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Stage 1 FIRA and Civil SSDA Report

Powerhouse Ultimo Renewal

14 Sep 2022 Rev E

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Document History

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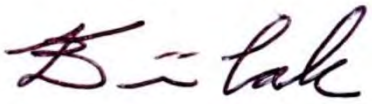

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Abbreviations

Abbreviation	Meaning
AEP	Annual Exceedance Probability (1% = 1 in 100)
AS/NZS	Australian/New Zealand Standards
ANZECC	Australian and New Zealand Environment and Conservation Council guidelines
Council	City of Sydney Council
DP	Deposited Plan
EIS	Environmental Impact Statement
ESD	Ecologically Sustainable Development
FFL	Finished Floor Level
FPL	Flood Planning Level
LGA	City of Sydney Local Government Area
m	metre
mm	millimetre
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
NABERS	National Australian Built Environment Rating System
NARCliM	NSW and ACT Regional Climate Modelling project.
OEH	NSW Office of Environment and Heritage
OSD	On-Site Detention
PMF	Probable Maximum Flood
RL	Reduced Level
SEARs	Secretary's Environmental Assessment Requirements
sqm	Square Metres
SSD	State Significant Development
SSDA	State Significant Development Application
TNSW	Transport for New South Wales
WELS	Water Efficiency Labelling and Standards
WSUD	Water Sensitive Urban Design

Contents

1.0 Introduction

1.1 Introduction

This report has been prepared on behalf of the Department of Enterprise, Investment and Trade (Create NSW) to support a State Significant Development (SSD) Development Application (DA) for alterations and additions to Powerhouse Ultimo at 500 Harris Street, Ultimo.

The Powerhouse Ultimo Renewal is a transformative $480-$500 million investment by the NSW Government to establish a world-class museum that will significantly contribute to an important and developing part of Sydney. The renewal will see Powerhouse Ultimo deliver a programming focus on design and fashion, presenting exhibitions that showcase the Powerhouse Collection, international exclusive exhibitions and programs that support the design and fashion industries.

1.2 Updates Following Response to Submissions

This report has been updated following Response To Submission for the Stage 1 SSD (SSD-32927319). The Powerhouse Ultimo Renewal Stage 1 State Significant Development Application (SSDA) sets out the concept proposal for the development, establishing overarching guidelines, principles and development controls for the detailed design, construction and operation of buildings and public domain that will be subject to a detailed (Stage 2) SSDA.

In response to submissions received during the public exhibition of the Stage 1 SSDA, the building envelopes above the state heritage listed Boiler House and Turbine Hall/ Engine Room and North Annex have been removed. These buildings remain largely intact externally and the removal of the envelopes above these structures reinforces the commitment to the retention and celebration of heritage within the site.

The proposed building envelope has been reduced above the Switch House, enabling a design response that reimagines the modern rooftop/ mezzanine addition. The envelope above the Pump House has also been reduced to ensure views to the Boiler House will remain unobstructed from Pier Street and Harris Street.

To provide further clarity of future built form (whilst providing for maximum potential design innovation through the design competition), the Applicant has determined a maximum gross floor area (GFA) that will apply to the future development. It is proposed that a maximum amount of GFA across the site of 40,000 square metres will apply, which represents an increase of 10,000 square metres compared to existing built form within the site. As such, with the retention of the state heritage listed buildings, any new built form will only form a relatively small proportion of the proposed envelope. The Design Guidelines require a minimum of 2,200 square metres of publicly accessible open space to be delivered within the site, limiting the extent of new building footprint able to be developed.

This updated version of the Stage 1 Civil Report (Appendix V to the EIS) confirms the conclusions of that report remain valid accounting for the proposed development within proposed GFA and building envelopes across the site.

Stormwater Servicing

- The site is adequately serviced by existing Sydney Water stormwater infrastructure. The proposed maximum GFA within the proposed building envelopes of the development will have no impact on the existing capacity of the Sydney Water stormwater assets as the existing site is already fully developed and the additional GFA will have no impact on the existing stormwater runoff from the site.
- Due to the proximity of construction works adjacent to the Sydney Water Assets, any proposed basement, structural works, excavation and retention systems will require Section 73 application and approval by Sydney Water, which can be sought following a Stage 2 SSDA.

Stormwater Concept Plan

- The maximum GFA within the proposed building envelopes will not result in any increase of impermeable areas across the site as the site is already fully developed. It is proposed to reuse the

existing stormwater system within the site where possible, and reuse existing connections to the external Sydney Water and/or Council system.

- A number of connection points exist for the connection of future built form to the existing stormwater infrastructure. As such there is no limitation on the built form design (that is subject to the design competition) as a result of stormwater connection points. Refer to Section 4 for further details.
- Assessment has demonstrated that water quality targets can be met for the full site (and accordingly the maximum GFA proposed), however further assessment will be required at the Stage 2 SSDA to determine if a whole of site upgrade of existing assets required.

Flooding

- The proposed maximum GFA of the development will not change the existing flood behaviour, will have no adverse impact on existing properties, and will meet City of Sydney Flood Planning requirements.
- The envelope approval sought for, allows the built form to be constructed in each of the envelope zones, which is not flood affected and above and outside the extent of the Probable Maximum Flood (PMF) which has an annual exceedance probability of at less than 1 in 10,000. Refer to Section 5 for further details

The responses received from the DPE and EHG are specifically addressed in Section 1.4 of this report.

1.3 Process

The Powerhouse Ultimo Renewal project is for the purposes of an 'information and education facility' with a capital investment value of more than $30 million, and such is classified as State Significant Development (SSD) pursuant to Section 13(1) of Schedule 1 of *State Environmental Planning Policy (Planning Systems) 2021.*

The delivery of the new Creative Industries Precinct for Powerhouse Ultimo will occur in stages, comprising the following:

- **Stage 1** – Concept DA establishing the planning, design, and assessment framework for the Powerhouse Ultimo Renewal Project including the indicative land uses, maximum building envelopes, general parameters for the future layout of the site, and strategies to guide the subsequent detailed design phases of the project including Urban Design Guidelines and Design Excellence Strategy.
- **Architectural Design Competition** – A competitive design process to critically analyse and provide design alternatives for the Powerhouse Ultimo Renewal project in accordance with the planning and development framework established for the site under the Concept DA. A winning design will be selected by a jury of experts and will inform the subsequent detailed design and assessment phase (Stage 2) of the project.
- **Stage 2** – A Detailed DA confirming the ultimate architectural design and operation of Powerhouse Ultimo and assessing any associated planning and environmental impacts. This Detailed DA will seek consent for the detailed design, construction and operation of the proposed development and follows the same planning assessment and determination process as the Concept DA (Stage 1).

1.4 SEARs

The Department of Planning and Environment (DPE) has issued Secretary's Environmental Assessment Requirements (SEARs) to the applicant for the preparation of an Environmental Impact Statement (EIS) for the proposed development. This report has been prepared by TTW to specifically address the civil items shown in Table 1:

Table 1 – SEARs (SSD-32927319)

SEARs	Report Reference
SEARs 14. Ground and Water Conditions • *Where applicable, provide an assessment of the potential operational and construction impacts on soil resources, including related infrastructure and riparian lands on and near the site.* • *Where applicable, provide an assessment of the potential operational and construction impacts on surface and groundwater resources (quality and quantity), including related infrastructure, hydrology, aquatic and groundwater dependent ecosystems, drainage lines, downstream assets, and watercourses.* • *Where applicable, provide an assessment of salinity and acid sulfate soil impacts.*	*Refer to section 4.3 and 4.4 for construction and operational impacts on surface water (quality and quantity).* *Refer to section 2.2, 4.2 and 4.3 for impacts on Drainage lines, downstream assets, and watercourses.* *Refer to Douglas Partners; Report on Preliminary Site Investigation (Contamination), and Report on Geotechnical Investigation, April 2022, for assessment of groundwater and soil conditions.*

SEARs 15. Stormwater and Wastewater
• *Where applicable, provide an Integrated Water Management Plan for the development that:*
  ◦ *is prepared in consultation with council and any other relevant drainage or water authority.*
  ◦ *details the proposed drainage design for the site including any on-site treatment, reuse and detention facilities, water quality management measures, and the nominated discharge points.*
  ◦ *demonstrates compliance with council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties, including during construction.*
• *Provide a stormwater concept plan prepared in consultation with, and compliant with the relevant standards of, the local council or other drainage or water authority.*
	Refer to section 4.0 for the Integrated Water Management Plan and stormwater.
	
	Refer to Section 4.3 for MUSIC assessment and WSUD measures.
	
	Refer to section 4.4 for runoff erosion and sediment control during construction.
	
	Refer to section 4.2 for the proposed stormwater concept plan.

SEARs 16. Flooding Risk • *Identify 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 and City of Sydney Interim Floodplain Management Policy.* • *Where applicable, assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.*	*Refer to section 5.0 for flooding assessment.* *Refer to section 5.2 for flooding impact assessment.* *Refer to Section 5.4 for the impact on flooding due to climate change.*
SEARs 23. Infrastructure Requirements and Utilities • *In consultation with relevant service providers:* • *Assess the impacts of the development on existing utility infrastructure and service provider assets surrounding the site, including the Inner West Light Rail.* • *Assess the impact on and detail any measures to protect Sydney Water stormwater assess which traverse the site.* • *Identify any infrastructure upgrades, including for the Inner West Light Rail, required on-site and off-site to facilitate the development and any arrangements to ensure that the upgrades will be implemented on time and be maintained.* • *Provide an infrastructure delivery and staging plan, including a description of how infrastructure requirements would be co-ordinated, funded and delivered to facilitate the development.*	*Refer to section 2.2 for existing Utilities and impact on Sydney Water Assets* *Refer to Steensen Varming; Site Infrastructure Management Strategy Stage 1 SSDA Report for assessment of other infrastructure and utilities.*

1.5 EHG Response

This section responds directly to the Department of Planning and Environment (DPE) and Environment and Heritage Group (EHG) comments provided (ref *DOC22/479653, 14 July 2022)* and specifically the following points, with responses and references to relevant sections of the report in bold:

EHG notes that the Stage 1 Civil Report, dated May 2022, (the flood report) does not include a flood impact and risk assessment (FIRA) to support the Powerhouse Ultimo Renewal EIS. The flood report is limited to outlining existing flood behaviour in the vicinity of the site as identified by City of Sydney Council's Darling Harbour catchment flood study and Darling Harbour floodplain risk management plan.

The proposed development has no significant impact on the existing flood behaviour or flood risk to the existing community as the proposed Zone 2 building envelope is located above and outside the extent of the PMF, and zones 1 and 3 have only very minor localised flood affectation from direct rainfall that can be managed through site stormwater management. A conservative assessment of full development of all three zones has no significant impact on the existing flood behaviour as discussed in Section 5.0.

The flood report does not address the Secretary's Environmental Assessment Requirements (SEARs) which states, 'Where applicable, assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required'.
Harbour catchment flood study and Darling Harbour floodplain risk management plan.
Accordingly, to adequately address the SEARs requirement, the EIS should be supported by an adequate FIRA to provide a sound understanding of flood behaviour for both existing and developed scenarios. This will enable decision making to be based on a comprehensive understanding of the flood hazard and risk to people and property for a full range of floods up to the PMF event.

A conservative assessment of full development of all three zones has no significant impact on the existing flood behaviour as discussed in Section 5.0. The proposed development therefore meets the SEARs 16 as outlined in Table 1 of Section 1.3 and referenced in Section 5.0 and 5.2 of the report, which has now been updated and expanded.

The FIRA should be prepared by suitably qualified flooding engineers and floodplain managers that specialise in flood risk management to ensure the assessment provides adequate information that can inform decision making in the Design Competition Stage and Stage 2 DA. The FIRA should address the following

- *the impacts of the proposed development on the flood behaviour and flood risk to the existing community*

The proposed development has no significant impact on the existing flood behaviour or flood risk to the existing community, refer to Section 5.2 for further details.

- *the impacts and risks of flooding on the development and its future users*

The development of the proposed building envelopes has no significant impact on the existing flood behaviour and very low flood risk to its future users, refer to Section 5.2 for further details.

- *how these impacts can be managed to minimise the growth in risk to the community due to the development*

The development of the proposed building envelopes has no significant impact on the existing flood behaviour and very low flood risk to the community, refer to section 5.2 for further details.

- *the emergency response issues and required management measures for the full range of flooding.*

The proposed development ground floor, although not fully realised at this stage will be located above the 1% AEP, with additional floors located above the PMF level. Proposed buildings would provide a safe refuge in the event of flooding for all flood events. If sufficient warning time is not provided to safely evacuate the site, then the emergency response is to shelter-in-place, refer to Section 5.5 for further details.

1.6 Site Description

Powerhouse Ultimo is situated upon the lands of the Gadigal people of the Eora Nation. It is located within the City of Sydney Local Government Area and its primary address is 500 Harris Street, Ultimo.

The site contains two heritage-listed buildings, being the 'Ultimo Power House' (c.1899-1905) and the 'Former Ultimo Post Office including interior' (c.1901), both of which are listed on the State Heritage Register under the *Heritage Act 1997.*

Other buildings within the site include the former tram shed (Harwood Building) and the 1988 museum building fronting Harris Street (Wran Building). A café building has been constructed immediately to the south of the Power House at the northern end of the Ultimo Goods Line. Located at the corner of Harris Street and Macarthur Street is a forecourt that acts as the main public entrance to the site, but provides limited activation and is disconnected from higher-quality urban spaces including the Ultimo Goods Line.

The primary focus of the Powerhouse Ultimo Renewal project is the museum to the north of Macarthur Street and bounded by Harris Street, Pier Street and the light rail corridor. However, some enabling and minor decoupling works will occur within the broader Powerhouse Ultimo precinct. Table 2 shows a description of the site and related lots.

No substantive works or changes in use are proposed to the Harwood Building located between Macarthur Street and Mary Ann Street.

Table 2 – Site Description

Lot/DP	Description	Owner
Lot 1 DP 631345	Ultimo Power House, Harris Street forecourt, café and southern carpark	The Trustees of the Museum of Applied Arts and Sciences
Lot 1 DP 781732	Wran Building	The Trustees of the Museum of Applied Arts and Sciences
Lot 3 DP 631345	Harris Street forecourt	The Trustees of the Museum of Applied Arts and Sciences
Lot 37 DP 82234	Harris Street forecourt	The Trustees of the Museum of Applied Arts and Sciences
Lot 1 DP 770031	Former Ultimo Post Office	The Trustees of the Museum of Applied Arts and Sciences
Lot 3 DP 216854	Harwood Building	The Trustees of the Museum of Applied Arts and Sciences

1.7 Site and Surrounding Context

Powerhouse Ultimo is situated upon the lands of the Gadigal people of the Eora Nation. The site is located at the interface between the suburbs of Ultimo, Pyrmont, Haymarket and Darling Harbour. This is reflected in its strategic positioning in relation to the local pedestrian, active transport, public transport, and road network. The site is located at the northern terminus of the Ultimo Goods Line from Central Station and close to the southern end of Tumbalong Boulevard.

Macarthur Street serves as a pedestrian-friendly east-west connection between Ultimo and the southern CBD. The Paddy's Markets and Exhibition Centre Light Rail Stations are both located in close proximity to the site, and bus stops at Harris Street provide access to Central as well as centres including Ryde and Parramatta via Victoria Road.

The urban context of the site is characterised by a wide array of land uses, development typologies and architectural styles. There is no consistent street wall height along Harris Street or intersecting local streets, with 2-storey historic terraces sitting in close proximity to more modern 6-8 storey commercial and mixed-use buildings. The recent urban renewal of Darling Square provides a rapid transition in density and building heights immediately to the east of the site, with a range of 20+ storey buildings within a modern setting. The Site location and surrounding area are shown in Figure 1.

The site is located in the vicinity of a number of locally listed heritage items identified under the Sydney LEP, including the Glasgow Arms Hotel, terrace-house groups along Harris St and Macarthur St, the former Millinery House building, the former National Cash Register building and the former Technological Museum/Sydney Technical College building in Harris Street.

The site contains two heritage-listed buildings, the 'Ultimo Powerhouse' (c.1899-1905) and the 'Former Ultimo
Post Office including interior' (c.1901), both of which are listed on the State Heritage Register under the Heritage Act 1997. An existing Conservation Management Plan (Architectural Projects, 2003) is in place

The site is not identified as being located within a Heritage Conservation Area; however, it is adjacent to and in the vicinity of the Harris St Ultimo Conservation Area.

