



Flooding and Hydrology Plan

A sub plan of the Operational Environmental Management Plan.

Information

Issue Date:

12/09/2024

Next Review Date:

31/01/2025

Network:

City & Southwest

Version:

04

Document Number:

SMCSWTS2-MTS-1NL-EM-PLN-002711

PDCS Reference

n/a

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Compliance table

Table 1 outlines how this Plan evidences its compliance to the Critical State Significant Infrastructure (CSSI) approval which was granted by the Minister of Planning on 9 January 2017 (CSSI 7400). Compliance with other statutory requirements including Revised Environmental Management Measures, Performance Outcomes and license conditions are detailed in Section 3.

Table 1 Compliance table

3.5 Description		Section
D3	Where an OEMP is required, the Proponent must include the following OEMP sub-plans in the OEMP: (d) Flooding and Hydrology (including emergency response planning).	This Plan.
D4	Each of the OEMP sub-plans must include the requirements set out in Condition D2 (a), (b) and (c).	Sections 4 and 5
D2	An OEMP is not required for the CSSI if the Proponent has an Environmental Management System (EMS) or equivalent as agreed with the Secretary, and can demonstrate, to the written satisfaction of the Secretary, that through the EMS: (a) The performance outcomes, commitments and mitigation measures, made and identified in the EIS as amended by the documents listed in A1, and requirements specified in the conditions of this approval can be achieved; (b) issues identified through ongoing risk analysis can be managed; and (c) procedures are in place for rectifying any non-compliance auditing, incident management or any other time during operation.	Sections 4 and 5
D5	The OEMP sub-plans must be developed in consultation with relevant agencies as identified in Condition D3. Where and agency(ies) request(s) is not included in an OEMP sub-plan, the Proponent must provide the Secretary justification as to why. Details of all information requested by an agency to be included in an OEMP sub-plan as a result of consultation, including copies of all correspondence from those agencies, must be provided with the relevant OEMP sub-plan.	Section 2
D6	The OEMP sub-plans must be submitted to the Secretary as part of the OEMP.	Section 1.1
E8	Measures identified in Chapter 11 of the PIR to maintain or improve flood characteristics, as amended by the documents listed in A1, must be incorporated into the detailed design of the CSSI. The incorporation of these measures into the detailed design, including modelling, must be reviewed and endorsed by a suitably qualified and experienced person in consultation with directly affected landowners and businesses, Sydney Water, DPI Water, OEH, NSW State Emergency Service (SES) and Relevant Councils.	Sections 2 and 4.
E9	Flood information including flood reports, models and geographic information system outputs, and work as executed information from a registered survey or certifying finished ground levels and the dimensions and finished levels of all structures within the flood prone land, must be provided to the relevant Councils, Sydney Water, OEH and the SES. The Relevant Councils, Sydney Water, OEH and the SES must be notified in writing that the information is available no later than one month following the completion of construction and be provided with that information. Information requested by the relevant Council, Sydney Water, OEH or the SES must be provided no later than six months following the completion of construction or within another timeframe agreed with the Relevant Council(s), Sydney Water, OEH and the SES.	Section 2
E107	The CSSI must be constructed and operated so as to maintain the NSW Water Quality Objectives where they are being achieved as at the date of this approval, and contribute towards achievement of the NSW Water Quality Objectives over time where they are not being achieved as at the date of this approval, unless an EPL in force in respect of the CSSI contains different requirements in relation to the NSW Water Quality Objectives, in which case those requirements must be complied with.	Sections 4 and 5 (and GWMP)
E108	Drainage feature crossings (permanent and temporary watercourse crossings and stream diversions) and drainage swales and depressions must be undertaken in accordance with relevant guidelines and designed by a suitably qualified and experienced person.	Section 4

1. Introduction

1.1. Overview and context

This Flooding and Hydrology Management Plan (FHMP or Plan) is a sub-plan to the overarching Operational Environmental Management Plan (OEMP) which provides the overall framework for the system and procedures to ensure environmental impacts are minimised and legislative and other requirements are fulfilled. It has been developed to address Conditions of Approval (CoAs) of the Project's Development Consent (CSSI 7400, as modified by CSSI 7400 MODs 1 to 9), which requires the preparation of the FHMP prior to commencement of operation. The CoA requires that the FHMP is prepared to the satisfaction of the Secretary of the Department of Planning, Housing and Infrastructure (DPHI), and necessitates consultation with:

- Directly affected landowners
- Office of Environment and Heritage (OEH)
- Department of Primary Industries – Water (DPI Water)
- State Emergency Services (SES)
- Sydney Water, and
- Relevant Councils (see section 2).

In the context of supporting the OEMP, the FHMP has also been prepared to be consistent with Guideline for the Preparation of Environmental Management Plans (DIPNR, 2004).

1.2. Plan Purpose

Metro Trains Sydney (MTS) has prepared this FHMP to identify and manage flooding and hydrology risks and impacts associated with the operation of the Sydney Metro Chatswood to Sydenham project (the Project).

It outlines operational environmental management measures that will be applied to activities across the Project alignment to manage flooding and hydrology risks and impacts, as detailed in Section 4.3.

1.3. Background

The Project involves the operation of a metro rail line and associated stations between Chatswood Station and just north of Sydenham Station. The Project passes through the local government areas (LGAs) of Willoughby, North Sydney, Sydney and Marrickville. Key operational components of the Project include:

- About 15.5 kilometres of twin rail tunnels (two tunnels located side-by-side) between Mowbray Road, Chatswood and Bedwin Road, Marrickville. The tunnel corridor extends about 30 metres either side of each tunnel centre line and around all stations.
- About 250 metres of above ground metro tracks between Chatswood Station and the northern dive structure.
- A northern dive structure (about 400 metres in length) and tunnel portal south of Chatswood Station and north of Mowbray Road, Chatswood.
- A southern dive structure (about 400 metres in length) and tunnel portal north of Sydenham Station and south of Bedwin Road, Marrickville.
- Metro stations at Crows Nest, Victoria Cross, Barangaroo, Martin Place, Pitt Street (Gadigal) and Waterloo, as well as underground platforms at Central Station and above ground platforms at Sydenham Station.
- Underground pedestrian links and connections to other modes of transport (such as the suburban rail network) and surrounding land uses.
- Services within each of the stations, including mechanical and fresh air ventilation equipment and electrical power substations.
- A permanent power supply from Surry Hills to Gadigal Station.
- A substation (for traction power supply at Artarmon).
- A services facility (for traction power supply and an operational water treatment plant) adjacent to the southern dive structure.

The Project was subject to assessment by the Department of Planning and Environment (DPE) and approval by the Minister of Planning under part 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). An Environmental Impact Statement (EIS) was prepared in May 2016 to describe and assess the Project and recommend management measures to address impacts. The EIS went on public exhibition on 11 May 2016 and submissions closed on 27 June 2016. A Submissions and Preferred Infrastructure Report (SPIR) was prepared to document submissions made during the EIS public display and provide responses to each submission. The impacts from operation of the Project are highlighted in the EIS and SPIR. The EIS has been developed to include a Flooding and Hydrology chapter. Collectively, the EIS and SPIR will be herein referred to as the Environmental Assessment Documentation (EAD).

The Project was declared Critical State Significant Infrastructure (CSSI) and approval was granted by the Minister of Planning in 9 January 2017 (CSSI 7400), including the following modifications (Development Consent):

- MOD 1 – Victoria Cross and Artarmon Substation (approved 18 October 2017)
- MOD 2 – Central Walk (approved 21 December 2017)
- MOD 3 – Martin Place Metro Station (approved 22 March 2018)
- MOD 4 – Sydenham Station and Metro Facility South (approved 13 December 2017)
- MOD 5 – Blues Point Acoustic Shed (approved 2 November 2018)
- MOD 6 – Administrative Changes (approved 21 February 2019)
- MOD 7 – Administrative Changes (approved 24 June 2020)
- MOD 8 – Blues Point Access Site (approved 25 November 2020)
- MOD 9 – Extension to standard construction hours (approved 30 June 2022).

1.4. Plan scope and objectives

This Plan addresses flooding and hydrology impacts associated with the Operation and Maintenance phase of the Project (O&M).

The key objective of the FHMP is to ensure all EAD, mitigation measures and licence/permit requirements relevant to flooding and hydrology are described, scheduled and assigned responsibly as outlined in:

- The EAD prepared for the Project.
- CSSI 7400 Approval.
- All relevant legislation and other requirements described in Section 3.1 of this Plan.

2. Consultation

In accordance with CoA D3 (d) of the Project's Development Consent, the FHMP must be prepared in consultation with relevant government agencies and stakeholders. The status of consultation with these parties and a summary of key issues raised is presented in Table 2. Note that further development in this area is required. As per the EIS, due to the network not anticipating to trigger significant impacts to flooding and hydrology, there are currently not directly affected landowners and therefore their consultation was not required. All correspondence and approvals from external stakeholders is provided in Appendix D.

Table 2: Consultation details

Agency/ stakeholder	Key issues raised	MTS update	Status
Directly affected landowners	N/A	N/A	Closed
OEH	Recommends that NSW State Emergency Service (SES) be provided the opportunity to comment on any flood emergency matters in the operational plan or the emergency plan referenced therein.	The NSW SES were already part of the external stakeholder consultation process	Closed – 5 th June, 2024
DPI Water	No comments	N/A	Closed
SES (v1 review)	The flooding information provided as part of this plan is incomplete, does not contain modelling. We recommend including addition information for NSW SES to adequately understand flood risks for the site, including access and egress during flooding conditions, and strategies for supporting and evacuating persons on site during a flood event.	Flooding information has been provided in v3 of the FHMP.	Closed – 21 st August, 2024 See Appendix D for communication between SES and MTS.
SES (v1 review)	NSW SES requests the following information to adequately assess flood risks: Provision of the related documents as listed in the Flooding & Hydrology Management Plan including: <ul style="list-style-type: none"> Operational Environmental Management Plan Incident Management Plan Severe Weather Conditions Response Plan 	These plans were sent to the NSW SES as per the email in Appendix D.	Closed – 14 th June, 2024
SES (v1 review)	Detailed site and flood mapping including: <ul style="list-style-type: none"> an assessment of the flood risk up to and including the Probable Maximum 	MTS has provided the detailed site and flood mapping requested by NSW SES in v4 of the FHMP.	Closed – 21 st August, 2024 See Appendix D for communication between SES and MTS.

Agency/ stakeholder	Key issues raised	MTS update	Status
	<p>Flood (PMF), on the site and access/egress routes.</p> <ul style="list-style-type: none"> climate change considerations. time to onset, duration, depth, velocity and hydraulic hazard of any flooding or isolation. an assessment of the impact of the proposed development on flood behaviour on the sites themselves as well as surrounding properties. 		
SES (v1 review)	<p>Detailed evacuation plans, which:</p> <ul style="list-style-type: none"> Outline the triggers for site evacuation. Explain how evacuation notifications will be delivered to all persons on site during both the construction and operational phases. Outline evacuation routes for all persons on site to a safe evacuation location for floods up to and including a PMF. Explain any changes to evacuation procedures during road closures related to construction. Are consistent with the NSW SES existing emergency management arrangements. 	MTS has provided evacuation maps in v3 of the FHMP.	Closed – 21st August, 2024 See Appendix D for communication between SES and MTS.
SES (v1 review)	Further, we recommend seeking advice from the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) regarding the impact of the proposed development on flood	The DCCEEW were already part of the external stakeholder consultation process.	Closed – 14 th June, 2024.

Agency/ stakeholder	Key issues raised	MTS update	Status
	behaviour for adjacent and downstream areas.		
SES (v2 review)	Recommend establishing clear triggers for implementing the plan at each site as well as undertaking alternative evacuation actions as identified in the Plan and the implementation of any temporary measures which have been identified. See Attachment A – Principle 2 for further information.	See Section 4.2.3 - MTS has provided clear triggers for implementing the plan at each site in v4 of the FHMP.	Closed – 26 th August 2024. See Appendix D for communication between SES and MTS.
SES (v2 review)	Recommend providing a quick reference of the emergency management actions and their triggers for each site in conjunction with the provided evacuation maps for quick reference for staff at each location.	See Section 4.2.3 - MTS has provided a quick reference of emergency management actions for each site in v4 of the FHMP.	Closed – 26 th August 2024. See Appendix D for communication between SES and MTS.
SES (v2 review)	Recommend developing a testing, monitoring and review schedule for the Plan within the Plan itself. FERP should be regularly exercised, similar to building fire evacuation drills and updated at regular intervals and whenever additional flood information is available or highlighted during the drills or flood events.	See Section 5.5 – MTS has provided an update of this section in v4 of the FHMP to address SES' comment.	Closed – 26 th August 2024. See Appendix D for communication between SES and MTS.
SES (v2 review)	Recommend identifying a safe refuge above the Probable Maximum Flood (PMF) at each evacuation area or site for travellers who may be unable to continue their journey outside the area, due to flooding.	See Section 4.2.3 – MTS has provided a safe refuge above the PMF at each evacuation area in v4 of the FHMP.	Closed – 26 th August 2024. See Appendix D for communication between SES and MTS.
SES (v2 review)	Recommend seeking advice from the Department of Climate Change, Energy, the Environment and Water (DEECW).	The DCCEEW were already part of the external stakeholder consultation process.	Closed – 14 th June 2024.
Sydney Water	Can you please provide us the following clarifications, <ul style="list-style-type: none"> the plan layout where the water treatment plant will be located in relation to the Marrickville Dive. At what point of our Eastern Channel will the plant be discharging into and 	See Figure 1, 2 and 3 for the plan and drainage layouts. Rate of discharge is described in Table 6. Updated in v2 of the FHMP.	Closed - Sydney Water provided their written approval that their comments were addressed on June 11, 2024. See Appendix D.

Agency/ stakeholder	Key issues raised	MTS update	Status
	<ul style="list-style-type: none"> What is the rate of discharge? 		
Willoughby Council	<p>Section E9 states</p> <ul style="list-style-type: none"> Flood information including flood reports, models and geographic information system outputs, and work as executed information from a registered survey or certifying finished ground levels and the dimensions and finished levels of all structures within the flood prone land, must be provided to the relevant Councils, Sydney Water, OEH and the SES. The Relevant Councils, Sydney Water, OEH and the SES must be notified in writing that the information is available no later than one month following the completion of construction and be provided with that information. Information requested by the relevant Council, Sydney Water, OEH or the SES must be provided no later than six months following the completion of construction or within another timeframe agreed with the Relevant Council(s), Sydney Water, OEH and the SES. <p>While Council certainly has some of the information, we do not have a total handover</p>	<p>This information would come from the design part of the project. This plan is only the Operational Flooding and Hydrology Management Plan and therefore does not require to outline this information.</p> <p>Updated in v2 of the FHMP.</p>	<p>Closed - Willoughby Council provided their written approval that their comments were addressed on 22nd July, 2024. See Appendix D.</p>

Agency/ stakeholder	Key issues raised	MTS update	Status
	package which as per the consent we should receive.		
Willoughby Council	<p>Council is curious as to the Management Measures of FH01</p> <p>The performance of the downstream drainage network will be maintained during operation.</p> <p>This does not provide frequency or any contact details. Given the reliance on drainage infrastructure within our LGA to offset impacts, Council thinks this should be detailed. If this is in a corresponding plan, please provide.</p>	<p>This makes part of MTS' general maintenance and inspection processes and procedures. MTS' engineering and environmental teams will manage this process via MTS' SQRE Management System Intalex.</p> <p>Updated in v2 of the FHMP.</p>	<p>Closed - Willoughby Council provided their written approval that their comments were addressed on 22nd July, 2024. See Appendix D.</p>
North Sydney Council	<p>Council requires that any unusual SW excess to be disposed of directly into Sydney Water mains SW and that such discharge does not delay/ disrupt the evacuation of surface/ local SW surge. Any such disposal of stormwater events in Metro facilities would need to be timed and coordinated with stakeholder agencies such as Sydney Water, Council, SES and emergency services.</p>	<p>Noted. Updated in v2 of the FHMP.</p>	<p>Open - MTS responded to North Sydney Council and despite multiple contacts made with Council, no response was provided. The observation from North Sydney Council has been addressed by MTS in this FHMP. It just has not been closed out by North Sydney Council.</p> <p>See Appendix D for a copy of the communication.</p>
City of Sydney	<p>Table 7 – where stations are flood prone the flood depths are presented in inconsistent ways, e.g. flood depths at Waterloo Station are quoted for the 100-year ARI event but PMF flood depths are used at Barangaroo Station.</p>	<p>Noted. This section is taken from the Sydney Metro Chatswood to Sydenham EIS; therefore it has been left in.</p> <p>Updated in v2 of the FHMP.</p>	<p>Closed - City of Sydney provided their written approval that their comments were addressed on 22nd July, 2024. See Appendix D.</p>
City of Sydney	<p>Opening sentence states "This section describes the overall approach to managing and mitigating risks or potential impacts associated with flooding and hydrology during operation of the Project", but table 8 does not include all risks identified in section 4.2, in particular the risk of flooding to Barangaroo Station, Martin Place Station and Waterloo Station.</p>	<p>The OEMP which is referenced in Table 8 contains a risk assessment with management of flooding risks. It also references Intalex which is MTS' SQRE Management System which contains inspections, audits and checklists which will contain flooding related risks.</p> <p>Updated in v2 of the FHMP.</p>	<p>Closed - City of Sydney provided their written approval that their comments were addressed on 22nd July, 2024. See Appendix D.</p>
Inner West Council	<p>The broad comment that there are no adverse consequences of flooding</p>	<p>See Section 4.3 - Updated in v2 of the FHMP.</p>	<p>Closed – Inner West Council provided their written approval that their comments were</p>

Agency/ stakeholder	Key issues raised	MTS update	Status
	because only existing flood affected areas are impacted, does not take into account the increased risk or hazard if the depth of flooding is increased. For example, a low hazard flood area could become a high hazard flood area or flood water could rise to the point where flood water enters buildings/houses, where it did not before. The report does not quantify these potential impacts.		addressed on 25 th July, 2024. See Appendix D. MTS sent them v3 of the FHMP on 30 th July, 2024. See Appendix D for this communication.
Inner West Council	We note that the Emergency Management Plan is referenced, but has not been provided for review, hence Council has not been able to provide any comment in this regard. We also note that the Emergency Management Plan is not reference as a related document in Appendix C.	Emergency Management Plan has been sent to Inner West Council. Emergency Management Plan now referenced in Appendix C. Updated in v2 of the FHMP.	Closed – Inner West Council provided their written approval that their comments were addressed on 25 th July, 2024. See Appendix D. MTS sent them v3 of the FHMP on 30 th July, 2024. See Appendix D for this communication.
Inner West Council	We note that the Marrickville tunnel dive structure is at risk of flood inundation in the 100-year ARI event, albeit that it is identified as a low risk. We note that this infers that the tunnel is likely to be subject to flooding in higher ARI events, including the PMF. These risks are not quantified in the Plan.	See Section 4.2.1.2 for information regarding flooding at the Marrickville Dive Structure. Updated in v2 of the FHMP.	Closed – Inner West Council provided their written approval that their comments were addressed on 25 th July, 2024. See Appendix D. MTS sent them v3 of the FHMP on 31 st July, 2024. See Appendix D for this communication.
Inner West Council	The Marrickville dive structure is stated to be protected by the level of the metro tracks. The reference is only to the height above existing ground level, rather than providing the level relative to the flood levels. Hence, this is a somewhat meaningless statement.	See Section 4.2.1.2 for information regarding flooding at the Marrickville Dive Structure. Updated in v2 of the FHMP.	Closed – Inner West Council provided their written approval that their comments were addressed on 25 th July, 2024. See Appendix D. MTS sent them v3 of the FHMP on 31 st July, 2024. See Appendix D for this communication.
Inner West Council	The table provides a lengthy description of the flood behaviour in and around the dive site. It would be useful if the Plan was supported by flood mapping to more clearly illustrate this flood behaviour.	Flood mapping now included in Section 4.2.3. Updated in v2 of the FHMP.	Closed - Inner West stated they would endorse the plan once the Marrickville Dive Site's Probable Maximum Flood map has been updated in the FHMP. Page 37 now has the updated Probable Maximum Flood map that was required by Inner West Council.

Agency/ stakeholder	Key issues raised	MTS update	Status
			MTS sent them v3 of the FHMP on 31st July, 2024 to close out this comment.
DPHI	<p>Comment 2.1</p> <p>'Table 2: Consultation Details' does not adequately respond to or close out some outstanding issues raised by the following government agencies/stakeholders:</p> <ul style="list-style-type: none"> State Emergency Service (SES) (particularly the request for detailed site flood mapping) North Sydney Council City of Sydney Inner West Council (evacuation plans) Willoughby Council <p>Please provide details of the consultation for each agency and stakeholder in the manner prescribed by condition A9 of the approval. As DPHI is not the approval authority for this document, Sydney Metro is responsible for satisfying itself that all consultation has been adequately closed out and the subplan should reflect this.</p>	<p>See Table 2 and Appendix D for more detail surrounding external consultation. Updated in v3 and 4 of the FHMP.</p>	<p>Closed – City of Sydney, Inner West Council, Willoughby Council, SES.</p> <p>North Sydney Council – See Appendix D for more detail.</p>
DPHI	<p>Comment 2.2</p> <p>Drawings are required detailing the Probable Maximum Flood extent and hazard categories for all parts of the project that are subject to inundation.</p>	<p>MTS have provided the drawings detailing Probable Maximum Flood extent and hazard categories for the stations. Updated in v3 of the FHMP.</p>	<p>Closed – Drawings of Probable Maximum Flood extents and hazard categories have been provided.</p>

3. Statutory requirements

3.1. Legal and other obligations

The legislation and planning instruments considered during development of this Plan are listed below.

- Environmental Planning and Assessment Act 1979 (EP&A Act)*
- Environmental Planning and Assessment Regulation 2000 (EP&A Regulation)*
- Protection of the Environment Operations Act 1997 (POEO Act)*
- Protection of the Environment Operations (General) Regulation 2009.*

The assessment of impacts, risks and management measures discussed in this plan has been informed by a number of guidelines relevant to surface hydrology and flood modelling and assessment:

- Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004).
- Managing Urban Stormwater: Soils and Construction Volume 2 (Department of Environment and Climate Change, 2008a).
- Floodplain Development Manual (NSW Government, 2005b).
- Floodplain Risk Management Guideline: Practical Consideration of Climate Change (Department of Environment and Climate Change, 2007b).
- Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments (Department of Environment, Climate Change and Water, 2010c) New guideline and changes to section 117 direction and EP&A Regulation on flood prone land.
- Planning Circular PS 07-003 (NSW Department of Planning, 2007).

3.2. Development consent conditions

The Project was declared Critical State Significant Infrastructure (CSSI) and approval was granted by the Minister of Planning in 9 January 2017 (CSSI 7400). The conditions of approval (CoAs) include flooding and hydrology requirements to be addressed in the operation phase of the Project. The relevant CoAs are summarised below, with details on how they are addressed within this Plan provided in Compliance Table 1:

- D3 (Operational Environmental Management Plan – OEMP)
- D4 (Operational Environmental Management Plan – OEMP)
- D2 (Operational Environmental Management Plan – OEMP)
- D5 (Operational Environmental Management Plan – OEMP)
- D6 (Operational Environmental Management Plan – OEMP)
- E8 Flooding
- E9 Flooding
- E107 Water
- E108 Water.

3.3. Revised environmental management measures

Revised environmental mitigation measures (REMMs) associated with flooding and hydrology management are listed in the SPIR and outlined in Table 3.

