
Appendix V

Flooding Assessment

Hunter Street West Over Station Development Flooding Assessment

Appendix V

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Glossary

Term	Definition
Annual Exceedance Probability (AEP)	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage. In this study AEP has been used consistently to define the probability of occurrence of flooding. The relationships, outlined in AEP and ARI conversion table, between AEP and ARI applies to this study (Ball et al, 2019).
Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
ARR	Australian Rainfall and Runoff (ARR) is a national guideline document used for the estimation of design flood characteristics in Australia. Reference is made to either ARR1987 (3 rd edition) or ARR2019 (4 th edition) as specified.
ASD	Adjacent Station Development
Average Recurrence Interval (ARI)	The long-term average number of years between the occurrences of a flood as big as or larger than the selected flood event. For example, floods with a discharge as great as or greater than the 20-year ARI flood event will occur on average once every 20 years. ARI is another way of expressing the likelihood of occurrence of a flood event. Also refer to AEP, which is the industry standard terminology for definition of design flood events.
Catchment	The land area draining through the mainstream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
CBD	Central business district
Concept and Stage 1 CSSI Approval	Application SSI-10038 including all major civil construction works between Westmead and The Bays, including station excavation and tunnelling, associated with the Sydney Metro West line
Concept SSDA	A concept development application as defined in section 4.22 the EP&A Act, as a development application that sets out concept proposals for the development of a site, and for which detailed proposals for the site or for separate parts of the site are to be the subject of a subsequent development application or applications.
Continuing flood risk	The risk a community is exposed to after floodplain risk management measures have been implemented. For a town protected by levees, the continuing flood risk is the consequences of the levees being overtopped. For an area without any floodplain risk management measures, the continuing flood risk is simply the existence of its flood exposure.
Council	City of Sydney
CSSI	Critical Stage Significant Infrastructure
DCP	Development Control Plan
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPA	Environment Protection Authority
Exceedances per year (EY)	The number of times a flood event is likely to occur or be exceeded within any given year.

Term	Definition
Existing flood risk	The risk a community is exposed to due to its location on the floodplain.
Flood risk	Potential danger to personal safety and potential damage to property resulting from flooding. The degree of risk varies with circumstances across the full range of floods. Flood risk in this manual is divided into 3 types, existing, future and continuing risks. They are described elsewhere in this glossary.
Future flood risk	The risk a community may be exposed to due to new development on the floodplain.
FSR	Floor space ratio
GFA	Gross floor area
Hydrologic modelling	Hydrologic modelling refers to the conversion of the design rainfall and runoff into flow hydrographs that are applied to the hydraulic model to define flood depths, flood extents, velocities and hazards for a range of design storms.
Hydrology	The study of the rainfall and runoff process; in particular, the evaluation of peak flows, flow volumes and the derivation of hydrographs for a range of floods.
Hydraulic modelling	Hydraulic modelling uses the rainfall, catchment and watercourse topography to predict flood behaviour including flood levels, flood extents, flood velocities and the duration of inundation in the catchment and watercourse.
LEP	Local Environmental Plan
OSD	Over Station Development.
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
Probable Maximum Flood (PMF)	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. The PMF defines the extent of flood prone land, that is, the floodplain.
Rain on grid hydraulic model	In these studies, hydrological assessment has been incorporated directly into the hydraulic models, rather than employing a separate hydrological model to derive flow hydrographs. Along with topographic information and model parameters reflecting the catchment and watercourse, flood behaviour including flood levels, flood extents, flood velocities and the duration of inundation in the catchment and watercourse can be predicted.
RCP	Representative Concentration Pathways
SEARs	Secretary's Environmental Assessment Requirements
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SSD	State Significant Development
SSDA	State Significant Development Application
SSI	State Significant Infrastructure
Stage 2 CSSI Application	Application SSI-19238057, including major civil construction works between The Bays and Hunter Street Station
Stage 3 CSSI Application	Application SSI-22765520, including rail infrastructure, stations, precincts and operation of the Sydney Metro West line

Term	Definition
Sydney Metro West	Construction and operation of a metro rail line and associated stations between Westmead and the Sydney CBD as described in section 1.1
TfNSW	Transport for New South Wales
TUFLOW	<p>TUFLOW is a computer program which is used to simulate free-surface flow for flood and tidal wave propagation. It provides coupled 1D and 2D hydraulic solutions using a powerful and robust computation. The engine has seamless interfacing with GIS and is widely used across Australia.</p> <p>There are two schemes available for solving the two-dimensional Shallow Water Equation (SWE). Testing indicates that Classic and HPC produce results which are consistent with each other (BMT, 2019). There is no exact solution to the SWE, which is why there are several solvers available.</p>
TUFLOW Classic	TUFLOW classic is the original TUFLOW solver which uses a 2nd order implicit finite difference solution. It uses a fixed timestep. The Classic solver's turbulence model is dependent on cell size with a fixed timestep.
TUFLOW HPC	The TUFLOW HPC (Heavily Parallelised Compute) solver uses a 2nd order explicit finite volume solution. TUFLOW HPC has increased stability with an adaptive timestep compared with Classic. The HPC model uses an updated turbulence scheme, which is cell size insensitive.

Executive summary

This flooding assessment supports a Concept State Significant Development Application (Concept SSDA) submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Concept SSDA is made under section 4.22 of the EP&A Act.

Sydney Metro is seeking concept approval for a commercial tower above the Hunter Street Station western site (the site), otherwise known as the over station development (OSD).

The Concept SSDA seeks consent for a building envelope and its use for a commercial and retail premises, a maximum building height of 51 storeys (213 m/reduced level 220.0), a maximum gross floor area (GFA) of 69,863m², pedestrian and vehicular access, circulation arrangements and associated car parking and the strategies and design parameters for the future detailed design of development.

This report responds specifically to the Secretary's Environmental Assessment Requirements (SEARs). It summarises the existing flooding conditions and details required upgrades, infrastructure and protection measures required to satisfy the identified flooding planning requirements. Assessment of the potential impacts of the proposed development on flooding considers selected flood events up to the Probable Maximum Flood (PMF), and focuses upon:

- compliance or otherwise with relevant council flood planning guidelines as well as considering ability to evacuate safely in extreme flood events
- interaction with the Stage 3 CSSI application which has the potential to adversely impact on metro flood immunity
- where required, mitigation and management measures have been identified.

The Stage 3 CSSI application has previously considered the potential for increase in flood risk and flood affectation on adjacent properties, land use compatibility in relation to flood hazard, compatibility with council floodplain risk management and where required mitigation and management measures have been recommended. The proposed development presents no additional footprint where there could be further flood impacts on adjacent properties and assets.

Section 4.3 contains a mitigation measure for further design refinement during future stages of design of the proposal to ensure that floor levels would be situated at or above a level consistent with the requirements outlined in section 3.1. These levels are consistent with the requirements of the City of Sydney Council's Interim Floodplain Management Policy.

These results are premised on the basis that flood protection measures would be employed to provide the necessary immunity to critical infrastructure for the Hunter Street Station as part of the Stage 3 CSSI application, and that the design and operation of the proposed development would not compromise metro station flood immunity.

1 Introduction

1.1 Sydney Metro West

Sydney Metro West will double rail capacity between Greater Parramatta and the Sydney Central Business District (CBD), transforming Sydney for generations to come. The once in a century infrastructure investment will have a target travel time of about 20 minutes between Parramatta and the Sydney CBD, link new communities to rail services and support employment growth and housing supply.

Stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street.

The Sydney Metro West station locations are shown in Figure 1-1 below.

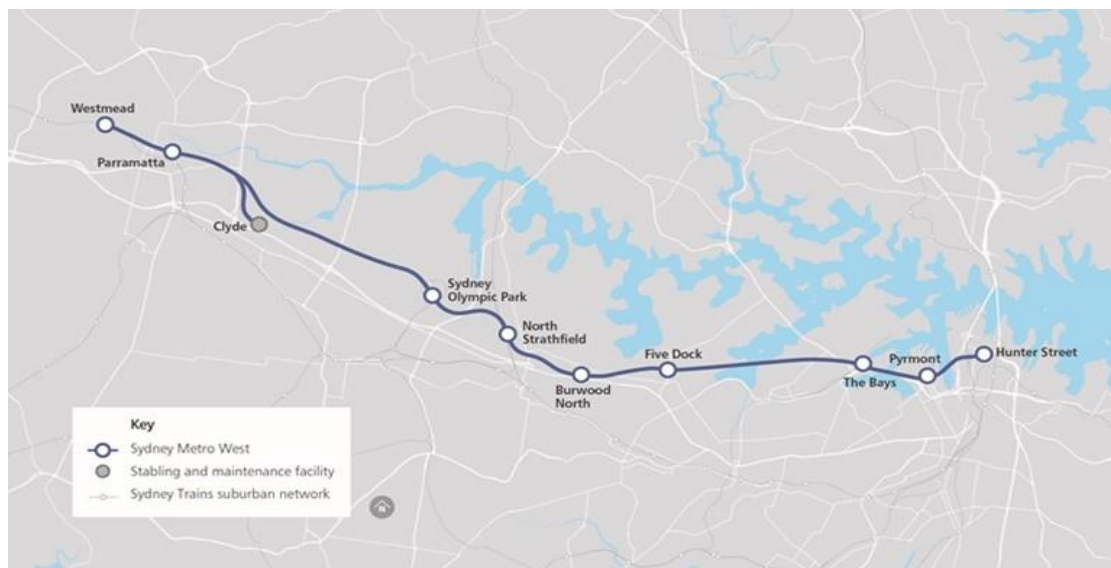


Figure 1-1 Sydney Metro West

1.2 Background and planning context

Sydney Metro is seeking to deliver Hunter Street Station under a two part planning approval process. The station fit out infrastructure is to be delivered under a Critical State Significant Infrastructure (CSSI) application subject to provisions under Division 5.2 of the EP&A Act, while the over station developments are to be delivered under a State Significant Development (SSD) subject to the provisions of Part 4 of the EP&A Act. It is noted a Planning Proposal request has been submitted to the City of Sydney Council to amend the planning controls on the site (refer to section 1.2.3).