The surrounding context of the site is informed by a wide variety of land uses, building densities and architectural styles as summarised below in regard to the immediate surrounds:

- Harris St (William Henry St – Macarthur St) – Mix of 2-6 storey residential buildings, a pub/hotel and 3-8 storey commercial and educational buildings
- Harris St (Macarthur St – Mary Ann St) – 2-3 storey commercial and residential terraces, with taller 6-8 storey commercial and educational buildings towards the Mary Ann St intersection
- Systrum St – 2-storey historic terraces in the north, modern 3-8 storey residential apartments towards the south
- Darling Square – 20 storey student accommodation buildings directly to the east, beyond which is a dense urban precinct with a range of employment, residential, and tourism uses, with Darling Harbour further north
- Mary Ann St – University of Technology Buildings 8 (Gehry Building) and 15 with a range of educational uses
- Ultimo Goods Line – Completed in 2012, the 'Goods Line' is a unique linear space that provides connection and amenity by reinterpreting the former railway and tram corridor.

Figure 1 - Site Location and Surroundings

2.0 Site Overview

2.1 Site Topography

The Site is located within the northern and lower area of Darling Harbour catchment; refer to Figure 2. The catchment is highly urbanised with a large network of stormwater infrastructure, which includes Council owned pit and pipe systems that discharge into Sydney Water owned trunk drainage. There are no open watercourses within the catchment, and the road networks and open spaces provide the primary overland flow paths following the natural topography of the land. Flows from the catchment discharge north to Darling Harbour. The natural topography of the surrounding area generally falls from the south and east to the north and west.

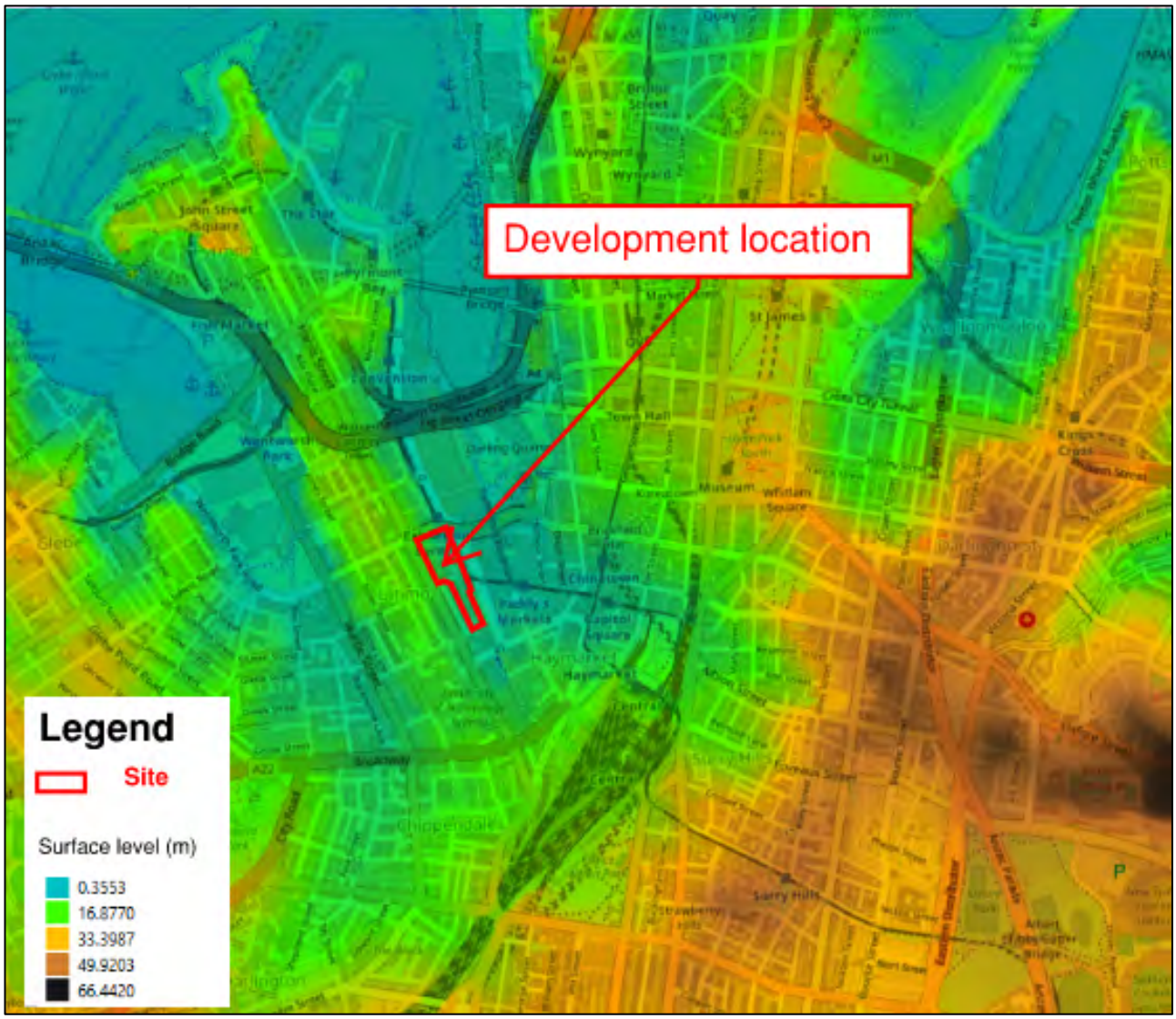


Figure 2 – Catchment Area Surface Level For Powerhouse Site And Surrounding Area

2.2 Existing Infrastructure

SEARs 23. Infrastructure Requirements and Utilities

In consultation with relevant service providers:

- ***Assess the impacts of the development on existing utility infrastructure and service provider assets surrounding the site, including the Inner West Light Rail.***
- ***Assess the impact on and detail any measures to protect Sydney Water stormwater assess which traverse the site.***
- ***Identify any infrastructure upgrades, including for the Inner West Light Rail, required on-site and off-site to facilitate the development and any arrangements to ensure that the upgrades will be implemented on time and be maintained.***
- ***Provide an infrastructure delivery and staging plan, including a description of how infrastructure requirements would be co-ordinated, funded and delivered to facilitate the development.***

Extensive services and existing utilities within the road reserve surrounding the site; figure 3 shows the existing utility services around the site. Collation of existing survey and services information will be completed during the Design Competition Stage and Stage 2 DA. Impacts on the existing infrastructure and any augmentation/amendments will be assessed by the relevant service consultant, and it is expected that existing utilities and infrastructure will be used wherever possible, refer to *Site Infrastructure Management Strategy Stage 1 SSDA Report, by Steensen Varming*. The existing and proposed stormwater infrastructure has been assessed in Section 4.0.

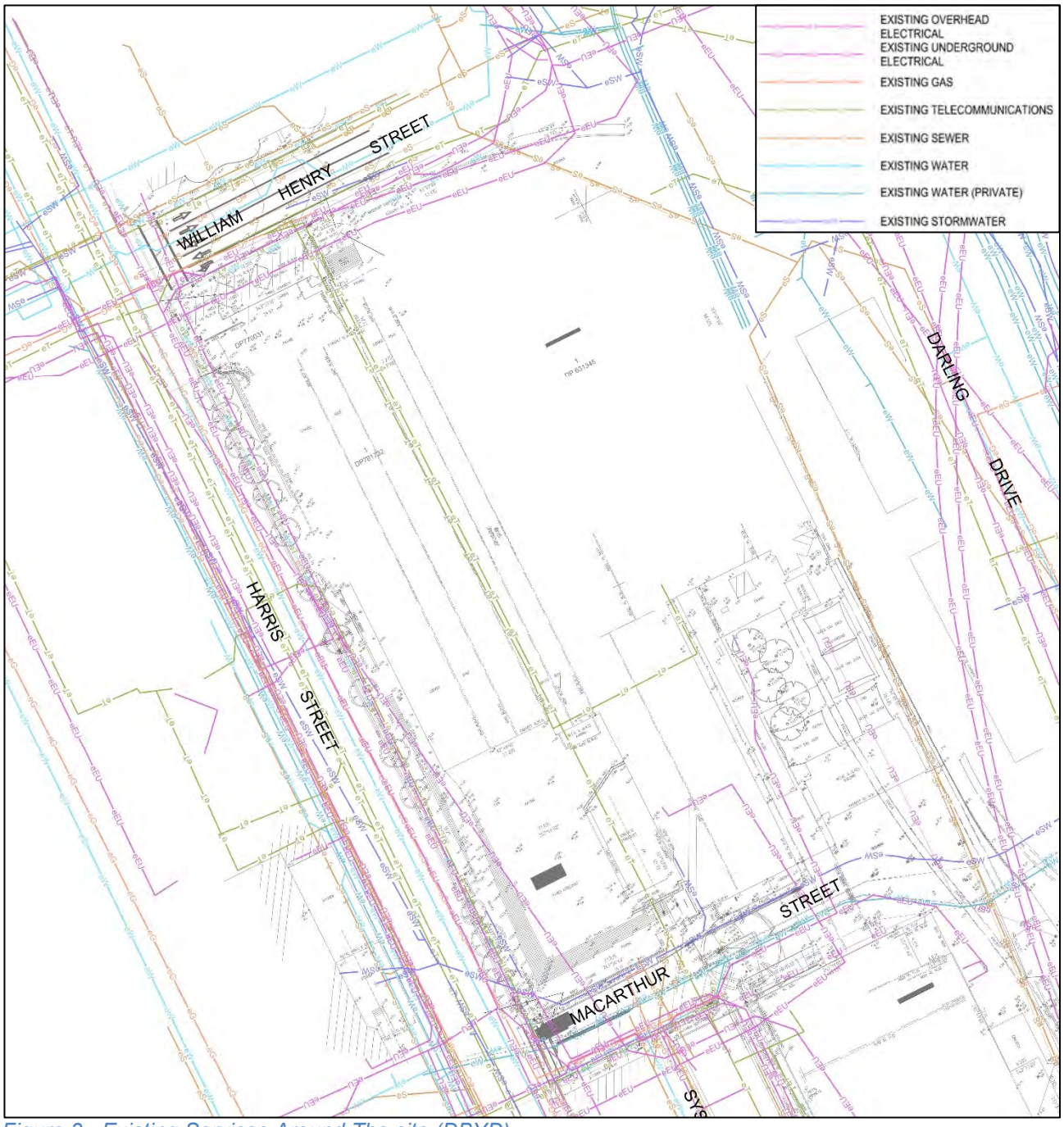


Figure 3 - Existing Services Around The site (DBYD)

Existing 300mm and 600mm Sydney Water stormwater pipes run through Harris Street and MacArthur Street. The stormwater pipes increase to 900mm before discharging to large Sydney Water Trunk Culverts in Darling Drive, as shown in Figure 4.

The development within proposed building envelope zones will have no impact on the existing capacity of the Sydney Water stormwater asset. The proposed stormwater runoff from the development will not increase as there will be no increase in impermeable area, as the existing site is fully developed.

Due to the proximity of construction works adjacent to the Sydney Water Assets, any proposed basement, structural works, and excavation or retention systems will require Section 73 application and approval by Sydney Water. A detailed assessment will be required by the structural engineer and Water Services Coordinator following the Stage 2 SSDA.

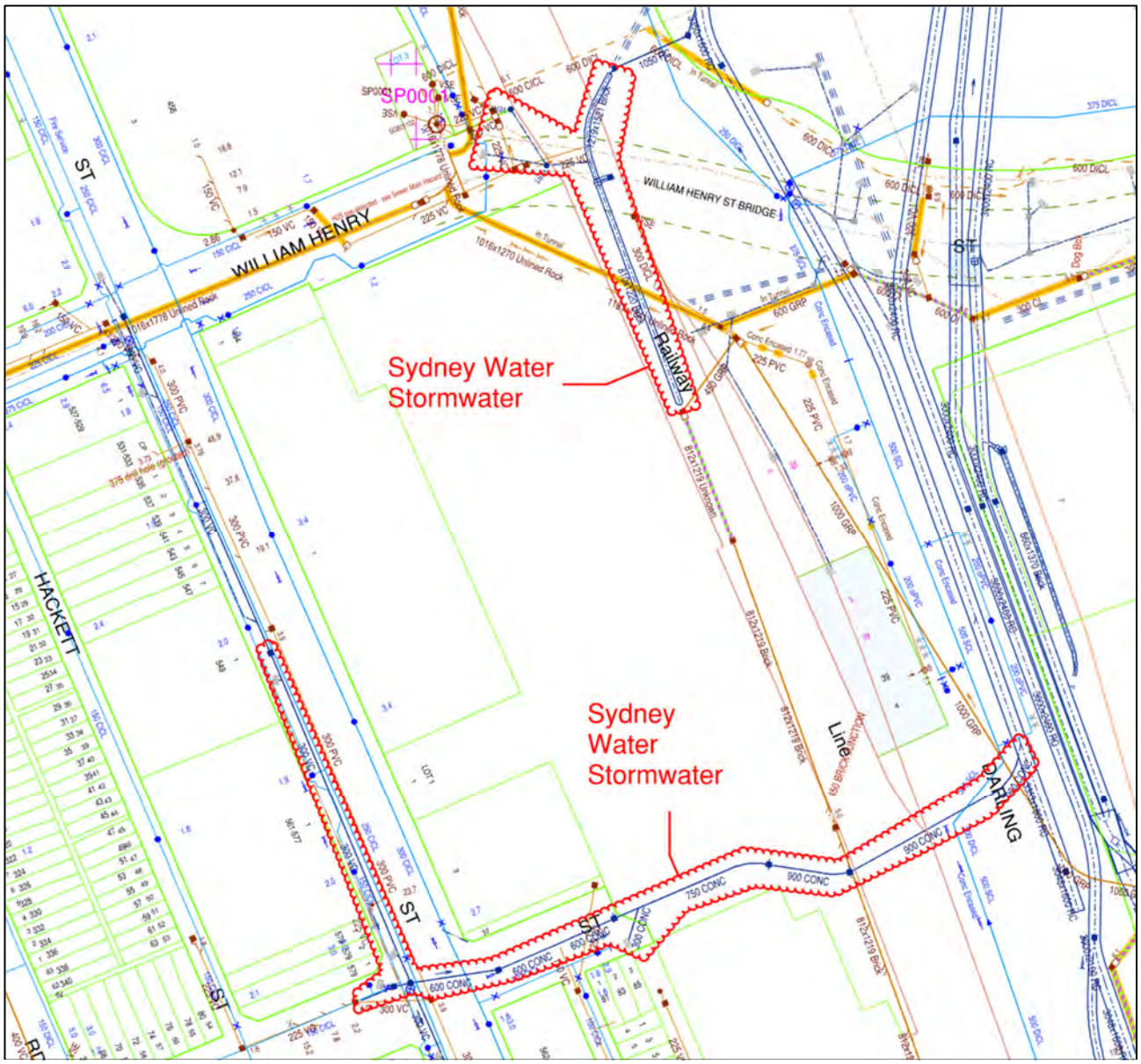


Figure 6 - Existing Sydney Water Stormwater Assets

3.0 Proposed Development and Building Envelope Zones

This Concept DA sets the vision for the renewal of Powerhouse Ultimo and the creation of the Powerhouse Creative Industries Precinct, with the detailed design, construction, and operation of the project to be sought at a separate and future stage (Stage 2).

Concept approval is sought for the following:

- A maximum building envelope for any new buildings and alterations and additions to existing buildings retained on the site across zones 1, 2 and 3. Architectural plans and sections of these zones are shown in figures 7-10.
- Use of the new spaces and built form as an 'information and education facility' including exhibition, education, and back of house spaces, and a range of related and ancillary uses to contribute to the operation of Powerhouse Ultimo.
- Endorsement of Urban Design Guidelines and a Design Excellence Strategy to guide the detailed design of the future building, internal spaces, and public domain areas that will be the subject of a competitive design process and a separate and future Stage DA.
- An updated Conservation Management Plan to ensure that future development occurs in a manner that is compatible with, and facilitates the conservation of, the heritage values of the site.
- General functional parameters for the future design, construction, and operation of buildings and uses on the site including the principles and strategies for the management of transport and access, flooding, sustainability, heritage and the like.

