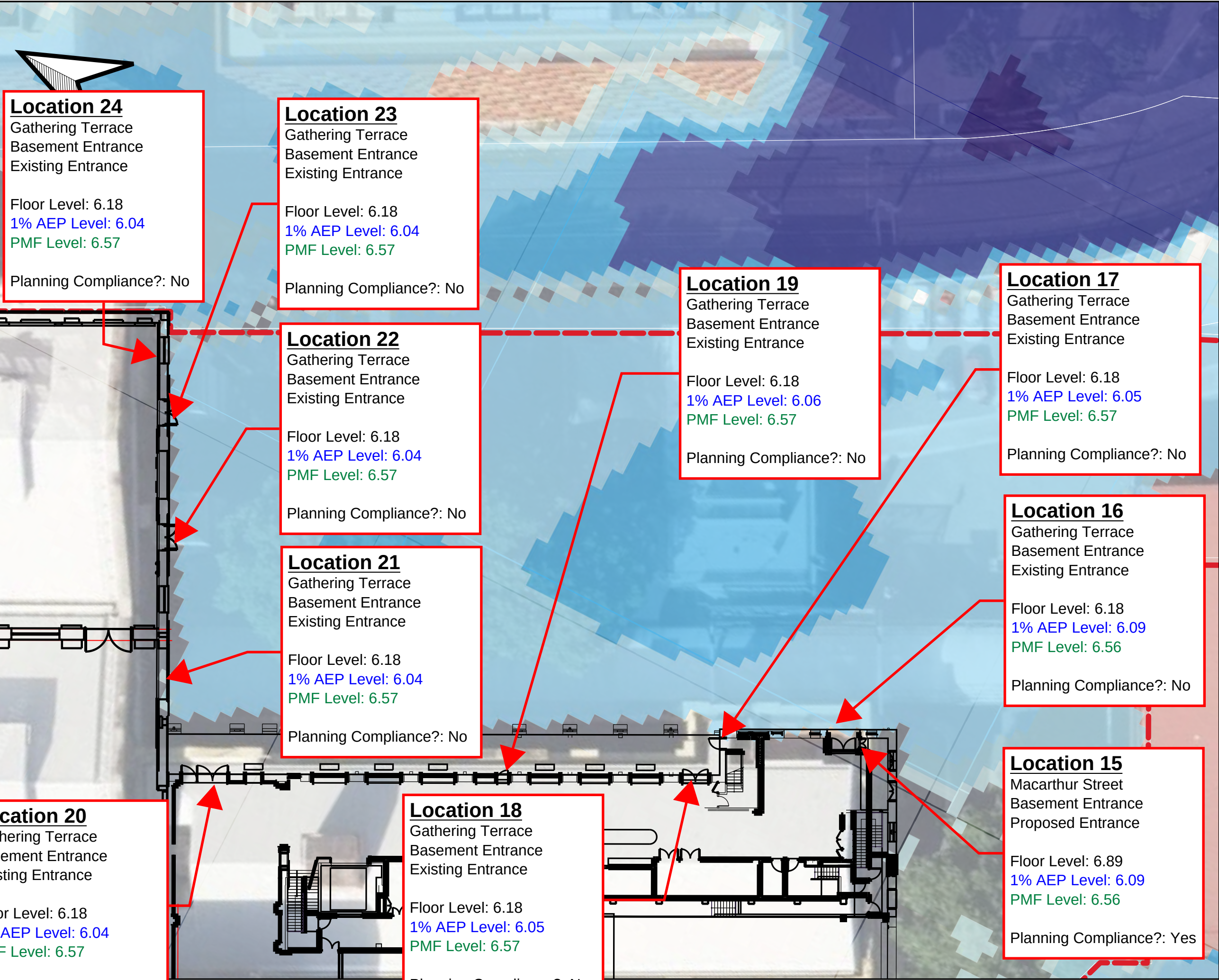
Job Title
Powerhouse Ultimo Renewal



FFL Flood Level Check Sheet 2

FFL, 1% AEP Flood Level and PMF Flood Level along Harris St and Macarthur St

Job No. 293588	Figure Status DRAFT
--------------------------	-------------------------------