1.2.1 Critical state significant infrastructure

The state significant infrastructure (SSI) planning approval process for the Sydney Metro West metro line, including delivery of station infrastructure, has been broken down into a number of planning application stages, comprising the following:

- Concept and Stage 1 CSSI Approval (SSI-10038) – All major civil construction works between Westmead and The Bays including station excavation, tunnelling and demolition of existing buildings (approved 11 March 2021)
- Stage 2 CSSI Application – All major civil construction works between The Bays and Hunter Street Station (approved 24 August 2022)

- Stage 3 CSSI Application – Tunnel fit-out, construction of stations, ancillary facilities and station precincts between Westmead and the Hunter Street Station, and operation and maintenance of the Sydney Metro West line (under assessment).

1.2.2 State Significant Development application

The SSD will be undertaken as a staged development with the subject concept state significant development application (Concept SSDA) being consistent with the meaning under section 4.22 of the EP&A Act and seeking conceptual approval for a building envelope, land uses, maximum building heights, a maximum gross floor area, pedestrian and vehicle access, vertical circulation arrangements and associated car parking. A subsequent Detailed SSDA/s is to be prepared by a future development partner which will seek consent for detailed design and construction of the development.

1.2.3 Planning Proposal

A Planning Proposal request has been submitted to the City of Sydney Council to amend the planning controls that apply to the Hunter Street Station under the Sydney Local Environmental Plan 2012 (LEP). Hunter Street Station includes both a western site (this application) and an eastern site.

The Planning Proposal request seeks to enable the development of a commercial office building on the site that would:

- comprise a maximum building height of between reduced level (RL) 213m and RL 220.0m (as it varies to comply with the relevant sun access plane controls)
- deliver a maximum gross floor area (GFA) of 69,912 m² (resulting in a maximum floor space ratio (FSR) of 18.71:1), measured above ground level
- facilitate the adaptive reuse of the existing Former Skinners Family Hotel within the overall development
- include site specific controls which ensure the provision of employment and other non-residential land uses
- require the mandatory consideration of a site-specific Design Guideline
- allow for the provision of up to 70 car parking spaces
- establish an alternative approach to design excellence.

The Planning Proposal request was submitted to the City of Sydney in May 2022 and is currently under assessment.

1.3 Purpose of the report

This Flooding Assessment report supports a Concept SSDA submitted to the Department of Planning and Environment (DPE) pursuant to Part 4 of the EP&A Act. The Concept SSDA is made under section 4.22 of the EP&A Act.

This report has been prepared to specifically respond to the Secretary's Environmental Assessment Requirements (SEARs) issued for the Concept SSDA on 08 August 2022 which states that the Environmental Impact Statement is to address the requirements.

Key issue	SEARs	Where addressed
6. Public space	<p>Illustrate the integration between station infrastructure and the development including:</p> <ul style="list-style-type: none"> any impact of the SSD on surrounding public domain, any existing or proposed connections to adjoining sites and the station public domain works that are needed to support the uses of the SSD (e.g. access, flood mitigation, open space, etc). 	Refer section 4.3 for further details on how the Hunter Street Station flood protection measures will also provide flood protection to elements of the proposed development
13. 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.	Refer section 4.3 for further details
13. Flooding risk	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 in accordance with the City of Sydney Interim Floodplain Management Policy, where required.	Refer section 4.3 for further details

This report summarises the existing flooding conditions and details any upgrades, infrastructure and protection measures required to satisfy the relevant flooding standards. Assessment of the potential impacts of the proposed development on flooding considers selected flood events up to the probable maximum flood (PMF), and focuses upon:

- compliance or otherwise with relevant council flood planning guidelines as well as considering ability to evacuate safely in extreme flood events
- interaction with the Stage 3 CSSI application which has the potential to adversely impact on metro flood immunity
- where required, mitigation and management measures have been identified.

The assessment presented in this report was undertaken for the Environmental Impact Statement of the separate but related proposal for the Stage 3 CSSI Application. It has also previously been presented in the associated Planning Proposal for Hunter Street Over Station Development Preliminary Flooding Report. The proposed development presents no additional footprint, compared to earlier applications, where there could be further flood impacts on adjacent properties and assets. There are potential risks in relation to the use of some aspects of the proposed development and potential for design or operation of the proposed development to impact on the flood immunity of the Hunter Street Station. These will be outlined in later sections along with mitigation measures where required.

2 The site and proposal

2.1 Site location and description

Hunter Street Station is in the northern part of the Sydney CBD, within the commercial core precinct of Central Sydney and within the Sydney Local Government Area (LGA). The Hunter Street metro station comprises of two sites – the western site and the eastern site. This report relates to the western site only.

The Hunter Street Station western site (the site) is on the corner of George and Hunter Street. It includes De Mestre Place, the heritage listed former Skinners Family Hotel, and land predominantly occupied by the existing Hunter Connection retail plaza. The site is occupied by commercial office buildings, restaurants, shops, as well as a range of business premises and employment and medical/health services premises.

The site area is 3,736 m² and will be cleared of all buildings and utilities prior to commencement of station construction activities. The site location is shown in Figure 2-1.

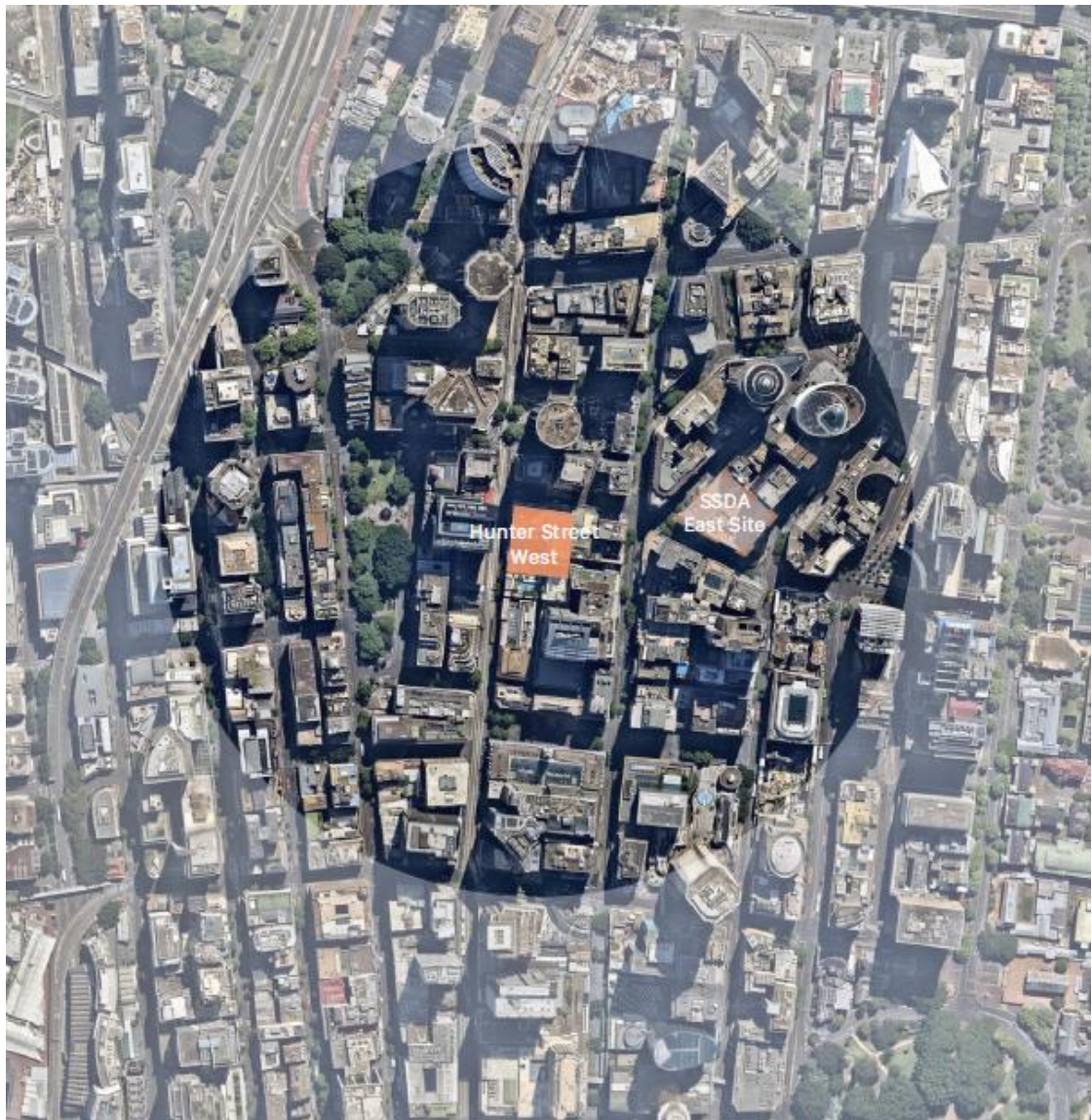


Figure 2-1 Location of the site

Table 2-1 sets out the address and legal description of the parcels of land that comprise the site.

Table 2-1 Site legal description

Address	Lot and DP
296 George Street, Sydney	Lot 1, DP438188
300 George Street, Sydney	CP and Lots 1-43, SP596
312 George Street, Sydney	Lot 1, DP211120
314-318 George Street, Sydney	Lot 13, DP622968
5010 De Mestre Place, Sydney (Over Pass)	Lot 1, DP1003818
9 Hunter Street, Sydney	Lot 2, DP850895
5 Hunter Street, Sydney (Leda House & Hunter Arcade)	CP and Lots 1-63, SP71068
5 Hunter Street, Sydney (Leda House & Hunter Arcade)	CP and Lots 1-14, SP65054
7-13 Hunter Street, Sydney (Hunter Connection)	CP and Lots 1-53, SP50276
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 57 and 58, SP61007
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 54, 55 and 56, SP60441
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 59, 60 and 61, SP62889
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 62, 63, 64 and 65, SP69300
7-13 Hunter Street, Sydney (Hunter Connection)	Lots 66 and 67, SP77409
7-13 Hunter Street, Sydney (Hunter Connection)	Lot 2, SP50276
De Mestre Place, Sydney	N/A
Total Area: 3,736 m²	

2.2 Overview of the proposal

The Concept SSDA will seek consent for a building envelope above the site (the proposed development). As detailed in Table 2-2 and Figure 2-2.