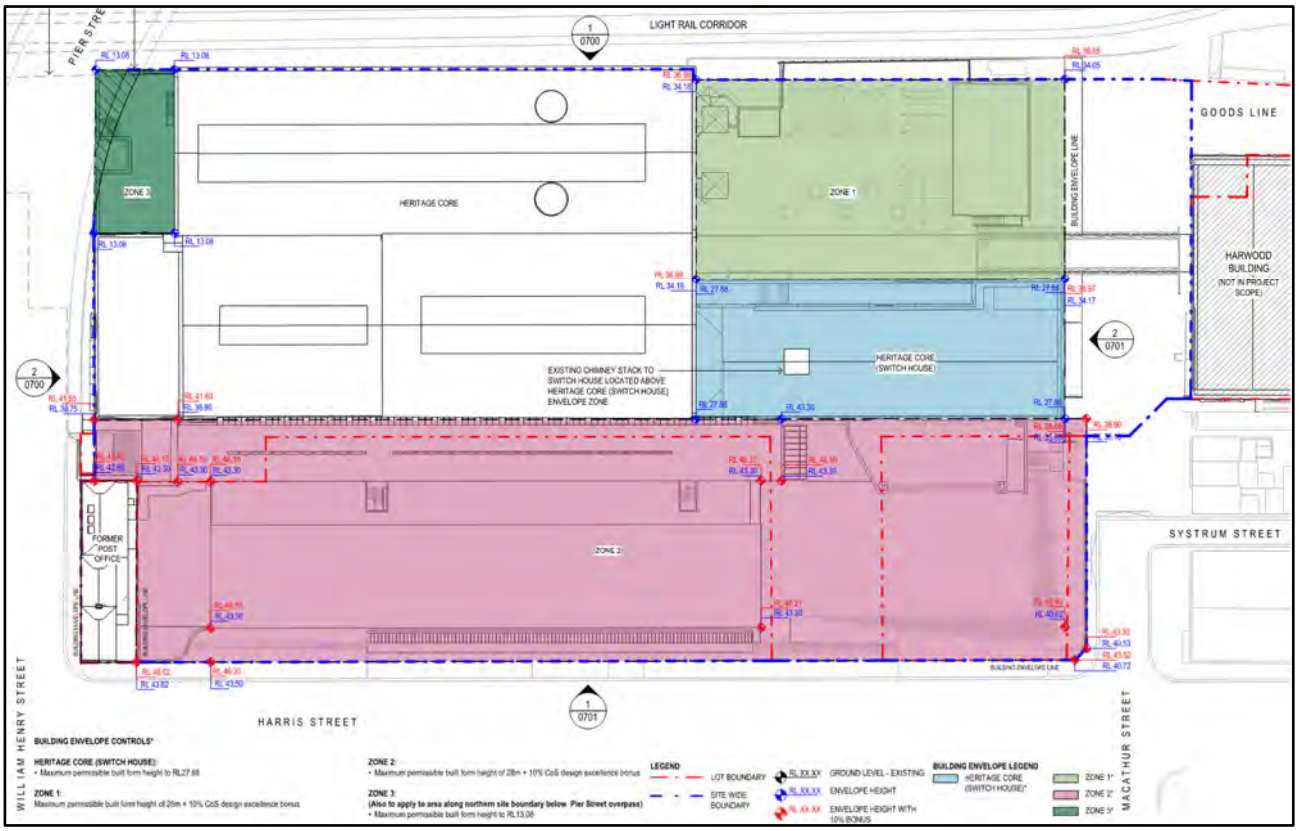


Figure 7 - Proposed Building Envelope Zones (John Wardle Architects)

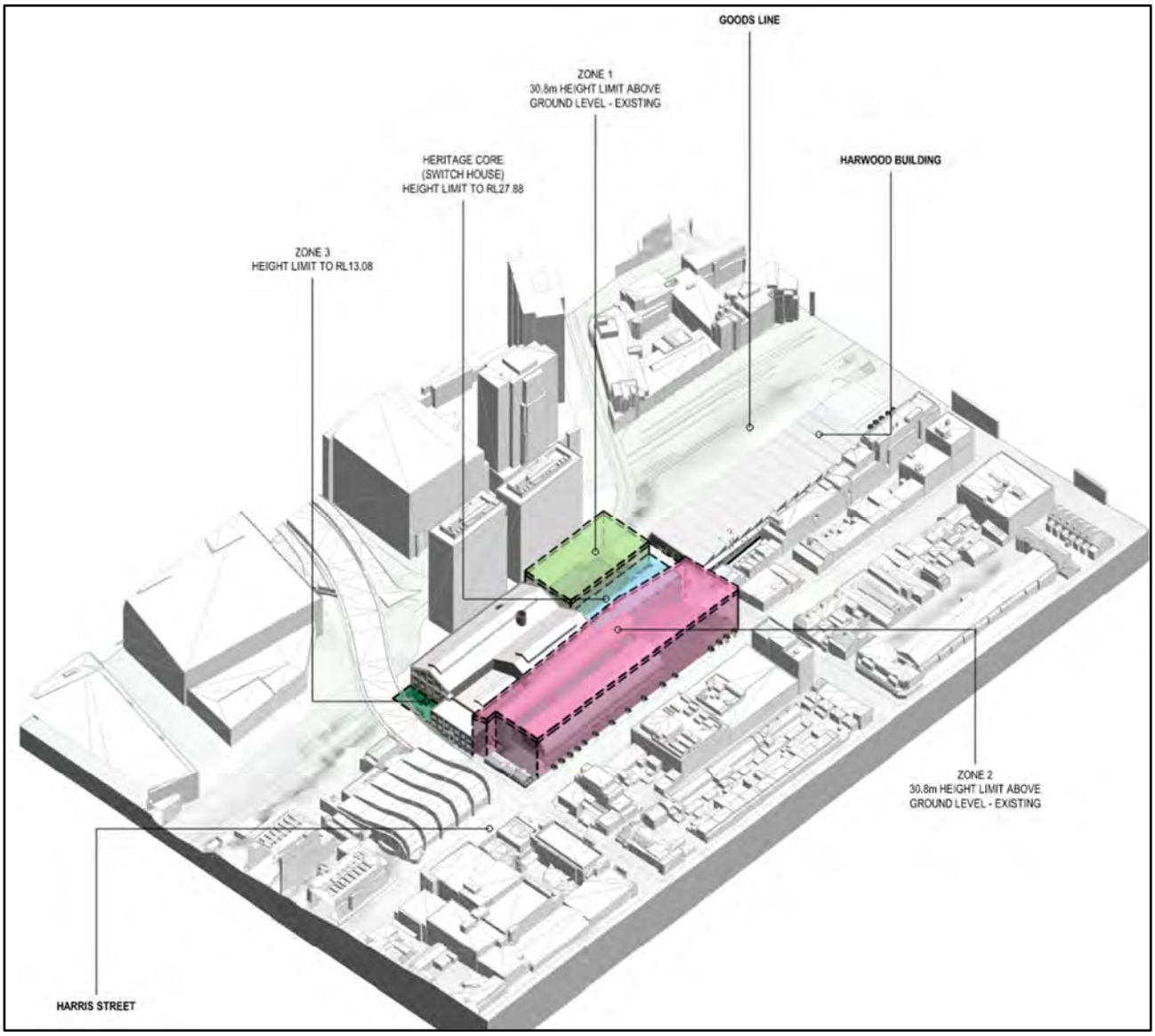


Figure 8 – 3d View of Building Envelope Zones (John Wardle Architects)

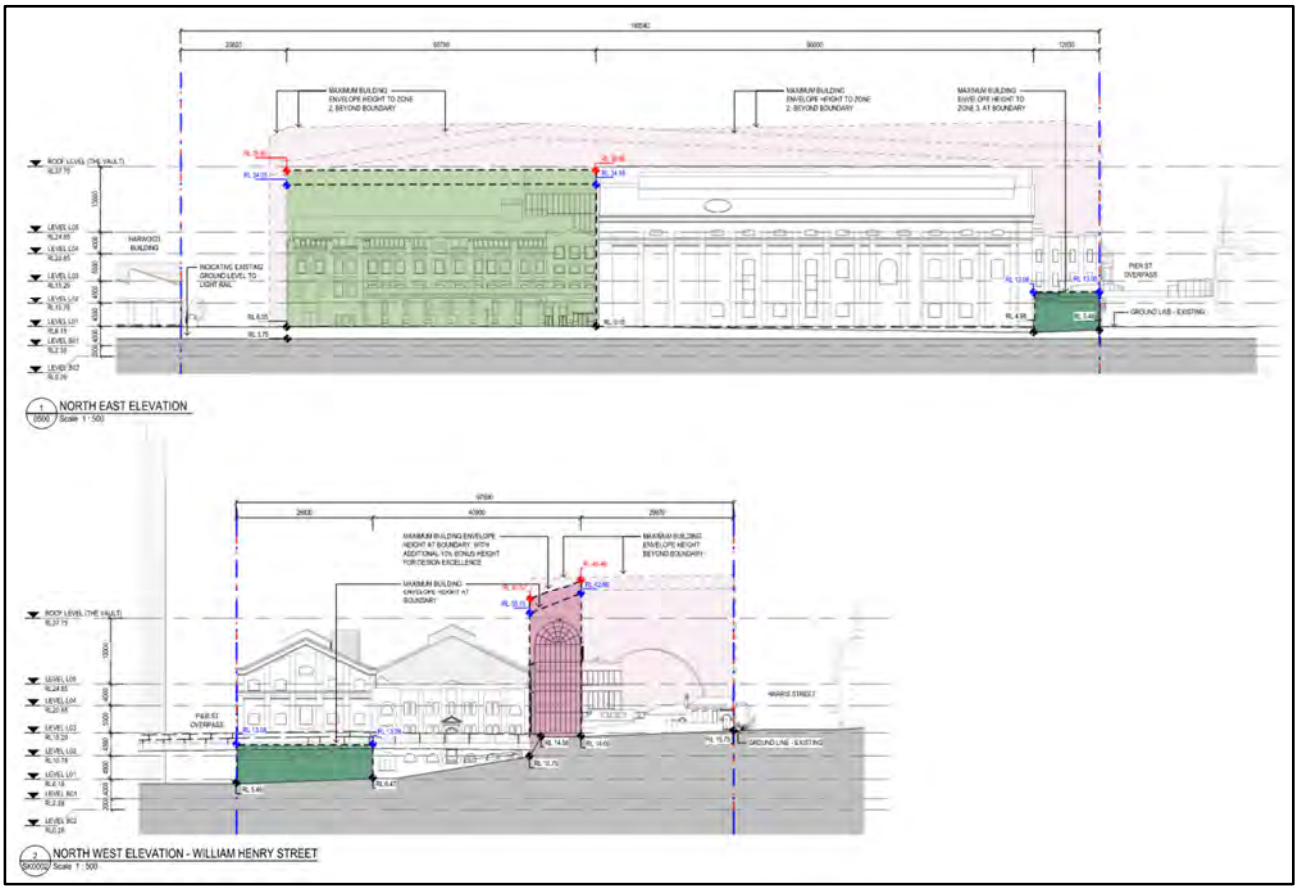


Figure 9 – Building Envelope Zones Section Views (John Wardle Architects)

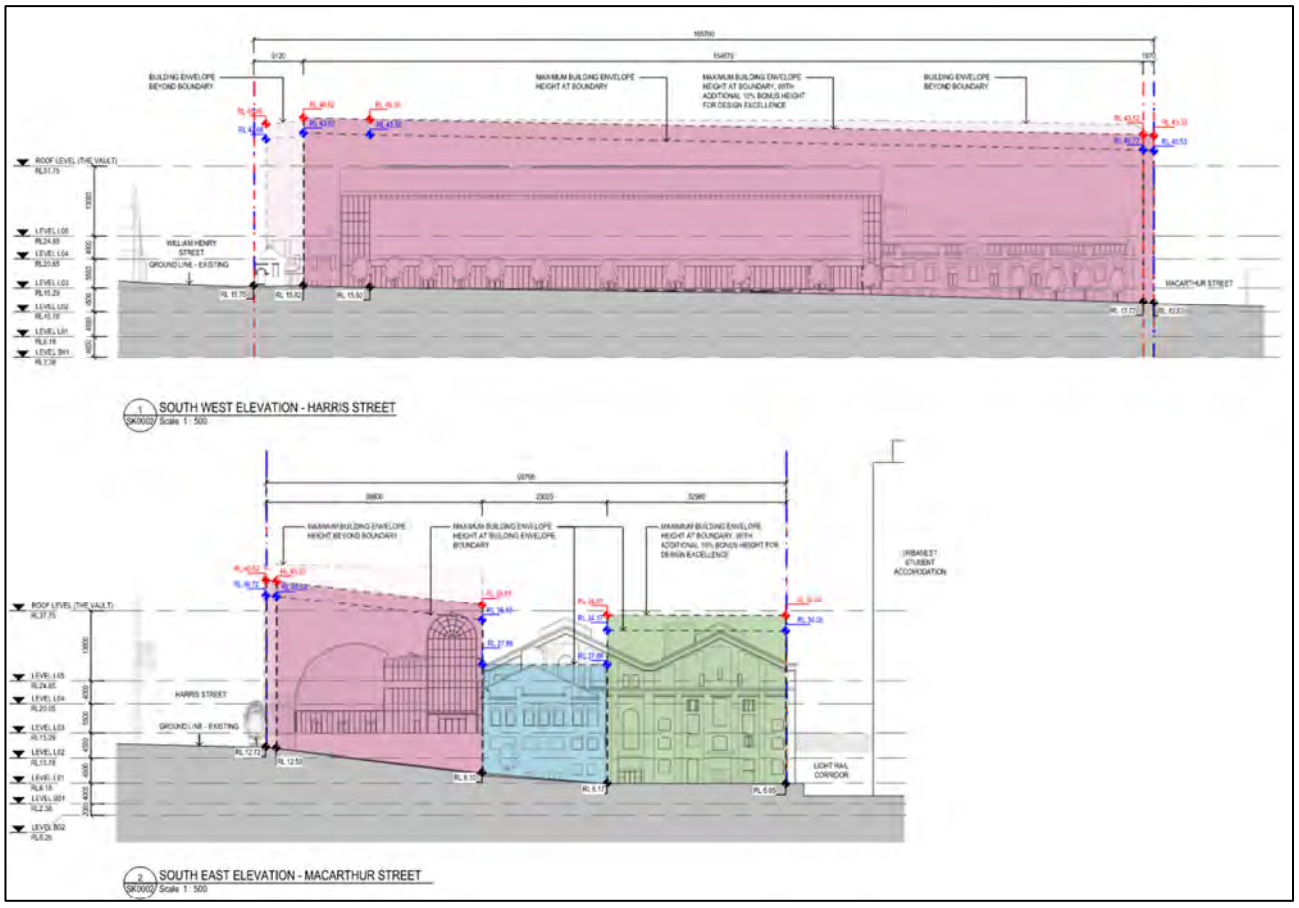


Figure 10 – Building Envelope Zones Section Views (John Wardle Architects)

4.0 Integrated Water Management Plan and Stormwater

SEARs 15. Stormwater and Wastewater

- *Where applicable, provide an Integrated Water Management Plan for the development that:*
  - *is prepared in consultation with council and any other relevant drainage or water authority.*
  - *details the proposed drainage design for the site including any on-site treatment, reuse and detention facilities, water quality management measures, and the nominated discharge points.*
  - *demonstrates compliance with council or other drainage or water authority requirements and avoids adverse impacts on any downstream properties, including during construction.*
- *Provide a stormwater concept plan prepared in consultation with, and compliant with the relevant standards of, the local council or other drainage or water authority.*

Water NSW requires a water management plan for commercial developments to include stormwater quality modelling, an erosion and sediment control plan, and an assessment of post development pollutants. The following section provide the Water Management Plan and addresses the Water NSW and SEARS requirements. The proposed stormwater concept plan is included in Section 4.2 and is in accordance with City of Sydney design requirements and has no adverse downstream impacts.

4.1 Existing Stormwater Catchments

Further investigation and survey are required to fully understand the existing stormwater system within the development site, existing catchments, stormwater controls (if any) and existing discharge points off-site. This investigation will be required to develop the stormwater concept design during the Design Competition stage and Stage 2 DA.

The approximate existing site stormwater catchments are shown in Figure 11. The total area is divided into two sub-catchments based on existing site levels and assumed gravity drainage system as follows:

- The majority of the area north of Macarthur Street falls to the east and south with existing connections to the Sydney Water Stormwater in Macarthur Street (approx. 15350sq.m).
- The north eastern area under the raised bridge deck (approx. 350 sq.m) drains by gravity to the east of the site into an existing Council Stormwater pipe located in Pier Street.