Location 24
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.04
PMF Level: 6.57

Planning Compliance?: No

Location 23
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.04
PMF Level: 6.57

Planning Compliance?: No

Location 22
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.04
PMF Level: 6.57

Planning Compliance?: No

Location 21
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.04
PMF Level: 6.57

Planning Compliance?: No

Location 19
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.06
PMF Level: 6.57

Planning Compliance?: No

Location 17
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.05
PMF Level: 6.57

Planning Compliance?: No

Location 16
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.09
PMF Level: 6.56

Planning Compliance?: No

Location 15
Macarthur Street
Basement Entrance
Proposed Entrance

Floor Level: 6.89
1% AEP Level: 6.09
PMF Level: 6.56

Planning Compliance?: Yes

Location 20
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.04
PMF Level: 6.57

Planning Compliance?: No

Location 18
Gathering Terrace
Basement Entrance
Existing Entrance

Floor Level: 6.18
1% AEP Level: 6.05
PMF Level: 6.57

Planning Compliance?: No

Legend

Project Boundary

Peak Flood Depth (m)

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.25
- 0.25 - 0.50
- 0.50 - 0.75
- 0.75 - 1.00
- 1.00 - 1.50
- > 1.50

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Client
INSW

Job Title
Powerhouse Ultimo Renewal

2.5 0 2.5 5 m
Scale at A3 1:300

FFL Flood Level Check Sheet 3

FFL, 1% AEP Flood Level and PMF Flood Level within Gathering Terrace

Job No. 293588	Figure Status DRAFT
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Appendix B

MUSIC Link Report

MUSIC-link Report

Project Details		Company Details	
Project:	Appendix A - Powerhouse Ultimo (CoS Targets and Greenstar 'Credit' Requirements) musicLink Report	Company:	Arup
Report Export Date:	16/07/2024	Contact:	Ramiya Ravindran
Catchment Name:	Powerhouse Ultimo MUSIC_CoS_Rev5	Address:	Barrack Place, Level 5/151 Clarence St, Sydney NSW 2000
Catchment Area:	1.678ha	Phone:	
Impervious Area*:	92.47%	Email:	ramiya.ravindran@arup.com
Rainfall Station:	66062 SYDNEY		
Modelling Time-step:	6 Minutes		
Modelling Period:	1/01/1982 - 31/12/1986 11:54:00 PM		
Mean Annual Rainfall:	1278mm		
Evapotranspiration:	1265mm		
MUSIC Version:	6.3.0		
MUSIC-link data Version:	6.34		
Study Area:	City of Sydney Sandy Loam Soil		
Scenario:	City of Sydney Development		

* takes into account area from all source nodes that link to the chosen reporting node, excluding Import Data Nodes

Treatment Train Effectiveness		Treatment Nodes		Source Nodes	
Node: Receiving Node	Reduction	Node Type	Number	Node Type	Number
Flow	14.6%	Sedimentation Basin Node	4	Urban Source Node	22
TSS	85.1%	Buffer Node	1		
TP	65.1%	Rain Water Tank Node	1		
TN	51%	Generic Node	6		
GP	92.8%	GPT Node	9		

Comments

SF Chamber notional detention time is less than the minimum; and N, P and SS k values are less than minimum specified values as they are not representative of traditional 'sedimentation' chambers. These are supplier (Ocean Protect) provided nodes.

C** for threshold hydraulic loading, total nitrogen, phosphorus and suspended solids are not applicable to rainwater tanks. Music report incorrectly stating values as they cannot be adjusted in the Rainwater tank node.