Table 2-2 Proposed development overview

Built form component	Proposed development outcome
Site area	3,736 m ²
Height	Building height of 213m (RL 220.00m)
Ground floor area	Up to 69,863 m ²
Land use(s)	Commercial office and retail
Carparking	Up to 70 car parking spaces

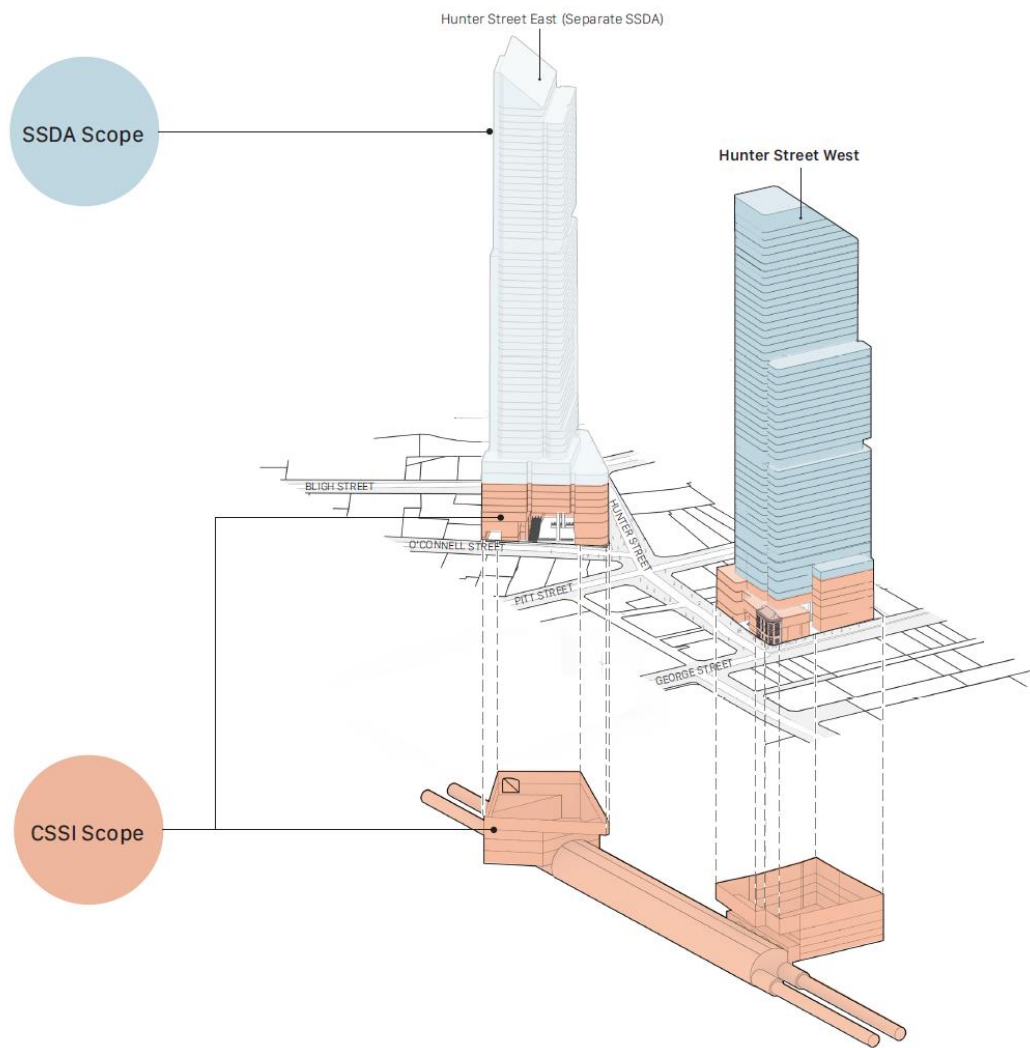


Figure 2-2 Proposed Concept SSDA development and CSSI scope

3 Scope of assessment

3.1 Flood planning requirements

The flooding assessment has been undertaken to satisfy State and Local Government guidelines. The flood criteria applicable to this study are set out below.

City of Sydney Council's Interim Floodplain Management Policy has the following general and flood planning level requirements which are applicable to this proposal. They include that:

- Proposed commercial buildings and car parking areas must meet the Flood Planning Level requirements outlined in the policy
- Proposed car park should not increase the risk of vehicle damage by flooding inundation
- Proposed commercial development or car parking areas should not increase the likelihood of flooding on other developments, properties or infrastructure
- Developments which have a lifespan of more than fifty years shall consider the impact due to sea level rise and impacts due to increased rainfall intensities
- Critical facility floor level must be at minimum equal to the 1% AEP climate change flood level with 0.5metres freeboard
- The Flood Planning Level for commercial developments would be the one per cent Annual Exceedance Probability (1% AEP) flood event
- The Flood Planning Level for below ground garage/ car park would be the greater of the Probable Maximum Flood (PMF) event, or the 1% AEP flood level with an allowance for freeboard of 0.5 metres
- The Flood Planning Level for retail developments would be a balance of protection from the 1% AEP flood event and achieving urban design outcomes.

Stage 3 CSSI application requirements (derived from various sources and applicable to the Hunter Street Station) expect that:

- Climate change would be incorporated directly into the flood assessment with:
 - allowance for climate change consistent with Representative Concentration Pathways (RCP) 8.5 out to 2100 (IPCC, 2014)
 - sea level rise of 0.9 metres over a period to 2100 (Sydney Metro, 2020)
 - rainfall intensity uplift 21.3 per cent determined accordance with Australian Rainfall and Runoff 2019 (Ball et al, 2019).
- Critical infrastructure would be protected from the PMF event, or the 1% AEP flood event level with an allowance for freeboard of 0.5 metres (whichever is greater)
- The flood events considered include the five per cent Annual Exceedance Probability with climate change allowance flood event (5% AEP climate change flood event), one per cent Annual Exceedance Probability with climate change allowance flood event (1% AEP climate change flood event) and Probable Maximum Flood event (PMF event)
- Increases in flood levels due to temporary and permanent infrastructure are minimised during flood events up to and including the 1% AEP climate change flood event

- Not worsening of flooding on properties or infrastructure up to the 1% AEP climate change flood event where not worsening is defined as:
 - a maximum increase in flood levels of 50mm
 - a maximum increase in time of inundation of one hour
 - no increase in potential soil erosion and scouring from any increase in flow velocity.
- Dedicated evacuation routes would not be adversely impacted in flood events up to and including the PMF flood event.

Consequently, the resulting criteria which would apply to the proposed development are as follows:

- The proposal shall not have an adverse impact on the flood immunity of the Hunter Street Station including the shared loading and car parking facilities and any services or other access points which dock connect to these areas or any other areas of the metro station
- Proposed commercial development would not increase the likelihood of flooding on other properties, assets and infrastructure
- The Flood Planning Level for commercial developments would be at least equal to the 1% AEP climate change flood event
- The Flood Planning Level for retail developments would be a balance of protection from the 1% AEP climate change flood event and achieving urban design outcomes.

3.2 Assumptions, dependencies and constraints

Modelling and analysis outlined in this report has been carried out based on the methodology briefly outlined below and in the context of the best available information at the time of the assessment.

Models for this assessment are based on those previously generated for the earlier Stage 3 CSSI application and Hunter Street Planning Proposal. These TUFLOW hydraulic flood models were originally established for the City Area Catchment Flood Study (BMT WBM, 2014) which was developed for the City of Sydney Council's floodplain management program pursuant to the Floodplain Development Manual (NSW Government 2005).

The Ecologically Sustainable Development Report, at Appendix P of the Environmental Impact Statement, outlines the approach to achieving a climate responsive design for the proposed development.

The Rail infrastructure, stations, precincts and operations Environmental Impact Statement (Sydney Metro, 2022) summarises the climate change risk assessment carried out to date on the broader Sydney Metro West project.

Technical assumptions, dependencies and constraints for the Hunter Street Station are contained within relevant project registers and will be addressed as part of the ongoing design process associated with the Stage 3 CSSI application.

4 Flooding assessment

4.1 Hydraulic modelling scenarios

A series of scenarios undertaken for the earlier Stage 3 CSSI application and Hunter Street Planning Proposal were reviewed based on the criteria outlined in sections 1.3 and 3.2.

Further to section 3.1, climate change has been directly incorporated into the assessment by the inclusion of a rainfall uplift and sea level rise as appropriate to the specific scenario being considered.

The scenarios considered for the baseline and end state assessment of this proposal are:

- 5% AEP climate change flood event
- 1% AEP climate change flood event
- PMF event.

4.2 Hydraulic modelling results

Modelling results for the above scenarios have been presented in Flood assessment maps showing flood depth with water surface level contours and hazard mapping.

Hazard maps have been developed with flood hazard categories in accordance with the Australian Institute of Disaster Resilience (2017b) Guideline 7-3. The hazard classifications are based on a combination of flow velocity and flood depth as shown on the diagram in Figure 4-1 and defined below:

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

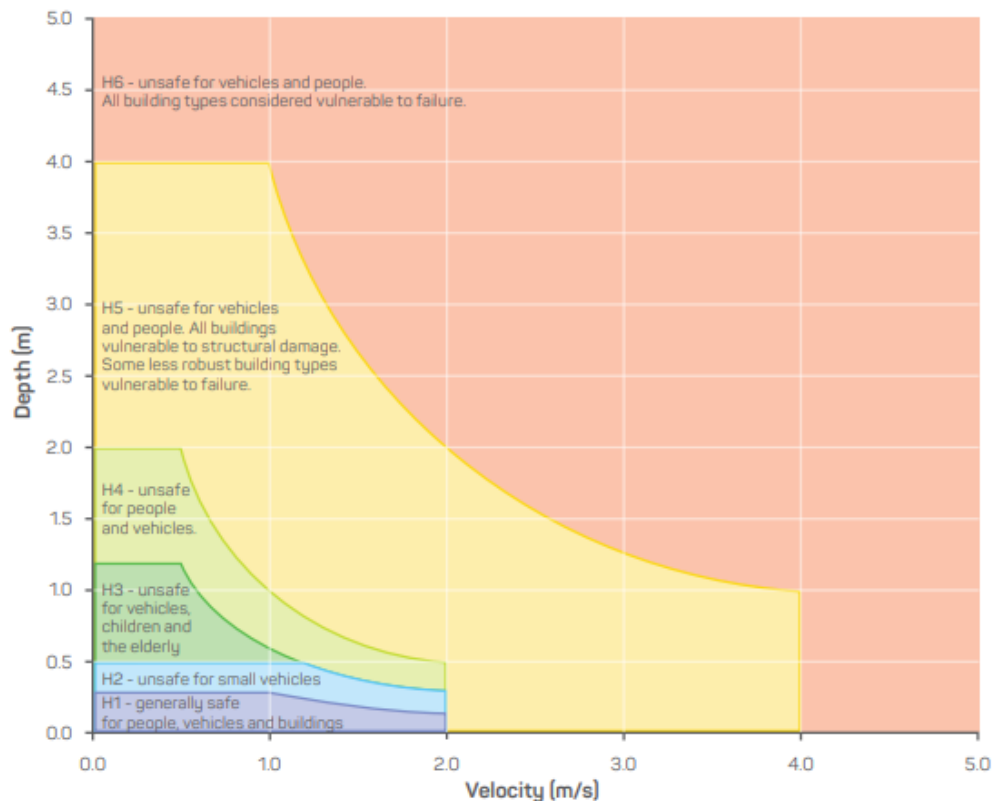


Figure 4-1 Flood hazard classifications

A summary of the flooding conditions at the proposed development and surrounding areas are as follows (described in section 4.1 and Appendix B Flood assessment maps):

