

Flood Emergency Response Plan

Project Marvel

Prepared for Mapletree SR Australia Management Pty Ltd / 21 November 2024

231204

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Rev	Date	Prepared By	Approved By	Remarks
1	04/11/2024	Ali Vahidi	Jamie Marshall	Draft for Review
2	21/11/2024	Ali Vahidi	Jamie Marshall	Issue

1. Introduction

TTW Pty Ltd (NSW) has been engaged by Mapletree SR Australia Management Pty Ltd to prepare a Flood Emergency Response Plan (FERP), to be implemented during the operation of the proposed logistics centre at 20 Kelso Crescent, Moorebank. The purpose of this FERP is to summarise the flood risks within the site, identify preparation measures that should be undertaken to mitigate such risks, and provide an action plan with steps to be completed during a flood event.

This FERP has been prepared in respect of a State Significant Development Application (SSDA) **SSD-58978472** for the construction and operation of the proposed Kelso Crescent multi-level warehouse. This FERP addresses issues raised by Biodiversity Conservation Science (BCS) Group on 16th July 2024. Table 1 summarises the relevant flood emergency management issues raised by BCS and how this has been addressed in this report.

Table 1: BCS Advice

No.	Advice	Response
1	<p>Modelling results from the Georges River Flood Study – Final Draft Mapping Compendium (BMT, September 2019) indicate the site would become isolated in events greater than and including the 2% AEP event.</p> <p>The site would become a high flood island for a 0.5% AEP and rarer events.</p> <p>The floodwater depth in the PMF event in areas adjoining to the site would be in the order of 2m and the hazard category would be H5 to H6.</p> <p>The southern portion of the site would function as flood storage in a 1% AEP event. The duration of isolation would be in the order of 24-36 hours or possibly longer at the site.</p>	Noted.
2	<p>The Georges River Evacuation Modelling Study (2022) indicates the site would be isolated because the western and eastern portions of Newbridge Road (adjacent to the site) and Seton Road are inundated from the 2% AEP and there is insufficient capacity via the road network to evacuate prior to these roads being cut.</p> <p>The study results further indicate insufficient capacity under the future growth scenarios of Liverpool CBD.</p>	Noted. Based on the information provided in the Georges River evacuation modelling and flood evacuation analysis, evacuation measures are only necessary for the PMF event.
3	<p>BCS recommends that any proposed emergency management strategy for the development is compatible with existing emergency management arrangements per the Local Flood Plan.</p> <p>Consultation with the NSW State Emergency Service is required.</p>	An email was sent to SES on October 21, 2024, and they directed us to the Liverpool City Flood Emergency Sub-Plan and the flood studies on the Liverpool Council website.
4	BCS also recommends the Flood Risk Management (FRM) Manual 2023 Support for Emergency Management Planning guideline	Noted.

	<p>(EM01) is used for detailed guidance. BCS is concerned that consistency with the emergency management principles contained therein could not be demonstrated. Principle 4 of the guideline states 'Decisions on redevelopment within the floodplain are supported by an EM strategy that does not increase risk to life from flooding'. Principle 5 states that 'Risks faced by the itinerant population need to be managed'. The principles of the guideline have not been addressed by the Flood Report.</p>	
<p>5</p>	<p>A shelter in place strategy for this development is not recommended and would not be consistent with the existing emergency management arrangements. The potential for secondary risks such as those resulting from fire and medical emergencies, as well as risks resulting from human behaviour need to be addressed. Occupants may attempt to evacuate by car despite a shelter in place strategy and encounter dangerous floodwater.</p>	<p>Noted. Evacuation strategy has been chosen for this study.</p>

1.1 Proposed Site

The proposed development site, shown in Figure 1, is located at 20 Kelso Crescent in Lot 1 DP1296586, within the Liverpool City Council Local Government Area (LGA).

The site is bounded by Kelso Crescent to the north and Seton Road to the south, with industrial buildings to the east and west.