Passing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Buffer	Terrace Buffer	Proportion of upstream impervious area treated	None	None	1
GPT	1 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.02
GPT	1 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.02
GPT	1 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.02
GPT	1 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.02
GPT	2 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.04
GPT	2 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.04
GPT	2 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.04
GPT	3 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.06
GPT	6 x OceanGuard	Hi-flow bypass rate (cum/sec)	None	99	0.12
Rain	90kL WRAN Rainwater Tank	% Reuse Demand Met	None	None	41.0504
Receiving	Receiving Node	% Load Reduction	None	None	14.6
Receiving	Receiving Node	GP % Load Reduction	90	None	92.8
Receiving	Receiving Node	TN % Load Reduction	45	None	51
Receiving	Receiving Node	TP % Load Reduction	65	None	65.1
Receiving	Receiving Node	TSS % Load Reduction	85	None	85.1
Sedimentation	SF Chamber (1.6m2)	% Reuse Demand Met	None	None	0
Sedimentation	SF Chamber (1.6m2)	Exfiltration Rate (mm/hr)	0	0	0
Sedimentation	SF Chamber (1.6m2)	Extended detention depth (m)	0.25	1	0.77
Sedimentation	SF Chamber (1.6m2)	High Flow Bypass Out (ML/yr)	None	None	0
Sedimentation	SF Chamber (1.6m2)	% Reuse Demand Met	None	None	0
Sedimentation	SF Chamber (1.6m2)	% Reuse Demand Met	None	None	0
Sedimentation	SF Chamber (1.6m2)	Exfiltration Rate (mm/hr)	0	0	0
Sedimentation	SF Chamber (1.6m2)	Exfiltration Rate (mm/hr)	0	0	0
Sedimentation	SF Chamber (1.6m2)	Extended detention depth (m)	0.25	1	0.77
Sedimentation	SF Chamber (1.6m2)	Extended detention depth (m)	0.25	1	0.54
Sedimentation	SF Chamber (1.6m2)	High Flow Bypass Out (ML/yr)	None	None	0
Sedimentation	SF Chamber (1.6m2)	High Flow Bypass Out (ML/yr)	None	None	0
Sedimentation	SF Chamber (3.8m2)	% Reuse Demand Met	None	None	0
Sedimentation	SF Chamber (3.8m2)	Exfiltration Rate (mm/hr)	0	0	0
Sedimentation	SF Chamber (3.8m2)	Extended detention depth (m)	0.25	1	0.77
Sedimentation	SF Chamber (3.8m2)	High Flow Bypass Out (ML/yr)	None	None	0
Urban	1. Roof [Area: 0.12ha]	Area Impervious (ha)	None	None	0.12
Urban	1. Roof [Area: 0.12ha]	Area Pervious (ha)	None	None	0
Urban	1. Roof [Area: 0.12ha]	Total Area (ha)	None	None	0.12
Urban	10. Switch House Roof (Macarthur Street) [Area:0.03]	Area Impervious (ha)	None	None	0.03
Urban	10. Switch House Roof (Macarthur Street) [Area:0.03]	Area Pervious (ha)	None	None	0
Urban	10. Switch House Roof (Macarthur Street) [Area:0.03]	Total Area (ha)	None	None	0.03
Urban	11. Roof Not To Tank (Macarthur Street) [Area:0.110]	Area Impervious (ha)	None	None	0.11
Urban	11. Roof Not To Tank (Macarthur Street) [Area:0.110]	Area Pervious (ha)	None	None	0

NOTE: A successful self-validation check of your model does not constitute an approved model by City of Sydney
MUSIC-*link* now in MUSIC by eWater – leading software for modelling stormwater solutions