- 5% AEP climate change flood event:
 - flood depths up to 0.04 metres occur at the north eastern portion of the site between the northern site boundary and Hunter Street
 - flood hazard categorisation indicates that all roads surrounding the site are within a low H1 hazard category
- 1% AEP climate change flood event:
 - flood depths of up to 0.35 metres occur at the north eastern portion of the site between the northern site boundary and Hunter Street
 - outside of the northern boundary, there are flood depths up to 0.2 metres between the western boundary and George Street
 - the northern portion of the site along Hunter Street has a H5 hazard along with a small section of George Street
 - the remainder of the site surrounds appears to be within the low H1 hazard category (generally safe for vehicles, people and buildings)
- PMF event:
 - a similar trend to the 1% AEP climate change flood event with the worst-case flooding occurring at the northern boundary with depths up to one metre
 - the western boundary is inundated up to 0.4 metres in the PMF flood event
 - flooding produces higher flood hazard categories of H5 and H6 with only pockets of the streets falling within the low hazard (H1) category.

4.3 Hydraulic modelling discussion

The results in section 4.2 and Appendix B Flood assessment maps demonstrate that the proposed development would not adversely affect flood behaviour resulting in affectation of other properties assets and infrastructure. Generally, the proposed development would provide an equivalent or better flood immunity to that of the Interim Floodplain Management Policy. Mitigation measures are outlined in Table 4-1 and section 4.5 where either ongoing design will be required to resolve specific issues or operational risks require management.

Responses to the SEARs for flooding for the proposed development are included in Table 4-1.

Table 4-1 Flooding SEARs response

SEARs	Response
<p>Illustrate the integration between station infrastructure and the development including:</p> <ul style="list-style-type: none"> any impact of the SSD on surrounding public domain, any existing or proposed connections to adjoining sites and the station public domain works that are needed to support the uses of the SSD (e.g. access, flood mitigation, open space, etc). 	<p>The results presented in section 4.2 and Appendix B Flood assessment maps are premised on the basis that flood protection measures would be employed where necessary to ensure the Hunter Street Station would continue to experience the requisite flood immunity at all access points as outlined in section 3.1.</p>
<p>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.</p>	<p>Results are generally consistent with the relevant City of Sydney Council flood study as outlined in section 3.2.</p> <p>Climate change has been considered and included in the analysis. The effect of climate change adopting RCP 8.5 estimates an increase in rainfall intensity of 21.3 per cent (Jacobs, 2020). Assessment has been undertaken as detailed in the Floodplain Development Manual (NSW Government 2005) with the exception that hazard mapping is consistent with the Australian Institute of Disaster Resilience (2017b) as supported by ARR 2019.</p> <p>In the 5% AEP climate change and 1% AEP climate change flood events the hazard classification is generally H1 low hazard which is accepted as safe for people, vehicles and buildings. Access and evacuation routes are readily available for the George Street retail opportunities via George Street. Hunter Street, which is expected to experience up to H5 high hazard category in the 1% AEP climate change flood event, will be too dangerous for evacuation.</p> <p>In the PMF event, Hunter and George Street are H5 high hazard typically for their full width with extensive sections of H6 high hazard on Hunter Street.</p>

SEARs	Response
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 in accordance with the City of Sydney <i>Interim Floodplain Management Policy</i> , where required.	<p>Post-developed flood impacts show that the proposal has negligible impacts on existing flooding behaviour. Generally, there is no increase in flood levels in all events due to the proposed development. There would be a negligible difference in flood hazard compared with the baseline scenario.</p> <p>Further design refinement during future stages of design of the proposal would ensure that floor levels would be situated at or above a level consistent with the requirements outlined in section 3.1 as follows:</p> <ul style="list-style-type: none"> Any function which has the potential to compromise the flood immunity of the Stage 3 CSSI application - PMF event, or the 1% AEP climate change flood event level with an allowance for freeboard of 0.5 metres (whichever is greater) Critical facilities (including fire control room and critical infrastructure control equipment rooms) - PMF event, or the 1% AEP climate change flood event level with an allowance for freeboard of 0.5 metres (whichever is greater) Commercial uses (including OSD lobby, service facilities and access to and from critical facilities) - 1% AEP climate change flood event level Retail opportunities - balance of protection from the 1% AEP climate change flood event and achieving urban design outcomes. <p>These levels are consistent with the requirements of the City of Sydney Council's <i>Interim Floodplain Management Policy</i>.</p> <p>On-site flood risk, design solutions and operational flood emergency response plans to mitigate flood risk, if required, for specific functions included in the detailed design of the proposal would be described in a future detailed SSDA.</p>

4.4 Consultation

Submissions have been received from the City of Sydney Council and Department of Planning and Environment for the Stage 3 CSSI application.

City of Sydney Council submission requested the following additional detail:

- consideration and assessment of alternative options prior to recommending active flood protection
- proposed flood mitigation measures.

The Department of Planning and Environment requested the following additional detail:

- level of passive flood protection afforded
- frequency of inundation or flood immunity
- frequency of activation of active flood protection.

Both maintained that the use of active flood protection is generally not supported. The Submissions Report (Sydney Metro, 2022b) outlines Sydney Metro responses to these issues.

City of Sydney Council have responded to the Hunter Street Planning Proposal as follows:

- requested additional information on the flood modelling that was undertaken for the Metro Station
- stated that they do not support the use of active flood protection to mitigate flood risks to a site
- required additional technical specifications for the Hunter Street Station Over Station Development Design Guidelines.

Sydney Metro is currently developing a response to these issues.

Further co-ordination and consultation meetings are anticipated as the design progresses to address stakeholder requirements.

4.5 Emergency response

Passive flood measures are planned for the proposed development. Active flood measures, associated with the CSSI Stage 3 application, are triggered from rising flood waters. The construction of the Hunter Street Station is under a separate planning approval, but it is suggested that as some areas of the proposed development are also protected by those measures that a holistic emergency management arrangement is applied as they are likely to be more successful than a piecemeal approach.

Sydney & North Sydney CBD Central Business Districts Evacuation Management Subplan applies to this location. Being co-located with the Hunter Street Station would afford easy access to the metro for building occupants if there was a city or precinct wide evacuation order.

5 Conclusion

This Flooding Assessment report has been written to support a Concept SSDA and to respond to the associated SEARs. Applicable flood planning requirements have been identified including the City of Sydney Council's Interim Floodplain Management Policy.

Models for this assessment are based on those previously generated for the earlier Stage 3 CSSI application and Hunter Street Planning Proposal. The results in section 4.2 and Flood assessment maps demonstrate that the proposed development would not adversely affect flood behaviour resulting in affectation of other properties assets and infrastructure.

Section 4.3 contains a mitigation measure for further design refinement during future stages of design of the proposal to ensure that floor levels would be situated at or above a level consistent with the requirements outlined in section 3.1. These levels are consistent with the requirements of the City of Sydney Council's Interim Floodplain Management Policy.

A response to the applicable SEARs is included in Table 4-1 and section 4.4.

These results are premised on the basis that flood protection measures would be employed to provide the necessary immunity to critical infrastructure for the Hunter Street Station as part of the Stage 3 CSSI application and that the design and operation of the proposed development would not compromise metro station flood immunity.

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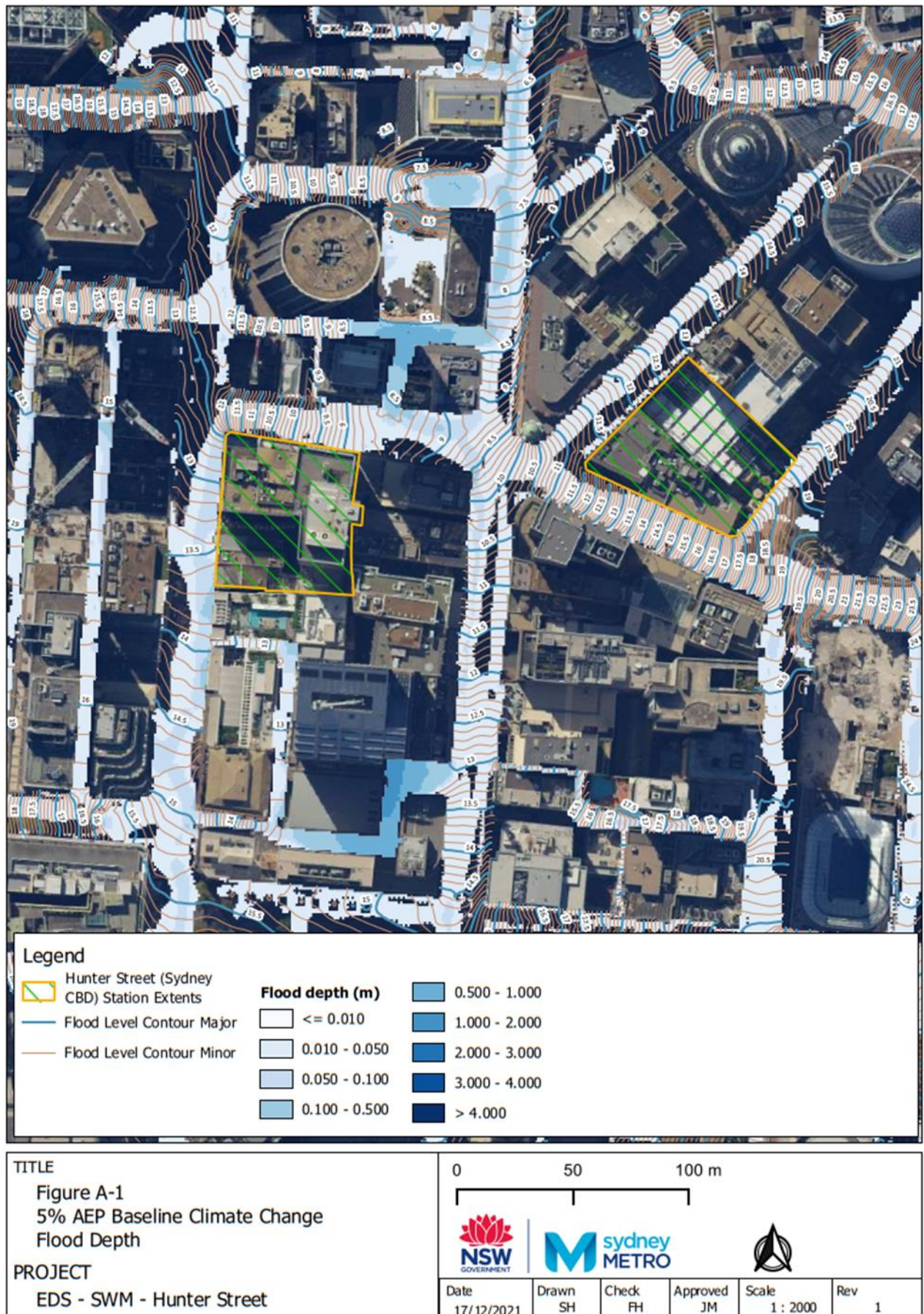
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Appendix A AEP and ARI conversion table