Table 3 REMMs associated with flooding and hydrology

REMM	Requirement	Document Reference
SCW7	Discharges from the tunnel water treatment plant would be monitored to ensure compliance with the discharge criteria determined in consultation with the NSW Environment Protection Authority.	Section 4 (and GWMP)
FH4	Where feasible and reasonable, detailed design would result in no net increase in stormwater runoff rates in all storm events unless it can be demonstrated that increased runoff rates as a result of the project would not increase downstream flood risk.	Section 4
FH5	Where space permits, on-site detention of stormwater would be introduced where stormwater runoff rates are increased. Where there is insufficient space for the provision of on-site detention, the upgrade of downstream infrastructure would be implemented where feasible and reasonable.	Section 4
FH6	Detailed design would occur in consultation with Marrickville Council to ensure future drainage improvement works around the Marrickville dive site would not be precluded.	Section 4
FH7	Consultation would be carried out with Marrickville Council to ensure flood-related outcomes of the project are consistent with any future floodplain risk management study and / or plan developed for the Marrickville Valley Catchment.	Section 4

REMM	Requirement	Document Reference
FH8	The frequency of Sydney Trains rail service disruptions due to flooding would not be increased in the vicinity of the Marrickville dive structure.	Section 4
FH9	<p>Design of the Marrickville dive structure would be reviewed to, where reasonable and feasible, further reduce flood levels for events up to and including the 100-year annual recurrence interval, including at private properties, within the road reserve at Bolton Street and around Sydenham Station.</p> <p>Flood modelling to support detailed design would be carried out in accordance with the following guidelines:</p> <ul style="list-style-type: none"> • Floodplain Development Manual (NSW Government, 2005b) • Floodplain Risk Management Guideline: Practical Consideration of Climate Change (Department of Environment and Climate Change, 2007b) • Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments (Department of Environment, Climate Change and Water, 2010c) • New guideline and changes to section 117 direction and EP&A Regulation on flood prone land, Planning Circular PS 07-003 (NSW Department of Planning, 2007). 	Section 4

3.4. Revised environmental performance outcomes

Revised environmental performance outcomes associated with flooding and hydrology during the operation phase are listed in the SPIR and detailed in the table below.

Table 4 environmental performance outcomes

Desired performance outcome	Environmental performance outcome	Document reference
<p>Flooding The project minimises adverse impacts on existing flooding characteristics. Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.</p> <p>Water – hydrology Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological system, including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved).</p> <p>Sustainable use of water resources.</p>	The performance of the downstream drainage network would be maintained during operation.	Section 4

3.5. Roles and responsibilities

Key roles and responsibilities applicable to this Plan are presented in Table 5. Further details regarding roles and responsibilities are outlined in Section 5.1 of the OEMP.

Table 5: Roles and responsibilities

Roles	Responsibilities
Learning & Development Manager	Work with Environment & Sustainability Advisor to develop training packages addressing environmental risk.

Roles	Responsibilities
	<p>Develop and implement the training delivery schedule for the O&M Phase, including environmental and sustainability aspects</p> <p>Operate reasonably independently, in accordance with MTS's policies; quality, safety and environmental management systems; processes and relevant legislation.</p>
Head of Safety, Quality, Risk & Environment	<p>Be an emergency contact and available to be contacted by EPA, DPIE and The Sydney Metro Authority Representatives on a 24-hour basis.</p> <p>Provide environmental oversight, direction and leadership regarding the environmental and sustainability management of the Project.</p> <p>Support the CEO-MTS on MTS operations and the management of stakeholders including, The Sydney Metro Authority, EPA and other State and Federal government bodies and other government agencies.</p> <p>Review the Project's management systems and key management plans to ensure and maintain compliance with the requirements of the MTS IMS, CoA and EPL.</p> <p>Ensure environmental incidents are managed and reported (to DPIE, EPA and Parent Companies) in accordance with the planning approval and EPL requirements.</p>
Environment & Sustainability Advisor	<p>Obtain all required approvals to facilitate O&M of the Project, including but not limited to the EPL.</p> <p>Undertake environmental risk assessment, and revisit this through the life of the project through continual review and improvement processes within the IMS.</p> <p>Key point of contact for environmental and planning approvals and sustainability stakeholders, including but not limited to DPIE, EPA, ISCA.</p> <p>Be an emergency contact and available to be contacted by EPA, DPIE and The Sydney Metro Authority Representatives on a 24-hour basis.</p> <p>Notify MTS, OpCo2 and agencies as required in response to environmental incidents and potential incidents.</p> <p>Identify and maintain a register of relevant legal, MTS IMS requirements, contractual and other requirements.</p> <p>Obtain all necessary approvals prior to commencing relevant works.</p> <p>Ensure the project induction includes appropriate training regarding the requirements of this OEMP, the EPL and any other key obligations.</p> <p>Ensure identified risks are analysed and evaluated according to agreed criteria. Regularly review identified risks and controls and maintain a risk register.</p> <p>Ensure regular inspections, observations, monitoring and audits are conducted to check the effectiveness of controls and that compliance is maintained.</p> <p>Review subcontractors' performance and compliance with MTS environmental and sustainability requirements.</p> <p>Enter and close out all environmental incidents in the O&M Phase Reporting System.</p> <p>Identify and implement corrective and preventative actions after incidents and share lessons learned within the MTS team or other projects, as applicable.</p>
GM Safety, Quality, Risk & Environment	<p>O&M related investigations, compliance inspections, and data and trend analysis to mitigate safety and environmental risks.</p>

Roles	Responsibilities
	<p>Maintain MTS compliance with relevant environmental standards, and legal and regulatory requirements.</p> <p>Support the Head of Safety, Quality, Risk & Environment with the delivery of key O&M milestones in alignment with MTS legal and regulatory requirements, business objectives and key performance indicators.</p> <p>Ensure preventative and corrective actions requested are completed within appropriate timeframes through efficient monitoring.</p> <p>Expected to operate reasonably independently, in accordance with MTS's policies; quality, safety and environmental management systems; processes and relevant legislation.</p>
GM Engineering & Maintenance Delivery	Responsible for establishing and executing O&M asset management strategy and asset management plan in adherence to the OEMP.
Head of Asset Management	Expected to operate reasonably independently in accordance with MTS's policies, Integrated Management System, processes, Safety Management System and relevant legislation.
Infrastructure Engineering Manager	Expected to operate reasonably independently in accordance with MTS's policies. SQRE management system, processes, and relevant legislations.
Infrastructure Delivery Manager	Expected to operate reasonably independently in accordance with MTS's policies. SQRE management system, processes, and relevant legislations.
Head of Strategy, Corporate Relations & Communications	Providing the delivery of internal and external communication (media, government and stakeholder relations).

3.6. Training

All employees, contractors and utility staff working on the Project will undergo site induction training, in accordance with the Training Management Plan and Section 5.2 of the OEMP. The site induction training will provide initial training on various environmental aspects, including flooding and hydrology management issues/measures.

Records will be kept of all personnel undertaking the site induction training, including the contents the training, date and name of trainer/s.

Targeted training or specific training will also be provided to personnel with a key role in flooding and hydrology monitoring and management, if required.

4. Implementation

4.1. Existing environment

4.1.1. Surface hydrology and drainage infrastructure

The project would be located within drainage catchments that ultimately drain to Middle Harbour, Sydney Harbour and Botany Bay. The catchments the project is located in, the receiving waters and associated drainage infrastructure are summarised in Table 6. All drainage catchments across the project are highly urbanised, with large impervious surfaces created by roads, footpaths and buildings. These impervious surfaces are interspersed with pervious surfaces associated with parkland areas and other unsealed surfaces (such as vacant land and landscaped areas). All natural watercourses have generally been replaced with constructed drainage systems (such as lined and unlined drainage channels, and sub-surface pit and pipe networks) that discharge into the downstream receiving environments (refer to Table 6).

Surface water is generally collected by developed stormwater networks, which consist of road kerb and guttering, lined and unlined drainage channels, and sub-surface pit and pipe networks. The majority of the drainage systems

are owned and maintained by the local council, while a number of the larger trunk drainage systems are assets of Sydney Water. The existing drainage systems, as they would relate to project elements, are described in the table below.

Table 6: Existing drainage catchments, receiving waters and associated drainage infrastructure

Project Location	Catchment	Receiving Waters	Drainage Infrastructure
Chatswood dive site (northern)	Near the top of Scotts Creek and Flat Rock Creek Catchments	Middle Harbour	<ul style="list-style-type: none"> Rail corridor runoff is collected by the rail drainage system and discharged into surrounding. council stormwater systems within the Flat Rock Creek Catchment. Runoff from the Chatswood dive site flows north into the Scotts Creek Catchment and is drained by a stormwater pipe that runs down Hammond. Lane and crosses under the rail corridor at Chapman Avenue.
Artarmon substation	Flat Rock Creek	Middle Harbour	<ul style="list-style-type: none"> Runoff is collected by the drainage networks on Reserve Road and Gore Hill Freeway.
Crows Nest Station	Flat Rock Creek	Middle Harbour	<ul style="list-style-type: none"> Runoff is collected by road kerb and gutter systems and discharged into stormwater pits at the intersection of Oxley Street and Clarke Lane.
Victoria Cross Station	Milson Park	Sydney Harbour	<ul style="list-style-type: none"> Runoff is collected by road kerb and gutter systems and discharged east towards Kirribilli.
Blues Point temporary site	N/A	Sydney Harbour	<ul style="list-style-type: none"> Runoff drains directly into Sydney Harbour.
Barangaroo Station	City Area (Sydney)	Sydney Harbour	<ul style="list-style-type: none"> Runoff is collected by a number of drainage pits and pipes on Hickson Road into the Barangaroo Water Treatment Plant. The water discharges west directly into Sydney Harbour.
Martin Place Station	City Area (Sydney)	Sydney Harbour	<ul style="list-style-type: none"> Runoff is collected by the drainage system in Castlereagh Street, which discharges north to-ward Circular Quay and Sydney Harbour.
Gadigal Station	City Area (Sydney)	Sydney Harbour	<ul style="list-style-type: none"> Runoff is collected by the road drainage systems, and drains north down Pitt Street and eventually discharges directly into Sydney Harbour.
Central Station	Darling Harbour (Sydney)	Sydney Harbour	<ul style="list-style-type: none"> Runoff is collected by the rail corridor drainage system and connects to larger pipe systems draining around and under the site. Rail corridor drainage in the northern half of the site connects to drainage in Eddy Avenue or a trunk drain under the site near Devonshire Street, both of which are part of the Darling Harbour catchment. Rail drainage in the southern half of the site connects to trunk mains under the site from Prince Alfred Park that are part of the Blackwattle Bay catchment.

Project Location	Catchment	Receiving Waters	Drainage Infrastructure
Waterloo Station	Alexandra Canal	Botany Bay via the Cooks River	<ul style="list-style-type: none"> Runoff is collected by drainage systems in Botany Road and Cope Street.
Sydenham Station, Marrickville dive site (southern) and SMTF-S	Marrickville Valley	Botany Bay via the Cooks River	<ul style="list-style-type: none"> Runoff is collected by the rail corridor drainage system or council stormwater system and discharged into the surrounding street and trunk drainage systems. The main drainage features comprise the Eastern Channel and the Sydenham Storage Pit located immediately north of the rail corridor. The Eastern Channel collects runoff from the areas of Enmore, Newtown, and St Peters and discharges it south to the Cooks River and ultimately to Botany Bay. A number of rail culverts between Sydenham Station and the Bedwin Road overbridge drain areas south of the rail line into the Eastern Channel. The Sydenham Storage Pit is a large detention basin that collects urban runoff from areas of Marrickville that is then pumped into Eastern Channel. The Eastern Channel and Sydenham Storage Pit are both assets of Sydney Water. Sydney Metro Trains Facility South contains the Marrickville Water Treatment Plant that collects all water flowing through the metro network tunnel and discharges it into Cooks River at a rate of 13 L/s. The Water Treatment Plant's discharge criteria is managed under EPL 21247. This criterion is outlined in the OEMP. See Figures 1, 2 and 3 below for a plan of the Marrickville Dive site, the location of the WTP and it's drainage layout

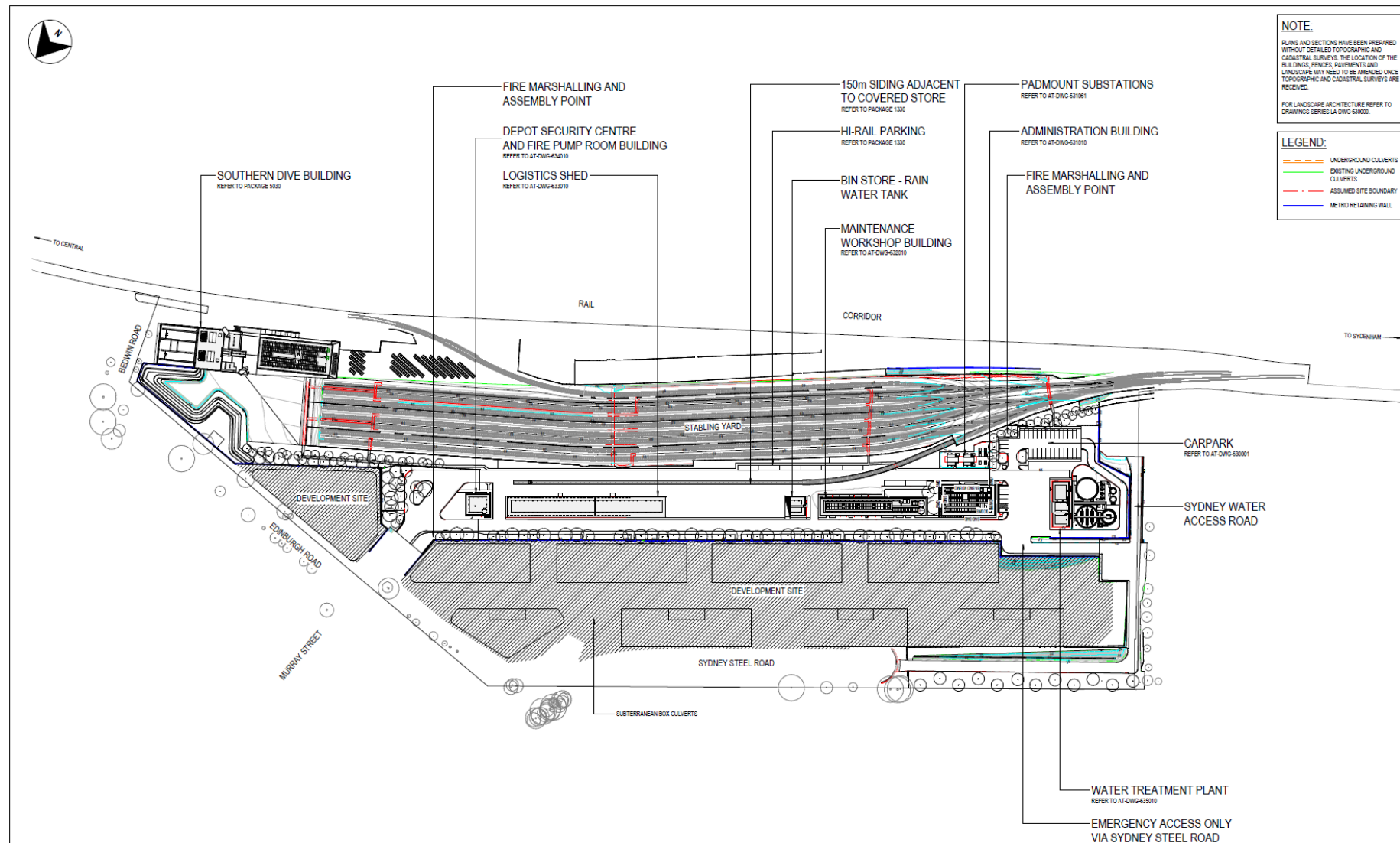


Figure 1: Marrickville Dive Site and location of WTP

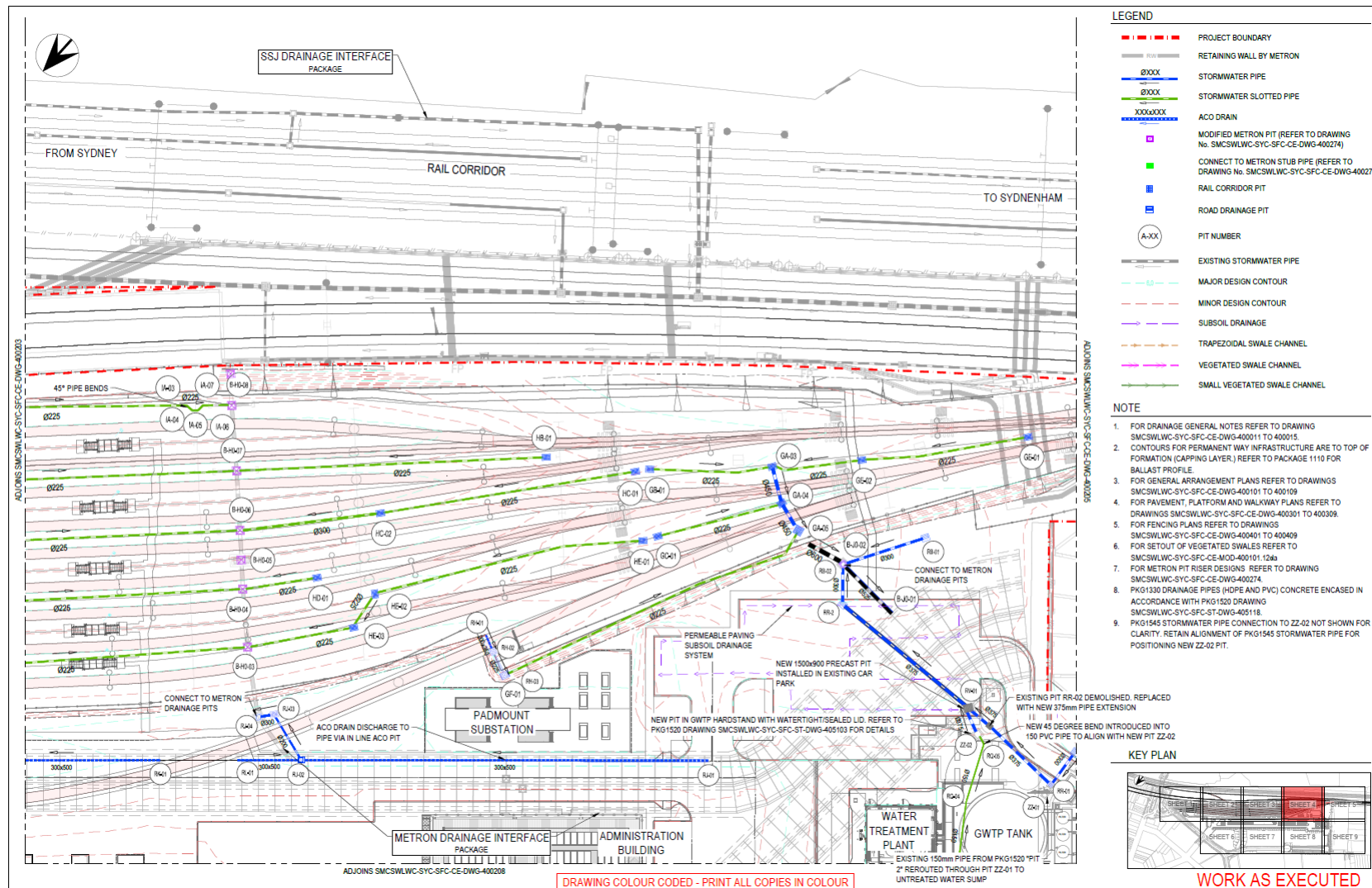


Figure 2: Marrickville Dive Site drainage layout 1

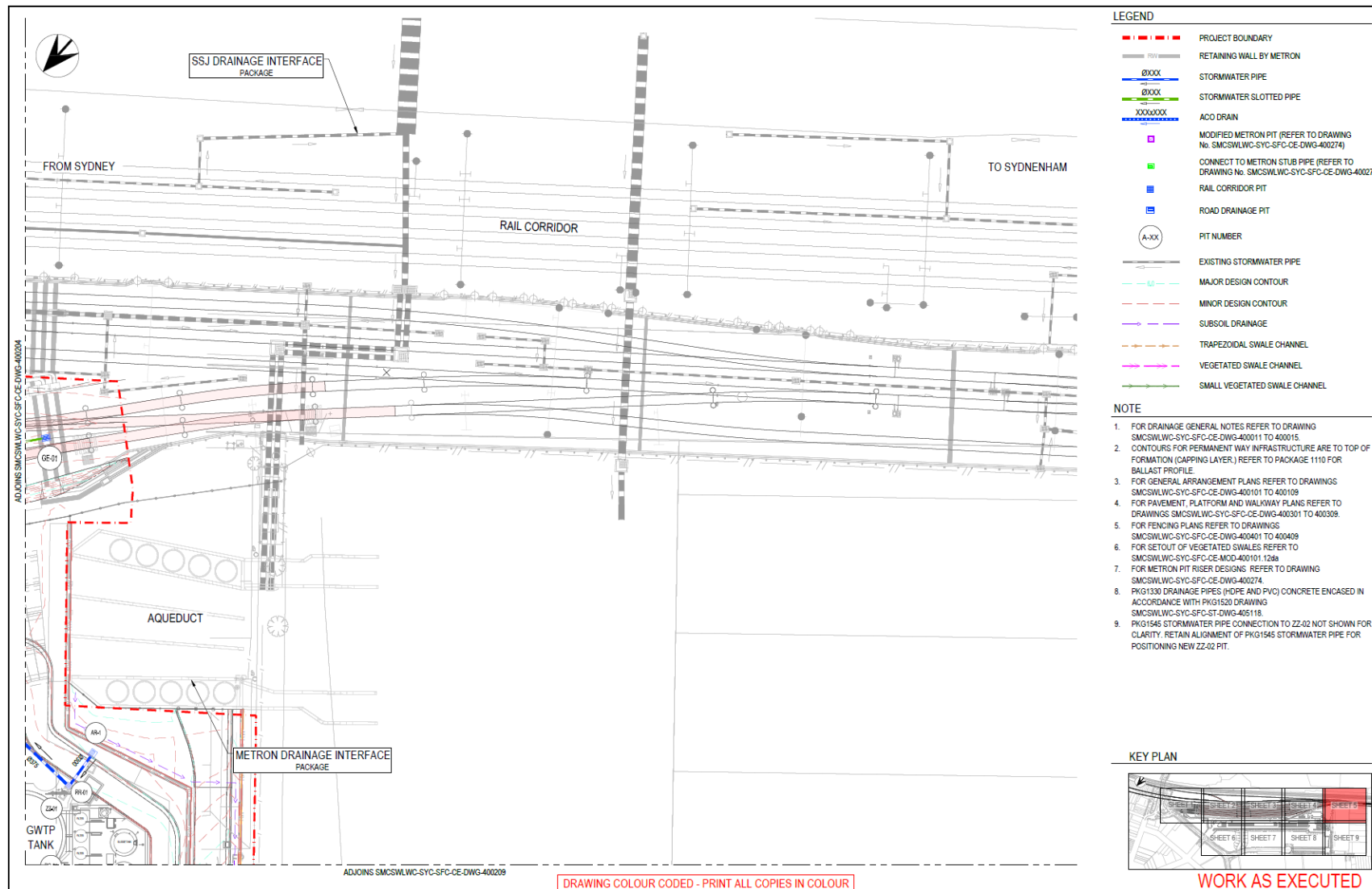


Figure 3: Marrickville Dive Site drainage layout 2

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4.1.2. Flooding

Due to the highly urbanised drainage catchments surrounding the project area, flooding behaviour is expected to be largely controlled by the capacity of stormwater drainage systems and roadways that form overland flow paths. Existing flooding behaviour around the various sites comprising the Project is outlined in the table below.