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	11. Roof Not To Tank (Macarthur Street) [Area:0.110]	Total Area (ha)	None	None	0.11
Urban	13. Post office Courtyard [Area: 0.03]	Area Impervious (ha)	None	None	0.023
Urban	13. Post office Courtyard [Area: 0.03]	Area Pervious (ha)	None	None	0.006
Urban	13. Post office Courtyard [Area: 0.03]	Total Area (ha)	None	None	0.03
Urban	15. Lower level Post Office Courtyard [Area: 0.007]	Area Impervious (ha)	None	None	0.007
Urban	15. Lower level Post Office Courtyard [Area: 0.007]	Area Pervious (ha)	None	None	0
Urban	15. Lower level Post Office Courtyard [Area: 0.007]	Total Area (ha)	None	None	0.007
Urban	16. Lower level Courtyard Planter Roof [Area: 0.006]	Area Impervious (ha)	None	None	0.006
Urban	16. Lower level Courtyard Planter Roof [Area: 0.006]	Area Pervious (ha)	None	None	0
Urban	16. Lower level Courtyard Planter Roof [Area: 0.006]	Total Area (ha)	None	None	0.006
Urban	17. Postoffice Courtyard Roof [Area: 0.013]	Area Impervious (ha)	None	None	0.013
Urban	17. Postoffice Courtyard Roof [Area: 0.013]	Area Pervious (ha)	None	None	0
Urban	17. Postoffice Courtyard Roof [Area: 0.013]	Total Area (ha)	None	None	0.013
Urban	18. Pump House Courtyard [Area:0.032]	Area Impervious (ha)	None	None	0.032
Urban	18. Pump House Courtyard [Area:0.032]	Area Pervious (ha)	None	None	0
Urban	18. Pump House Courtyard [Area:0.032]	Total Area (ha)	None	None	0.032
Urban	2. Roof (Terrace Discharge through downpipe) [Area: 0.119ha]	Area Impervious (ha)	None	None	0.119
Urban	2. Roof (Terrace Discharge through downpipe) [Area: 0.119ha]	Area Pervious (ha)	None	None	0
Urban	2. Roof (Terrace Discharge through downpipe) [Area: 0.119ha]	Total Area (ha)	None	None	0.119
Urban	20. Terrace [Area:0.116]	Area Impervious (ha)	None	None	0.113
Urban	20. Terrace [Area:0.116]	Area Impervious (ha)	None	None	0
Urban	20. Terrace [Area:0.116]	Area Pervious (ha)	None	None	0
Urban	20. Terrace [Area:0.116]	Area Pervious (ha)	None	None	0.116
Urban	20. Terrace [Area:0.116]	Total Area (ha)	None	None	0.113
Urban	20. Terrace [Area:0.116]	Total Area (ha)	None	None	0.116
Urban	21. Building outskirts [Area:0.03]	Area Impervious (ha)	None	None	0.03
Urban	21. Building outskirts [Area:0.03]	Area Pervious (ha)	None	None	0
Urban	21. Building outskirts [Area:0.03]	Total Area (ha)	None	None	0.03
Urban	22. Building outskirts [Area:0.088]	Area Impervious (ha)	None	None	0.088
Urban	22. Building outskirts [Area:0.088]	Area Pervious (ha)	None	None	0
Urban	22. Building outskirts [Area:0.088]	Total Area (ha)	None	None	0.088
Urban	23. Half Boiler roof [Area: 0.024ha]	Area Impervious (ha)	None	None	0.024
Urban	23. Half Boiler roof [Area: 0.024ha]	Area Pervious (ha)	None	None	0
Urban	23. Half Boiler roof [Area: 0.024ha]	Total Area (ha)	None	None	0.024
Urban	3. Roof (Terrace Dsicharge) [Area: 0.144ha]	Area Impervious (ha)	None	None	0.144
Urban	3. Roof (Terrace Dsicharge) [Area: 0.144ha]	Area Pervious (ha)	None	None	0
Urban	3. Roof (Terrace Dsicharge) [Area: 0.144ha]	Total Area (ha)	None	None	0.144
Urban	4. WRAN roof [Area: 0.217ha]	Area Impervious (ha)	None	None	0.217
Urban	4. WRAN roof [Area: 0.217ha]	Area Pervious (ha)	None	None	0
Urban	4. WRAN roof [Area: 0.217ha]	Total Area (ha)	None	None	0.217