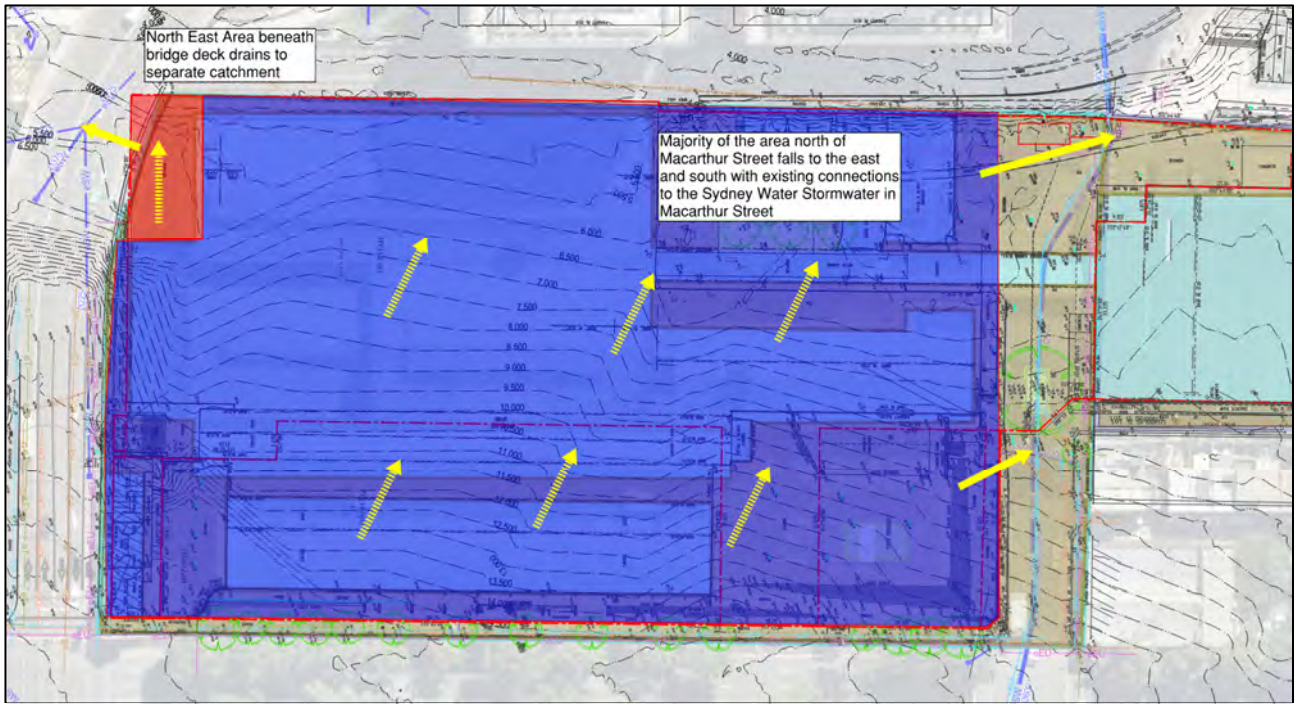


Figure 11 – Existing Stormwater Catchments

4.2 Proposed Stormwater Concept Plan

Sydney Water has confirmed that there is no on-site detention (OSD) required or any restriction on stormwater discharge required for the development site; refer to Appendix A. There is no net change in peak flows following development as the site is fully developed and there is not expected to be any increase in impermeable area following development. A detailed site catchment assessment will be required during the Stage 2 SSDA and will be informed by the proposed landscape, civil and architectural design.

The proposed stormwater concept allows for the reuse of the existing stormwater infrastructure across the development site, with a possible stormwater connection for each building envelope zone to an existing Council or Sydney Water stormwater pit. Water Quality treatment (WSUD) will be required for this new building and will be located within the development site area upstream of the Council connection pit. The proposed connection points for each envelope zone are shown in figure 13.

The proposed stormwater minor system will be designed to convey the 5% AEP (1 in 20 years) flows, and the major system will be designed to convey the 1% AEP (1 in 100 years) flows in accordance with the City of Sydney Stormwater design requirements.

As there is no effective change in impermeable areas from the site, there will be no change in stormwater flows and no downstream impact to the capacity of existing stormwater assets associated with the development. The proposed site catchment areas and flows are shown in figure 12 and Table 3 respectively.

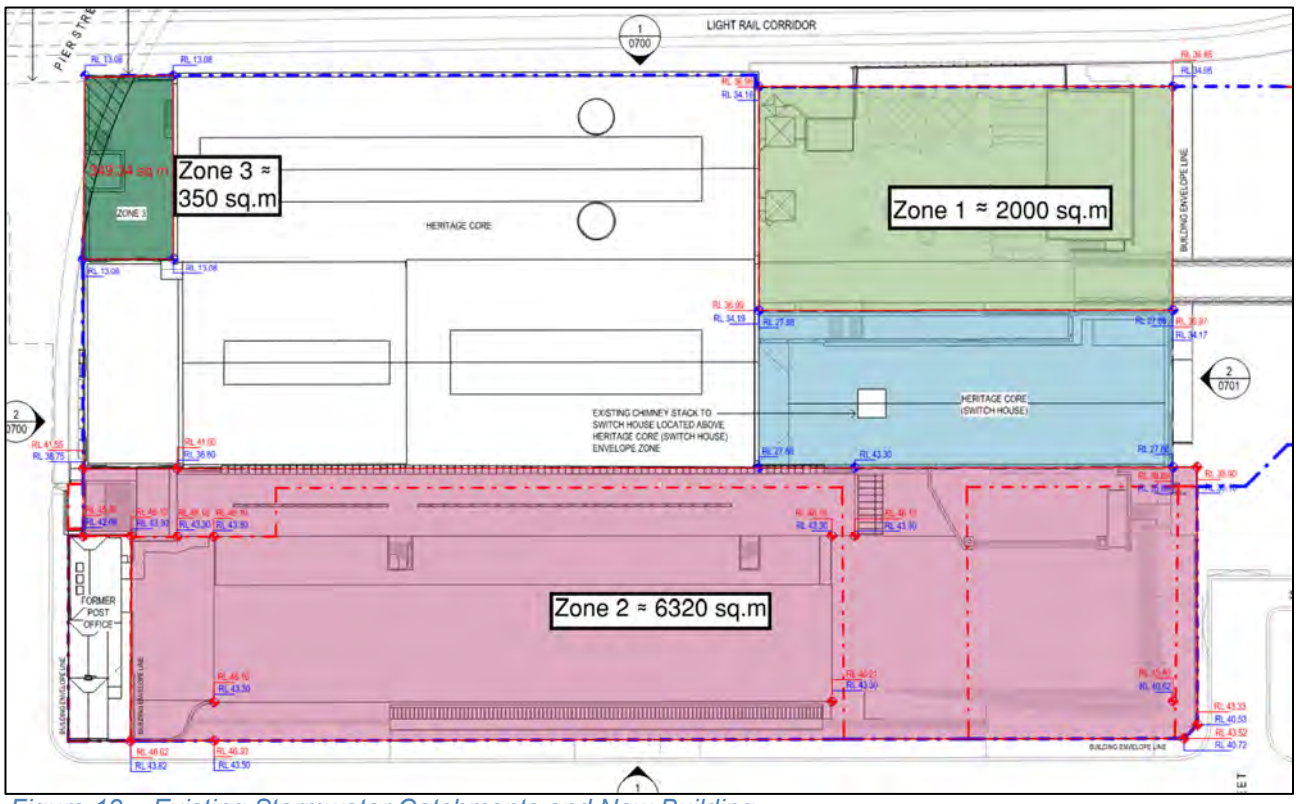


Figure 12 – Existing Stormwater Catchments and New Building

Table 3. Peak Stormwater Flows for Each Catchment For 5% AEP and 1% AEP Storm Events

	5% AEP Flow	1% AEP Flow
Zone 1 (2000 sq.m)	102 l/s	140 l/s
Zone 2 (6320 sq.m)	322 l/s	442 l/s
Zone 3 (350 sq.m)	18 l/s	25 l/s
Total Site north of Macarthur Street (15700 sq.m)	**800 l/s**	**1100 l/s**

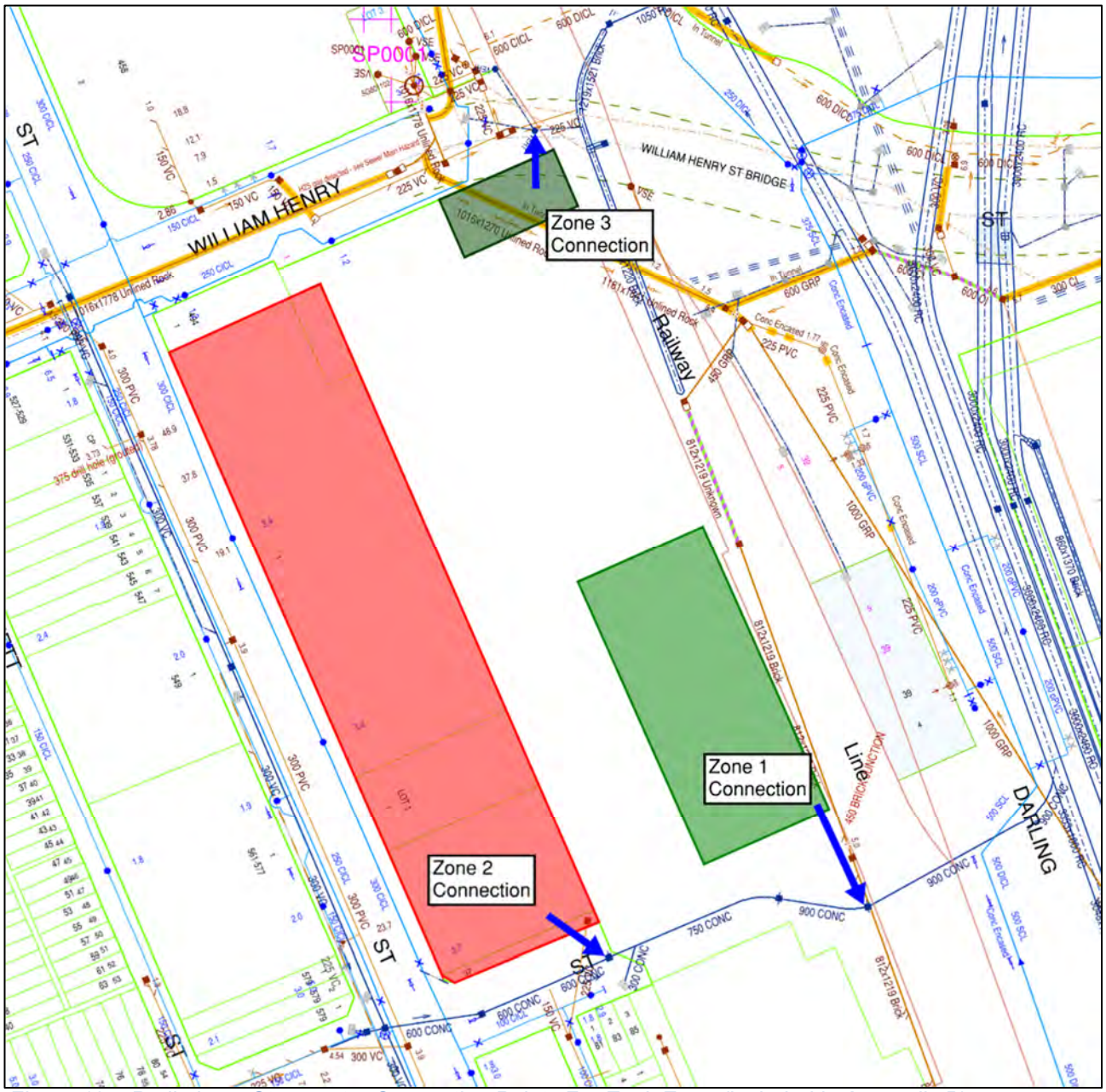


Figure 13 – Preliminary Stormwater Connection Points For Each Zone (included in Appendix B)

4.3 Stormwater Quality Assessment

In accordance with City of Sydney Water Quality requirements, any development larger than 1000 sq.m is required to meet pollutant reduction targets set by Sydney Water, as shown in Table 4. MUSIC modelling has been completed to demonstrate how the stormwater quality targets will be achieved.

The proposed stormwater quality measures will need to be integrated with the landscaping, irrigation, water use/reuse and reticulation; this will be further detailed in the Integrated Water Management Plan to be produced by the Hydraulic Engineer.

The water quality measures required will be installed upstream of each proposed point of connection, as shown in figure 13.

The following water quality assessment is for the full development site, assuming that there is no existing water quality infrastructure that can be reused. Further investigation into the existing stormwater system and further water quality analysis will be required during the Stage 2 DA when the proposed built form and site layout is developed.

Table 4 - Council Stormwater Quality Targets

Pollutant	Average annual pollutant load reduction objective (%)[1]
Gross pollutants (>5 mm)	90
Total suspended solids	85
Total phosphorous	60
Total nitrogen	45

4.3.1 Water Quality Requirements - Full Site

A preliminary MUSIC model has been completed for the full site, which confirms that the following water quality treatment devices would be installed that meet the Sydney Water pollution load reduction targets. This is a conservative model that assumes that there are no existing water quality treatment devices currently installed on-site that can be reused. Further stormwater investigation and confirmation with Sydney Water and Council will be required during the Stage 2 DA.

- One OceanGuard gross pollutant trap is required per 2000m² of impermeable area. This equates to;
  - 7 OceanGuards for Area-1,
  - 3 x OceanGuards as a minimum for area 2
  - 1x OceanGuard for the Bypass area.
- For Area 1, dual DN3250 manholes, each containing 17 x StormFilters.
- For Area 2, a single DN3250 manhole containing 16 x StormFilters.

These devices meet the required water quality targets, as shown in Figure 14 and table 5. Further assessment will be required as part of the design development during the Stage 2 DA.

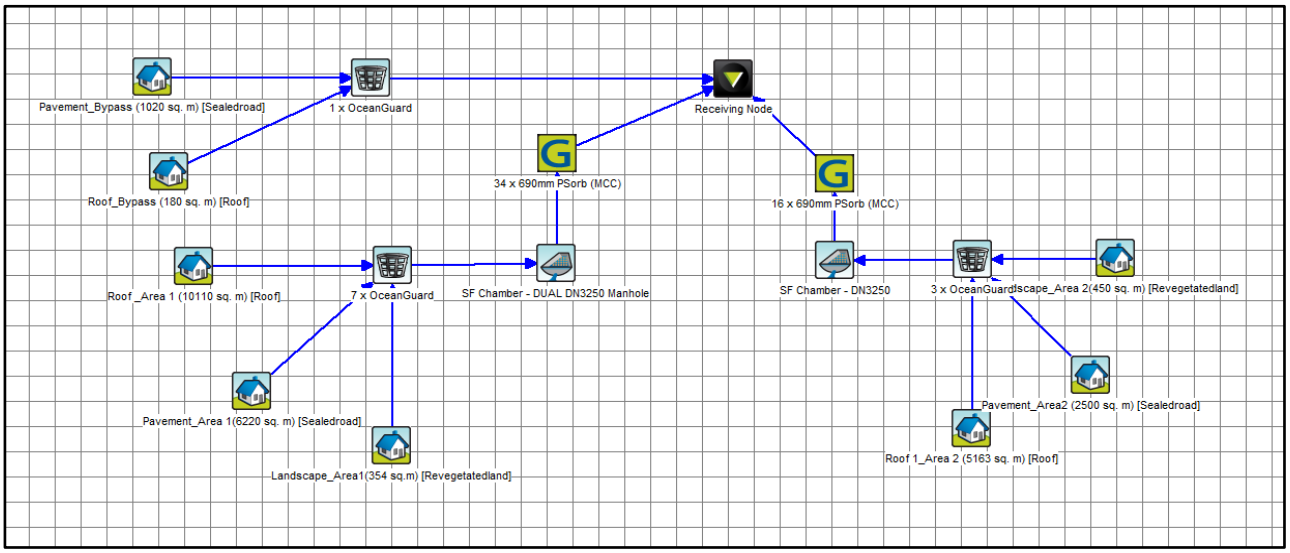


Figure 14 - Preliminary Music Model for the Full Site

Table 5 – Proposed WSUD Results For Pollutant Reduction – Full Site

	Sources	Residual Load	% Reduction
Flow (ML/yr)	30.3	30.3	0
Total Suspended Solids (kg/yr)	4280	538	87.4
Total Phosphorus (kg/yr)	9.4	2.96	68.6
Total Nitrogen (kg/yr)	68.3	33.7	50.7
Gross Pollutants (kg/yr)	727	0.078	100

4.4 Erosion and Sediment Control

A detailed erosion and sediment control plan will be implemented during the construction stage and will be in accordance with Council's requirements and Landcom NSW's Managing Urban Stormwater, Soils and Construction ("Blue Book"). Typical measures to be implemented would include:

- Provision of sediment and erosion controls at locations downstream of construction areas (e.g. sediment fences, sediment basins, others as required).
- Provision of stormwater diversions around the construction site for run-off from upstream undisturbed areas.
- Identification of stockpile locations.
- Identification and locations of sediment control barriers
- Protection of existing stormwater using geotextile filters, sandbags or similar.
- Identification of work staging to limit the area and duration of soils exposure
- Identify suitable locations for construction vehicle access and wheel wash facilities

An indicative erosion and sediment control plan has been produced, refer to Figure 15 and Appendix B. This plan will need to be updated to reflect the site development proposal for the Design Competition stage and Stage 2 DA.