Frequency Descriptor	EY	AEP (%)	AEP (1 in x)	ARI
Very frequent	12			
	6	99.75	1.002	0.17
	4	98.17	1.02	0.25
	3	95.02	1.05	0.33
	2	86.47	1.16	0.50
	1	63.2	1.58	1.00
Frequent	0.69	50.00	2	1.44
	0.5	39.35	2.54	2.00
	0.22	20.00	5	4.48
	0.2	18.13	5.52	5.00
	0.11	10.00	10.00	9.49
Infrequent	0.05	5.00	20	20.0
	0.02	2.00	50	50.0
	0.01	1.00	100	100
	0.005	0.50	200	200
Rare	0.002	0.20	500	500
	0.001	0.10	1000	1000
	0.0005	0.05	2000	2000
	0.0002	0.02	5000	5000
Extremely Rare				
Extreme			PMP	

Appendix B Flood assessment maps

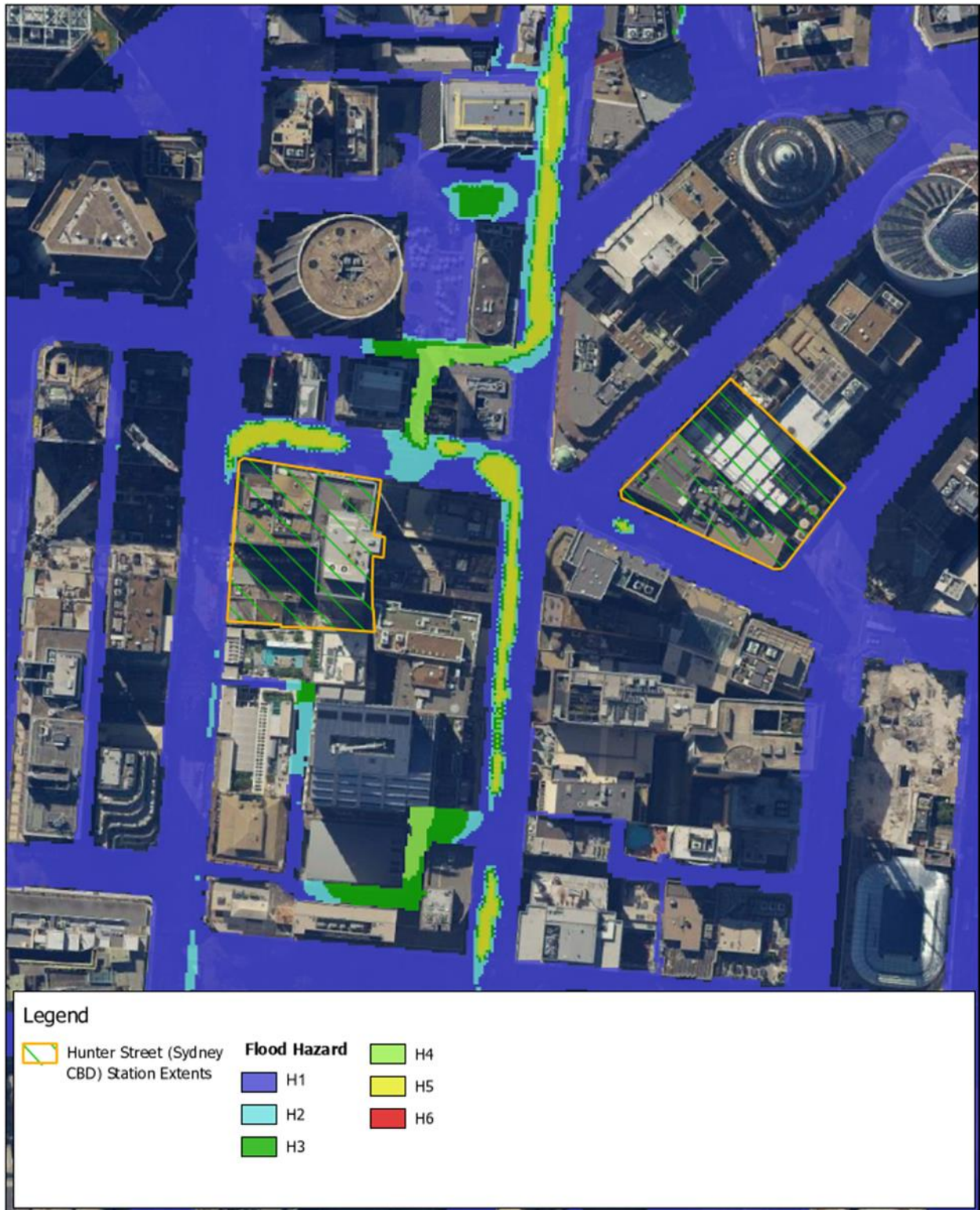




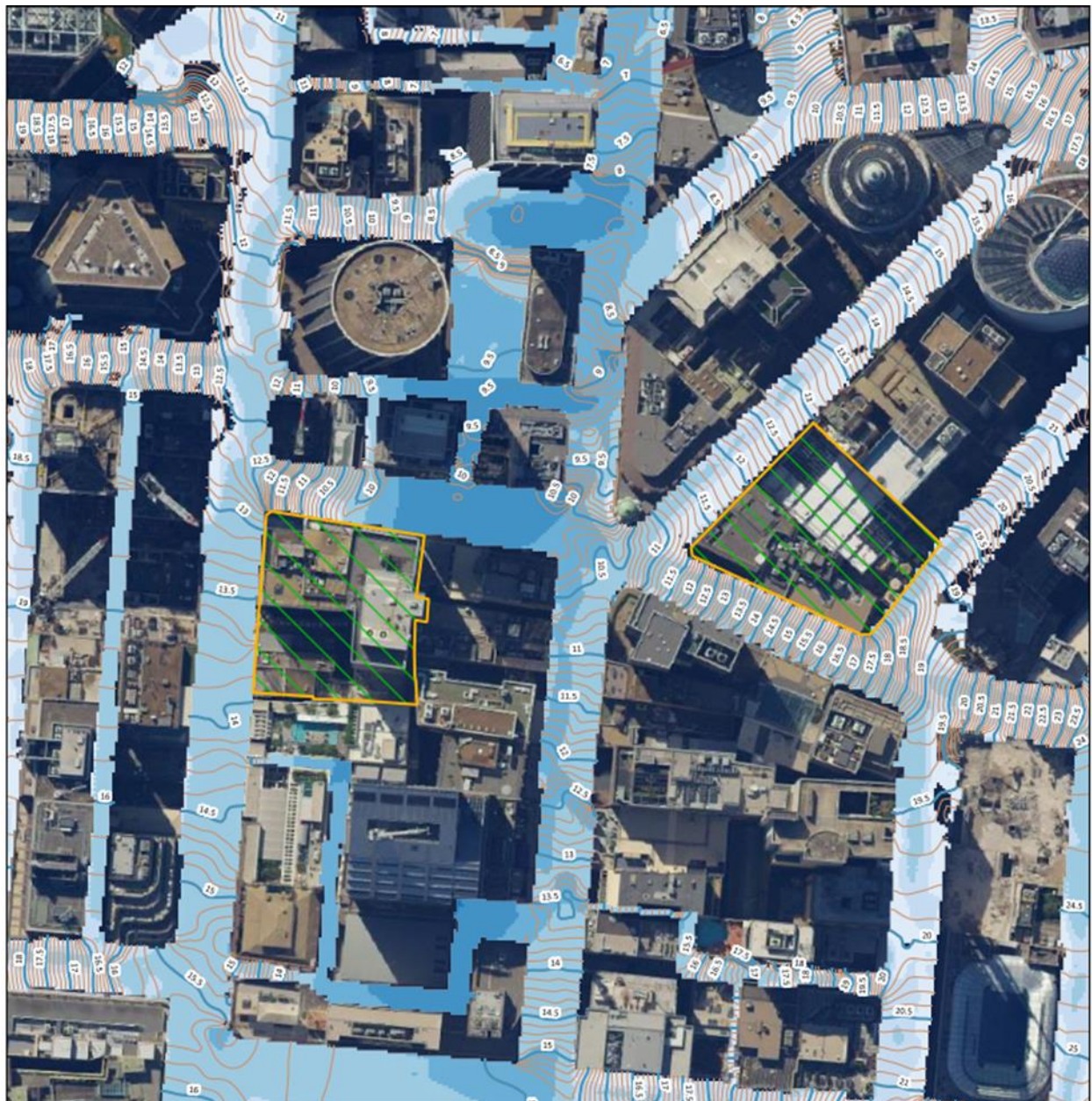
TITLE Figure A-2 5% AEP Baseline Climate Change Flood Hazard PROJECT EDS - SWM - Hunter Street	0 50 100 m   					
	Date 17/12/2021	Drawn SH	Check FH	Approved JM	Scale 1 : 2000	Rev 1