Only certain parameters are reported when they pass validation

Node Type	Node Name	Parameter	Min	Max	Actual
Urban	5. Half Boiler Room [Area: 0.2ha]	Area Impervious (ha)	None	None	0.2
Urban	5. Half Boiler Room [Area: 0.2ha]	Area Pervious (ha)	None	None	0
Urban	5. Half Boiler Room [Area: 0.2ha]	Total Area (ha)	None	None	0.2
Urban	50% of 12 + 8 Cloister [Area: 0.030]	Area Impervious (ha)	None	None	0.03
Urban	50% of 12 + 8 Cloister [Area: 0.030]	Area Pervious (ha)	None	None	0
Urban	50% of 12 + 8 Cloister [Area: 0.030]	Total Area (ha)	None	None	0.03
Urban	50% of 12. Cloister [Area: 0.028]	Area Impervious (ha)	None	None	0.028
Urban	50% of 12. Cloister [Area: 0.028]	Area Pervious (ha)	None	None	0
Urban	50% of 12. Cloister [Area: 0.028]	Total Area (ha)	None	None	0.028
Urban	6. Half Boiler roof [Area: 0.107ha]	Area Impervious (ha)	None	None	0.107
Urban	6. Half Boiler roof [Area: 0.107ha]	Area Pervious (ha)	None	None	0
Urban	6. Half Boiler roof [Area: 0.107ha]	Total Area (ha)	None	None	0.107
Urban	7. Switchhouse (Hardstand) [Area:0.093]	Area Impervious (ha)	None	None	0.088
Urban	7. Switchhouse (Hardstand) [Area:0.093]	Area Pervious (ha)	None	None	0.004
Urban	7. Switchhouse (Hardstand) [Area:0.093]	Total Area (ha)	None	None	0.093
Urban	9. Switch House Roof (Macarthur Street) [Area:0.021]	Area Impervious (ha)	None	None	0.021
Urban	9. Switch House Roof (Macarthur Street) [Area:0.021]	Area Pervious (ha)	None	None	0
Urban	9. Switch House Roof (Macarthur Street) [Area:0.021]	Total Area (ha)	None	None	0.021

Only certain parameters are reported when they pass validation

Failing Parameters

Node Type	Node Name	Parameter	Min	Max	Actual
Rain	90kL WRAN Rainwater Tank	Threshold Hydraulic Loading for C** (m/yr)	0	0	3500
Rain	90kL WRAN Rainwater Tank	Total Nitrogen - C** (mg/L)	0	0	1.4
Rain	90kL WRAN Rainwater Tank	Total Phosphorus - C** (mg/L)	0	0	0.13
Rain	90kL WRAN Rainwater Tank	Total Suspended Solids - C** (mg/L)	0	0	12
Sedimentation	SF Chamber (1.6m2)	Notional Detention Time (hrs)	8	12	0.0379
Sedimentation	SF Chamber (1.6m2)	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber (1.6m2)	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber (1.6m2)	Total Suspended Solids - k (m/yr)	8000	8000	1
Sedimentation	SF Chamber (1.6m2)	Notional Detention Time (hrs)	8	12	0.0379
Sedimentation	SF Chamber (1.6m2)	Notional Detention Time (hrs)	8	12	0.0512
Sedimentation	SF Chamber (1.6m2)	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber (1.6m2)	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber (1.6m2)	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber (1.6m2)	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber (1.6m2)	Total Suspended Solids - k (m/yr)	8000	8000	1
Sedimentation	SF Chamber (1.6m2)	Total Suspended Solids - k (m/yr)	8000	8000	1
Sedimentation	SF Chamber (3.8m2)	Notional Detention Time (hrs)	8	12	0.0391
Sedimentation	SF Chamber (3.8m2)	Total Nitrogen - k (m/yr)	500	500	1
Sedimentation	SF Chamber (3.8m2)	Total Phosphorus - k (m/yr)	6000	6000	1
Sedimentation	SF Chamber (3.8m2)	Total Suspended Solids - k (m/yr)	8000	8000	1

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