Table 7: Existing flood behaviour

Location	Existing Flood Behaviour
Chatswood dive site (northern)	The Chatswood dive site is located near the top of the Scotts Creek and Flat Rock Creek drainage catchments. Localised flooding of the construction site and in the rail corridor has the potential to occur during high intensity rainfall events.
Artarmon substation	The site is located near the ridge between sub-catchments and would therefore not be affected by flooding. The main overland flow path near the site is on Reserve Road, which drains south before turning east along the northern side of the Gore Hill Freeway
Crows Nest Station	The site is located at the top of the Flat Rock Creek catchment. During high intensity rainfall events, flows are carried away from the site by the existing road drainage infrastructure
Victoria Cross Station	Urbanised areas of North Sydney drain towards the site. The main overland flow paths around the site are down Berry Street and Miller Street and there is a low point in Miller Street immediately north of the Pacific Highway intersection. The catchment upstream of the Miller Street low point covers about 17 hectares. Flood levels at the Miller Street low point, in the vicinity of the station site, are limited by the downstream level of the Pacific Highway
Barangaroo Station	The site is located along a low-lying area of Hickson Road. The catchment draining toward Hickson Road extends about 200 metres east to Observatory Hill. When the stormwater system capacity is exceeded, floodwaters flow onto Hickson Road from a low point on High Street near Lance Lane. Ponding currently occurs on Hickson Road in the Barangaroo Station site area in events as frequent as the two-year average recurrence interval. Ponding depths of between 0.5 and 0.75 metres would occur in the probable maximum flood event. There will be changes (improvements) to the existing flood environment in this location as a result of drainage infrastructure upgrade work proposed as part of the Central Barangaroo development
Martin Place Station	The catchment falling towards the site extends about 200 metres east to Macquarie Street. The overland flow paths around the site are down Elizabeth, Castlereagh and Hunter streets. Overland flooding occurs during a five-year average recurrence interval event and flood depths of between 0.25 to 0.5 metres would occur in the probable maximum flood. High hazard flooding occurs in Hunter Street in flood events at or higher than the 20-year average recurrence interval.
Gadigal Station	The site is located near the top of the City Area (Sydney) catchment. During high intensity rainfall events, flows would be carried by the surrounding roads and associated drainage networks and would not result in flooding in the vicinity of the Gadigal Station site
Central Station	Urbanised areas of Surry Hills drain towards Central Station from the east. The main overland flow paths that approach Central Station are from: <ul style="list-style-type: none"> › Foveaux Street, where floodwaters continue west down Eddy Avenue toward George Street › Devonshire Street and Prince Alfred Park, where floodwaters enter the Central Station site and pond in low-lying sections of the rail track next to Prince Alfred Park in events as frequent as the two-year average recurrence interval
Waterloo Station	Urban areas of Redfern drain towards the site. Cope Street and Botany Road are the main overland flow paths around the site. Flood depths of up to one metre occur near the Cope Street and Wellington Street intersection in the 100-year average recurrence interval event.
Sydenham Station, Marrickville dive site (southern) and SMTF-S	The Marrickville dive site would be located in low-lying terrain where flooding occurs. Areas to the north and south of the existing rail lines (T2, T3 and T4 rail lines) drain towards the Marrickville dive site and Eastern Channel. The main overland flow path from the north is down Murray Street before floodwaters enter the upstream section of Eastern Channel. Catchments from south of the rail corridor drain via a number of culverts under the rail line into Eastern Channel. These culverts flow full in flood events with an average recurrence interval of two years or more, causing floodwaters to flow over the rail line near the Bedwin Road overbridge and Sydenham Station. Currently in a 10-year average recurrence interval event, overland stormwater flows mostly occur to the south of the rail corridor. From Grove and Sutherland streets, stormwater flows westward and across Unwins Bridge Road and through commercial properties before pooling mostly in low-lying areas on Bolton Street. Low-level flooding occurs within the rail corridor immediately to the north of Sydenham Station. Low to mid-level flooding also occurs on Murray Street. Currently in a 100-year

Location	Existing Flood Behaviour
	<p>average recurrence interval event, overland stormwater flows follow similar flow paths to the one in 10-year annual recurrence interval event.</p> <p>Low to mid-level flooding occurs in Grove and Sutherland streets and Unwins Bridge Road and high-level flooding is predicted to occur in Bolton Street. Mid-level flooding (about 0.75 metres peak depth) is predicted to occur on Murray Street in this flood event. At Sydenham Station, flooding of the rail tracks between station platforms occurs with peak depths reaching about 0.5 metres. Low-level flooding of the rail corridor occurs to the north of Sydenham Station and also in the vicinity of Murray Street (south of Bedwin Road) in the 100-year average recurrence interval flood event.</p> <p>Currently the modelled probable maximum flood event results in extensive flooding around the Marrickville dive site. The majority of the existing rail line between the Bedwin Road overbridge and Sydenham Station would be flooded with depths varying between 0.5 and 1.5 metres. Under current site conditions mid to high-level flooding is modelled to occur in the probable maximum flood event on Unwins Bridge Road, and high-level flooding to depths exceeding 1.5 metres is predicted to occur on Murray Street, Bolton Street and at Sydenham Station between the station platforms</p>

4.2. Impacts and risks

4.2.1. EIS identified impacts

4.2.1.1. Surface hydrology and drainage infrastructure

The project has the potential to alter localised stormwater catchment flows and the operation of existing stormwater drainage networks. Potential impacts associated with increased local drainage catchment areas and increased runoff due to an increase in impervious surfaces may occur as a result of widening of the T1 North Shore Line corridor at Chatswood and at the Artarmon substation site. At all other locations, the aboveground station infrastructure are located within the footprint of existing development and would have a negligible impact on the existing surface hydrology.

Surface hydrology impacts on existing stormwater drainage networks have been primarily addressed through design measures including:

- Location of the footprint within existing development areas so as to have a negligible impact on the existing surface hydrology.
- All surface water from aboveground facilities and tunnel dive structures are collected by new drainage infrastructure and connected to existing stormwater systems.
- Surface water from aboveground facilities and tunnel dive structures, including for the T1 North Shore Line corridor and at the Artarmon substation site, is managed such that there would be no net increase in discharge rates from existing discharge locations into the downstream drainage system for all storm events.
- On-site detention of stormwater is introduced where surface water runoff rates are increased and where space for on-site detention is available.
- The southern services facility, located adjacent to the Marrickville dive site includes a water treatment plant to treat all tunnel water prior to release into Eastern Channel.

4.2.1.2. Flooding

Barangaroo Station, Martin Place Station and Waterloo Station sites are at risk of flooding during operation. Aboveground stations and ancillary infrastructure would have a negligible impact on existing flood behaviour because the infrastructure is located within the footprint of existing structures or located away from identified overland flow paths. To avoid flooding impacts on project infrastructure, station entries aboveground rail system facilities are located above the Probable Maximum Flood level and at least 0.5 metres above the 100-year average recurrence interval flood level, where feasible and reasonable.

To avoid inundation, the tunnel dive structures have been designed at or above the Probable Maximum Flood level for mainstream flooding. Drainage at the dive structures are designed to manage flows for the 100-year average recurrence interval event. No flooding impacts on, or as a result of, the project are anticipated at or surrounding the Chatswood dive site. To avoid flooding of the Marrickville dive structure, the metro tracks have been designed at a

level of about 6.3 metres Australian Height Datum near the start of the dive structure, which is about 1.5 metres above the existing ground level. As per the probable maximum flood extent map of the Marrickville Dive Site in Section 4.2.3, the 100 year ARI event change in flood level at the site would not be over 450mm and therefore no flooding is expected. Potential operational risks

The establishment of project infrastructure within flood-prone areas such as at the Marrickville dive structure has the potential to affect the existing flood behaviour surrounding the sites due to the loss of overland flow path capacity, loss of floodplain storage and change to local catchment boundaries (which could change the distribution of stormwater between existing drainage networks). During operation, the flood hazard at the Marrickville tunnel dive structure in the 100-year average recurrence interval event is low, with high hazard areas being located at the Bolton Street low point (a flood storage location) and along Eastern Channel (a floodway).

The project will result in increased flood levels in areas that currently experience flooding (that is, no additional properties would be flood-affected as a result of the project in scenarios up to and including the 100-year average recurrence interval flood event). With the implementation of flood mitigating drainage infrastructure treatments, flood levels would increase only in those parts of the road network and rail corridor that currently experience flooding (for example Bolton Street and the rail corridor from Bedwin road up to and including Sydenham Station. It must be noted, that as per Line Wide's Climate Change Impact Assessment Report (2024), the entry portals to the tunnel and the ground levels at the project sites associated the Line Wide Package have been set to be above the PMF flood level, including the Marrickville dive site. Furthermore, in accordance with the SWTC drainage, infrastructure has been designed to account for a 10% increase in rainfall intensity to account for climate change. Section 4.2.3 displays the probable maximum flood extent drawings for all parts of the project

4.2.1.3. Emergency management

Given that the increase in flood levels would only occur at areas already subject to flooding, the project would not require changes to existing community emergency management arrangements for flooding and there would not be increased social and / or economic costs to the community as consequence of flooding.

Emergency management arrangements, including for flooding events, are detail in the Emergency Management Plan (NWRLOTS-NRT-ADM-PM-PLN-721428).

4.2.2. Probable Maximum Flood extent drawings and analysis

This section contains drawings detailing the Probable Maximum Flood extent and hazard categories (if known) for all parts of the project. It also includes an assessment of the flood risk up to and including the Probable Maximum Flood (PMF) on the site and access/egress routes, climate change considerations, time to onset, duration, depth, velocity and hydraulic hazard of any flooding or isolation as well as an assessment of the impact of the proposed development on flood behaviour on the sites themselves as well as surrounding properties. Specific triggers for evacuations, emergency management actions and safe refuge locations above the PMF have also been outlined. As Central station and Sydenham stations are owned and operated by Sydney Trains, MTS will follow their advice and instructions in times of emergency and/or evacuation.

4.2.2.1. Chatswood Dive Site

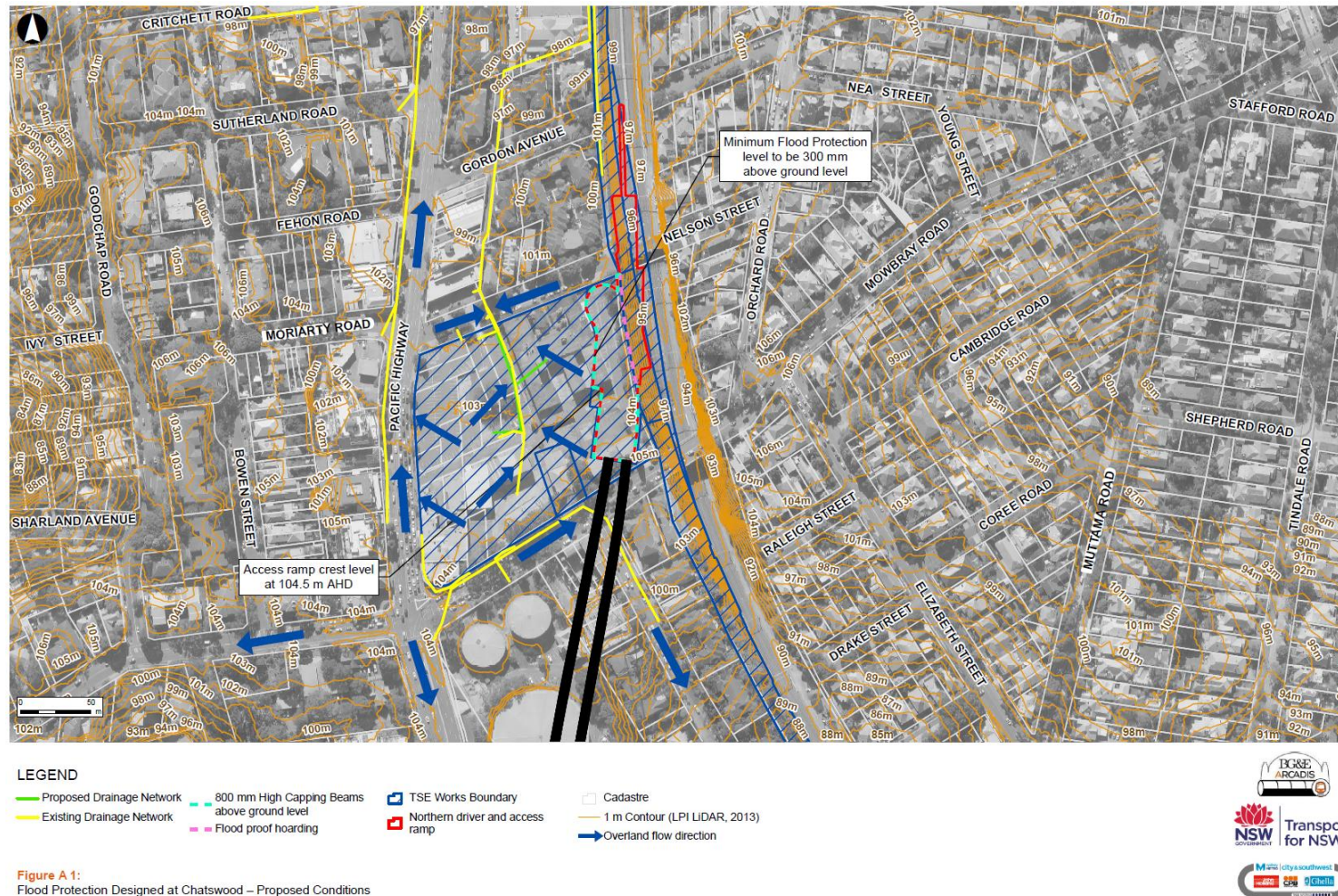


Figure 4: Chatswood Dive Site Flood Protection Diagram

Trigger for implementation of F&H Plan

As stated in Section 4.2.1.2, to avoid inundation, the tunnel dive structures have been designed at or above the Probable Maximum Flood (PMF) level for mainstream flooding. Drainage at the dive structures is designed to manage flows for the 100-year average recurrence interval event. No flooding impacts on, or as a result of, the project is anticipated at or surrounding the Chatswood dive site. Therefore, no triggers for implementing the Flooding and Hydrology Plan are required.

Emergency Management Actions

As this site is a dive site and not an active metro station, there is currently no site incident management plan to indicate emergency management actions or triggers, therefore the MTS Emergency Management Plan is to be consulted for this purpose.

Safe Refuge Location above the PMF

As the dive structures have been designed at or above the PMF, the entire location is a safe refuge location.

Crows Nest



Figure 5: Crows Nest PMF Diagram

The following information has been obtained from the Crows Nest Station Design and Technical Services Report for Sydney Metro.

Crows Nest station is situated on the Pacific Highway in Crows Nest, which is the highest point in the catchment draining to Middle Harbour. The Crows Nest station site is highly urbanised and the streets have a steep gradient. Given the highly impervious nature of the Site surrounds, it is expected that storms of a “flash flood” nature would produce the worst-scenario flooding outcome around the station. The North Sydney Local Government Area (LGA) Flood Study (WMA water, 2017) model was provided by North Sydney Council (NSC) to use as the base case flood model for defining flood behaviour in the vicinity of Crows Nest Station. The objective of the North Sydney LGA Flood Study (WMA water, 2017) was to investigate local overland flooding and mainstream flooding to determine the nature and extent of the flood hazard over the entire LGA. It is acknowledged that this Flood Study model represents the best estimate of flood behaviour in the North Sydney LGA.

Given the positioning of the station at the top of the catchment and steep gradient of the adjacent roads, the 1% AEP flood depths in the gutter next to the station are typically less than 150 mm, with the exception of an undrained sag on Pacific Highway adjacent to the station where the gutter flow depth in the design scenario is 200 mm. Similarly, the PMF flood depths in the gutter next to the Site are typically less than 250 mm with the exception of the Pacific Highway undrained sag next to the northern Site, where the PMF flood depth in the design scenario is 320 mm. It is noted the proposed Crows Nest Station building footprint covers the same surface area as the existing site. The adverse flood impacts are therefore not a result of flow obstructions related to an increased building footprint occupying the Site, rather by regarding the roads and footpaths near the Site.

The adopted climate change factor of 19.7% for the 1% AEP event rainfall is derived from the 2090 representative concentration pathway (RCP) scenario 8.5 conditions for the Crows Nest location, as recommended by AR&R 2019. It shall be noted that sea-level rise would not impact the Site which is situated at an elevation of around 88 m AHD. As shown in Appendix R Figure A04 and Table 2-14, the 1% AEP + 19.7% increase in rainfall intensity flood level adjacent to the Site is always lower than the PMF flood level. As the PMF flood is a worse case scenario and therefore not subject to climate change, this indicates that climate change would have no impact on the flood protection levels for Crows Nest station. Furthermore, 1% AEP flood levels are not sensitive to climate change in the vicinity of Crows Nest station.

Trigger for implementation of F&H Plan

The MTS Severe Weather Conditions Response Plan (SWCR) outlines MTS’ response to minimise the impact and risk resulting from severe weather conditions such as rainfall. Responsible MTS employees, contractors and employees of MTS contractors are bound by the SWCR. For a general overview of the definitions and processes related to severe weather conditions, see this plan.

For Crows Nest specifically, triggers would include:

- When expected or actual rainfall is over 30mm over a 6-hour period, or over 100mm over a 24-hour period that could result in a flash flood, especially on the corner of Clarke Lane and Oxley Street which features the most at risk flooding area on the site. MTS station staff can monitor the NSW SES’ utilisation of the Australian Warning System on their website or the HazardWatch website and app or from local severe weather alerts. The MTS Environment and Sustainability Advisor to also monitor expected rainfall events and let relevant station staff know.
- Flooding from other sources such as water intrusions or surrounding premises’/roads.
- Internal or external pump failures (e.g. sump pumps)

Emergency Management Actions

The Site Incident Management Plan (SIMP) for Crows Nest is the document that outlines site specific information related to emergencies at the Metro Station. See that document for all relevant emergency management actions.

See below for a quick reference guide for emergency management actions:

1. When a flash flood or sustained heavy rainfall requires an evacuation, the station staff report the incident with MTS’ Operations Control Centre (OCC) who manage the overall information flow for internal and external communications relating to MTS and the Metro Station. This includes to emergency services such as Police, Ambulance and the NSW SES)

2. Station staff, with help from the OCC decide if a full evacuation, partial evacuation, or a shelter in place situation is required.

If a full evacuation is necessary, the station's wardens help evacuate customers via the egress routes to Assembly area A located in Figure 6 below just off Hume Street. This assembly point is safe from a PMF and will ensure customers are safe until emergency services (such as the SES) arrive. Also, if customers are unable to continue their journey outside the area, then a partial evacuation or a shelter in place situation would be advised.

If a partial evacuation is required, the stations wardens will ensure customers move away from the localised flooding hazard to a safe area within the station.

When conditions external to the building cause a greater hazard to occupants than remaining within the building, a shelter in place is implemented and the station's warden's assist customers to find safety in the station itself.

3. All persons at the relevant Assembly Areas are required to stay until the surrounding area is deemed safe by emergency services and MTS' OCC.

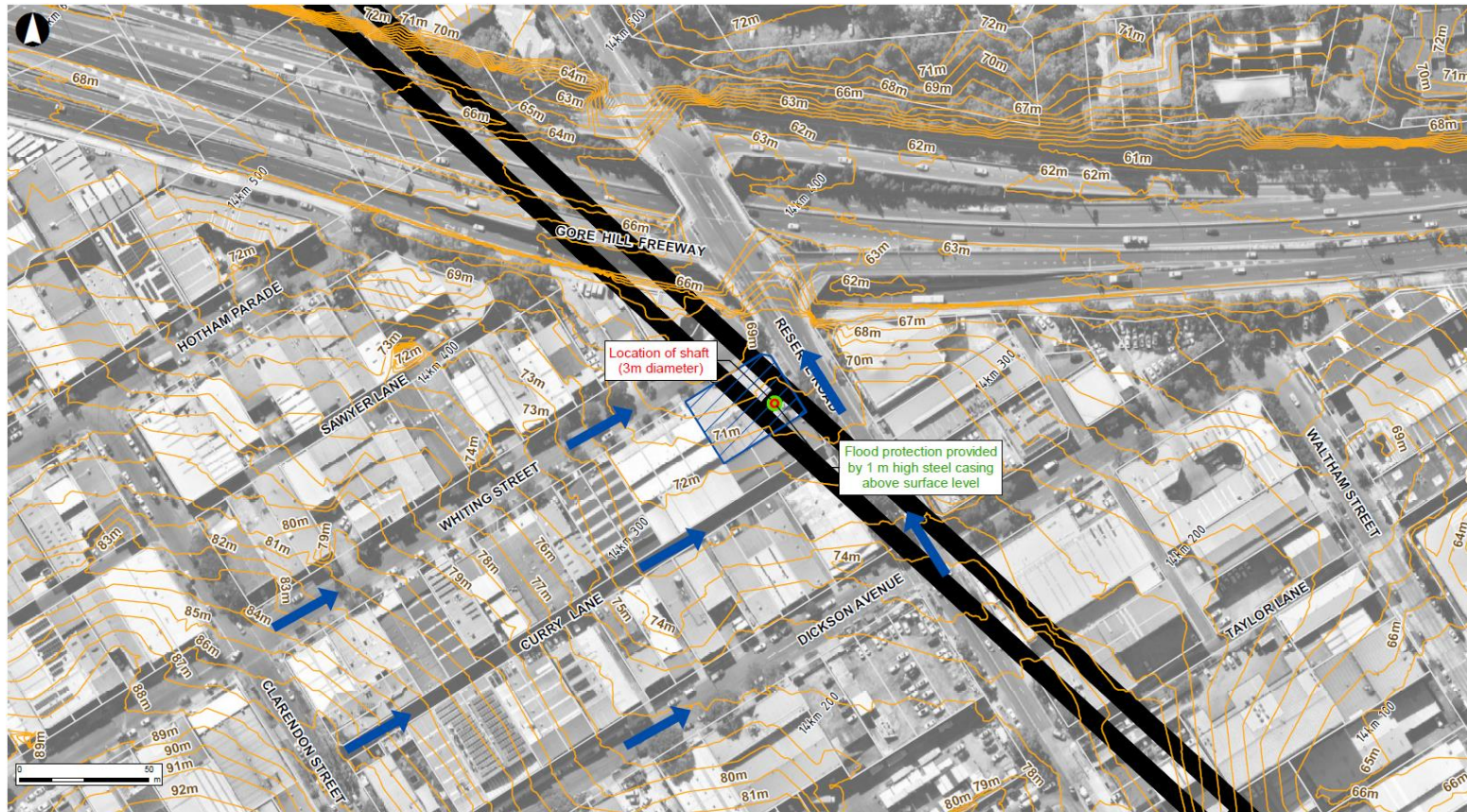
Safe Refuge Location above the PMF

Reviewing the information above with the site evacuation map below, it is deemed that a PMF will have minimal effect on the access/egress of persons evacuating the site to Assembly Area A and customers will be safe there. However the MTS staff on site will be able to assist in the event of a flooding emergency. There is also an Emergency Control Centre on site and this is where the Chief Warden establishes control, communication and coordination of the Emergency Control Organisation team and liaises with the OCC and emergency services. This process will also assist in the event of a flooding emergency to ensure customers are safe from a PMF.



Figure 6: Crows Nest Site Plan and Evacuation Map

Artarmon Substation



LEGEND








-  Running Tunnel
-  TSE Works Boundary
-  Location of substation shaft
-  Location of flood protection
-  Cadastre
-  1 m Contour (LPI LiDAR, 2013)
-  Overland flow direction

Figure C 1:
Flood Protection Designed at Artarmon Substation Shaft – Proposed Conditions



Figure 7: Artarmon Shaft Flood Protection Diagram

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Trigger for implementation of F&H Plan

The Artarmon substation will be protected by a 1m high steel casing above the surface level to prevent water from entering inside from the ground level. It will also be managed such that there would be no net increase in discharge rates from existing discharge locations into the downstream drainage system for all storm events. Therefore there is no requirement for triggers for evacuation.