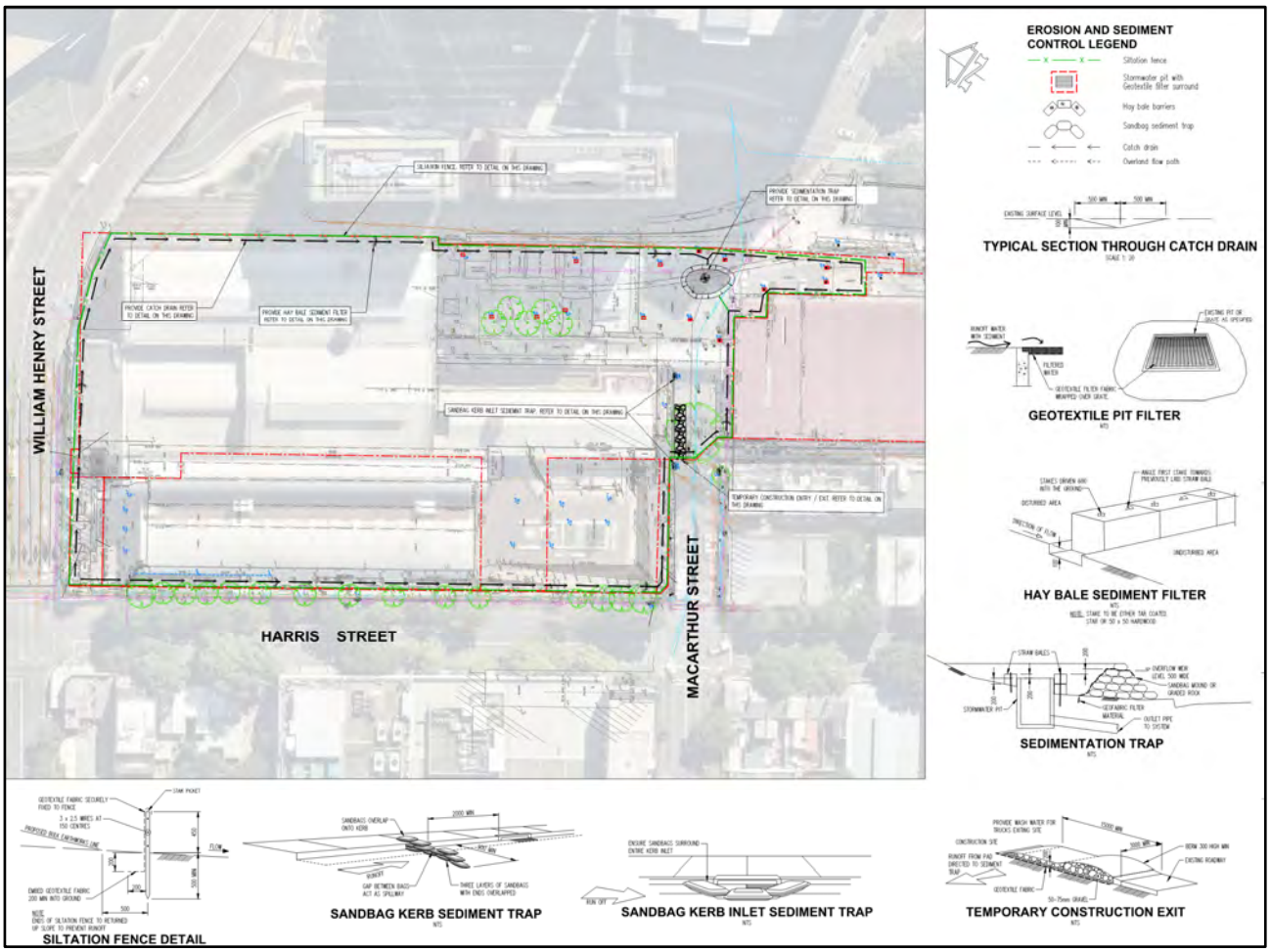


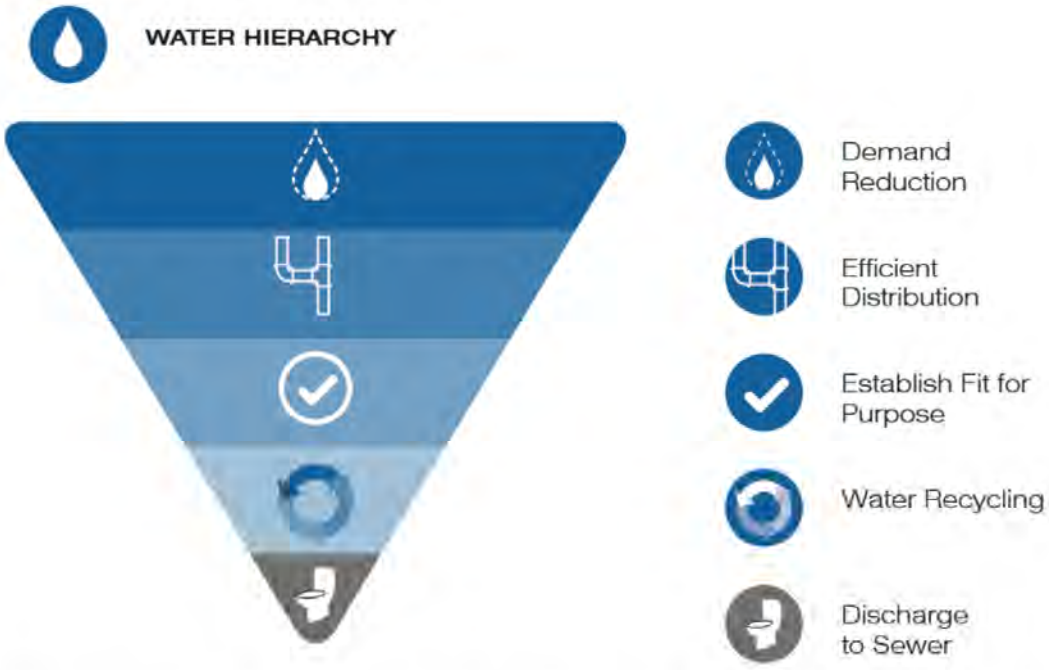
Figure 15 - Preliminary Erosion and Sediment Control Plan, refer to Appendix B.

4.5 Water Supply and Reuse

The proposed water supply requirements and design approach is detailed by the Hydraulic Engineer, refer to the *Ecologically Sustainable Development (ESD), Steensen Varming, April 2022*.

This report confirms that there will be a future opportunity to connect to the planned City of Sydney recycled water network that would enable all water consumption for toilet flushing and irrigation to come from non-potable sources. Further design consideration of this future connection to the Recycled Water Network will be made during the later design stages of the development.

Figure 16 below is an extract from the ESD report showing the hierarchy of water initiatives proposed for the development, with further detail to be provided during later design stages.



The following water initiatives have been proposed and their individual merits will be assessed further during future design stages:

- **Water efficient fixtures / fittings will be specified.** These include fittings such as taps, showerheads, toilets, zip taps, dishwashers etc certified under the WELL rating scheme.
- **Sensors** within water networks to identify possible leaks and act quickly to reduce losses;
- **Rainwater Reuse** - Rainwater collection and reuse systems will be accessed. Reuse options include landscape irrigation and toilet flushing;
- **Sea water heat rejection** – large reduction in potable water use and already existing – potential cost for upgrading to meet additional capacity requirements.
- No cooling tower or cooling tower water use reduction strategies
- **Fire Systems test water** capture and storage for re-use using the rainwater tank will be accessed;
- **Drip and demand-controlled irrigation** to optimise irrigation supply;

Figure 16 - Preliminary Erosion and Sediment Control Plan, refer to Appendix B.

5.0 Flooding

SEARs 16. Flooding Risk

The EIS Shall:

- *Identify 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 and City of Sydney Interim Floodplain Management Policy.*
- *Where applicable, assess the impacts of the development, including any changes to flood risk on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required.*

The following sections detail the exiting flood risk to the development site and flood impact associated with the development. These sections confirm that the site is generally flood free with low flood risk around the development site with Low flood hazard and shallow flood depths experienced in the external road system. The proposed development will not change the existing flood behaviour, will have no adverse impact on existing properties, and will meet City of Sydney Flood Planning requirements. Discussion with Council is required during the Design Competition Stage and Stage 2 DA to confirm the treatment of Flood Planning Levels to the Loading Dock/basement and the existing Switch House/Café building.

5.1 Existing Flooding

Assessment of flood risk for the development is in accordance with the NSW Floodplain Development Manual 2005, and Council's interim Floodplain Management Policy. The council have completed the Darling Harbour catchment flood study (Oct 2014) and Darling Harbour floodplain risk management plan (Sep 2016). This flood study forms the basis for the site-specific flood impact assessment.

The existing Darling Harbour flood model has been obtained from Council to confirm existing flood behaviour and flood levels at the site location. The flood study identifies that the site is generally flood-free, with only a localised area at the low end of Macarthur Street experiencing shallow flooding-typically less than 200mm deep in the 1% AEP and approximately 250mm deep in the PMF. More significant flooding is experienced downstream of the site within the railway corridor; however, this is significantly lower (approximately 3m) than the development site.

Existing Flood extent, depths and levels for the 5%, 1% AEP and PMF are shown in figures 17, 18 and 19 respectively.

Flood Hazard is generally low across the development site in the 5% and 1% AEP, with localised steeper road areas experiencing High Flood Hazard in the PMF at the junction of Macarthur Street and Harris Street. Refer to figures 20, 21 and 22, respectively for the 5%, 1% AEP and PMF Flood Hazard across the site.

Overland flow along Harris Street is typically less than 80mm in the 5% AEP, less than 100mm in the 1% AEP flood and less than 150mm in the PMF. Overland flow along Macarthur Street is typically less than 30mm in both the 1% AEP and PMF.

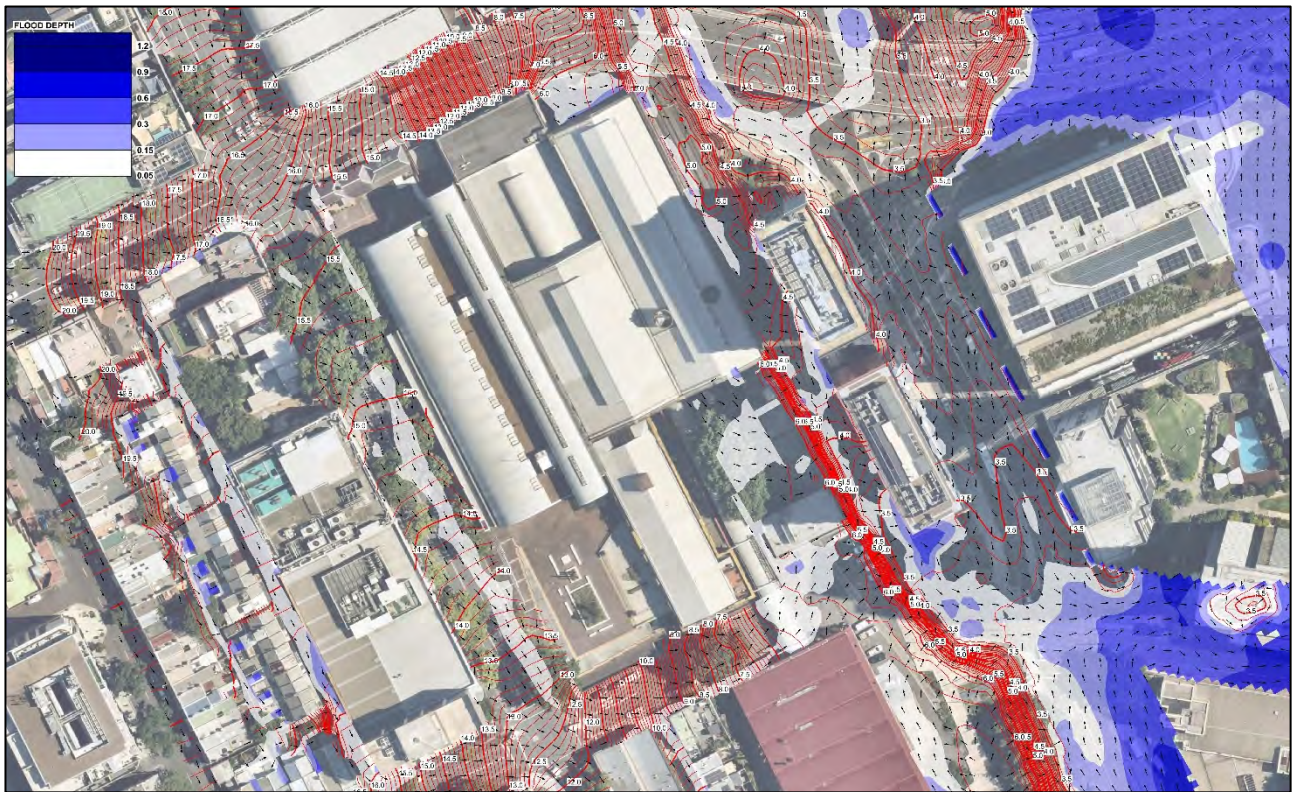


Figure 17 - Darling Harbour Flood Study – Existing 5% AEP Flood Depths and Levels

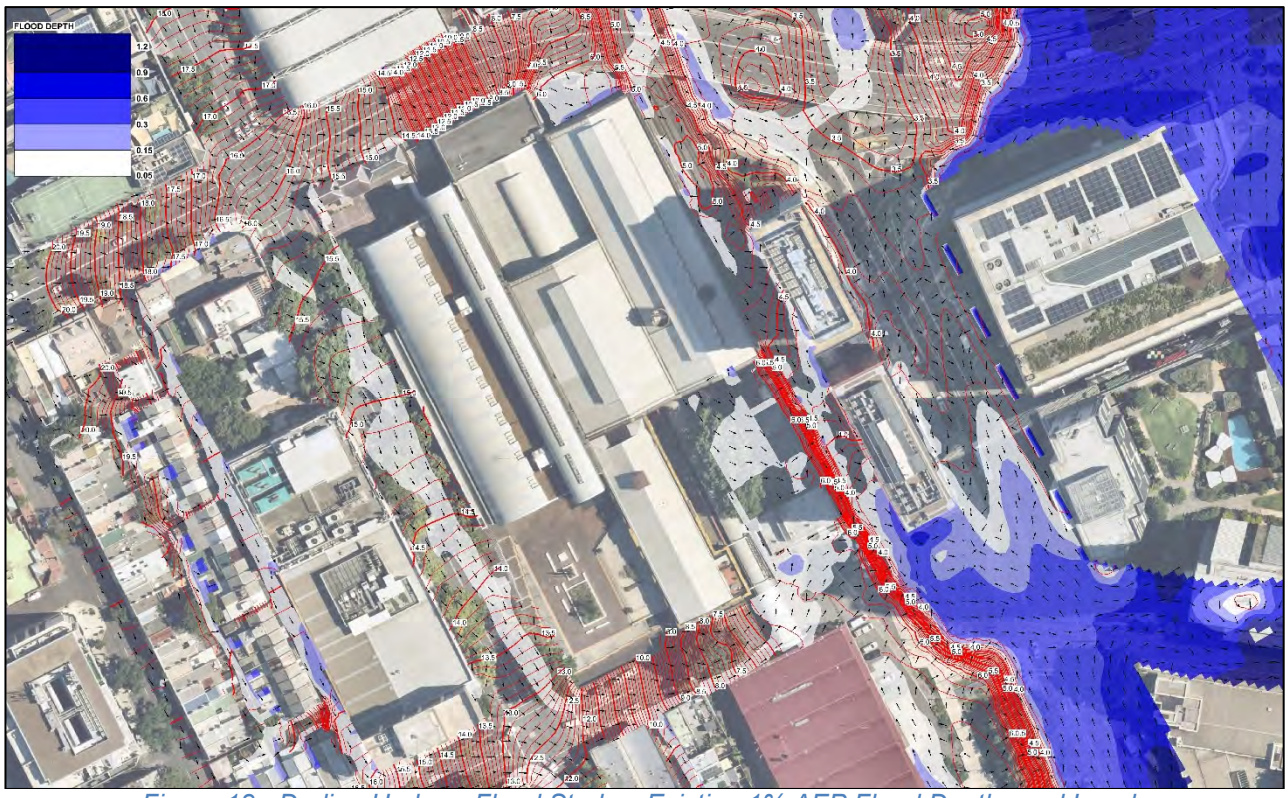


Figure 18 - Darling Harbour Flood Study – Existing 1% AEP Flood Depths and Levels