TITLE Figure A-3 1% AEP Baseline Climate Change Flood Depth PROJECT EDS - SWM - Hunter Street	0 50 100 m					
				Date	Drawn	Check
	17/12/2021	SH	FH	Approved	Scale	Rev
				JM	1 : 2000	1



TITLE Figure A-4 1% AEP Baseline Climate Change Flood Hazard PROJECT EDS - SWM - Hunter Street	0 50 100 m					
				Date	Drawn	Check
	17/12/2021	SH	FH	Approved	Scale	Rev
		JM	1 : 2000			1



Legend

Hunter Street (Sydney CBD) Station Extents

Flood Level Contour Major

Flood Level Contour Minor

Flood depth (m)

≤ 0.010

0.010 - 0.050

0.050 - 0.100

0.100 - 0.500

0.500 - 1.000

1.000 - 2.000

2.000 - 3.000

3.000 - 4.000

> 4.000

TITLE

Figure A-5
PMF Baseline Climate Change
Flood Depth

PROJECT

EDS - SWM - Hunter Street

0 50 100 m



Date
17/12/2021

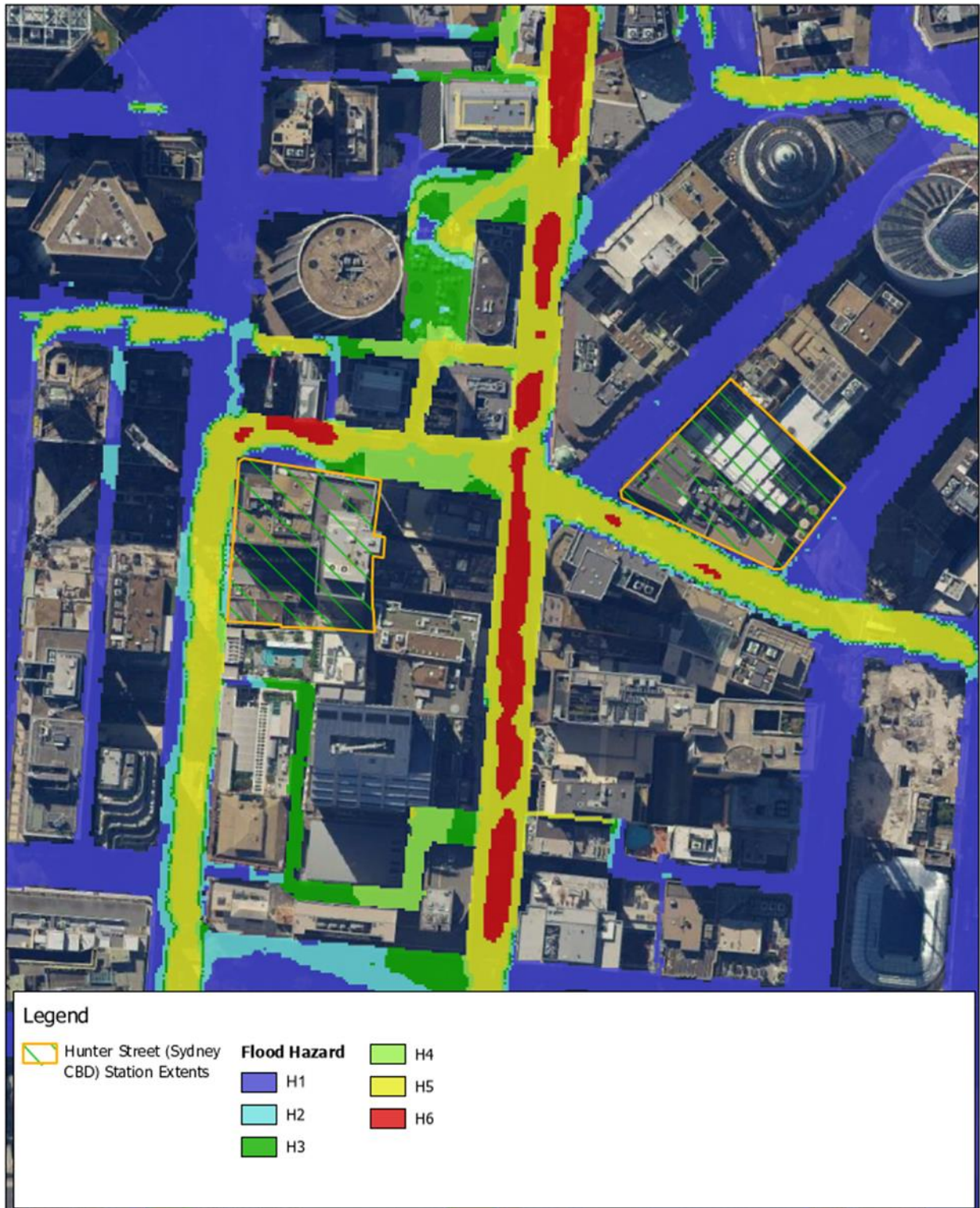
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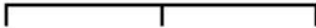



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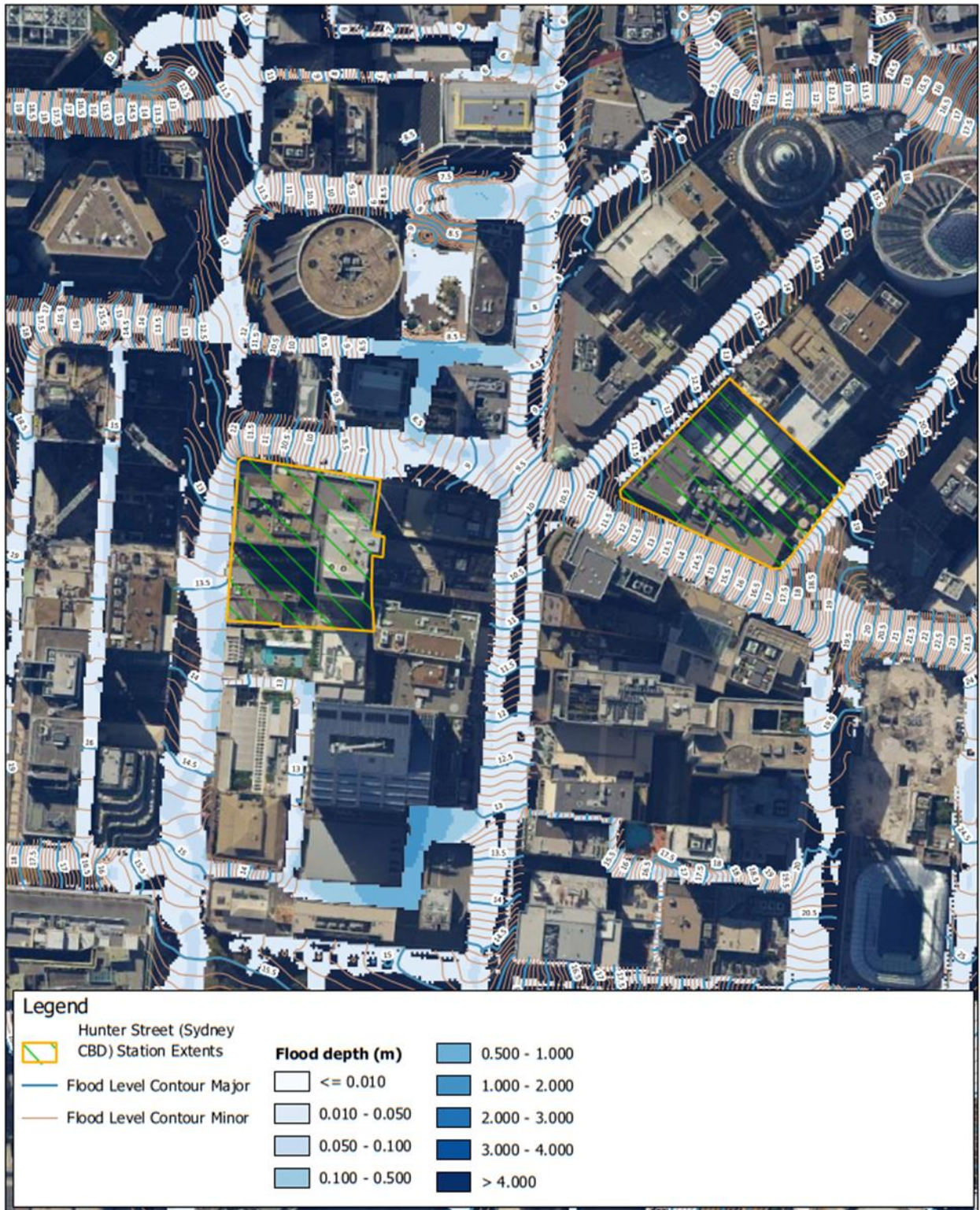
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TITLE Figure A-6 PMF Baseline Climate Change Flood Hazard PROJECT EDS - SWM - Hunter Street	0 50 100 m 					
	  					