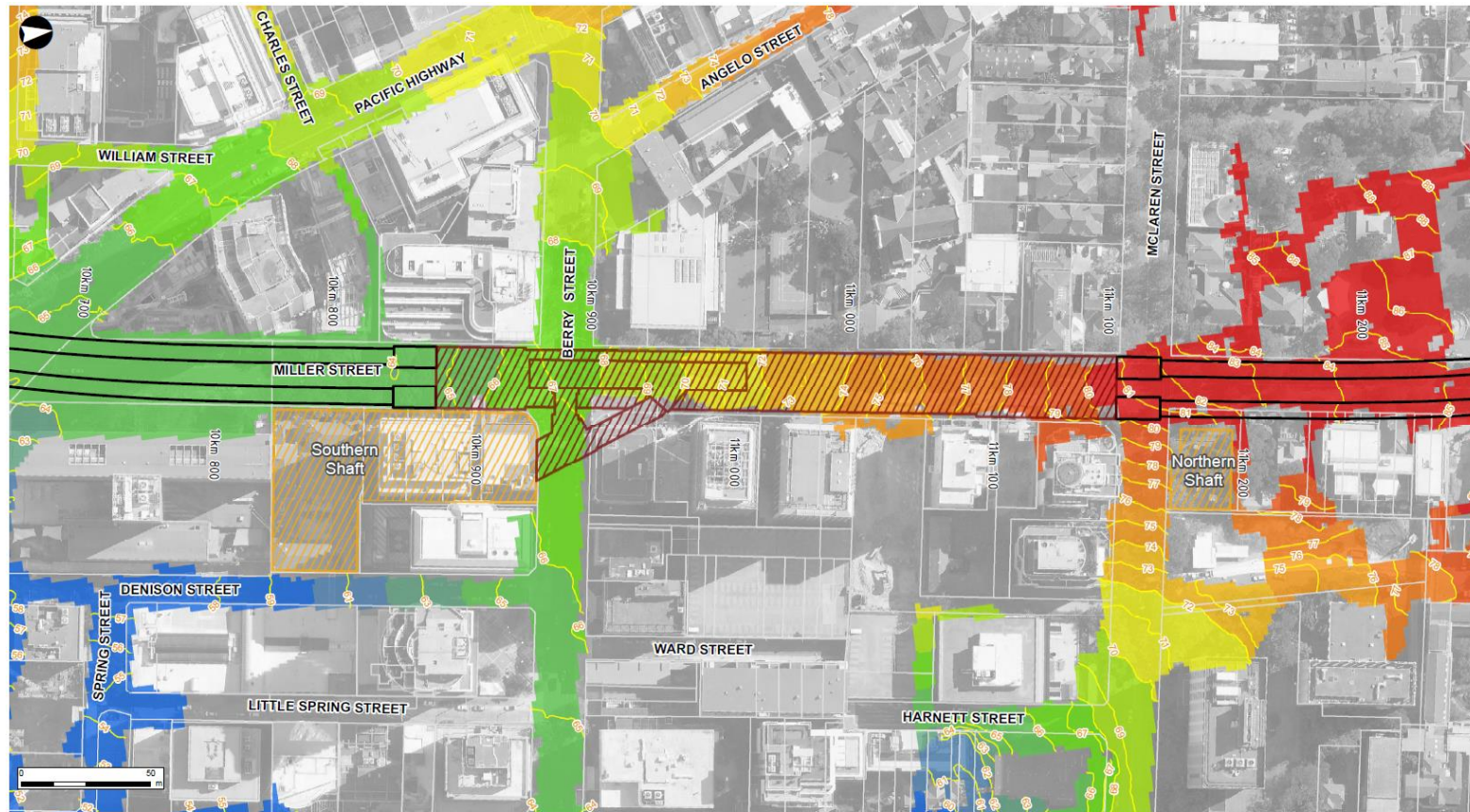
Emergency Management Actions

As this site is a substation and not an active metro station, there is currently no site incident management plan to indicate emergency management actions or triggers, therefore the MTS Emergency Management Plan is to be consulted for this purpose.

Safe Refuge Location above the PMF

No safe refuge location is required.

Victoria Cross



LEGEND










		Flood Level (mAH)					
							
							

Figure D 5:
Peak Flood Level at Victoria Cross for the Probable Maximum Flood Event – Proposed Conditions

Figure 8: Victoria Cross PMF Diagram

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Flooding and Hydrology Plan
SMCSWTS2-MTS-1NL-EM-PLN-002711 | version 04
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The following information has been obtained from the Stormwater Management Plan and Flood Impact Assessment - Victoria Cross Integrated Station Development Document (SMCSWSVI-LLC-SVC-CE-REP-000005). The Victoria Cross (south) re-development site and the adjoining MLC site are located at a low point in Miller Street (approximately mid-block between Mount Street and Berry Street). Stormwater runoff collects at this low point and during larger storm events the water discharges through the two properties to the downstream street network. Surface runoff will be collected by a series of Council owned existing and new stormwater inlet pits along the Miller Street kerb alignment and directed into the proposed new stormwater storage tank in the Miller Street verge before discharging into the re-aligned Sydney Water trunk main and continuing downstream through the site.

After flood mapping of the site, results indicate minor afflux (flood level increase) during a PMF event. Most of the afflux is less than 50mm and located on Berry Street and Spring Street. There are a few spots where the afflux is between 50mm and 100mm, these locations are on Miller Street, Denison Street and Mount Street. However, the magnitude of increase is comparable with the flood modelling results obtained previously by the Design Stage 1 design.

The Victoria Cross Station has two stations entrance boxes connected by a cavern platform directly beneath Miller Street. The North Station Entrance is located at 50 McLaren Street, North Sydney, and includes an additional station entrance, boosting access for customers. The modelling results show that there is a flow path in Miller Street and it goes southwards before spreading to two flow paths in the intersection with McLaren Street. One goes eastwards along McLaren Street and the other one goes southwards along Miller Street. There are two breaking out spots in Miller Street in the 100year ARI event, where flow leaves the road reserve. The first one occurs north of the entrance and flows bypass the east boundary of the north station building. The second one flows directly into the site.

After flooding mapping of the site, results indicate minor afflux (flood level increase) during a PMF event. Most of the afflux is less than 50mm and located on McLaren Street, Miller Street (south of the site) and an isolated patch in the northeast of the building. The flood level increase is greater than 50mm adjacent Miller Street, South of the site. Having checked street view, the flood level increase is exaggerated as the model did not allow water to flow across possible gaps between buildings. A check for flood ingress into the station entries has been undertaken to confirm all entrances, openings, voids or paths from the street level to the station are protected from flood ingress in all storm events up to and including the PMF.

For the climate change analysis, the Floodplain Risk Management Guideline – Practical Consideration of Climate Change (October 2007) recommends sensitivity analysis on flood modelling should be undertaken to develop an understanding of the effect of various levels of change in the hydrologic regime on the project at hand. Specifically, it is suggested that increases of 10%, 20% and 30% to rainfall intensity be considered. In this assessment, 10% rainfall increase has been adopted as the base design rainfall. The increase of 20% and 30% in rainfall intensity for the 100year ARI event has been analysed. The maps of flood level difference are documents in Appendix A.3 of the Victoria Cross Integrated Station Development Document. The flood level is increased in the whole catchment covering both north and south station entrance. The increase is greater than 50mm in front of the MLC building. However, the pedestrian link crossing the south station site is not overtopped even a 30% increase in rainfall in the 100year ARI event. The sea level component of climate change has not been incorporated into the design as it is too far removed to have any meaningful impact on the outcomes of the modelling.

The conclusion of the Victoria Cross Integrated Station Development Document deemed that the flood modelling indicated that flood waters surrounding and internal to the development can be managed to mimic or improve existing flood impacts without having a significant impact on adjoining and downstream properties. Significant improvement has been made to the site itself through careful grading and upgraded trunk stormwater infrastructure which allows stormwater flows to be collected and conveyed underground for storm events up to the 1% AEP (100year ARI) rather than overland as is currently the case. The impacts of climate change has been incorporated in the stormwater and flood modelling with an increase of 10% rainfall intensity which is also reflected in the design of the local and trunk stormwater drainage systems. Safety is of paramount importance during the design of this overland flow with careful grading to any building entrance and levels set to prevent these flows from entering the building. Where this cannot be achieved, safety measures have been incorporated in the form of flood barriers to prevent flows from entering the building (e.g. at lift shafts). Hazard has been assessed through the site link and adjacent to the building in accordance with Australian Rainfall & Runoff categories to ensure that there is safe access to and from the building.

Trigger for implementation of F&H Plan

The MTS Severe Weather Conditions Response Plan (SWCR) outlines MTS' response to minimise the impact and risk resulting from severe weather conditions such as rainfall. Responsible MTS employees, contractors and employees of MTS contractors are bound by the SWCR. For a general overview of the definitions and processes related to severe weather conditions, see this plan.

For Victoria Cross specifically, triggers would include:

- When expected or actual rainfall is over 30mm over a 6-hour period, or over 100mm over a 24-hour period that could result in a flash flood, especially on Miller Street, Denison Street and Mount Street near the northern site which features the most at risk flooding area on the site. MTS station staff can monitor the NSW SES' utilisation of the Australian Warning System on their website or the HazardWatch website and app or from local severe weather alerts. The MTS Environment and Sustainability Advisor to also monitor expected rainfall events and let relevant station staff know.
- Flooding from other sources such as water intrusions or surrounding premises'/roads.
- Internal or external pump failures (e.g. sump pumps)

Emergency Management Actions

The Site Incident Management Plan (SIMP) for Victoria Cross is the document that outlines site specific information related to emergencies at the Metro Station. See that document for all relevant emergency management actions.

See below for a quick reference guide for emergency management actions:

1. When a flash flood or sustained heavy rainfall requires an evacuation, the station staff report the incident with MTS' Operations Control Centre (OCC) who manage the overall information flow for internal and external communications relating to MTS and the Metro Station. This includes to emergency services such as Police, Ambulance and the NSW SES)
2. Station staff, with help from the OCC decide if a full evacuation, partial evacuation, or a shelter in place situation is required.

If a full evacuation is necessary, the station's wardens help evacuate customers via the egress routes to Assembly area A located in Figure 9 below to Ted Mac Civic Park. This assembly point is safe from a PMF and will ensure customers are safe until emergency services (such as the SES) arrive. If the access to Miller Street is flooded and it is not possible to assemble at Ted Mac Civic Park, then the below partial evacuation or shelter in place options could be advised. Also, if customers are unable to continue their journey outside the area, then a partial evacuation or a shelter in place situation would be advised.

If a partial evacuation is required, the stations wardens will ensure customers move away from the localised flooding hazard to a safe area within the station.

When conditions external to the building cause a greater hazard to occupants than remaining within the building, a shelter in place is implemented and the station's warden's assist customers to find safety in the station itself.

3. All persons at the relevant Assembly Areas are required to stay until the surrounding area is deemed safe by emergency services and MTS' OCC.

Safe Refuge Location above the PMF

Reviewing the information above with the site evacuation map below, it is deemed that a PMF will have minimal effect on the access/egress of persons evacuating the site to Assembly Area A and customers will be safe there. However, the MTS staff on site will be able to assist in the event of a flooding emergency. There is also an Emergency Control Centre on site and this is where the Chief Warden establishes control, communication and coordination of the Emergency Control Organisation team and liaises with the OCC and emergency services. This process will also assist in the event of a flooding emergency to ensure customers are safe from a PMF.

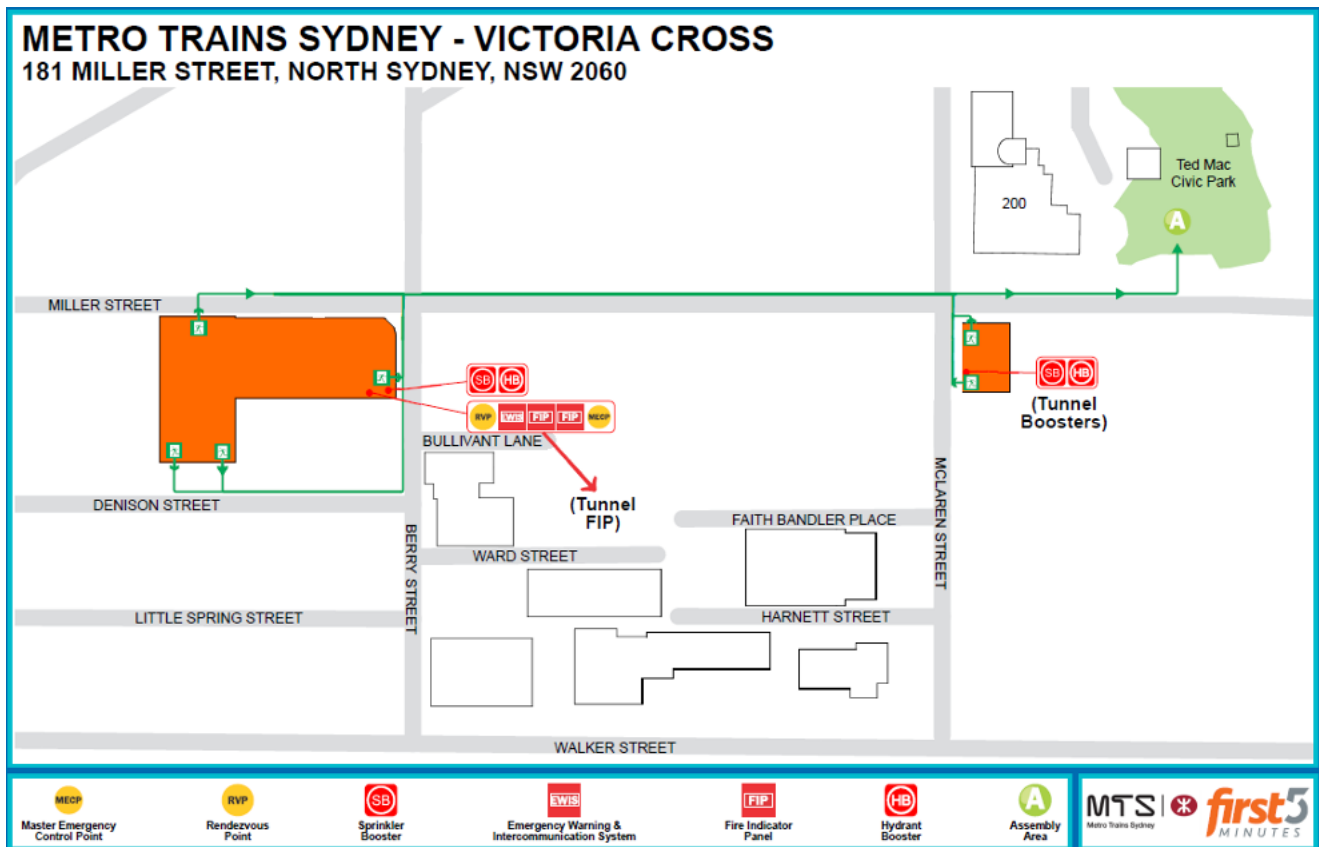


Figure 9: Victoria Cross Site Plan and Evacuation

Blues Point Shaft

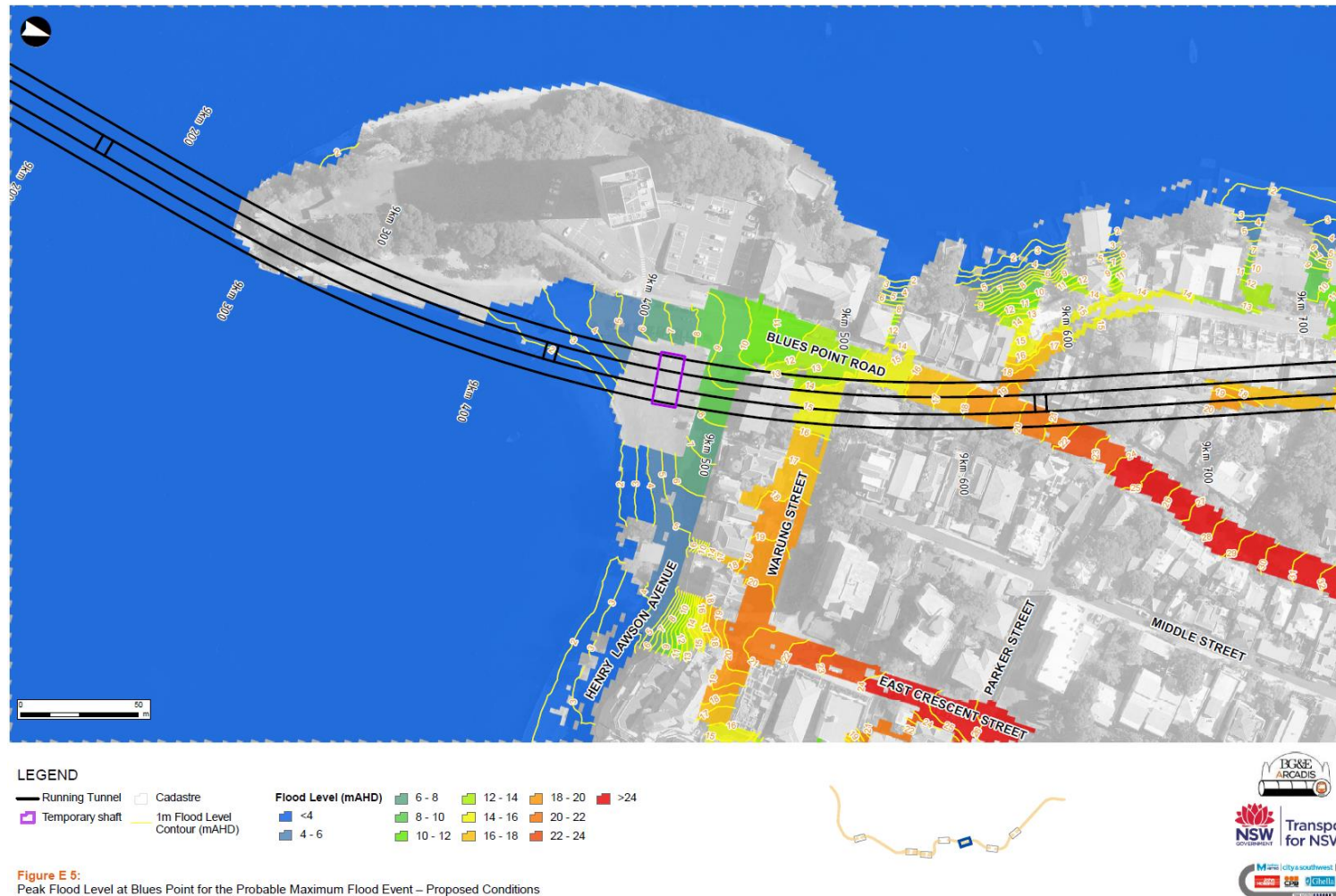


Figure 10: Blues Point Shaft PMF Diagram

An MTR, John Holland and UGL Rail Company



Trigger for implementation of F&H Plan

The Blues Point shaft will be managed such that there would be no net increase in discharge rates from existing discharge locations into the downstream drainage system for all storm events. Therefore there is no requirement for triggers for evacuation.

Emergency Management Actions

As this site is a shaft and not an active metro station, there is currently no site incident management plan to indicate emergency management actions or triggers, therefore the MTS Emergency Management Plan is to be consulted for this purpose.

Safe Refuge Location above the PMF

No safe refuge location is required.

Barangaroo

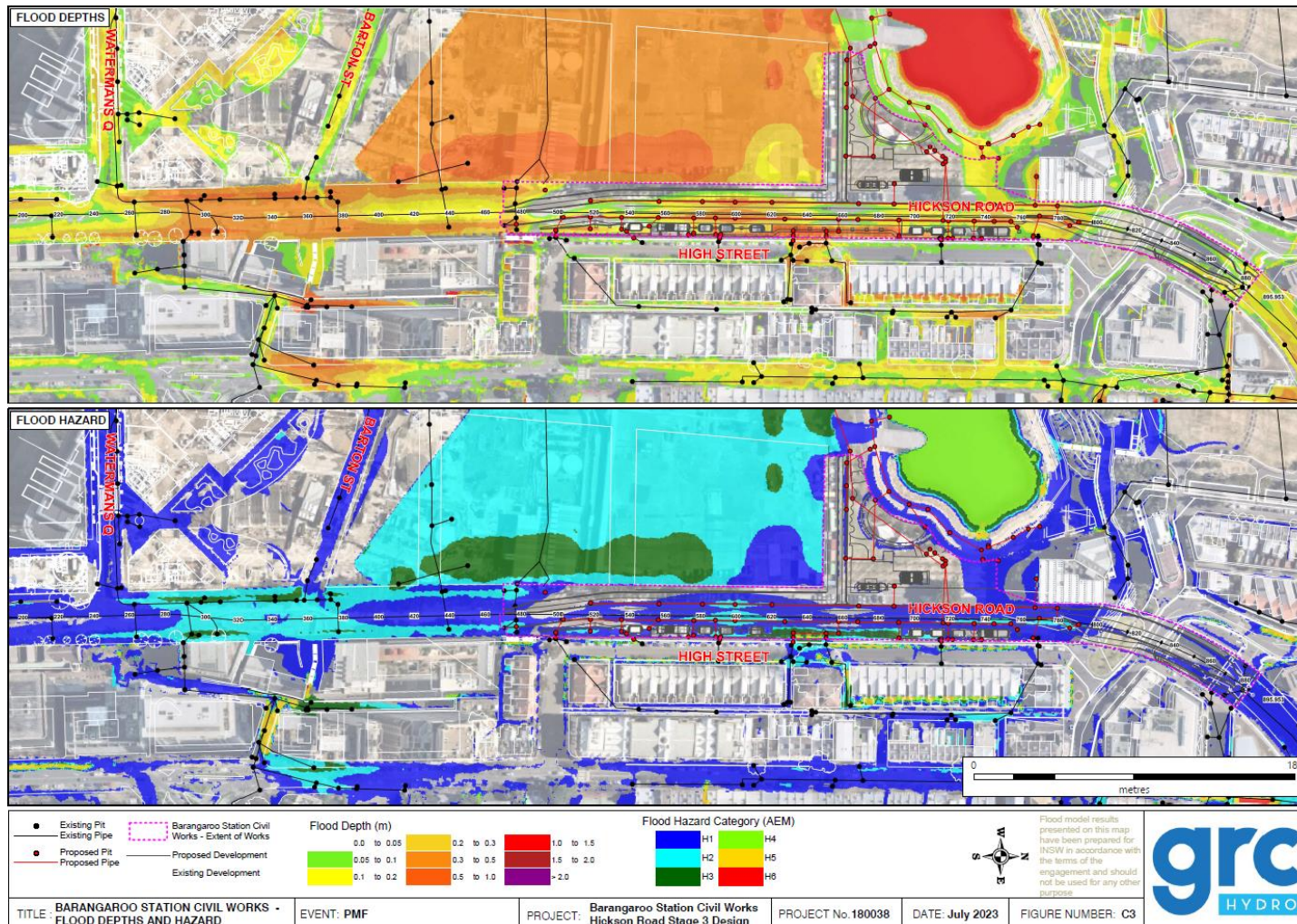


Figure 11: Barangaroo PMF Diagram

An MTR, John Holland and UGL Rail Company



The following information has been obtained from the Barangaroo Station Civil Works, Hickson Road Stage 3 Design - Flood Modelling Report (SMCSWSBR-BDA-SBR-DM-REP-000140).

During the PMF event, flood levels surrounding the Barangaroo Station are generally expected to be decreased due to increased stormwater capacity. Increases in flood levels are noted on Hickson Road due to the raising of the road, however, depths are generally similar to existing conditions with increases/decreases occurring due to shifting of road sag/crest locations. Hazards within the road corridor is generally unchanged,

For climate change effects, the 'Barangaroo Ultimate Conditions' PMF (2100 climate conditions) event shows flood depths on Hickson Road within the 'Barangaroo Station Civil Works' area of typically less than 0.5 m and flood levels ranging from ~3.6 mAHD at the southern Metro Pod to 2.9 mAHD to the north of the Metro Station Entrance. The flood impact mapping for both the 1% AEP + 10% rainfall & Representative Concentration Pathway 8.5 (RPC) events shows reductions in the extent of flooding on Hickson Road due to increased pipe conveyance. Other flood impacts are similar to that presented for the 1% AEP event impact comparison, with increased impacts noted in the 'flow through garden' beneath the High Street sag, to the east of Hickson Road. These areas are not proposed for future public access/use.