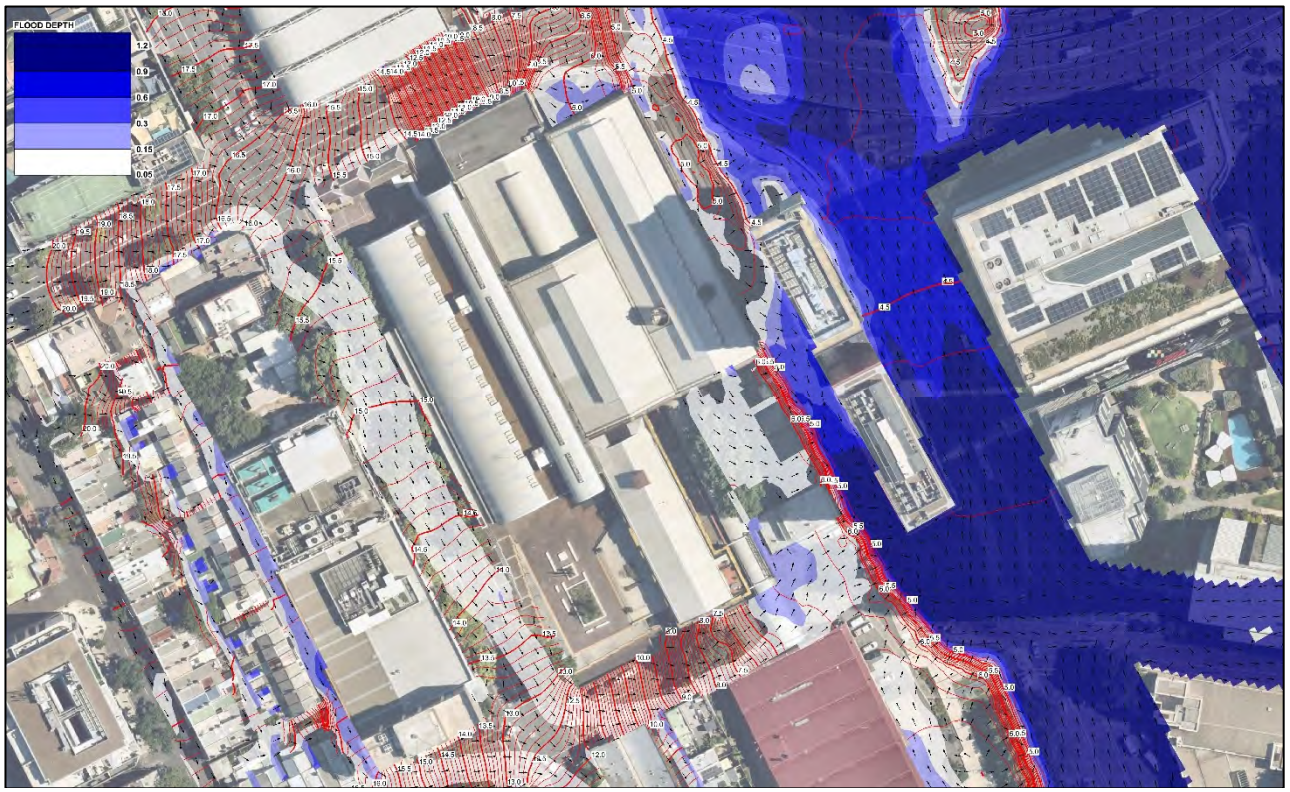


Figure 19 - Darling Harbour Flood Study – Existing PMF Flood Depths and Levels

Figure 20 – Existing 5% AEP Flood Hazard in accordance with NSW Floodplain Management Manual

Figure 21 – Existing 1% AEP Flood Hazard in accordance with NSW Floodplain Management Manual

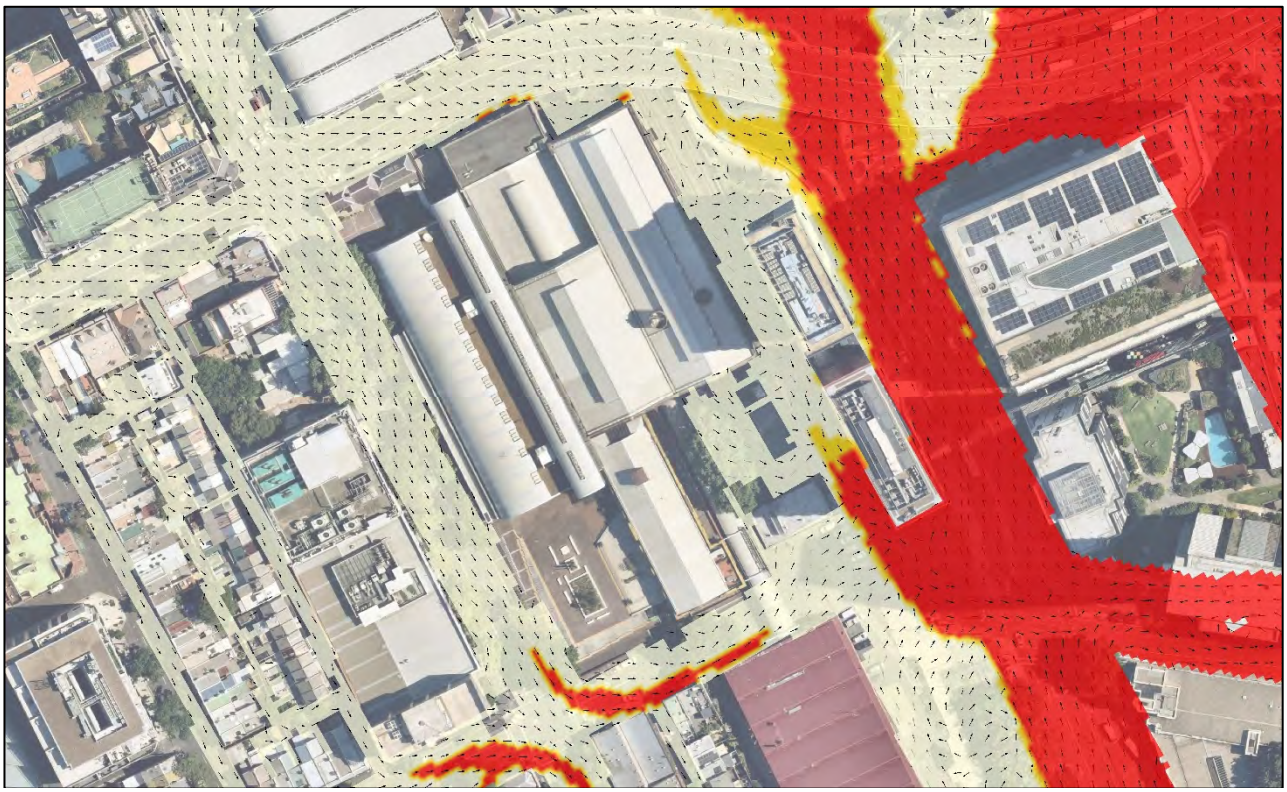


Figure 22 - Existing PMF Flood Hazard in accordance with NSW Floodplain Management Manual

5.2 Post Development Flood Impact and Risk Assessment

At this early stage the proposed building location(s) are not yet confirmed and will be determined through the Design Competition and the Stage 2 SSDA. However, for this Stage 1 SSDA a conservative approach has been made where the full building envelopes of Zones 1-3 (refer to Section 3) are blocked out from the model to represent these areas being fully developed, in reality only a portion of the envelope area will be developed with the proposed building(s).

The flood impact associated with the development shows that there is no significant change in flood behaviour, flood depths or flood hazard as a result of the development. A flood afflux map is shown in figure 23 and shows that there is no significant impact associated with the full development of the building envelopes, except for a very localised area within Zone 3 (beneath Pier Street) which could be managed by stormwater improvements and dedicated overland flow paths within this zone.

The post development (full development of the building envelopes) flood extent, depths and levels for the 5%, 1% AEP and PMF are shown in figures 24, 25 and 26 respectively.

Following development, the Flood Hazard would still be low across the development site in the 5% and 1% AEP, with localised steeper road areas experiencing High Flood Hazard in the PMF at the junction of Macarthur Street and Harris Street. Refer to figures 27, 28 and 29, respectively for the 5%, 1% AEP and PMF Flood Hazard across the site.

The proposed Stage 1 concept will have no significant impact on flooding and therefore meets the SEARs 16 Flooding Risk, The City of Sydney Interim Floodplain Management Policy, the NSW Floodplain Development Manual 2005 and the Floodplain Risk Management Manual and Guidelines 2022

Further detailed analysis of the flood impact will be required during the Stage 2 SSDA to assess the proposed built form and site grading and will also need to include any proposed stormwater works.

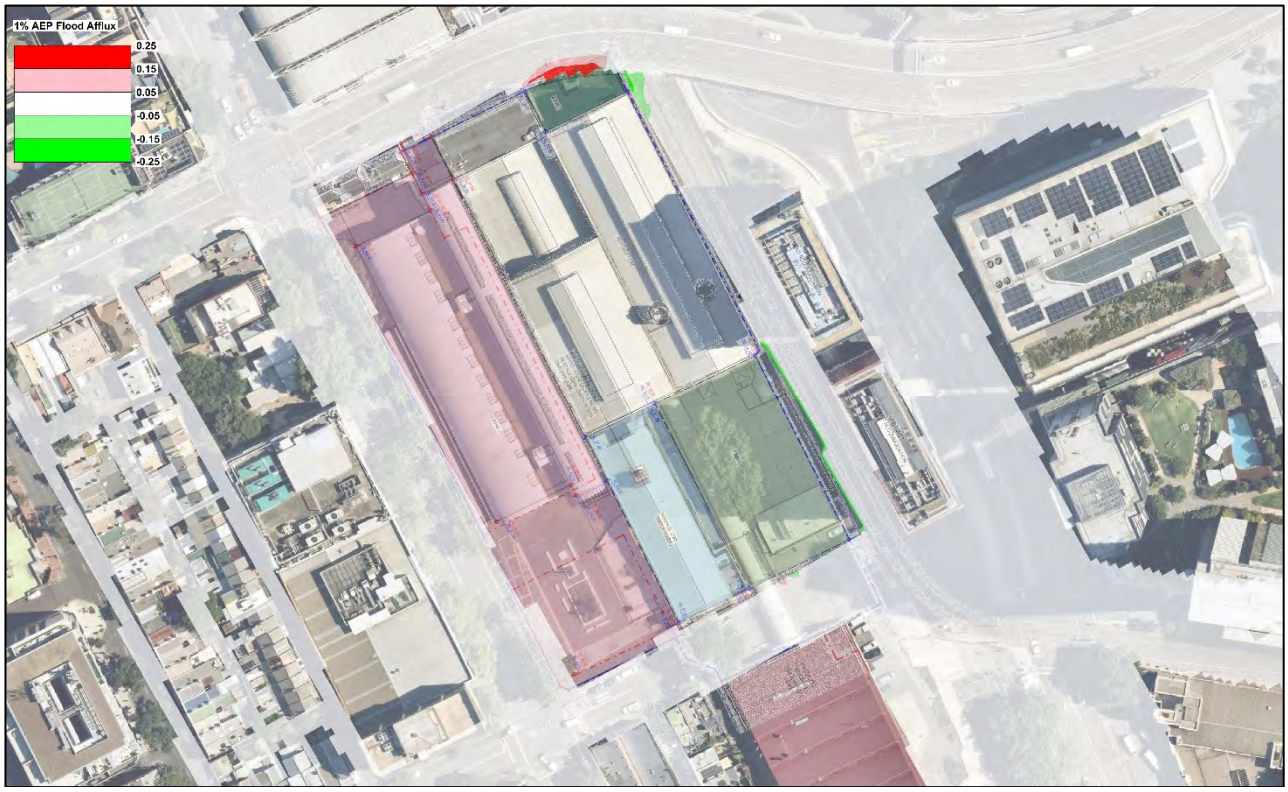


Figure 23 – Proposed Flood Impact - Conservative Assessment Of Full Development Of Building Envelopes