Date	Drawn	Check	Approved	Scale	Rev	
17/12/2021	SH	FH	JM	1 : 2000	1	



TITLE
Figure B-1
5% AEP Developed Scenario
Flood Depth

PROJECT
EDS - SWM - Hunter Street

0 50 100 m



Date
17/12/2021

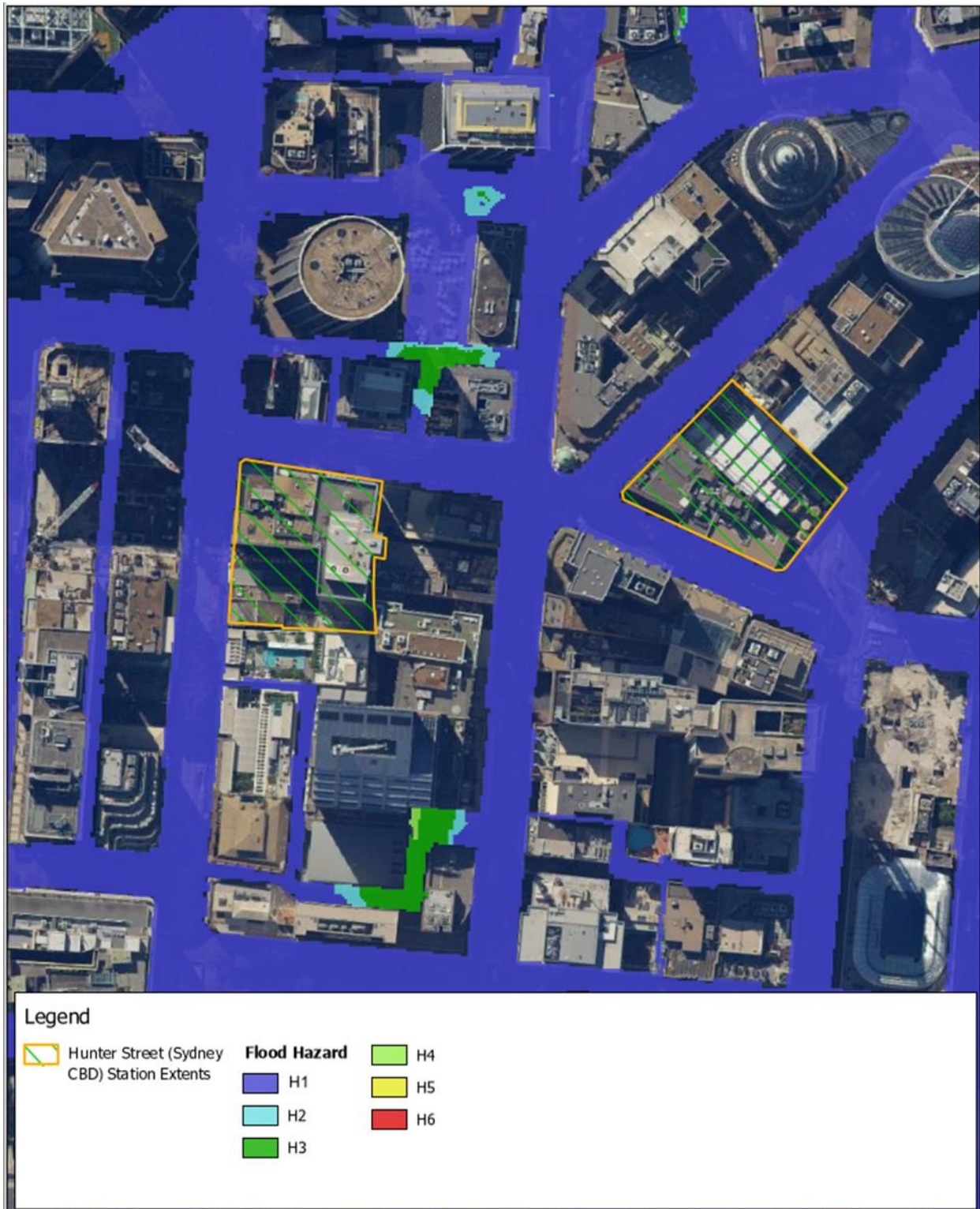
Drawn
SH

Check
FH

Approved
JM

Scale
1 : 2000

Rev
1



TITLE
Figure B-2
5% AEP Developed Climate
Change Flood Hazard

PROJECT
EDS - SWM - Hunter Street


0 50 100 m



Date 17/12/2021	Drawn SH	Check FH	Approved JM	Scale 1 : 2000	Rev 1
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Legend

 Hunter Street (Sydney CBD) Station Extents

 Flood Level Contour Major

 Flood Level Contour Minor

Flood depth (m)

 ≤ 0.010

 0.010 - 0.050

 0.050 - 0.100


 0.100 - 0.500

 0.500 - 1.000

 1.000 - 2.000

 2.000 - 3.000

 3.000 - 4.000

 > 4.000

TITLE

Figure B-3
1% AEP Developed Climate
Change Flood Depth

PROJECT

EDS - SWM - Hunter Street

0 50 100 m



Date
17/12/2021

Drawn
SH

Check
FH

Approved
JM

Scale
1 : 2000

Rev
1



TITLE
Figure B-4
1% AEP Developed Climate
Change Flood Hazard

PROJECT
EDS - SWM - Hunter Street

0 50 100 m



Date
17/12/2021

Drawn
SH

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FH

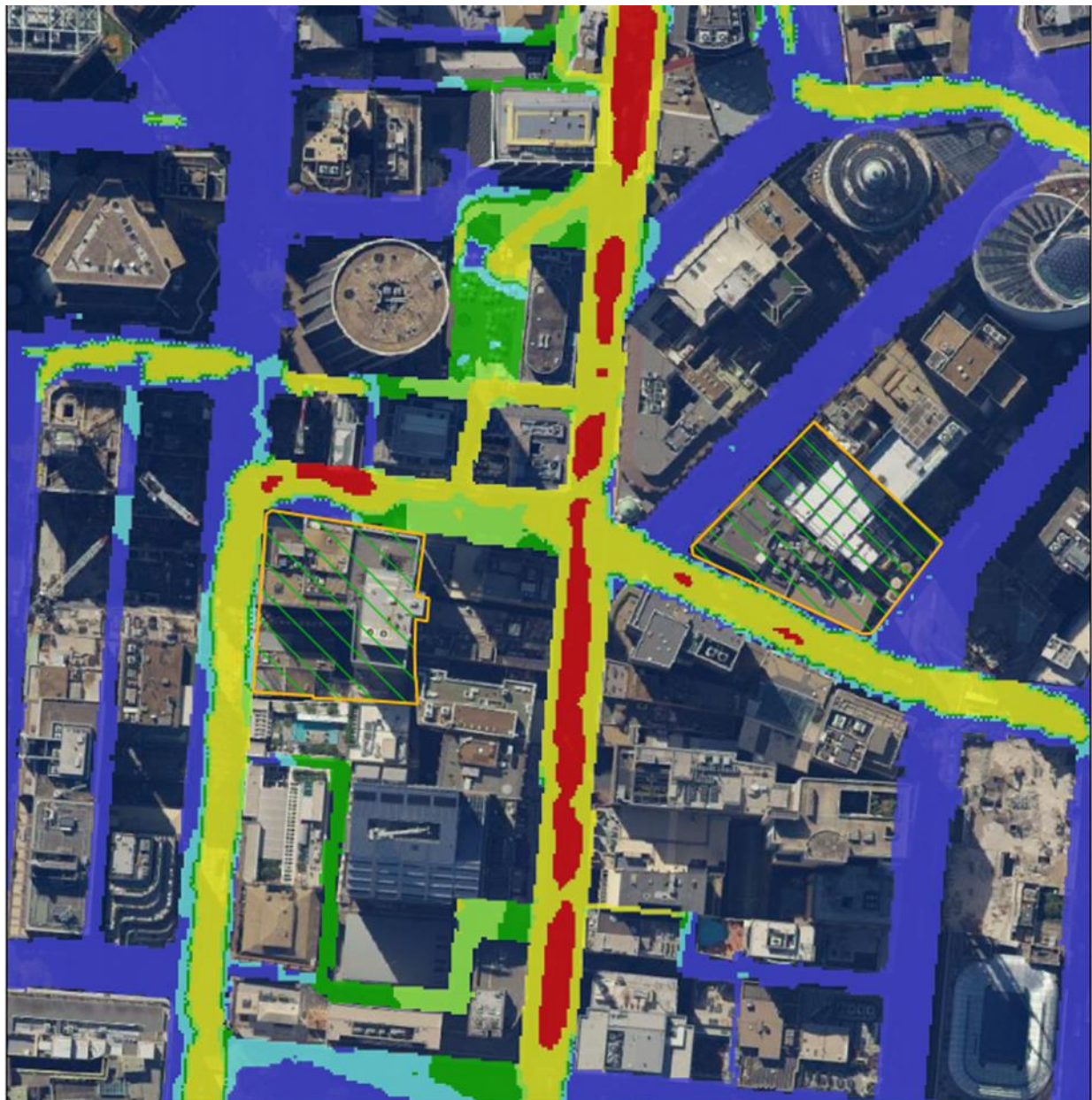
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Scale
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Rev
1



TITLE Figure B-5 PMF Developed Climate Change Flood Depth PROJECT EDS - SWM - Hunter Street	0 50 100 m					
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	17/12/2021	SH	FH	Approved	Scale	Rev
				JM	1 : 2000	1



Legend

 Hunter Street (Sydney CBD) Station Extents	Flood Hazard	 H4
	 H1	 H5
	 H2	 H6
	 H3	