Trigger for implementation of F&H Plan

The MTS Severe Weather Conditions Response Plan (SWCR) outlines MTS' response to minimise the impact and risk resulting from severe weather conditions such as rainfall. Responsible MTS employees, contractors and employees of MTS contractors are bound by the SWCR. For a general overview of the definitions and processes related to severe weather conditions, see this plan.

For Barangaroo specifically, triggers would include:

- When expected or actual rainfall is over 30mm over a 6-hour period, or over 100mm over a 24-hour period that could result in a flash flood, especially on Hickson Road. MTS station staff can monitor the NSW SES' utilisation of the Australian Warning System on their website or the HazardWatch website and app or from local severe weather alerts. The MTS Environment and Sustainability Advisor to also monitor expected rainfall events and let relevant station staff know.
- Flooding from other sources such as water intrusions, surrounding premises'/roads or even from Sydney Harbour which Barangaroo Metro Station is situated near.
- Internal or external pump failures (e.g. sump pumps)

Emergency Management Actions

The Site Incident Management Plan (SIMP) for Barangaroo is the document that outlines site specific information related to emergencies at the Metro Station. See that document for all relevant emergency management actions.

See below for a quick reference guide for emergency management actions:

1. When a flash flood or sustained heavy rainfall requires an evacuation, the station staff report the incident with MTS' Operations Control Centre (OCC) who manage the overall information flow for internal and external communications relating to MTS and the Metro Station. This includes to emergency services such as Police, Ambulance and the NSW SES)
2. Station staff, with help from the OCC decide if a full evacuation, partial evacuation, or a shelter in place situation is required.

If a full evacuation is necessary, the station's wardens help evacuate customers via the egress routes to Assembly area A located in Figure 12 below. Barangaroo station and this assembly point are safe from a PMF and will ensure customers are safe until emergency services (such as the SES) arrive. If customers are unable to continue their journey outside the area, then a partial evacuation or a shelter in place situation would be advised.

If a partial evacuation is required, the stations wardens will ensure customers move away from the localised flooding hazard to a safe area within the station.

When conditions external to the building cause a greater hazard to occupants than remaining within the building, a shelter in place is implemented and the station's warden's assist customers to find safety in the station itself.

3. All persons at the relevant Assembly Areas are required to stay until the surrounding area is deemed safe by emergency services and MTS' OCC.

Safe Refuge Location above the PMF

Reviewing the information above with the site evacuation map below, it is deemed that a PMF will have minimal effect on the access/egress of persons evacuating the site to Assembly Area A and customers will be safe there. However, the MTS staff on site will be able to assist in the event of a flooding emergency. There is also an Emergency Control Centre on site and this is where the Chief Warden establishes control, communication and coordination of the Emergency Control Organisation team and liaises with the OCC and emergency services. This process will also assist in the event of a flooding emergency to ensure customers are safe from a PMF.

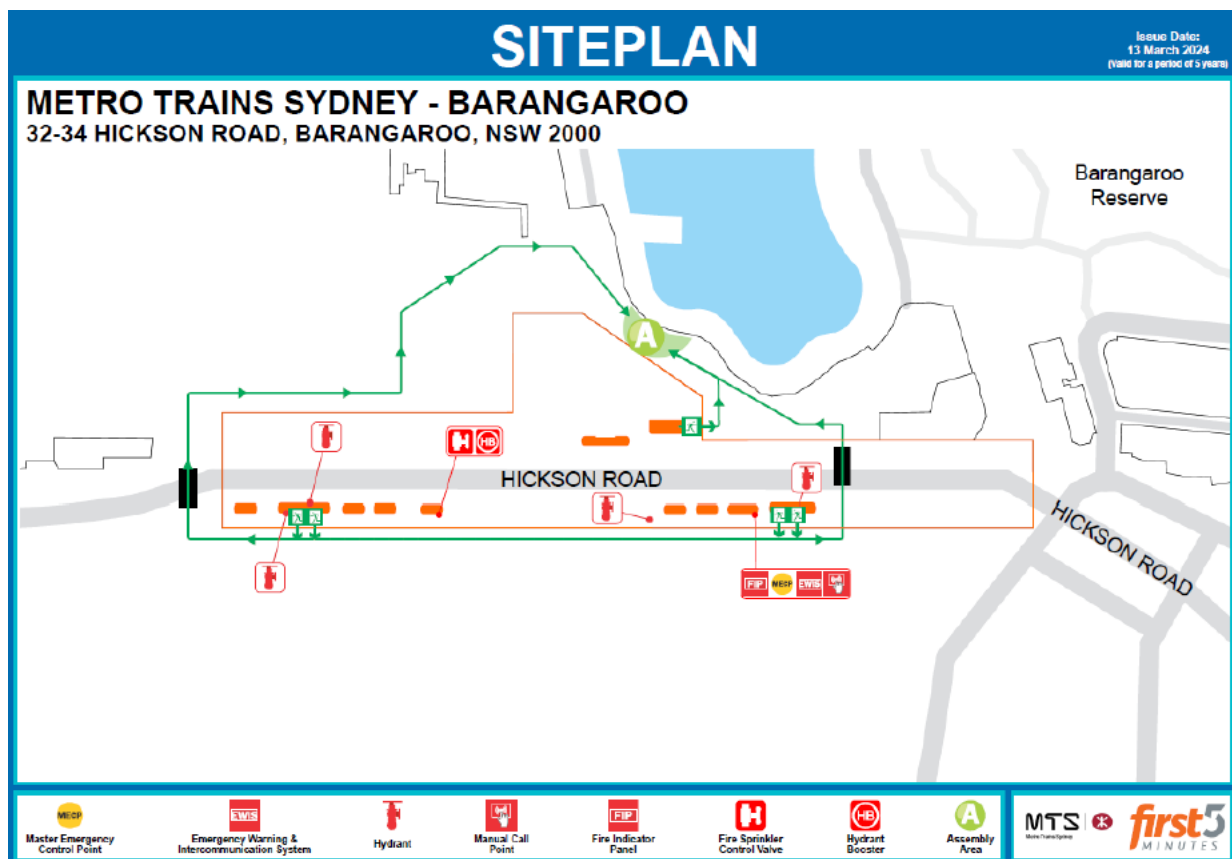


Figure 12: Barangaroo Site Plan and Evacuation Map

Martin Place

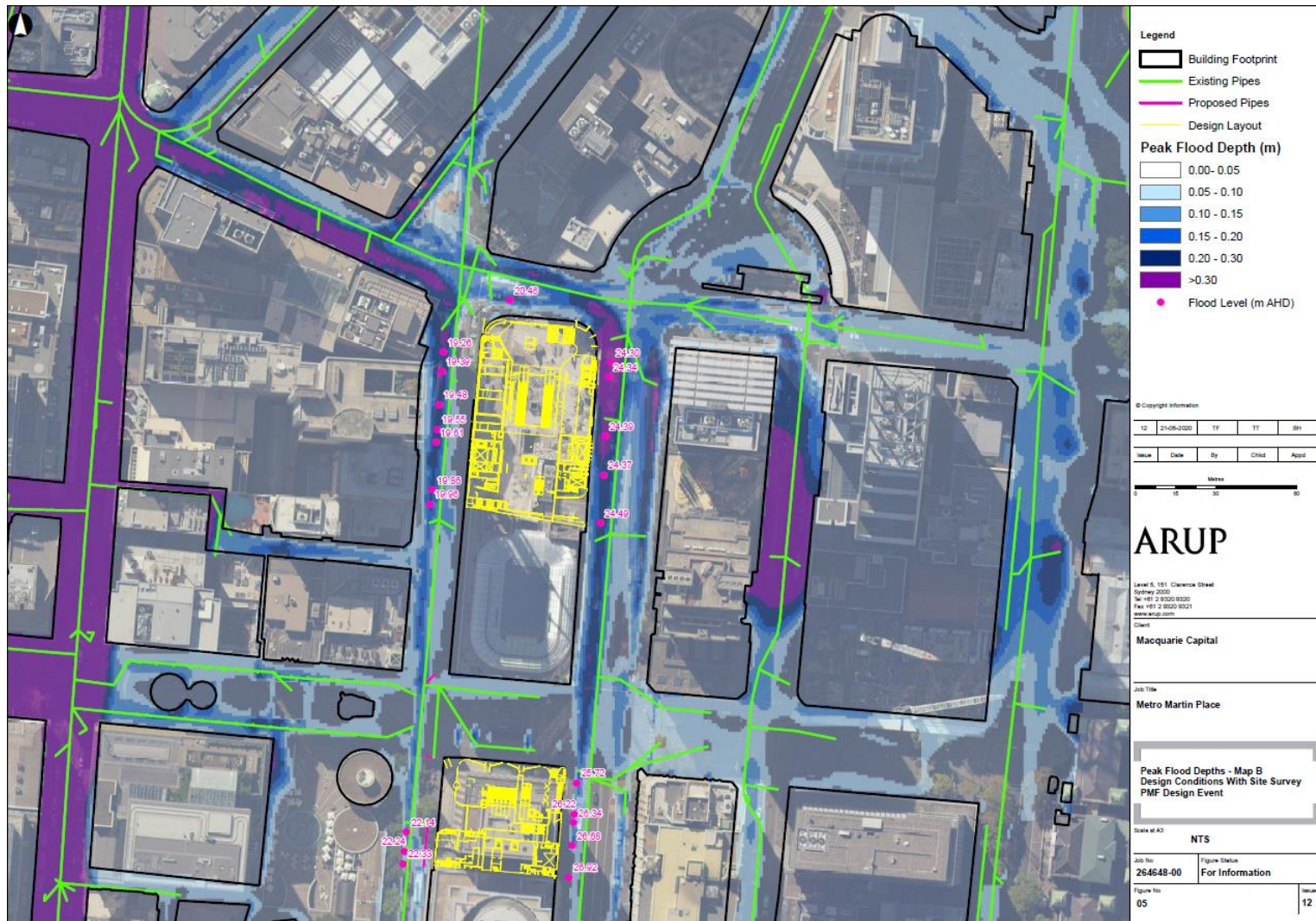


Figure 13: Martin Place PMF Diagram

An MTR, John Holland and UGL Rail Company



The following information has been obtained from the Sydney Metro Martin Place Integrated Station Development SMP-402: Civil Engineering Design Report (CSWSMP-MAC-SMA-CE-REP-999904).

Flood modelling had been undertaken using 1D/2D hydraulic modelling software, TUFLOW. The City of Sydney has provided the City Area Catchment Flood Model to undertake this assessment. Flood modelling undertaken considers the impact of the integrated development including the North and South Towers and Sydney Metro Martin Place station. The flood maps indicate the flood levels in the vicinity of the proposed SMMP project are below the design criteria in the REMM (FH9) project requirement to not worsen existing flooding characteristics (defined as a maximum increase in flood levels of 50mm) from the existing condition for the 100 year ARI flood event. For the purposes of determining flood planning levels for the OSD and Metro entrances, requirements to accommodate the 100-year ARI event, includes an allowance of 30% rainfall increase to account for climate change.

Trigger for implementation of F&H Plan

The MTS Severe Weather Conditions Response Plan (SWCR) outlines MTS' response to minimise the impact and risk resulting from severe weather conditions such as rainfall. Responsible MTS employees, contractors and employees of MTS contractors are bound by the SWCR. For a general overview of the definitions and processes related to severe weather conditions, see this plan.

For Martin Place specifically, triggers would include:

- When expected or actual rainfall is over 30mm over a 6-hour period, or over 100mm over a 24-hour period that could result in a flash flood. MTS station staff can monitor the NSW SES' utilisation of the Australian Warning System on their website or the HazardWatch website and app or from local severe weather alerts. The MTS Environment and Sustainability Advisor to also monitor expected rainfall events and let relevant station staff know.
- Flooding from other sources such as water intrusions, surrounding premises'/roads.
- Internal or external pump failures (e.g. sump pumps)

Emergency Management Actions

The Site Incident Management Plan (SIMP) for Martin Place is the document that outlines site specific information related to emergencies at the Metro Station. See that document for all relevant emergency management actions.

See below for a quick reference guide for emergency management actions:

1. When a flash flood or sustained heavy rainfall requires an evacuation, the station staff report the incident with MTS' Operations Control Centre (OCC) who manage the overall information flow for internal and external communications relating to MTS and the Metro Station. This includes to emergency services such as Police, Ambulance and the NSW SES)
2. Station staff, with help from the OCC decide if a full evacuation, partial evacuation, or a shelter in place situation is required.

If a full evacuation is necessary, the station's wardens help evacuate customers via the egress routes to Assembly area A located in Figure 14 below. This assembly point is safe from a PMF and will ensure customers are safe until emergency services (such as the SES) arrive. If customers are unable to continue their journey outside the area, then a partial evacuation or a shelter in place situation would be advised.

If a partial evacuation is required, the stations wardens will ensure customers move away from the localised flooding hazard to a safe area within the station.

When conditions external to the building cause a greater hazard to occupants than remaining within the building, a shelter in place is implemented and the station's warden's assist customers to find safety in the station itself.

3. All persons at the relevant Assembly Areas are required to stay until the surrounding area is deemed safe by emergency services and MTS' OCC.

Safe Refuge Location above the PMF

Reviewing the information above with the site evacuation map below, it is deemed that a PMF will have minimal effect on the access/egress of persons evacuating the site to Assembly Area A and customers will be safe there. However, the MTS staff on site will be able to assist in the event of a flooding emergency. There is also an Emergency Control Centre on site, and this is where the Chief Warden establishes control, communication and coordination of the Emergency Control Organisation team and liaises with the OCC and emergency services. This process will also assist in the event of a flooding emergency to ensure customers are safe from a PMF.

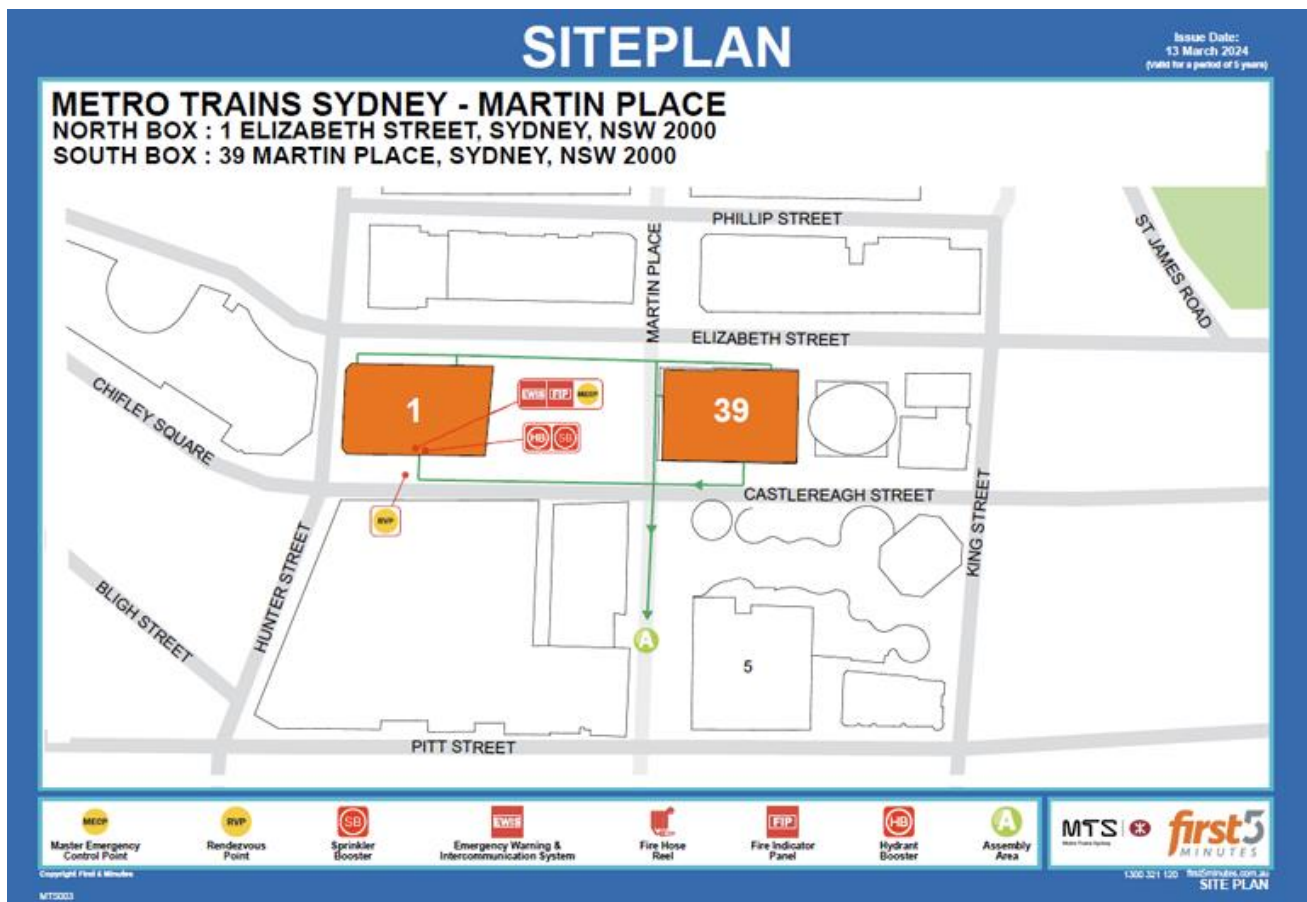


Figure 14: Martin Place Site Plan and Evacuation Map

Gadigal

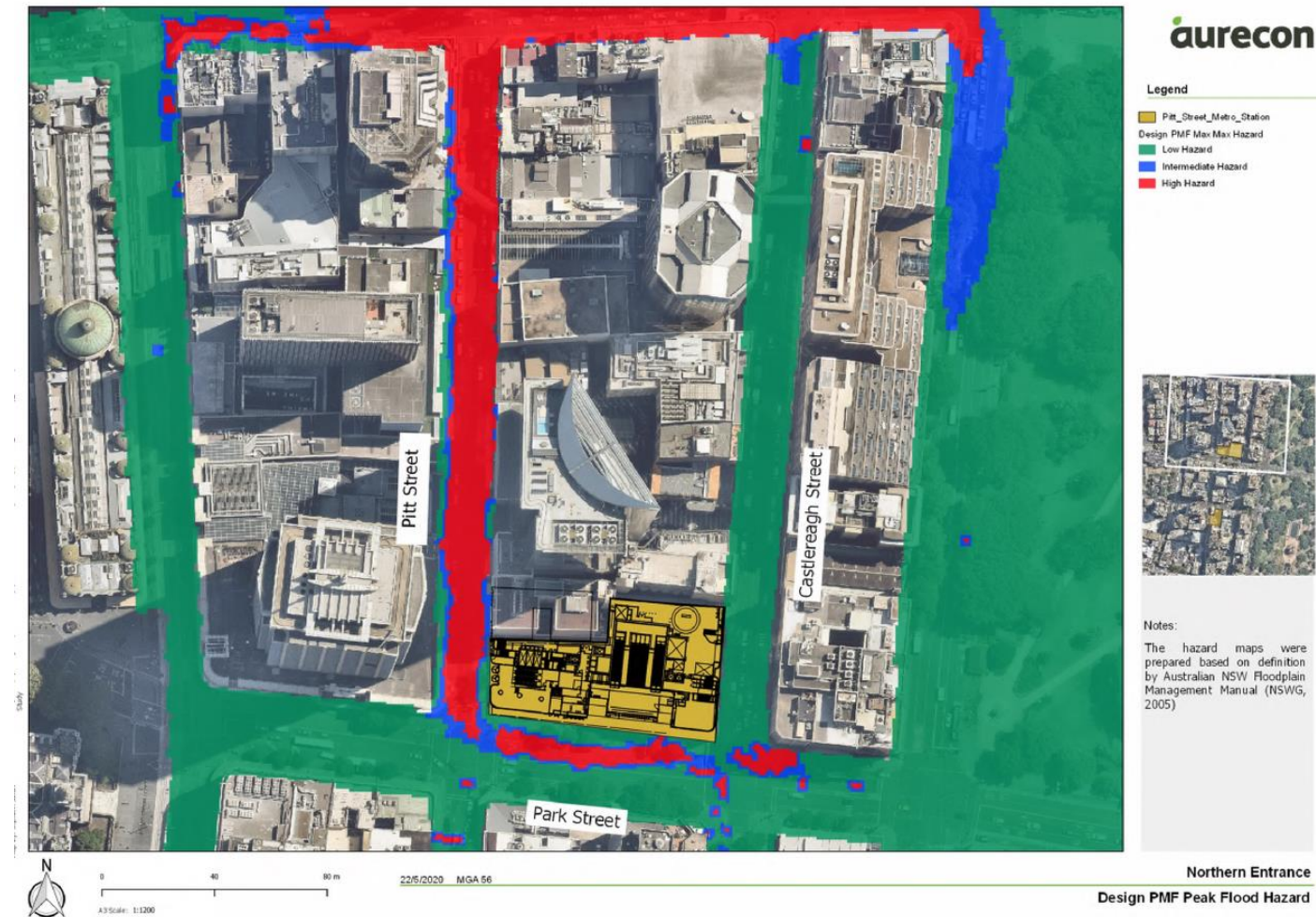



Figure 15: Gadigal PMF Diagram – Northern Entrance

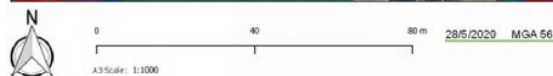
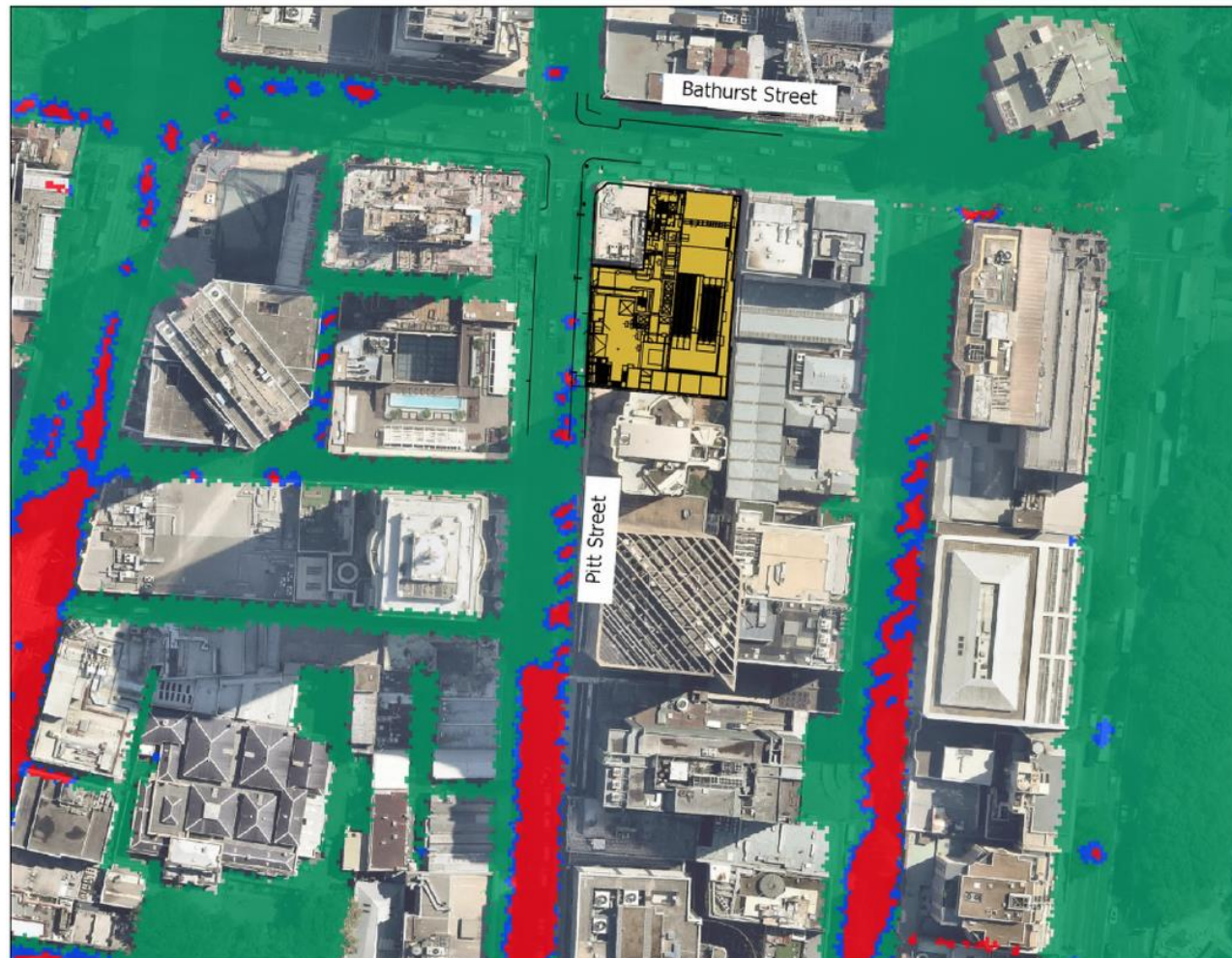
Legend

-  Pitt Street Metro Station
-  Design PMF Max Max Hazard
-  Low Hazard
-  Intermediate Hazard
-  High Hazard



Notes:

The hazard maps were prepared based on definition by Australian NSW Floodplain Management Manual (NSWG, 2005)



Southern Entrance
Design PMF Peak Flood Hazard

Figure 16: Gadigal PMF Diagram – Southern Entrance

The following information has been obtained from the Sydney Metro City and Southwest – Pitt Street Integrated Station Development SMP-402: Civil Engineering Design Report (SWCSWSPS-AUR-ALLCE-REP-000002).