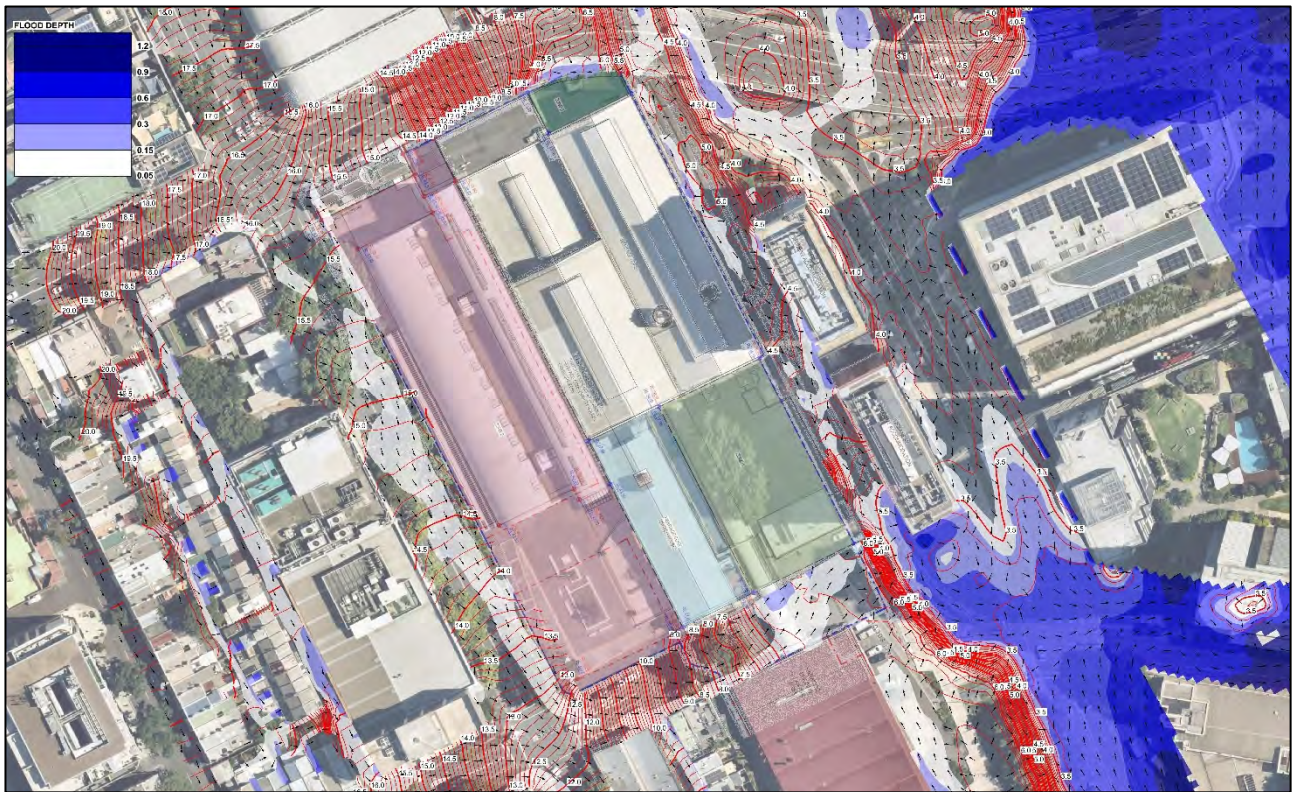


Figure 24 - Proposed 5% AEP Flood Depths and Levels

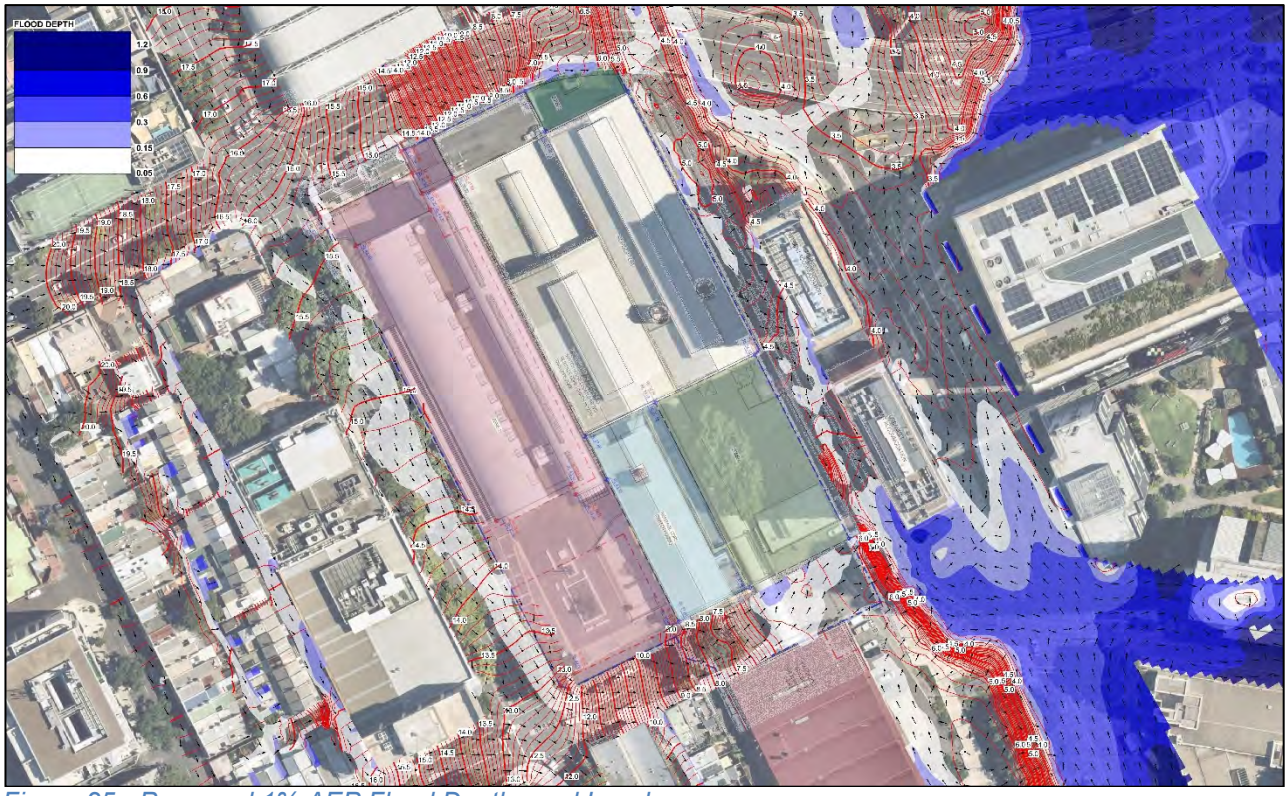


Figure 25 - Proposed 1% AEP Flood Depths and Levels

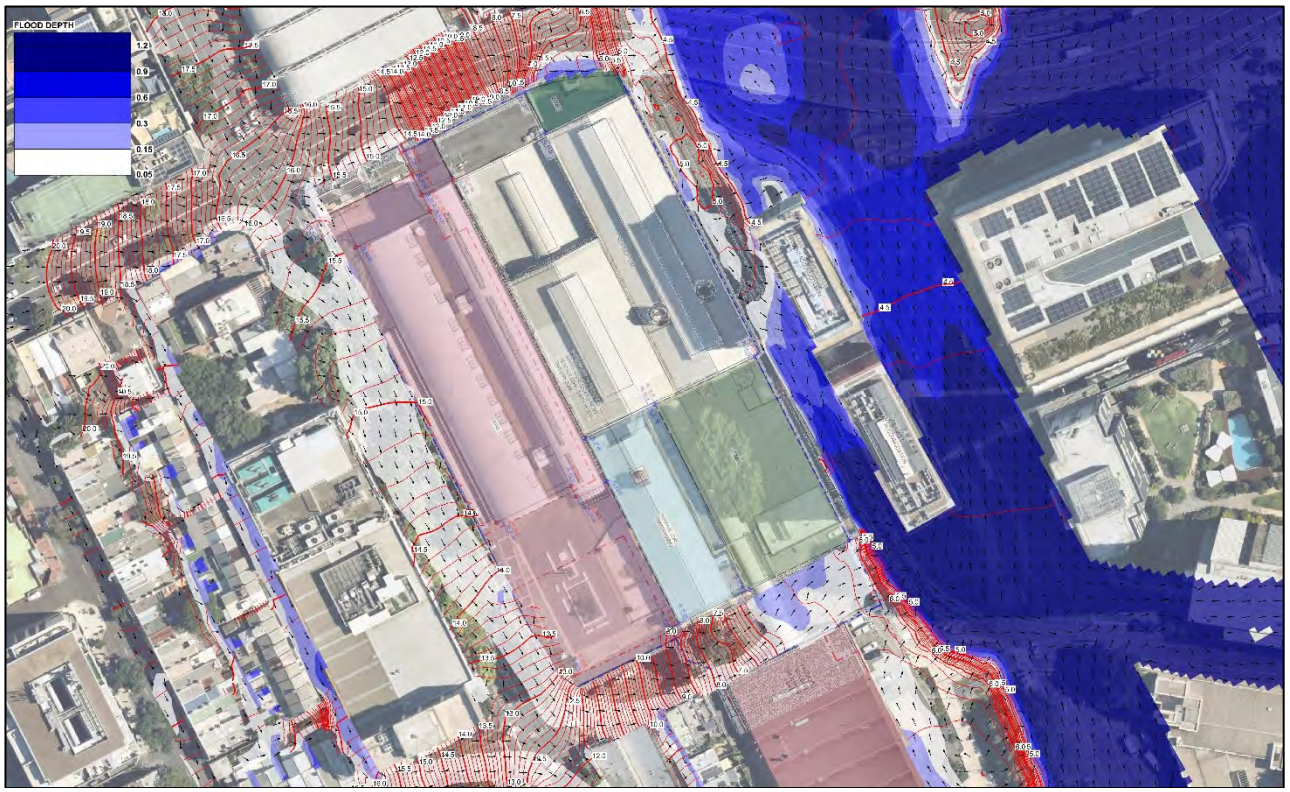


Figure 26 - Proposed PMF Flood Depths and Levels

Figure 27 – Proposed 5% AEP Flood Hazard in accordance with NSW Floodplain Management Manual

Figure 28 – Proposed 1% AEP Flood Hazard in accordance with NSW Floodplain Management Manual

Figure 29 - Propose PMF Flood Hazard in accordance with NSW Floodplain Management Manual

5.3 Flooding Planning Levels

Proposed development impacted by flooding must comply with the Flood Planning Levels requirements from the City of Sydney's Interim Floodplain Management Policy, as outlined in Table 7, with sections highlighted that are relevant for this development. The Flood Planning Level for commercial floor levels is the 1% AEP and the higher of the PMF or the 1% +500mm for basements.

There is no proposed change to the existing floor levels of the heritage listed buildings. However, the 1% AEP flood level at the bottom of Macarthur Street (RL 6.29m) is currently higher than the floor level of the adjacent Switch Room Building (RL 6.18) and Café (RL 6.19m) and does not meet the flood planning requirements. Further work will be required during the Design competition Stage and Stage 2 DA to either remove or reduce the flooding in this area (through stormwater modification, increased inlet capacity and/or site grading) or through the possible use of flood barriers which will need to be discussed and approved with Council.

It is assumed that the existing heritage building floor levels cannot be changed and will meet the merit approach for achieving the flood planning requirements. Further assessment of the proposed floor levels, and flood planning levels at all proposed building entrances will be required during the Design Competition and Stage 2 DA.

Table 7 - Flood Planning Level Requirements (extract of Council's Interim Floodplain Management Policy)

Development		Type of flooding	Flood Planning Level
Residential	Habitable rooms	Mainstream flooding	1% AEP flood level + 0.5 m
		Local drainage flooding (Refer to Note 2)	1% AEP flood level + 0.5 m or Two times the depth of flow with a minimum of 0.3 m above the surrounding surface if the depth of flow in the 1% AEP flood is less than 0.25 m
		Outside floodplain	0.3 m above surrounding ground
	Non-habitable rooms such as a laundry or garage (excluding below-ground car parks)	Mainstream or local drainage flooding	1% AEP flood level
Industrial or Commercial	Business	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood level
	Schools and child care facilities	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood level + 0.5m
	Residential floors within tourist establishments	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m
	Housing for older people or people with disabilities	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m or a the PMF, whichever is the higher
	On-site sewer management (sewer mining)	Mainstream or local drainage flooding	1% AEP flood level
	Retail Floor Levels	Mainstream or local drainage flooding	Merits approach presented by the applicant with a minimum of the 1% AEP flood. The proposal must demonstrate a reasonable balance between flood protection and urban design outcomes for street level activation.
Below-ground garage/ car park	Single property owner with not more than 2 car spaces.	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m
	All other below-ground car parks	Mainstream or local drainage flooding	1% AEP flood level + 0.5 m or the PMF (whichever is the higher) See Note 1
	Below-ground car park outside floodplain	Outside floodplain	0.3 m above the surrounding surface
Above ground car park	Enclosed car parks	Mainstream or local drainage flooding	1% AEP flood level
	Open car parks	Mainstream or local drainage	5% AEP flood level
Critical Facilities	Floor level	Mainstream or local drainage flooding	1% AEP flood level + 0.5m or the PMF (whichever is higher)
	Access to and from critical facility within	Mainstream or local drainage flooding	1% AEP flood level

5.4 Flooding Impact Due to Climate Change

Climate change is expected to have an adverse impact on sea levels and rainfall intensities, both of which have the potential to have significant impact on flood behaviour at specific locations. Climate change projections in NSW are generated from the NSW and ACT Regional Climate Modelling (NARCliM) project.
The NARCliM projections for total rainfall for the Sydney Metropolitan Region will decrease in spring and winter, and increase in autumn and summer. The NARCliM projections for extreme rainfall are that both rainfall intensities and the frequency of extreme events will increase.

The current flood policy adopted by City of Sydney, and used in the Darling Harbour Flood Study, allows for a 90cm increase in sea level rise by 2100 from the 2009 Mean Sea Level. This is also in accordance with the projections of the 'very high greenhouse gas scenario' (RCP8.5)

Current predictions for extreme rainfall are that peak rainfall intensity is likely to increase by up to 10%, however sensitivity analysis using an increase in peak rainfall of up to 30% has been adopted in accordance with Council's Darling Harbour Flood Study.

Flood modelling has been completed to allow for possible impacts of climate change for the proposed development, with the combined impact of increased sea levels of 90cm, and increased rainfall of up to 30%. These combined impacts of climate change do not have a significant increase in flooding within or adjacent to the Site refer to figures 30 and 31.

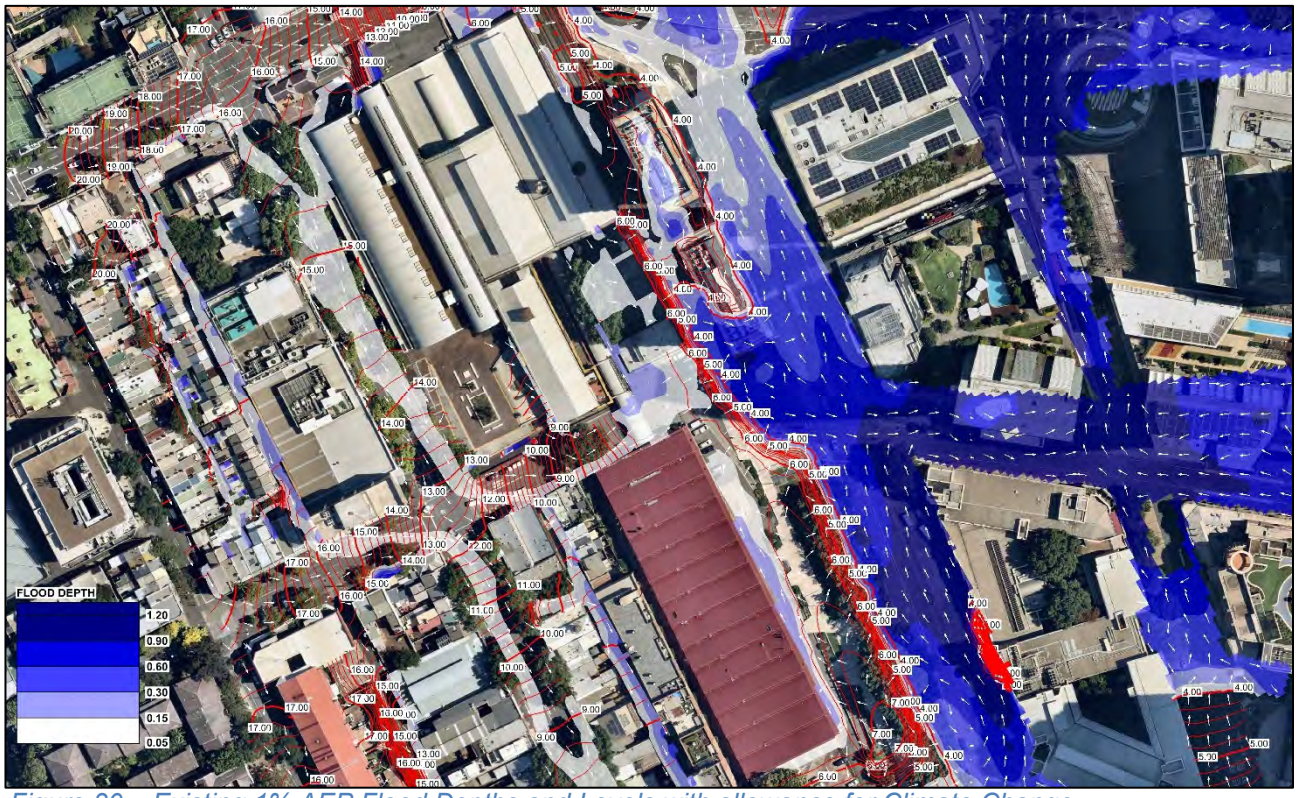


Figure 30 – Existing 1% AEP Flood Depths and Levels with allowance for Climate Change

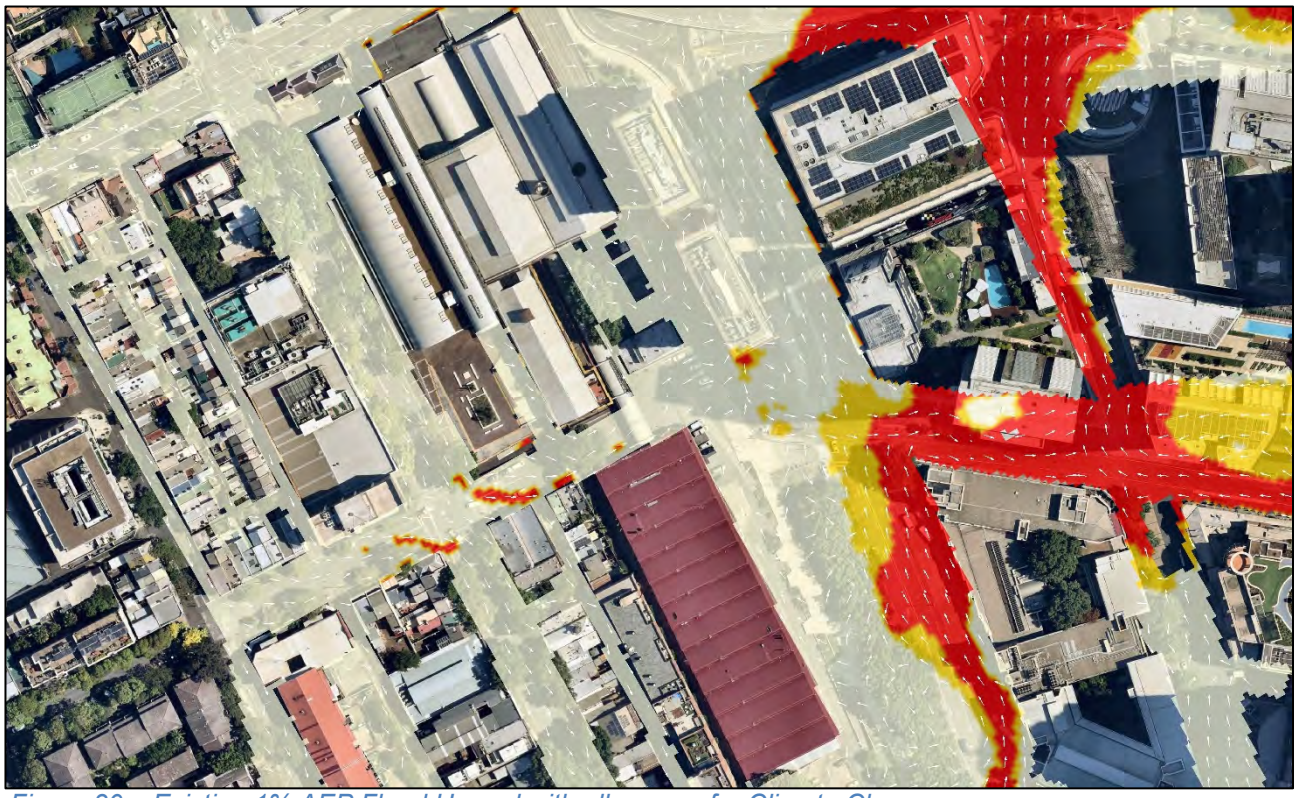


Figure 30 – Existing 1% AEP Flood Hazard with allowance for Climate Change

5.5 Flood Emergency Response

A detailed Flood Emergency Response Plan will be produced as part of the Detailed Stage 2 DA following progression of the design competition and understanding of the proposed development form. However an overview of the proposed Flood Emergency Response is as follows and gives high level guidance for future design stages of the development.