TITLE

Figure B-6
PMF Developed Climate
Change Flood Hazard

PROJECT

EDS - SWM - Hunter Street

0 50 100 m



Date
17/12/2021

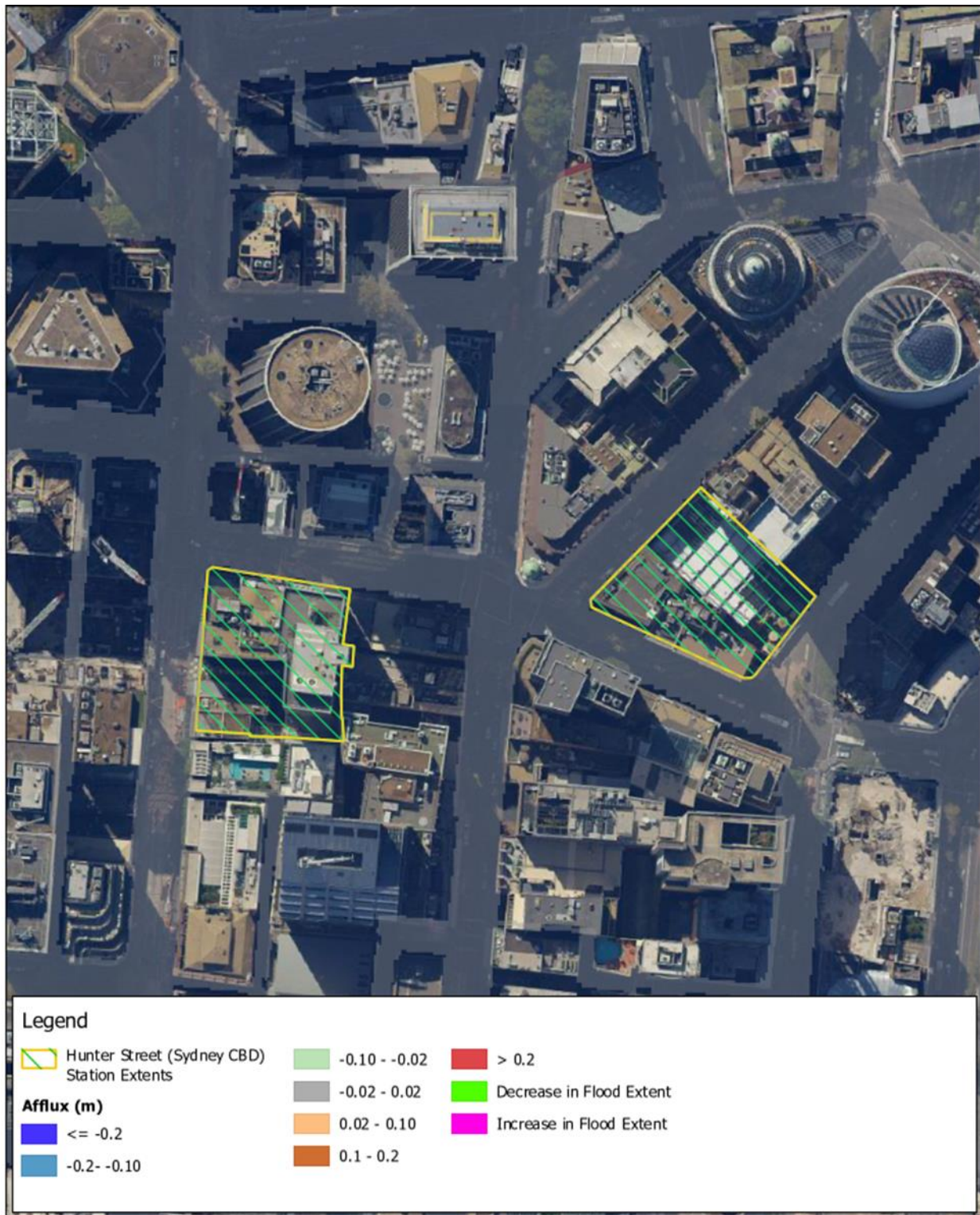
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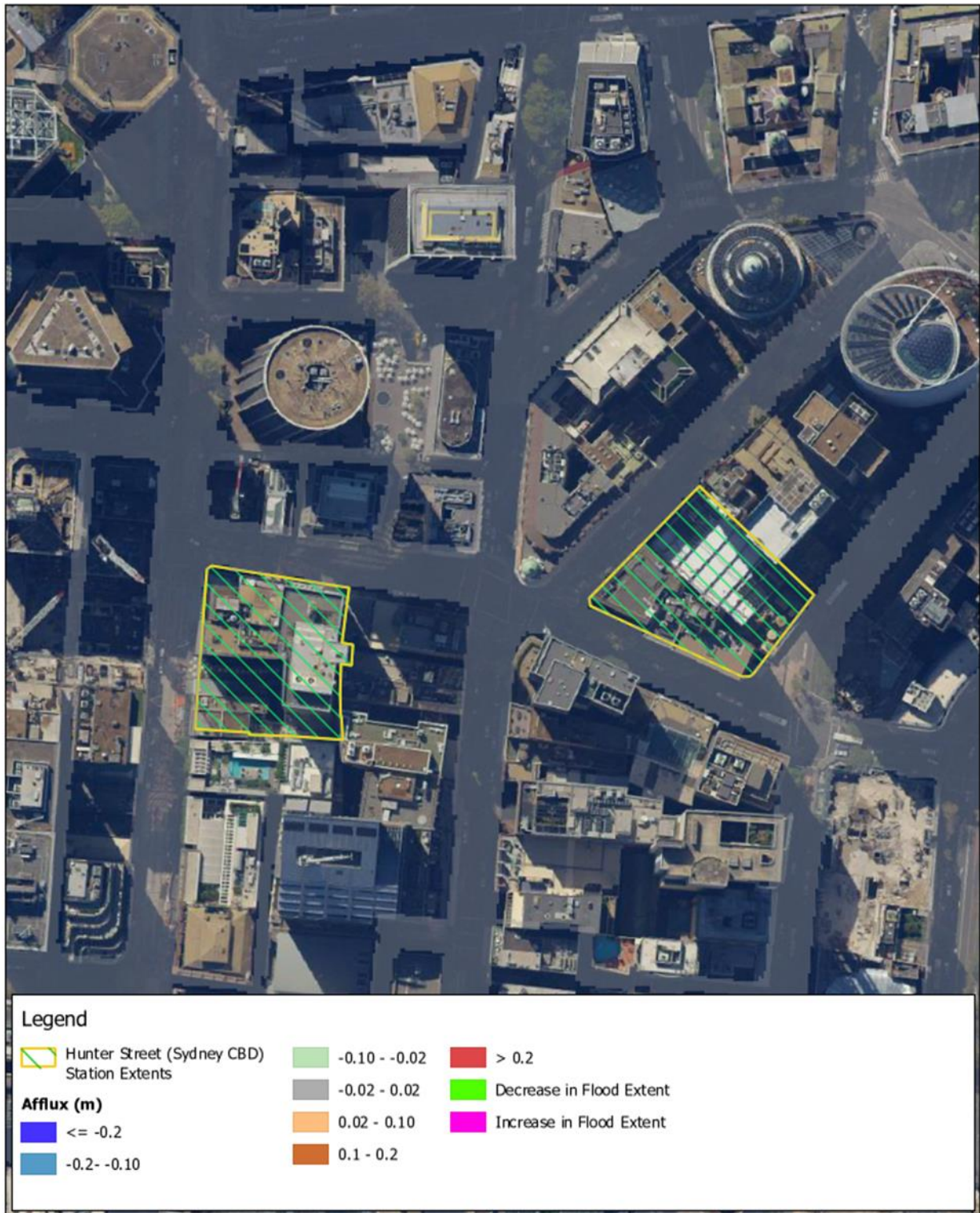
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Rev
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TITLE Figure C-1 5% AEP Developed Climate Change Scenario Flood Impact PROJECT EDS - SWM - Hunter St	0 50 100 m 					
	Date 17/12/2021	Drawn SH	Check FH	Approved JM	Scale 1 : 2000	Rev 1



TITLE
Figure C-2
1% AEP Developed Climate Change
Scenario Flood Impact

PROJECT
EDS - SWM - Hunter St

0 50 100 m



Date
17/12/2021

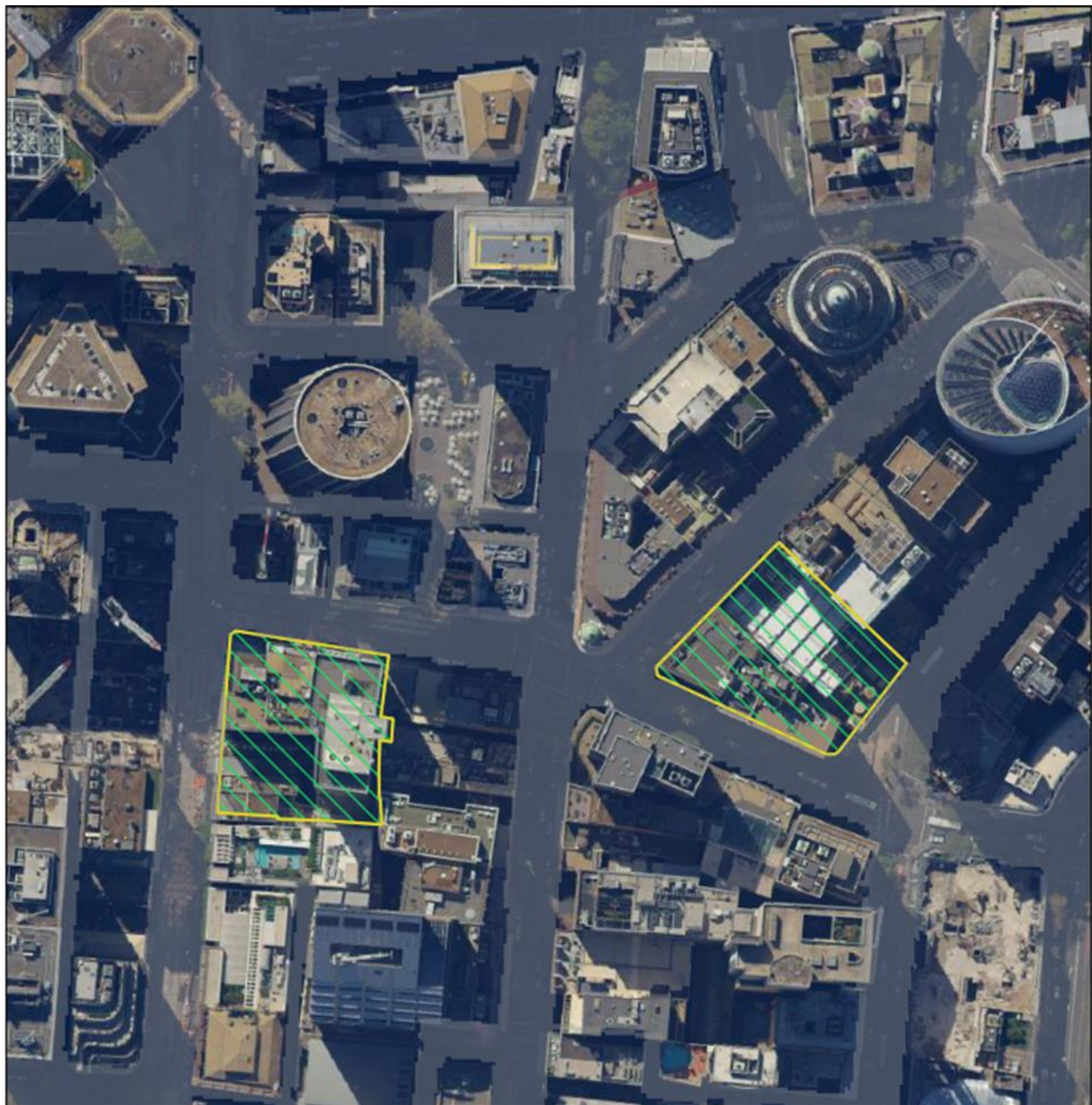
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SH

Check
FH

Approved
JM

Scale
1 : 2000

Rev
1



Legend


 Hunter Street (Sydney CBD)
Station Extents


Afflux (m)

 ≤ -0.2

 $-0.2 - -0.10$


 $-0.10 - -0.02$


 $-0.02 - 0.02$

 $0.02 - 0.10$

 $0.1 - 0.2$

 > 0.2

 Decrease in Flood Extent

 Increase in Flood Extent

TITLE

Figure C-3
PMF Developed Scenario
Flood Impact

PROJECT

EDS - SWM - Hunter St

0 50 100 m



Date
17/12/2021

Drawn
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Check
FH

Approved
JM

Scale
1 : 2000

Rev
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