The Gadigal station (formerly called Pitt Street Station) is located under Pitt Street between Park Street and Bathurst Street. Gadigal Station is an underground station with entrances from Pitt Street, Park Street and Bathurst Street. It is critical that the flood behaviour around the proposed entrances is predicted to ensure that the potential flooding of the entrances (and therefore the underground station) is minimised. The surface flows on Park Street (southern side of the northern part of the station) flow from east to west and towards the Park Street/Pitt Street intersection. Flows from either side of the Park Street then turn into Pitt Street towards north at the location of the Park Street /Pitt Street intersection. The southern part of the station (located within DH catchment) is located at south-eastern corner of Pitt Street/Bathurst Street intersection with access proposed from both Pitt Street and Bathurst Street. The station's southern site is almost located on top of the catchment.

For the flood modelling, a climate change assessment has been undertaken to assess the potential impacts of future climate change on the flood behaviour around the proposed development and on the development design levels. Based on the TUFLOW results, the maximum flood levels along Park Street vary between approximately 24.4m AHD in Park Street/Castlereagh intersection and approximately 23.0m AHD in Park Street/Pitt Street intersection in PMF event. Maximum flood depth of up to approximately 440mm are predicted in Park Street in the PMF event (the highest depth predicted in Park Street/Pitt Street intersection). Maximum flood velocities of up to 2.5m/s are predicted along Park Street in a PMF event with flood hazard classification of low (classification No 1). It is noted that the hazard maps were prepared based on definition by Australian NSW Floodplain Management Manual (NSW, 2005). Therefore minor increases in the peak flood depth and velocity is anticipated as a result of the station along Park Street in PMF event. However, the flood hazard is still expected to be low. In Pitt Street, the maximum flood level of 22.7m AHD and maximum flood depth of 570mm are predicted in PMF. Peak flow velocities of up to 2.0m/s are predicted along the Pitt Street frontage of the proposed development in PMF. The flood hazard is predicted to be low (hazard classification 1) in PMF.

For the Darling Harbour side of the station, the maximum flood levels along Bathurst Street vary between approximately 26.5m AHD in Bathurst/Castlereagh Road intersection and approximately 25.6m AHD in Bathurst/Pitt Street intersection in PMF event. Maximum flood depth of up to 240mm are predicted in Bathurst Street in PMF with deepest at the Bathurst/Pitt Street intersection. Maximum flood velocities of generally less than 1m/s are predicted in Bathurst Street in a PMF event. Based on the results, only minimal changes in the flood behaviour along Bathurst is predicted as a result of the proposed development compared to the existing case in a PMF event.

Trigger for implementation of F&H Plan

The MTS Severe Weather Conditions Response Plan (SWCR) outlines MTS' response to minimise the impact and risk resulting from severe weather conditions such as rainfall. Responsible MTS employees, contractors and employees of MTS contractors are bound by the SWCR. For a general overview of the definitions and processes related to severe weather conditions, see this plan.

For Gadigal specifically, triggers would include:

- When expected or actual rainfall is over 30mm over a 6-hour period, or over 100mm over a 24-hour period that could result in a flash flood. MTS station staff can monitor the NSW SES' utilisation of the Australian Warning System on their website or the HazardWatch website and app or from local severe weather alerts. The MTS Environment and Sustainability Advisor to also monitor expected rainfall events and let relevant station staff know.
- Flooding from other sources such as water intrusions, surrounding premises'/roads.
- Internal or external pump failures (e.g. sump pumps)

Emergency Management Actions

The Site Incident Management Plan (SIMP) for Gadigal is the document that outlines site specific information related to emergencies at the Metro Station. See that document for all relevant emergency management actions.

See below for a quick reference guide for emergency management actions:

4. When a flash flood or sustained heavy rainfall requires an evacuation, the station staff report the incident with MTS' Operations Control Centre (OCC) who manage the overall information flow for internal and

external communications relating to MTS and the Metro Station. This includes to emergency services such as Police, Ambulance and the NSW SES)

5. Station staff, with help from the OCC decide if a full evacuation, partial evacuation, or a shelter in place situation is required.

If a full evacuation is necessary, the station's wardens help evacuate customers via the egress routes to Assembly area A located in Hyde Park in Figure 14 below. This assembly point is safe from a PMF and will ensure customers are safe until emergency services (such as the SES) arrive. If customers are unable to continue their journey outside the area, then a partial evacuation or a shelter in place situation would be advised.

If a partial evacuation is required, the stations wardens will ensure customers move away from the localised flooding hazard to a safe area within the station.

When conditions external to the building cause a greater hazard to occupants than remaining within the building, a shelter in place is implemented and the station's warden's assist customers to find safety in the station itself.

6. All persons at the relevant Assembly Areas are required to stay until the surrounding area is deemed safe by emergency services and MTS' OCC.

Safe Refuge Location above the PMF

Reviewing the information above with the site evacuation map below, it is deemed that a PMF will have minimal effect on the access/egress of persons evacuating the site to Assembly Area A and customers will be safe there. However, the MTS staff on site will be able to assist in the event of a flooding emergency. There is also an Emergency Control Centre on site, and this is where the Chief Warden establishes control, communication and coordination of the Emergency Control Organisation team and liaises with the OCC and emergency services. This process will also assist in the event of a flooding emergency to ensure customers are safe from a PMF.

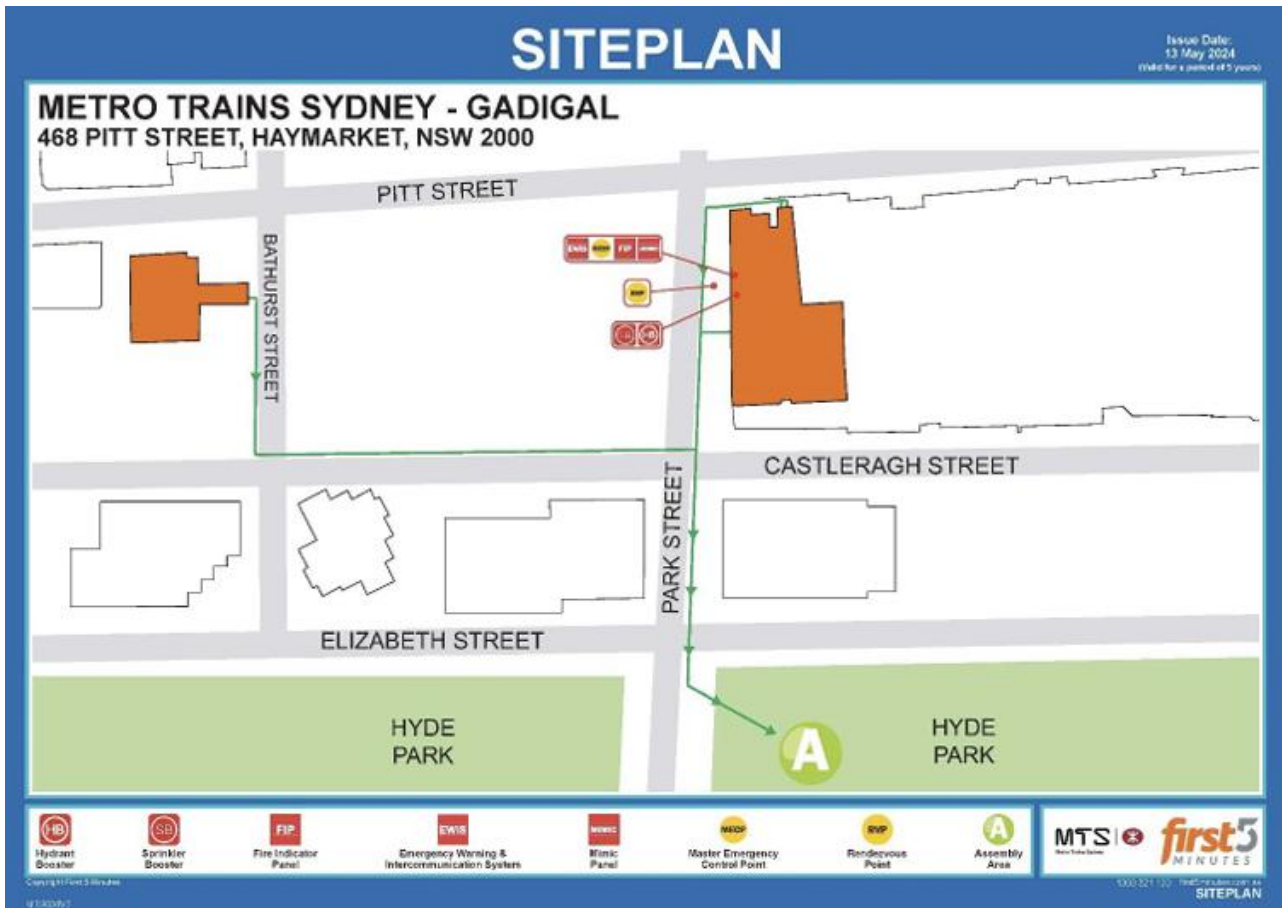


Figure 17: Gadigal Site Plan and Evacuation Map

Waterloo

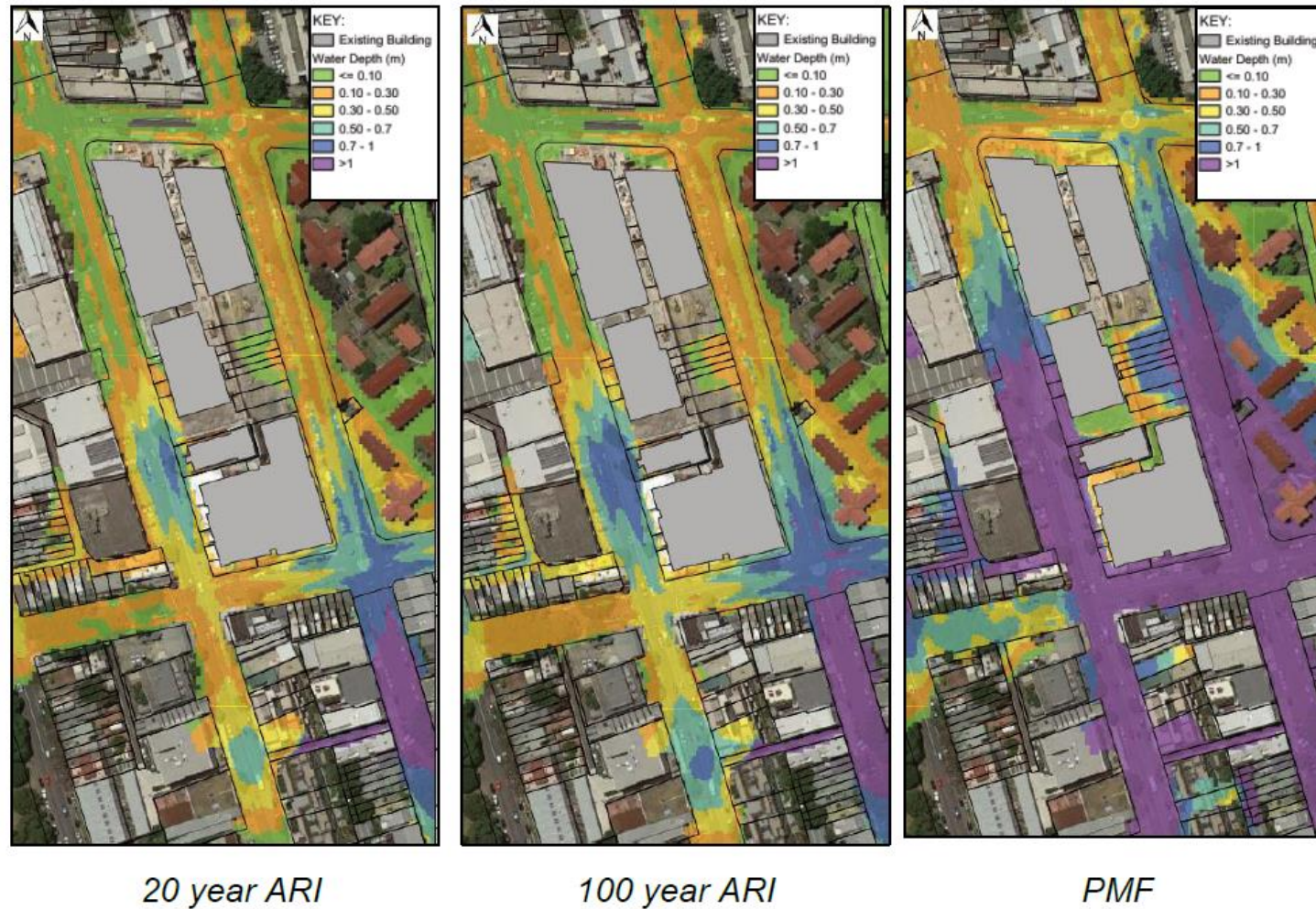


Figure 18: Waterloo 20 year, 100 year, PMF Diagram

An MTR, John Holland and UGL Rail Company



The following information has been obtained from the Sydney Metro City and Southwest – Waterloo Integrated Station Development (SMCSWSWL-WSP-SWL-CE-REP-200001).

The Waterloo station is located within Sydney's suburb of Waterloo, within the Metro Quarter. The Metro Quarter (MQD) comprises the land bounded by Botany Road, Raglan Street, Cope Street and Wellington Street, but excluding the Congregational Church located at 103 Botany Road. The flood assessment had been informed by detailed hydraulic modelling that allowed to define the flood mechanisms and conditions at the site and surrounding area. The PMF model run duration was extended to ensure peak water levels at the site and surrounding areas are properly captured. The 20, 100 year ARI and PMF flood events were assessed. A climate change sensitivity analysis had also been undertaken for the 100 year ARI to assess the possible effects of climate change (CC) to the flood conditions. The climate change scenario shows that water level around the site area might increase up to approximately 70 mm; this is in line with the climate change sensitivity analysis presented in the Waterloo Metro Quarter State Significant Precinct Study (October 2018) which demonstrated that climate change might generate water level increases of up to 60 mm around the site area.

Trigger for implementation of F&H Plan

The MTS Severe Weather Conditions Response Plan (SWCR) outlines MTS' response to minimise the impact and risk resulting from severe weather conditions such as rainfall. Responsible MTS employees, contractors and employees of MTS contractors are bound by the SWCR. For a general overview of the definitions and processes related to severe weather conditions, see this plan.

For Waterloo specifically, triggers would include:

- When expected or actual rainfall is over 30mm over a 6-hour period, or over 100mm over a 24-hour period that could result in a flash flood. MTS station staff can monitor the NSW SES' utilisation of the Australian Warning System on their website or the HazardWatch website and app or from local severe weather alerts. The MTS Environment and Sustainability Advisor to also monitor expected rainfall events and let relevant station staff know.
- Flooding from other sources such as water intrusions, surrounding premises'/roads.
- Internal or external pump failures (e.g. sump pumps)

Emergency Management Actions

The Site Incident Management Plan (SIMP) for Waterloo is the document that outlines site specific information related to emergencies at the Metro Station. See that document for all relevant emergency management actions.

See below for a quick reference guide for emergency management actions:

1. When a flash flood or sustained heavy rainfall requires an evacuation, the station staff report the incident with MTS' Operations Control Centre (OCC) who manage the overall information flow for internal and external communications relating to MTS and the Metro Station. This includes to emergency services such as Police, Ambulance and the NSW SES)
2. Station staff, with help from the OCC decide if a full evacuation, partial evacuation, or a shelter in place situation is required.

If a full evacuation is necessary, the station's wardens help evacuate customers via the egress routes to Assembly area A located in Figure 19 below. This assembly point is safe from a PMF and will ensure customers are safe until emergency services (such as the SES) arrive. If customers are unable to continue their journey outside the area, then a partial evacuation or a shelter in place situation would be advised.

If a partial evacuation is required, the stations wardens will ensure customers move away from the localised flooding hazard to a safe area within the station.

When conditions external to the building cause a greater hazard to occupants than remaining within the building, a shelter in place is implemented and the station's warden's assist customers to find safety in the station itself.

3. All persons at the relevant Assembly Areas are required to stay until the surrounding area is deemed safe by emergency services and MTS' OCC.

Safe Refuge Location above the PMF

Reviewing the information above with the site evacuation map below, it is deemed that a PMF will have minimal effect on the access/egress of persons evacuating the site to Assembly Area A and customers will be safe there. However, the MTS staff on site will be able to assist in the event of a flooding emergency. There is also an Emergency Control Centre on site, and this is where the Chief Warden establishes control, communication and coordination of the Emergency Control Organisation team and liaises with the OCC and emergency services. This process will also assist in the event of a flooding emergency to ensure customers are safe from a PMF.

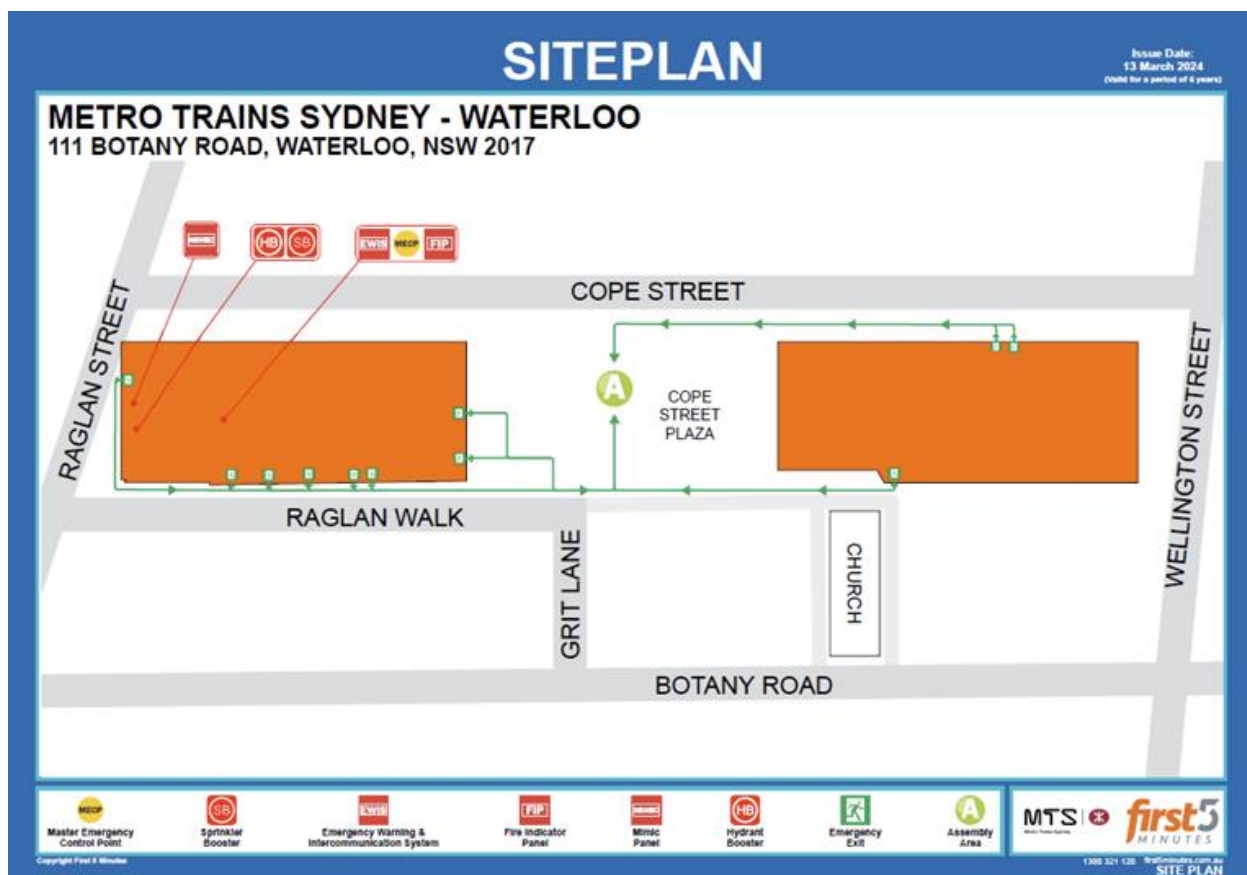


Figure 19: Waterloo Site Plan and Evacuation Map

Marrickville Dive Site

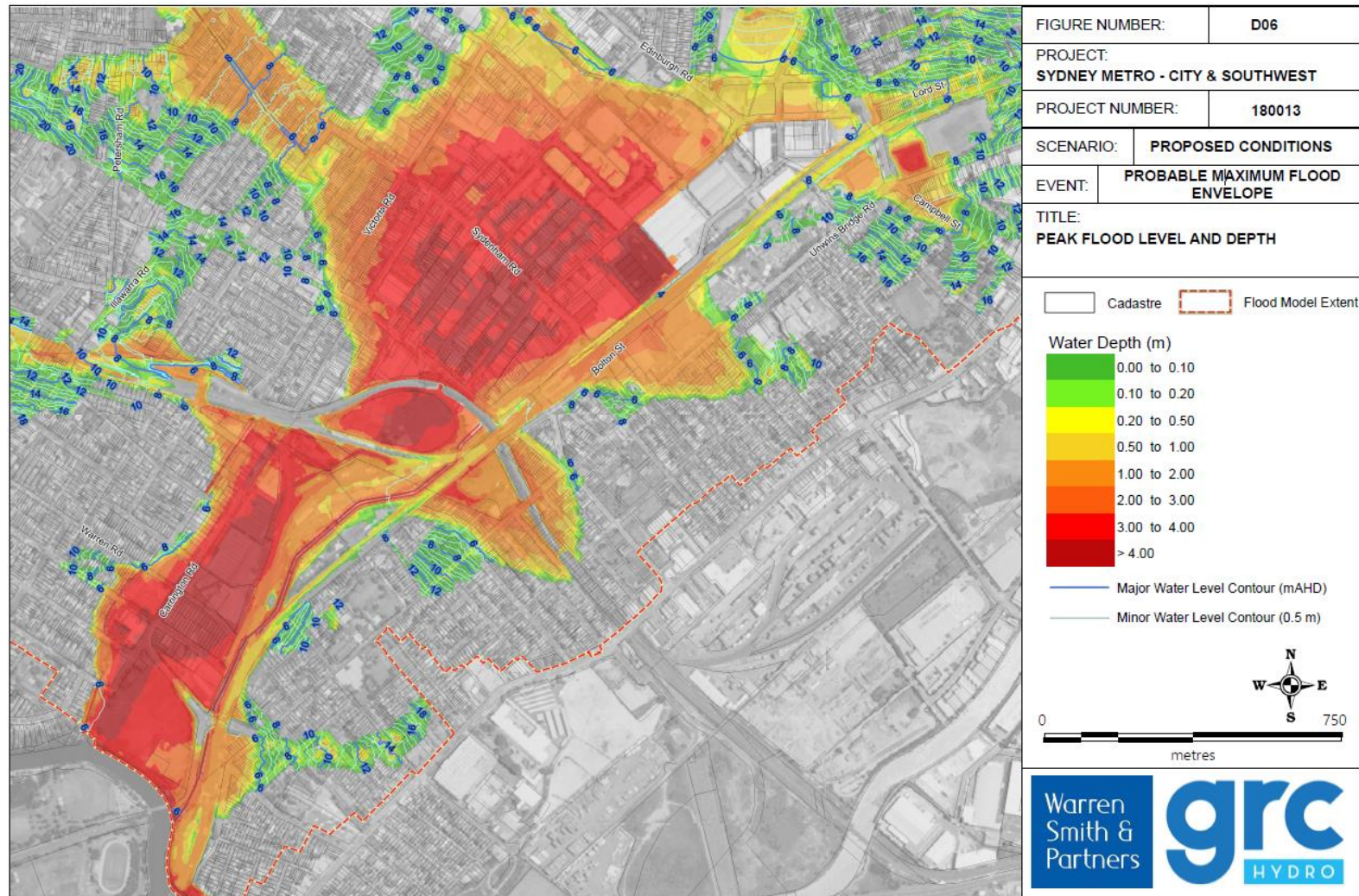


Figure 20: Marrickville Dive Site PMF Diagram

An MTR, John Holland and UGL Rail Company



Trigger for implementation of F&H Plan

As stated in Section 4.2.1.2, to avoid inundation, the tunnel dive structures have been designed at or above the Probable Maximum Flood (PMF) level for mainstream flooding. Drainage at the dive structures is designed to manage flows for the 100-year average recurrence interval event. No flooding impacts on, or as a result of, the project is anticipated at or surrounding the Marrickville dive site. Therefore, no triggers for implementing the Flooding and Hydrology Plan are required.