The critical storm duration for the peak flood levels around the site is the 90 minute storm event, with peak flows , however shorter storm durations can occur that can may flood the local area more quickly but to lower peak levels than those documented in this report.

The proposed building envelopes experience low or no flood up to the PMF extent. The proposed building will be multi storey and will also have additional floors above the PMF that provide a safe refuge for users and staff, and therefore the proposed emergency response is to shelter on site if sufficient warning time is not provided to enable safe evacuation of the site.

If there is sufficient warning time prior to the onset of flooding, to safely evacuate all users and staff from the site and allow a safe onward journey away from flooding, then this option should be considered first.

A suitable evacuation route from the site to a flood free area during the PMF event is shown in figure 32. A suitable flood evacuation route from the development site is to head west along Macarthur Street and toward William Street. Warnings will be made not to head east towards Darling Drive as this area will experience the highest risk of flooding.

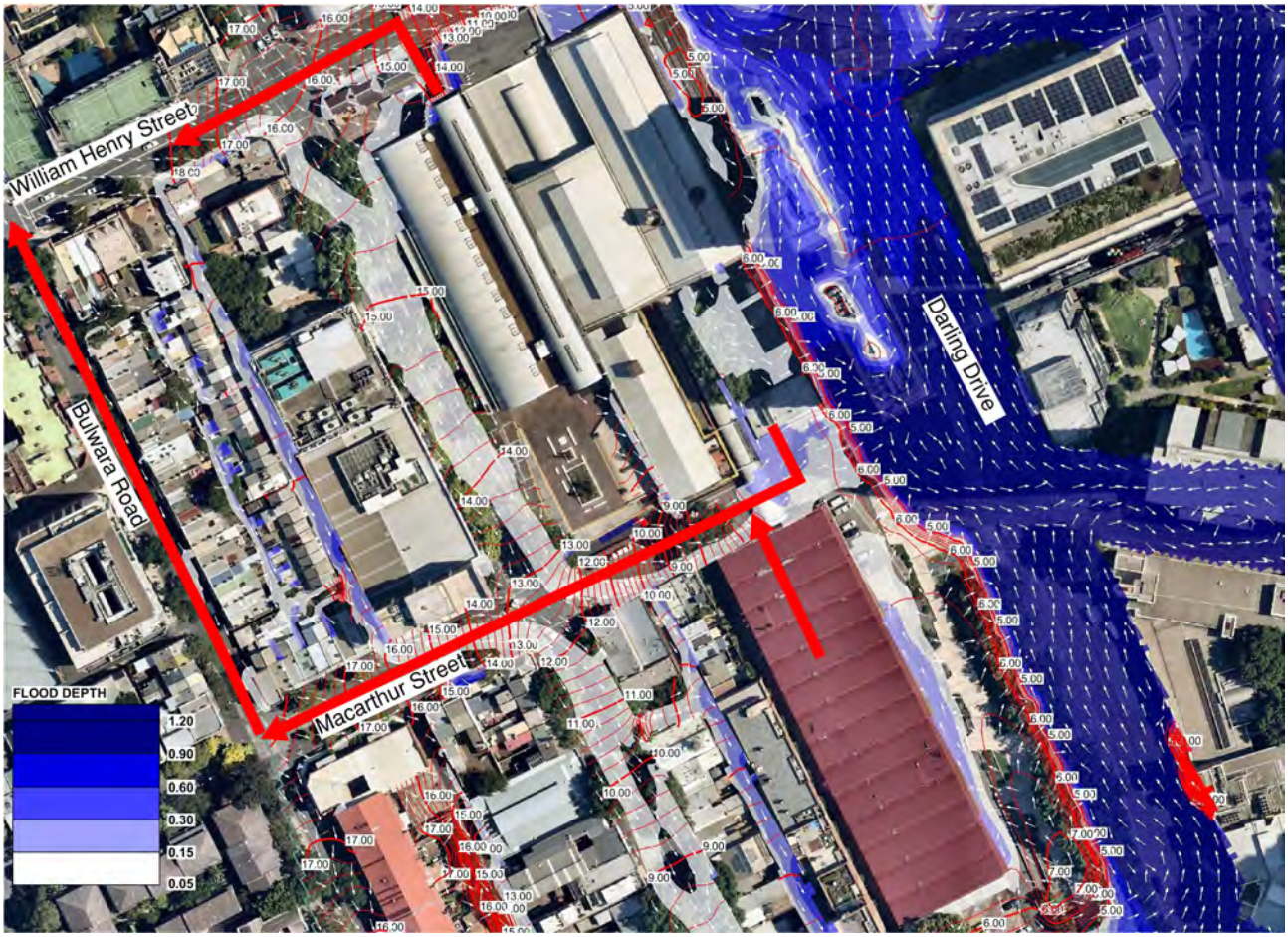


Figure 32 – Flood Evacuation Route to William Henry Street Showing the Peak PMF Extent

6.0 Conclusion

This Flood Impact, Risk Assessment and Civil report has demonstrated that the proposed Stage 1 Concept proposal of alterations and additions to the Powerhouse Museum are consistent with the Secretary's Environmental Assessment Requirements (SEARS) and address the Department of Planning and Environment (DPE) and Environment and Heritage Group (EHG) response to submissions. The proposed development is consistent with CoS Stormwater and Flood Planning Requirements and the NSW Flood Prone Land Policy, Flood Risk Management Manual and Guide.

Stormwater Servicing

- The site is adequately serviced by existing Sydney Water stormwater infrastructure. The proposed maximum GFA within the proposed building envelopes of the development will have no impact on the existing capacity of the Sydney Water stormwater assets as the existing site is already fully developed and the additional GFA will have no impact on the existing stormwater runoff from the site.
- Due to the proximity of construction works adjacent to the Sydney Water Assets, any proposed basement, structural works, excavation, and retention systems will require Section 73 application and approval by Sydney Water, which can be sought following a Stage 2 SSDA.

Stormwater Concept Plan

- The maximum GFA within the proposed building envelopes will not result in any increase of impermeable areas across the site as the site is already fully developed. It is proposed to reuse the existing stormwater system within the site where possible and reuse existing connections to the external Sydney Water and/or Council system.
- A number of connection points exist for the connection of future built form to the existing stormwater infrastructure. As such there is no limitation on the built form design (that is subject to the design competition) as a result of stormwater connection points. Refer to Section 4 for further details.
- Assessment has demonstrated that water quality targets can be met for the full site (and accordingly the maximum GFA proposed), however further assessment will be required at the Stage 2 SSDA to determine if a whole of site upgrade of existing assets is required.

Flooding

- The proposed maximum GFA of the development will not change the existing flood behaviour, will have no adverse impact on existing properties, and will meet City of Sydney Flood Planning requirements.
- The envelope approval sought for, allows the built form to be constructed in each of the envelope zones, which is not flood affected and above and outside the extent of the Probable Maximum Flood (PMF) which has an annual exceedance probability of at less than 1 in 10,000. Refer to Section 5 for further details

Appendix A

Sydney Water Confirmation of no OSD Required

From: Stormwater <Stormwater@sydneywater.com.au>
Sent: Wednesday, 16 March 2022 12:30 PM
To: Amir Zalnezhad <amir.zalnezhad@ttw.com.au>
Cc: Ali Attar <ali.attar@ttw.com.au>; Eirian Crabbe <Eirian.Crabbe@ttw.com.au>
Subject: RE: [External] RE: OSD requirements for the powerhouse Museum

Amir,

On Site Detention is not required for any development at Power House Museum, Harris Street, Ultimo.

Best Regards

Jeya Jeyadevan
Senior Capability Assessor
Business Development

Mobile 0409 318 827
jeya.jeyadevan@sydneywater.com.au

Level 13, 1 Smith Street
Parramatta NSW 2150

Appendix B

Indicative Erosion and Sediment Control Plan

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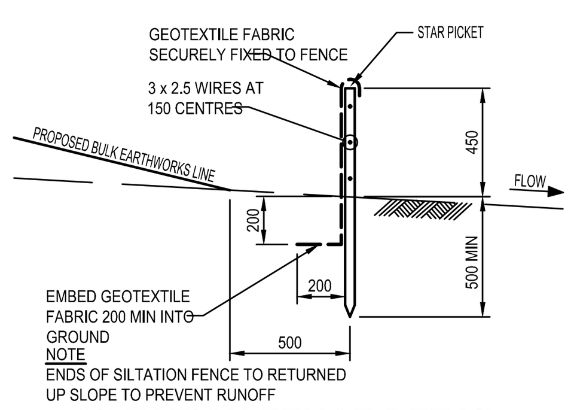
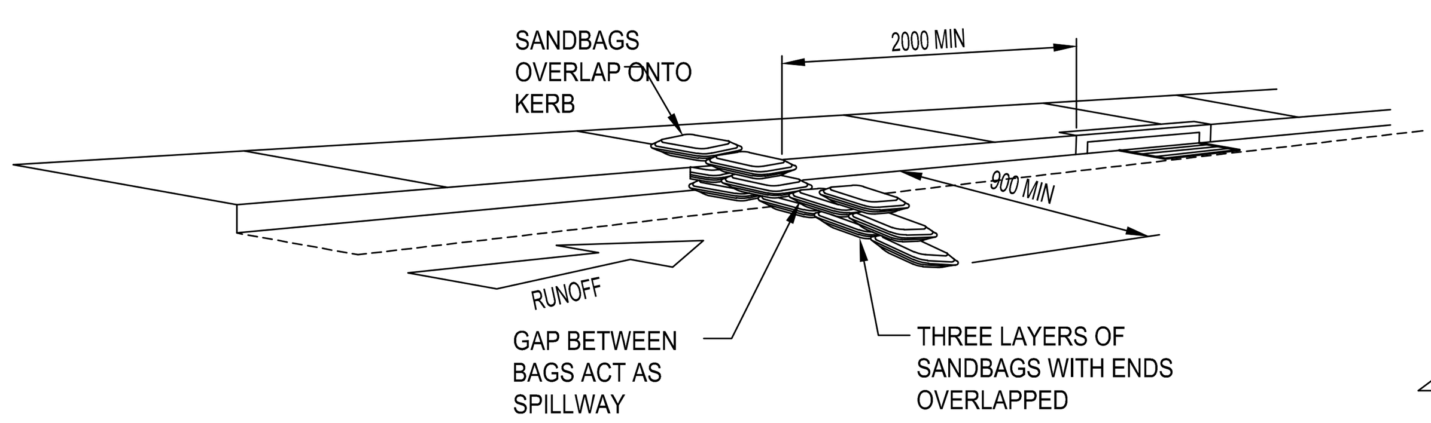


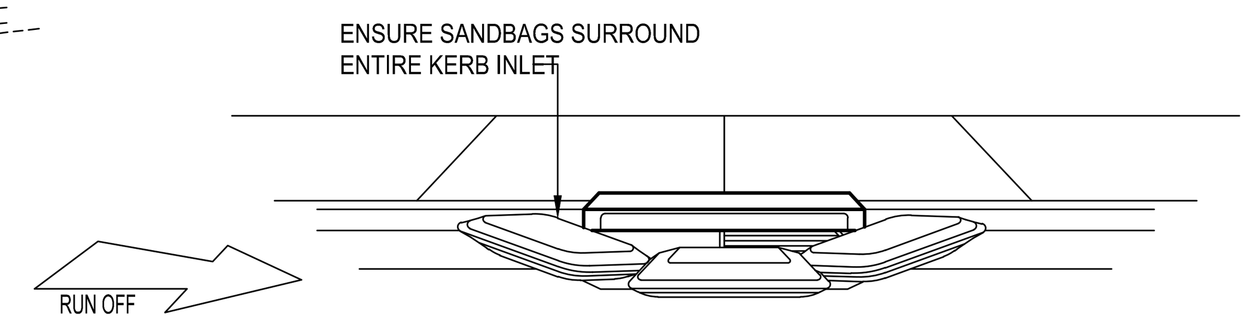
SILTATION FENCE DETAIL

SCALE 1: 20



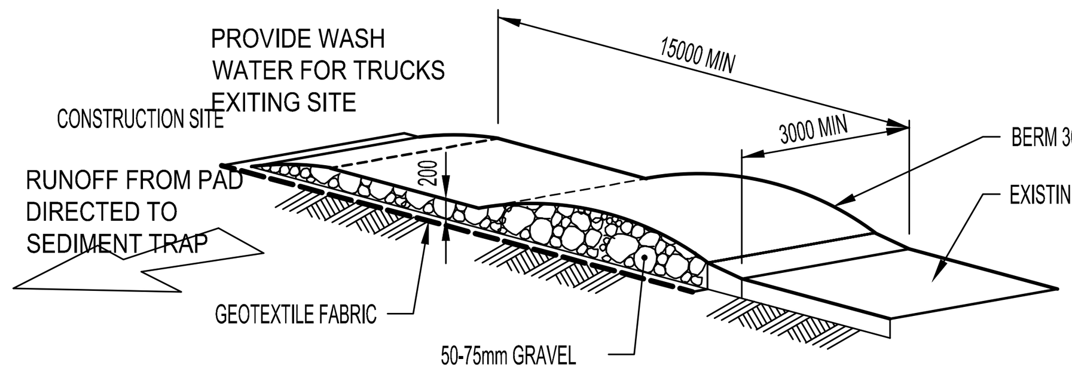
SANDBAG KERB SEDIMENT TRAP

NTS



SANDBAG KERB INLET SEDIMENT TRAP

NTS



TEMPORARY CONSTRUCTION EXIT

NTS

EROSION AND SEDIMENT CONTROL LEGEND

- Siltation fence
- Stormwater pit with Geotextile filter surround
- Hay bale barriers
- Sandbag sediment trap
- Catch drain
- Overland flow path

0 5 10 15 20 25 30 35 40m

1:500 A1 1:1000 A3

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FileName: C02.dwg - USER: lashw - Plot File Created: Apr 12, 2022 - 9:27am

Rev	Description	Eng	Draft	Date
P1	ISSUE FOR INFORMATION	EC	LW	12.04.22

Architect: ARCHITECTS NAME, ARCHITECTS ADDRESS

Engineer: TTW Structural Civil Traffic Façade — 612 9439 7288 | Level 6, 73 Miller Street, North Sydney, NSW 2060

Project: POWER HOUSE ULTIMO RENEWAL

Sheet Subject: EROSION AND SEDIMENT CONTROL PLAN

Scale: A1 1:500 | Drawn | Authorised

Job No: 212058 | Drawing No: C02 | Revision: P1

Plot File Created: Apr 12, 2022 - 9:27am