Emergency Management Actions

As this site is a dive site and not an active metro station, there is currently no site incident management plan to indicate emergency management actions or triggers, therefore the MTS Emergency Management Plan is to be consulted for this purpose.

Safe Refuge Location above the PMF

As the dive structures have been designed at or above the PMF, the entire location is a safe refuge location.

4.3. Management measures

This section describes the overall approach to managing and mitigating risks or potential impacts associated with flooding and hydrology during operation of the Project. Management measures are outlined in the table below.

Table 8 Management Measures

ID	Management Measure	Timing	Responsibility	Reference or Source
FH01	The performance of the downstream drainage network will be maintained during operation.	During operation	GM Engineering & Maintenance Delivery	Environmental Performance Outcome (SPIR) Intalex
FH02	Continue existing community emergency management arrangements in the event of flooding in the road network or rail corridor.	During operation	Head of Safety, Quality, Risk & Environment	Environmental Impact Statement (EIS) OEMP Intalex

Further operation mitigation measures have been outlined in the EIS. They are FH4, FH6, FH7, FH8 and FH9 (See Section 3.3). Although these measures are listed as Operational, the requirement and compliance for these would have been completed in the Design and Construction phase of the project. Therefore, as MTS are only the operator of the CSW network, MTS are only using the designed assets that have been transferred to them. This means that the compliance of these measures are not applicable to this Operational Flooding and Hydrology Plan. Therefore, management measures that can be implemented by MTS are general maintenance of the infrastructure and assets as well as regular inspections of the stations and sites to ensure rubbish, debris or other obstacles are not blocking flood protection devices or tools. The maintenance and inspection processes are outlined in the OEMP and are managed through MTS's SQRE Management System, Intalex.

In significant rainfall events where the likelihood of flooding is increased, temporary measures will be implemented by MTS station staff at the metro stations.

Temporary measures could include:

- Temporary barriers to block water, e.g. sandbags
- Waterway modifications altering flow

- Temporary storage of water, e.g. water tanks

5. Monitoring and review

5.1. Monitoring requirements

Monitoring as it relates to stormwater and flooding would be performed in accordance with Section 4.3 of the OEMP document.

5.2. Environmental auditing

Environmental audits will be undertaken in accordance with the indicative audit schedule provided in Table 15 of the OEMP, which includes an environmental audit, a sustainability audit and an operation performance audit. All environmental audits will be carried out in accordance with Section 8.2 of the OEMP.

5.3. Reporting

Reporting as it relates to stormwater and flooding would be performed in accordance with Section 8.5 of the OEMP document.

5.4. Hold points

The activity detailed in Table 9: Hold Points is recognised as a hold point and will not proceed without objective review and approval by the nominated authority (refer to Section 4.1.5 of the OEMP).

Table 9: Hold Points

Hold Point	Action/Permit Required	Document Reference
New Maintenance or repair work	Prior to commencement of a new activity, not previously undertaken in a particular area need Environment & Sustainability Advisor approval.	Operations Phase Environmental and Sustainability Plan

5.5. Review and improvement

Review and improvement of this Plan will be undertaken in accordance with the Conditions of Consent, the Quality Management Plan and Section 9 of the OEMP. Continuous improvement will be achieved by the ongoing evaluation of environmental management performance and effectiveness of this Plan against environmental policies, objectives and targets.

MTS' Pollution Incident Response Management Plan (PIRMP) outlines water and flood risks and the consequences and controls in place to manage them. As part of MTS' EPL and PIRMP annual renewal process, MTS must test the PIRMP to ensure that the risks identified in the plan can be managed safely and securely. Therefore, MTS intends to test this plan with the flood risks accordingly with this process to ensure this plan is continually accurate and relevant. MTS will also review and update this plan whenever additional flood information is available or highlighted during drills or flood events.

5.6. Incidents

In the event of an environmental incident or unpredicted impacts relating to flooding and hydrology as it relates to the Project, it is the responsibility of all personnel to report the incident or the event immediately to the Environment & Sustainability Advisor and the Head of Safety, Quality, Risk & Environment.

All environmental incidents are to be reported and managed in accordance with the Pollution Incident Response Management Plan (PIRMP) and the Incident Management Framework (IMF). Incidents are classified based on the incidents severity as shown in the IMF.

All incidents will be managed and reported according to Section 7 of the OEMP.

Arrangements relating to incidents including flooding during operation are detailed in the Incident Management Plan - Sydney Metro Northwest and City & Southwest (SMCSWTS2-MTS-CSW-PM-PLN-002145).

5.7. Complaints

All stormwater and flooding related complaints will be handled in accordance with Section 4.4 of the OEMP and the Stakeholder Community Involvement Plan (SCIP).

5.8. Non-compliance, non-conformances and corrective actions

All non-compliances, non-conformances and resulting corrective actions associated with flooding and hydrology will be managed in accordance with Section 8.4 of the OEMP.

6. Relevant documentation

6.1. References

Floodplain Development Manual (NSW Government, 2005b)

Floodplain Risk Management Guideline: Practical Consideration of Climate Change (Department of Environment and Climate Change, 2007b)

Floodplain Risk Management Guide: Incorporating Sea Level Rise Benchmarks in Flood Risk Assessments (Department of Environment, Climate Change and Water, 2010c)

New guideline and changes to section 117 direction and EP&A Regulation on flood prone land, Planning Circular PS 07-003 (NSW Department of Planning, 2007).

Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004)

Managing Urban Stormwater: Soils and Construction Volume 2 (Department of Environment and Climate Change, 2008a).

A

APPENDIX

Appendix A. Document control

Appendix A1. Document information

Document Number:	SMCSWTS2-MTS-1NL-EM-PLN-002711
Version:	04
Issue Date:	04/09/2024
Network	City & Southwest

Appendix A2. Approval record

Function	Position	Name	Signature	Date
Prepared by:	Environment & Sustainability Advisor	Peter Scioscia		
Reviewed by:	Head of Safety, Quality, Risk & Environment	Melissa Northey		
Approved by:	General Manager Safety, Quality, Risk & Environment	Amanda Calvez		
Approved by:	A/General Manager Engineering & Maintenance Delivery	Michael Leah		
Approved by:	MTS Chief Executive Officer	Daniel Williams		
Endorsed by:	MTR Representative	Ronnie Tong		
Authorised by:	OpCo2 Delivery Director	Phil Dark		
Approved by:	NRT Chief Executive Officer	Steve Herman		

Appendix A3. Amendment record

Date	Rev	Amendment description	By
14/05/2024	01	Initial release.	Peter Scioscia
28/06/2024	02	Updated plan due to external stakeholder consultation comments for submission to DPHI.	Peter Scioscia
28/07/2024	03	Updated plan as per comments from DPHI and issued to DPHI prior to FPS.	Peter Scioscia
04/09/2024	04	Further updated plan as per comments from DPHI and to address v2 of SES' comments to MTS. All required consultation and comments are now closed.	Peter Scioscia

B

APPENDIX

Appendix B. List of acronyms

Acronym	Definition
BS	Barangaroo Station
C&SW	City & Southwest
Development Consent	<ul style="list-style-type: none"> CSSI 7400 – NSW Minister of Planning, January 2017 MOD 1 – Victoria Cross and Artarmon Substation (determined 18 October 2017) MOD 2 – Central Walk (determined 21 December 2017) MOD 3 – Martin Place Metro Station (determined 22 March 2018) MOD 4 – Sydenham Station and Metro Facility South (determined 13 December 2017) MOD 5 – Blues Point Acoustic Shed (determined 2 November 2018) MOD 6 – Administrative Changes (determined 21 February 2019) MOD 7 – Administrative Changes (determined 24 June 2020) MOD 8 – Blues Point Access Site (determined 25 November 2020) MOD 9 – Extension to standard construction hours (determined 30 June 2022).
C2S	Chatswood to Sydenham
CEMF	Construction Environmental Management Framework
CEMP	Construction Environmental Management Plan
CoA(s)	Condition(s) of Approval
CSSI	Critical State Significant Infrastructure
DIA	Discharge Impact Assessment
DPE	NSW Department of Planning and Environmental (formerly DPIE)
DPIE	Department of Planning, Industry and Environment (new DPE)
DPI Water	NSW Department
EIS	Environmental Impact Statement
EMS	Environmental Management System
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation</i>
EPA	NSW Environment Protection Authority
EPL	Environmental Protection Licence
EAD	Environmental Assessment Documentation
FHMP	Flooding and Hydrology Management Plan
GWMP	Operational Groundwater Management Plan
IMF	Incident Management Framework
IMS	Integrated Management System
ISCA	Infrastructure Sustainability Council of Australia
LGA	Local Government Area
MTS	Metro Trains Sydney Pty Ltd

Acronym	Definition
OEH	The Office of Environment and Heritage within the Department of Climate change, Energy, the Environment and Water
OEMP	Operational Environmental Management Plan
OpCo / OpCo2	NRT Group
O&M	Operation and Maintenance
PIRMP	Pollution Incident Response Management Plan
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
REMMs	Revised Environmental Mitigation Measures
ROM	Railway Operating Manual
SAR	Site Audit Report
SCIP	Stakeholder Community Involvement Plan
SES	The NSW State Emergency Services
SPIR	Submissions and Preferred Infrastructure Report
SQRE	Safety, Quality, Risk and Environment
SMCSW	Sydney Metro City & Southwest
TSOM	Trains, Systems, Operations and Maintenance
WTP	Water Treatment Plant

C

APPENDIX

Appendix C. Related documents

Note: some documents will be closely interconnected and will need to be reviewed when this one is changed. Others are simply related content that supplement the material in this document.

Document Number	Document Title	Review
SMCSWTS2-MTS-CSW-EM-PLN-002107	Carbon and Energy Management Plan	Yes
NWRLOTS-NRT-ADM-PM-PLN-721428	Emergency Management Plan	Yes
NWRLOTS-NRT-ADM-EM-PRO-720473-01	Fauna Handling Procedure	Yes
NWRLOTS-NRT-PRD-PM-PLN-000874	Flora & Fauna Management Plan	Yes
SMCSWTS2-MTS-1NL-EM-PLN-002712	Groundwater Management Plan	Yes
SMCSWTS2-MTS-CSW-HE-PLN-002100	Heritage Management Plan	No
NWRLOTS-NRT-ADM-PM-PLN-721419	Human Resource Plan	No
NWRLOTS-NRT-ADM-PM-PLN-721417	Incident Management Plan	No
NWRLOTS-NRT-SWD-FA-POL-723353	MTS Procurement Policy	No
SMCSWTS2-MTS-CSW-EM-PLN-002106	Noise and Vibration Management Plan	Yes
NWRLOTS-NRT-ADM-EM-PRO-720474-01	Noise & Vibration Monitoring Procedure	No
SMCSWTS2-MTS-CSW-EM-PLN-002697	Operational Environmental Management Plan	Yes
NWRLOTS-NRT-ADM-EN-PLN-720416	Pollution Incident Response Management Plan	Yes
NWRLOTS-NRT-ADM-PM-PLN-721403	Quality Management Plan	No
NWRLOTS-NRT-ADM-PM-PLN-721405	Risk Management Plan	No
NWRLOTS-NRT-SWD-AM-PLN-723029	Severe Weather Conditions Response Plan	No
NWRLOTS-NRT-SWD-RS-FRW-720717	SMS Element 17: Procurement and Contract Management	No
NWRLOTS-NRT-ADM-EM-PRO-720472-01	Spill Management Procedure	Yes
NWRLOTS-NRT-ADM-EN-PLN-720252	Stakeholder Community Involvement Plan	No
NWRLOTS-NRT-ADM-PM-PLN-721415	Training Management Plan	No
NWRLOTS-NRT-ADM-EM-PRO-720475-01	Unexpected Heritage Finds Procedure	No
NWRLOTS-NRT-ADM-EM-PRO-720476-01	Unexpected Contaminated Finds Procedure	Yes
NWRLOTS-NRT-ADM-EM-PRO-720471-01	Waste Resource Management Procedure	Yes
NWRLOTS-NRT-ADM-EM-PRO-720478-01	Water Quality Monitoring Program	Yes
NWRLOTS-NRT-ADM-EM-PRO-720479-01	Weed Management Procedure	Yes

D

APPENDIX

Appendix D: External Consultation

Department of Climate Change, Energy, the Environment and Water (OEH)



Department of Climate Change, Energy, the Environment and Water

Your ref: SSI-7400
Our ref: DOC24/232416

Ms Shelley Reed
Department of Planning, Housing and Infrastructure
4 Parramatta Square, 12 Darcy Street
PARRAMATTA NSW 2150
5 June 2024

Subject: BCS response on Metro Trains Sydney – Sydney Metro City Southwest – Chatswood to Sydenham - post approval Flooding and Hydrology Management Plan – SSI-7400

Dear Ms Reed

I refer to an email received by the Biodiversity, Conservation and Science (BCS) Group on 28 May 2024 from Metro Trains Sydney requesting comments on the post approval Flooding and Hydrology Management Plan for SSI-7400 as required by the Condition of Approval (CoA) D3 in the Infrastructure Approval for the Sydney Metro City Southwest – Chatswood to Sydenham project (dated 9 January 2017).

BCS has a role in providing flood risk management advice on major projects to the Department is to ensure flooding is considered prior to approval. The advice BCS provided at the assessment stage remains relevant. BCS does not have a formal role or capacity to review and provide comment on post approval flood reports, even while consultation with BCS may be included in Conditions of Approval from time to time with the agreement of BCS.

BCS recommend that NSW State Emergency Service (SES) be provided the opportunity to comment on any flood emergency matters in the operational plan or the emergency plan referenced therein.

Please note that all BCS advice on major projects in Greater Sydney is managed by the BCS Planning Team, which includes advice on flood risk management. All requests for advice on major projects must be sent to the Planning Team.

If you have any queries please contact rog.gsrplanning@environment.nsw.gov.

Yours sincerely



Susan Harrison
Senior Team Leader Planning
Greater Sydney
Biodiversity, Conservation and Science

CC Peter Scioscia, Metro Trains Sydney

4 Parramatta Square | 12 Darcy Street Parramatta NSW 2150 | Locked Bag 5022 Parramatta NSW 2124 | dpie.nsw.gov.au

DPI Water

Department of Climate Change, Energy, the Environment and Water



Our ref: OUT24/7684

Peter Scioscia
Metro Trains Sydney
Email: Peter.Scioscia@metrotrains-sydney.com.au
6 June 2024

Subject: Sydney Metro Chatswood to Sydenham Project (SSI 7400-PA-528) – Flooding and Hydrology Sub-Plan and Groundwater Management Sub-Plan

Dear Peter Scioscia

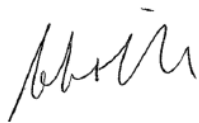
I refer to your request for advice dated 27 May 2024 to the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) Water Group about the above matter.

The NSW DCCEEW Water Group has reviewed the two sub-plans and considers the groundwater management plan requires additional information and clarification to address issues regarding monitoring and impact verification, hydrogeology conceptualisation and inflow rates. No comments are provided for the flooding and hydrology sub-plan.

Please see Attachment A for detailed comments.

Should you have any further queries in relation to this submission please do not hesitate to contact DCCEEW Water Assessments water.assessments@dpie.nsw.gov.au.

Yours sincerely



Rob Brownbill
Manager, Water Assessments, Knowledge Division
Department of Climate Change, Energy, the Environment and Water





Our Ref: ID2494

Your Ref:

12 June 2024

Peter Scioscia
PO Box 3839
Rouse Hill Village 2155

email: peter.scioscia@metrotrains-sydney.com.au

Dear Peter,

Flooding and Hydrology Plan for Sydney Metro City & Southwest Network

Thank you for the opportunity to provide advice on the State Significant Development Application for the Flooding and Hydrology Plan for Sydney Metro City and Southwest Network. It is understood that the proposed development seeks to “*identify and manage flooding and hydrology risks and impacts associated with the operation of the Sydney Metro Chatswood to Sydenham project*”¹

The NSW State Emergency Service (NSW SES) is the agency responsible for dealing with floods, storms and tsunamis in NSW. This role includes, planning for, responding to and coordinating the initial recovery from floods. As such, the NSW SES has an interest in the public safety aspects of the development of flood prone land, particularly the potential for changes to land use to either exacerbate existing flood risk or create new flood risk for communities in NSW.

The NSW SES recommends that consideration of flooding issues is undertaken in accordance with the requirements of NSW Government’s Flood Prone Land Policy as set out in the Flood Risk Management Manual 2023 (the Manual) and supporting guidelines, including the Support for Emergency Management Planning and relevant planning directions under the *Environmental Planning and Assessment Act, 1979*. Some of the key considerations relating to emergency management are further detailed in Appendix A.

The flooding information provided as part of this plan is incomplete, does not contain modelling. We recommend including addition information for NSW SES to adequately understand flood risks for the site, including access and egress during flooding conditions, and strategies for supporting and evacuating persons on site during a flood event.

NSW SES requests the following information to adequately assess flood risks:

- **Provision of the related documents** as listed in the Flooding & Hydrology Management Plan including:
 - Operational Environmental Management Plan

¹ MTS, 2024, Flooding and Hydrology Plan, Section 1.2 Plan Purpose, Page 5



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www.ses.nsw.gov.au
ABN: 88 712 649 015





- Incident Management Plan
- Severe Weather Conditions Response Plan
- **Detailed site and flood mapping including:**
 - an assessment of the flood risk up to and including the Probable Maximum Flood (PMF), on the site and access/egress routes.
 - climate change considerations.
 - time to onset, duration, depth, velocity and hydraulic hazard of any flooding or isolation.
 - an assessment of the impact of the proposed development on flood behaviour on the sites themselves as well as surrounding properties.
- **Detailed evacuation plans, which:**
 - Outline the triggers for site evacuation.
 - Explain how evacuation notifications will be delivered to all persons on site during both the construction and operational phases.
 - Outline evacuation routes for all persons on site to a safe evacuation location for floods up to and including a PMF.
 - Explain any changes to evacuation procedures during road closures related to construction.
 - Are consistent with the NSW SES existing emergency management arrangements.

Further, we recommend seeking advice from the NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) regarding the impact of the proposed development on flood behaviour for adjacent and downstream areas.

You may also find the following Guidelines, originally developed for the Hawkesbury Nepean Valley and available on the NSW SES website useful:

- [Reducing Vulnerability of Buildings to Flood Damage](#)
- [Designing Safer Subdivisions](#)
- [Managing Flood Risk Through Planning Opportunities](#)

Please feel free to contact Kate Dawes via email at rra@ses.nsw.gov.au should you wish to discuss any of the matters raised in this correspondence. The NSW SES would also be interested in receiving future correspondence regarding the outcome of this referral via this email address.

Yours sincerely,



Elspeth O'Shannessy
 Manager Emergency Risk Assessment
 NSW State Emergency Service





MTS email to NSW SES

RE: Response ID2494 RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation and Rev...




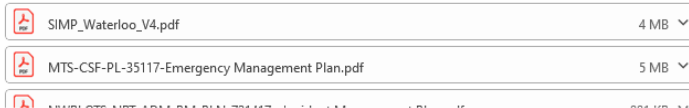
Peter Scioscia

To: NSW SES Risk Reduction
Cc: Shelly Stingmore


 Reply
  Reply All
  Forward
 


Fri 14/06/2024 12:55 PM

 If there are problems with how this message is displayed, click here to view it in a web browser.
 This message is part of a tracked conversation. Click here to find all related messages or to open the original flagged message.



Hi Daniela,

Thanks for sending the feedback through to us.

- Regarding the request for detailed site and flood mapping and the points under that heading, MTS is just the operator of the Sydney Metro Trains. We will not be doing any work, building new structures, or changing the existing flood risk that was outlined in the design and construction phase.

See here for a quote from the Sydney Metro City and Southwest EIS *"When operational, the aboveground station infrastructure would be located within the footprint of existing development and would have a negligible impact on the existing surface hydrology. All surface water from aboveground facilities and tunnel dive structures would also be collected by new drainage infrastructure and connected to existing stormwater systems. No additional properties would be flood-affected as a result of the project."*

Therefore, the Plan was written with that in mind, so no site and flood mapping were created as there is no requirement for them as we are just the operator. This is the Operational Flooding and Hydrology Plan.

This is also relevant to your recommendation of seeking advice from the NSW DCCEEW as we are just the operator of the Metro and will not be building/developing anything.

- Regarding the provision of the related documents. See attached for the Operational Environmental Management Plan, the Incident Management Plan and the Sever Weather Conditions Response Plan.
- Regarding the evacuation plans, see attached for our Emergency Management Plan as well as an example of one of the stations' Site Incident Management Plan (SIMP) that will be used. These outline the triggers for site evacuation, notifications, routes, and are consistent with SES existing emergency management arrangements.

Hope this satisfies your requests. If you have any questions, please let me know.

Regards,

Peter Scioscia
 Environment and Sustainability Advisor
 Metro Trains Sydney
 47 Tallawong Road
 Tallawong NSW 2762
 PO Box 3839
 Rouse Hill Village 2155
 M: 0492 233 352
 E: Peter.Scioscia@metrotrains-sydney.com.au

SES Reply email to MTS

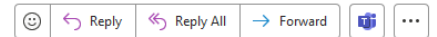
RE: Response ID2494 RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation and Rev...



NSW SES Risk Reduction <rra@ses.nsw.gov.au>

To: Peter Scioscia; NSW SES Risk Reduction

Cc: Shelly Stingmore



Mon 24/06/2024 3:07 PM

This message is part of a tracked conversation. Click here to find all related messages or to open the original flagged message.

Dear Peter,

Thank you for providing the additional documentation for Metro Trains Sydney City South including the Operational Environmental Management Plan, Severe Weather Conditions Response Plan, Incident Management Plan, Emergency Management Plan and Waterloo Site Incident Management Plan.

While we are happy to review and consider these arrangements for any future operational response, we would like to reiterate that in order for us to provide meaningful, site specific advice regarding the flood risk and emergency management constraints for each site we typically require additional information as outlined below, as well as a turnaround time of 3-4 weeks. This assessment typically considers the flood risk on the site across all extents of flooding, impacts to life and property from flooding and emergency response implications, including the suitability of evacuation routes and other mitigation measures, as well as recommendations for the reduction of risk.

Noting that your initial consultation period has now closed, we would be happy to work with you to provide advice for future updates of Emergency Plans. For any future updates, we request the following information in advance:

- **Detailed site and flood mapping including:**
 - an assessment of the flood risk up to and including the Probable Maximum Flood (PMF), on the site and access/egress routes.
 - climate change considerations.
 - time to onset, duration, depth, velocity and hydraulic hazard of any flooding or isolation.
 - an assessment of the impact of the proposed development on flood behaviour on the sites themselves as well as surrounding properties.
- **Detailed evacuation plans, which:**
 - Outline the triggers for site evacuation.
 - Explain how evacuation notifications will be delivered to all persons on site during both the construction and operational phases.
 - Outline evacuation routes for all persons on site to a safe evacuation location for floods up to and including a PMF.
 - Explain any changes to evacuation procedures during road closures related to construction.
 - Are consistent with the NSW SES existing emergency management arrangements.

Evacuation plans for each station should include specific triggers for evacuation, as well as the proposed route for site users to evacuate out of the flood hazard. We note that a number of sites are listed as having surrounding roadway inundation during a flood event; evacuation routes should therefore consider people evacuating from the area to a safe flood-free location rather than just exiting the station itself.

While we appreciate MTS is the operator of Sydney Metro Trains and is not conducting construction works likely to change the flood impacts, a detailed understanding of flood behaviour at the site is critical in developing evacuation plans to avoid site users being evacuated into potentially dangerous areas outside the station. We recommend referring to the best available flood information for the area, which may include flood studies produced by councils or other relevant agencies, or local site specific studies if they are available

Please feel free to contact me via email at rra@ses.nsw.gov.au should you wish to discuss any of the matters raised in this correspondence or if are any questions about the above.

Regards




Kate Dawes (she / her)
 Planning and Research Officer | Emergency Risk Assessment
 NSW State Emergency Service - Metro Zone
 E kate.dawes1@ses.nsw.gov.au

MTS reply to SES with V3 and update on comments – 31st July, 2024

RE: Response ID2494 RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Con...




Peter Scioscia



To:  NSW SES Risk Reduction

Cc:  Shelly Stingmore

  Reply  Reply All  Forward  

Wed 31/07/2024 10:07 AM

 This message is part of a tracked conversation. Click here to find all related messages or to open the original flagged message.

 SMCSWTS2-MTS-1NL-EM-PLN-002711 - Flooding and Hydrology Plan - Tracked Changes.pdf 6 MB 

Hi Kate and Shelly,

Please see attached for MTS' updated Flooding and Hydrology Plan (tracked changes).

We feel we have worked on the detailed site and flood mapping comment (see section 4.2.3), however we are still working on obtaining and detailing the detailed evacuation plans to include flooding. This means we would like to work with the SES post submission of the Flooding and Hydrology Plan to get this comment resolved.

Can you confirm you are OK with us submitting the plan as it currently is to DPHI, knowing we will resolve the evacuation plans post submission?

Apologies for the rush, **but we do require an answer today as we are re-submitting the plan back to DPHI tomorrow**. Are you able to urgently get back to me on this please?

Let me know if you have any issues or questions on this.

Thanks,

Peter Scioscia
Environment and Sustainability Advisor
Metro Trains Sydney
 47 Tallawong Road
 Tallawong NSW 2762
 PO Box 3839
 Rouse Hill Village 2155
 M: 0492 233 352
 E: Peter.Scioscia@metrotrains-sydney.com.au



SES email to MTS providing second review comments

From: NSW SES Risk Reduction <rra@ses.nsw.gov.au>
Sent: Wednesday, August 21, 2024 11:45 AM
To: Peter Scioscia <peter.scioscia@metrotrains-sydney.com.au>
Cc: NSW SES Risk Reduction <rra@ses.nsw.gov.au>; Helen Slater <helen.slater@ses.nsw.gov.au>
Subject: Response ID2589 - Flooding & Hydrology Management Plan for Sydney Metro City & Southwest Updated

Good morning Peter

Thank you for providing NSW SES the opportunity to review the updated Flooding and Hydrology Management Plan for Sydney Metro City and Southwest.

Please find NSW SES response attached for consideration.

Kind regards.

Daniela



Daniela Mitreski
Program Support Officer | Emergency Risk Assessment Branch |
Emergency Management Directorate
NSW State Emergency Service – State Headquarters
E rra@ses.nsw.gov.au



Our Ref: ID 2589

Your Ref:

21 August 2024

Peter Scioscia
Metro Trains Sydney
PO Box 3839
Rouse Hill Village NSW 2155

Via email

email: peter.scioscia@metrotrains-sydney.com.au

CC: helen.slater@ses.nsw.gov.au

Dear Peter,

Flooding & Hydrology Management Plan for Sydney Metro City & Southwest

Thank you for the opportunity to provide advice on the Flooding & Hydrology Management Plan for Sydney Metro City & Southwest. It is understood that the proposed development seeks to “identify and manage flooding and hydrology risks and impacts associated with the operation of the Sydney Metro Chatswood to Sydenham project¹”.

The NSW State Emergency Service (NSW SES) is the agency responsible for dealing with floods, storms and tsunami in NSW. This role includes, planning for, responding to and coordinating the initial recovery from floods. As such, the NSW SES has an interest in the public safety aspects of the development of flood prone land, particularly the potential for changes to land use to either exacerbate existing flood risk or create new flood risk for communities in NSW.

The NSW SES recommends that consideration of flooding issues is undertaken in accordance with the requirements of NSW Government’s Flood Prone Land Policy as set out in the Flood Risk Management Manual 2023 (the Manual) and supporting guidelines, including the Support for Emergency Management Planning and relevant planning directions under the *Environmental Planning and Assessment Act, 1979*. Some of the key considerations relating to emergency management are further detailed in Appendix A.

We refer to our previous correspondence dated 12 June 2024, 24 June 2024 and 31 July 2024 and note and appreciate the additional information and revisions to the Flooding and Hydrology Plan (the Plan) as provided. Additionally, we offer the following advice.

In summary, we:

- Note that the Plan includes eleven identified sites with varying uses including dive sites, passenger stations, a substation site and one temporary site.

¹ MTS, 2024, Flooding and Hydrology Plan, Section 1.2 Plan Purpose, Page 5



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- Note the included sites are affected by a range of flooding impacts as outlined in table 7 of the Plan² and supported by the provided mapping.
- Recommend establishing clear triggers for implementing the plan at each site as well as undertaking alternative evacuation actions as identified in the Plan³ and the implementation of any temporary measures which have been identified⁴. See Attachment A – Principle 2 for further information.
- Recommend providing a quick reference of the emergency management actions and their triggers for each site in conjunction with the provided evacuation maps for quick reference for staff at each location.
- Recommend developing a testing, monitoring and review schedule for the Plan within the Plan itself. FERP should be regularly exercised, similar to building fire evacuation drills and updated at regular intervals and whenever additional flood information is available or highlighted during the drills or flood events.
- Recommend identifying a safe refuge above the Probable Maximum Flood (PMF) at each evacuation area or site for travellers who may be unable to continue their journey outside the area, due to flooding.
- Recommend seeking advice from the Department of Climate Change, Energy, the Environment and Water (DEECW).

You may also find the following Guidelines, originally developed for the Hawkesbury Nepean Valley and available on the NSW SES website useful:

- [Reducing Vulnerability of Buildings to Flood Damage](#)

Please feel free to contact Kate Dawes via email at rra@ses.nsw.gov.au should you wish to discuss any of the matters raised in this correspondence. The NSW SES would also be interested in receiving future correspondence regarding the outcome of this referral via this email address.

Yours sincerely,



Elspeth O'Shannessy
Manager, Emergency Risk Assessment
NSW State Emergency Service

² Metro Trains Sydney, 2024, Flooding and Hydrology Plan, Table 7 Existing Flood Behaviour, Page 23

³ Metro Trains Sydney, 2024, Flooding and Hydrology Plan, Waterloo Site, Page 47

⁴ Metro Trains Sydney, 2024, Flooding and Hydrology Plan, Section 4.3 Management Measures, Page 49

SES email to MTS stating SES review comments are now closed

From: NSW SES Risk Reduction <rra@ses.nsw.gov.au>
Sent: Monday, August 26, 2024 4:10:20 PM
To: Peter Scioscia <peter.scioscia@metrotrains-sydney.com.au>; NSW SES Risk Reduction <rra@ses.nsw.gov.au>
Cc: Helen Slater <helen.slater@ses.nsw.gov.au>
Subject: RE: Response ID2589 - Flooding & Hydrology Management Plan for Sydney Metro City & Southwest Updated

Hi Peter,

Thank you for sending through the revised plan. We appreciate the updates and have no further advice regarding this document at this stage. Any outstanding comments can be closed, however we would like to highlight that Emergency Plans should be treated as living documents and reviewed and updated in line with the specified review schedule.

Regards
Kate



Kate Dawes (she / her)
Planning and Research Officer | Emergency Risk Assessment
NSW State Emergency Service - Metro Zone
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Sydney Water

From: Hanka Shabilla <HANKA.SHABILLA@sydneywater.com.au>

Sent: Tuesday, June 11, 2024 2:49 PM

To: Peter Scioscia <peter.scioscia@metrotrains-sydney.com.au>; Benjamin Schipp <BENJAMIN.SCHIPP2@transport.nsw.gov.au>; John Ieroklis <John.Ieroklis@transport.nsw.gov.au>

Cc: Julia Diamond <Julia.Diamond@transport.nsw.gov.au>; Saeed Zebian <Saeed.ZEBIAN@transport.nsw.gov.au>; Ben Nugteren <Ben.Nugteren@transport.nsw.gov.au>; Gaya Prem kumar <Gaya.Premkumar@transport.nsw.gov.au>

Subject: RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation and Review Period Timeline

Thank you for that Peter,

Apologies for responding late, I have been unwell and just got back.

Thank you for sending the EPL.

Can you please provide us the following clarifications,

- the plan layout where the water treatment plant will be located in relation to the Marrickville Dive.
- At what point of our Eastern Channel will the plant be discharging into and
- What is the rate of discharge?

Thank you.


Kind Regards,

Hanka Shabilla


Mob 0466 491 392

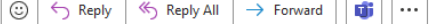
MTS email to external stakeholders requesting confirmation of close out of comments

Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation


Peter Scioscia
 To: rog.gsrplanning@environment.nsw.gov.au; michael.carney@member.ses.nsw.gov.au; allison.flaxman@ses.nsw.gov.au; scott.kavanagh@willoughby.nsw.gov.au; Gavin.McConnell@northsydney.nsw.gov.au; TMitchell@cityofsydney.nsw.gov.au; tbershtein@cityofsydney.nsw.gov.au; david.paton@innerwest.nsw.gov.au; +5 others

Mon 24/06/2024 4:39 PM


 SMCSWTS2-MTS-1NL-EM-PLN-002711 - Flooding and Hydrology Plan.pdf 2 MB



Hi,

Please see attached for our updated Flooding and Hydrology Management Plan with your comments considered (See section 2).

If we could ask that you review the plan and reply to us by COB Wednesday the 26th of June with any further comments you may have, or your written approval that we have addressed your concerns.

Thanks very much for taking the time to review the plan. If you have any further questions, please don't hesitate to let me know.


Regards,

Peter Scioscia
 Environment and Sustainability Advisor
 Metro Trains Sydney
 47 Tallawong Road
 Tallawong NSW 2762
 PO Box 3839
 Rouse Hill Village 2155
 M: 0492 233 352
 E: Peter.Scioscia@metrotrains-sydney.com.au

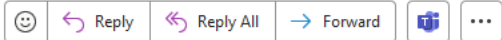



Sydney Water comments closed out

RE: [External] Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Pla...


Hanka Shabilla <HANKA.SHABILLA@sydneywat>
 To: [Peter Scioscia](mailto:Peter.Scioscia@metrotrains-sydney.com.au)
 Cc: [Ryan Tudor](mailto:Ryan.Tudor@sydneywat.nsw.gov.au); [Saeed Zebian](mailto:Saeed.Zebian@sydneywat.nsw.gov.au)

Tue 25/06/2024 8:50 AM




 Click here to download pictures. To help protect your privacy, Outlook prevented automatic download of some pictures in this message.

Thank you Peter,
 No further comments.

Kind Regards,

Hanka Shabilla
 Mob 0466 491 392

Willoughby Council closed out

RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation



Kavanagh, Scott <Scott.Kavanagh@Willoughby.nsw.gov.au>

To  Peter Scioscia

Cc  Pei, Aston

 Follow up. Start by Monday, 22 July 2024. Due by Monday, 22 July 2024.

Hey Peter.

We have no further comments

Regards

Scott

Scott Kavanagh - *Design and Drainage Team Leader*

WILLOUGHBY CITY COUNCIL

PO Box 57 Chatswood NSW 2057

P +61 2 9777 1059 | M

E Scott.Kavanagh@Willoughby.nsw.gov.au

willoughby.nsw.gov.au | visitchatswood.com.au | theconcourse.com.au

Council acknowledges the Gamaragal People as the Traditional Owners of these lands. We pay our respects to their Elders past and present.



City of Sydney closed out

An MTR, John Holland and UGL Rail Company



RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation

PS

Peter Scioscia

To

Carl Hastings

Cc

Tegan Mitchell



 Reply

 Reply All

 Forward





Mon 22/07/2024 11:03 AM

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 SIMP_Martin Place_V4.pdf

4 MB

 MTS-CSF-PL-35117-Emergency Management Plan.pdf

5 MB

 AIMP_Central_V3.0.pdf

4 MB

 SIMP_Barangaroo_V3.01.pdf

3 MB

 SIMP_Gadigal_Pitt Street_V3.01.pdf

2 MB

Hi Carl,

Thanks for getting back to me with your approval.

See attached for the documents you have requested.

Regards,

Peter Scioscia
Environment and Sustainability Advisor
Metro Trains Sydney
47 Tallawong Road
Tallawong NSW 2762
PO Box 3839
Rouse Hill Village 2155
M: 0492 233 352
E: Peter.Scioscia@metrotrains-sydney.com.au



From: Carl Hastings <CHastings@cityofsydney.nsw.gov.au>
Sent: Monday, July 22, 2024 10:37 AM
To: Peter Scioscia <peter.scioscia@metrotrains-sydney.com.au>
Cc: Tegan Mitchell <TMitchell@cityofsydney.nsw.gov.au>
Subject: RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation

Hi Peter,

Our reviewers have confirmed that the comments and response can be closed out for the Metro City Southwest Flooding and Hydrology Management Plan.

Could we please request MTS to send to the City emergency management plans related to metro stations within City of Sydney referred in the following snap?

SES	Detailed evacuation plans, which: <ul style="list-style-type: none">Outline the triggers for site evacuation.Explain how evacuation notifications will be delivered to all persons on site during both the construction and operational phases.Outline evacuation routes for all persons on site to a safe evacuation location for floods up to and including a PMF.Explain any changes to evacuation procedures during road closures related to construction.Are consistent with the NSW SES existing emergency management arrangements.	MTS evacuation plans were sent to the NSW SES as per the email in Appendix D. At the time of submission, there has been no reply from the NSW SES. Supplementary plans also sent to the NSW SES were Emergency Management Plan and the Site Incident Management Plans Update post consultation: This comment from SES remains open after submission (See Appendix D). MTS commits to working with SES on this comment to ensure they are satisfied, and the comment can be closed out.
-----	---	---

Kind regards,
Carl Hastings
Planning Coordinator - Transport Major Projects
City Access & Transport



Tel: +61 2 9246 7560

Inner west Council closed out

An MTR, John Holland and UGL Rail Company



RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Con...



David Paton <David.Paton@innerwest.nsw.gov.au>
To: Peter Scioscia
Cc: Minas Kassiou; Rafaah Georges; James Ogg; Julia Diamond; Michael Huy

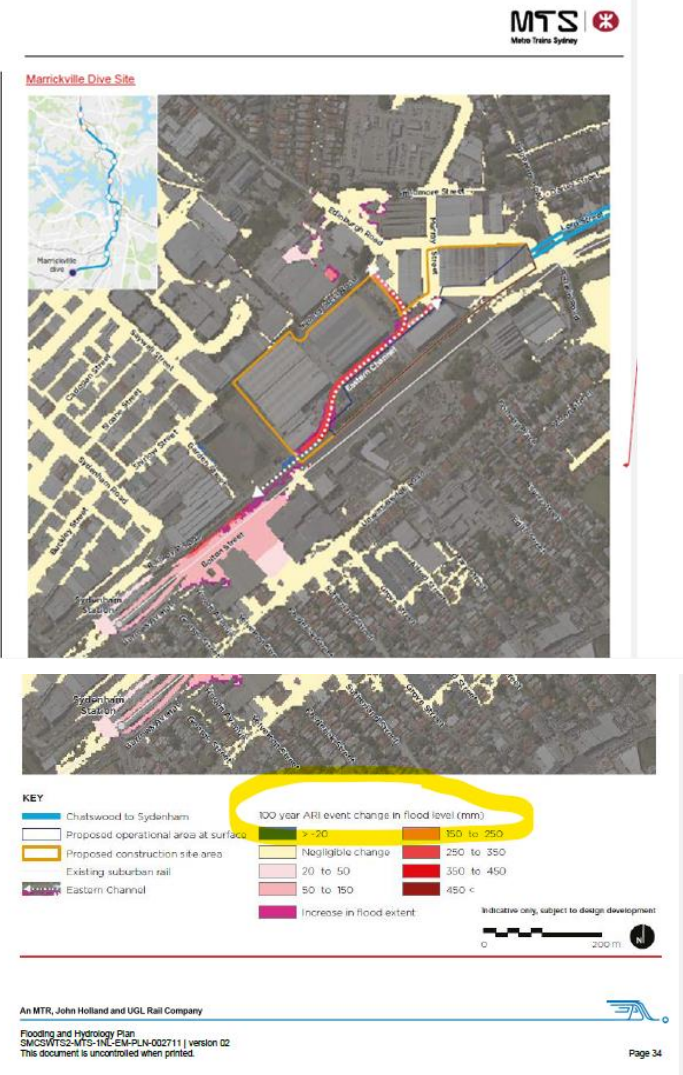
Thu 25/07/2024 10:57 PM

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Click here to download pictures. To help protect your privacy, Outlook prevented automatic download of some pictures in this message.

Hi Peter,

We are happy with the changes made on the last version, except that there appears to be an error with one of the figures added to the document.

As per the below screenshot, the PMF map for the Marrickville Dive Site shows the 100 year ARI event change map rather than the PMF extent and hazard categories.



We are happy to endorse the Plan once this map is corrected.

Regards

David Paton
Engineering Services Manager
p +61 2 9392 5642 e David.Paton@innerwest.nsw.gov.au



Council acknowledges the Traditional Custodians of these lands, the Gadigal-Wangal people of the Eora Nation.







RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation



Peter Scioscia

To  David Paton

Cc  Minas Kassiou;  Rafaah Georges;  James Ogg;  Michael Huy



 Reply

 Reply All

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Wed 31/07/2024 1:02 PM

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SMCSWTS2-MTS-1NL-EM-PLN-002711 - Flooding and Hydrology Plan.pdf 6 MB

Hi all,

See attached for our updated Flooding and Hydrology Plan where you'll see more information regarding flood modelling as well as the updated figure for the Marrickville Dive Site.

Any issues or questions, please let me know.

Thanks,







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Metro Trains Sydney




RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation

 David Paton <David.Paton@innerwest.nsw.gov.au>
To:  Peter Scioscia
Cc:  Minas Kassior;  Rafaah Georges;  James Ogg;  Michael Huy

  Reply  Reply All  Forward  

Wed 31/07/2024 4:51 PM

 You replied to this message on 31/07/2024 4:53 PM.
This message is part of a tracked conversation. Click here to find all related messages or to open the original flagged message.

Hi Peter,

Thanks for the updated version.

Might I suggest you fix the below formatting error for Section 4.2.2 in the ToC and on Page 23.

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4.2.2. To avoid inundation, the tunnel dive structures have been designed at or above the Probable Maximum Flood level for mainstream flooding. Drainage at the dive structures are designed to manage flows for the 100-year average recurrence interval event. No flooding impacts on, or as a result of, the project are anticipated at or surrounding the Chatswood dive site. To avoid flooding of the Marrickville dive structure, the metro tracks have been designed at a level of about 6.3 metres Australian Height Datum near the start of the dive structure, which is about 1.5 metres above the existing ground level. As per the probable maximum flood extent map of the Marrickville Dive Site in Section 4.2.3, the 100 year ARI event change in flood level at the site would not be over 450mm and therefore no flooding is expected. Potential operational risks	23
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Regards

David Paton
Engineering Services Manager
p +61 2 9392 5642 e David.Paton@innerwest.nsw.gov.au



Council acknowledges the Traditional Custodians of these lands, the Gadigal-Wangal people of the Eora Nation.

MTS emails to North Sydney Council

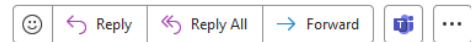
RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation




Peter Scioscia

To: Jerimia Tukadra

Cc: Melissa Northey; Tfns ExternalContact349; Amanda Calvez



Wed 24/07/2024 12:56 PM

 This message was sent with High importance.
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Hi Jerimia,

I have to follow up on this again as it is critically important we close this out as soon as possible now as it relates to first passenger services for the new Sydney Metro line. I have tried calling you a few times now with no luck.

As stated below, we need written approval of North Sydney council's comment regarding our plan. Can you please review the previous email and either give its approval or let me know what we can do to improve it?

We need to finalise this COB today.

Thanks,

Peter Scioscia
Environment and Sustainability Advisor
Metro Trains Sydney
47 Tallawong Road
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PO Box 3839
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M: 0492 233 352
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From: Peter Scioscia
Sent: Tuesday, July 23, 2024 11:01 AM
To: Jerimia Tukadra <Jerimia.Tukadra@northsydney.nsw.gov.au>
Subject: RE: Metro Trains Sydney - Sydney Metro City Southwest Flooding and Hydrology Management Plan Consultation

Hi Jerimia,

Just wanted to follow up on this again due to the urgency, and the fact that North Sydney's Council's comment was more of an FYI, than something you needed feedback on.

Your comment said **"Council requires that any unusual SW excess to be disposed of directly into Sydney Water mains SW and that such discharge does not delay/ disrupt the evacuation of surface/ local SW surge. Any such disposal of stormwater events in Metro facilities would need to be timed and coordinated with stakeholder agencies such as Sydney Water, Council, SES and emergency services."**

For which we replied **"Noted"** as all stormwater water is captured in our SW pipes and treated at our Marrickville Water Treatment Plant, all along the network.

As stated, we need written approval this is OK with your council, so can you please reply to this email with your approval or let me know if you have further questions.

Thanks,

Peter Scioscia
Environment and Sustainability Advisor