Figure 1: Site Location (Source: Nearnmap image dated 11th July 2024)

The proposed redevelopment includes works across the entirety of the site. The proposed uses of the site include:

- A two-storey warehouse facility with associated office space, carparking and servicing areas.
- Access driveways from Kelso Crescent (two truck entry driveways, one truck exit, and one car entry/exit driveway) and Seton Road (one truck exit driveway, and one car entry/exit driveway).

The ground floor plan for the proposed development is shown in Figure 2.



Figure 2: Proposed Ground Floor Layout (Source: Nettleton Trite, dated 19/06/2023)

1.2 Reference Documents

The FERP has been prepared with reference to the following:

- Anzac Creek Floodplain Risk Management Study and Plan (BMTWBM) 2008.
- Australian Rainfall and Runoff – A Guide to Flood Estimation, Commonwealth of Australia (Geoscience Australia), 2019.
- Bureau of Meteorology (BOM) Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.15, 2024.
- Flood Safe guidelines and the relative Flood Safe Tool Kits
- Liverpool City Development Control Plan (DCP), 2021, Chapter 9.
- Liverpool City Local Environmental Plan (LEP), 2021.
- Molino Stewart - Georges River Evacuation Modelling - Flood Evacuation Analysis, 2022;
- NSW Department of Planning and Environment - Flood Risk Management Manual, 2023;
- NSW Department of Planning and Environment - Flood Risk Management Guideline EM01 - Support for Emergency Management Planning, 2023;
- NSW Planning Portal Spatial Viewer ([Spatial Collaboration Portal - Map Viewers \(nsw.gov.au\)](https://www.nsw.gov.au/spatial-collaboration-portal));
- NSW State Emergency Service (SES) Guidelines;
- NSW State Emergency Service (SES) Liverpool City Flood Emergency Sub Plan (2023) (<https://www.ses.nsw.gov.au/media/6239/liverpool-lfp-vol-1-endorsed-april-2023.pdf>)

1.3 Previous Studies

The Georges River Evacuation Modelling and Flood Evacuation Analysis report, prepared by Molino Stewart Pty Ltd, is the most recent and reliable study available for this project. Completed in March 2022, the study was developed through extensive consultation with NSW SES. It utilizes an agent-based Life Safety Model to assess the road transport capacity of the Liverpool LGA for evacuating during a Georges River Probable Maximum Flood (PMF). The study considers various factors, including warning dissemination, evacuee responses, traffic flow, and flood progression. It provides a dynamic, visual representation of evacuation processes, traffic buildup, dissipation, and the overtaking of vehicles by rising floodwaters.

This study defines and models multiple flood evacuation scenarios for the Georges River to demonstrate how different assumptions impact the evacuation process. The following scenarios are discussed in the report:

- **Scenario 1:** The base case, using 2016 Census population and vehicle data (ABS, 2016) and 2011 Journey to Work data (Transport for NSW, 2011).
- **Scenario 2:** A future scenario that includes intensified development within current zoning, considering both residential and non-residential infill, as well as planned road upgrades.
- **Scenario 3:** A future scenario based on current rezoning and development planning proposals, as advised by Council.
- **Scenario A:** Scenario 2, with additional non-residential vehicle evacuation destinations based on workers' locations.
- **Scenario B:** A variation of Scenario 3, incorporating updated planning proposals, revised vehicle yield assumptions for new developments, road and capacity upgrades, and multiple non-residential evacuation destinations

A summary of the modelled scenarios is summarised in Appendix A.

The floodplain in this study was divided into subsectors using preliminary boundaries provided by NSW SES. It was assumed that each subsector would receive an evacuation order 12 hours prior to either its evacuation route being blocked, or its premises being flooded by the PMF. The Project Marvel study area is located within subsector I4 as shown in Figure 3. The northern part of this subsector is classified as a high flood island, indicating that a portion of the site remains flood-free during a PMF event.

The modelling indicates that successful evacuation of the proposed development is achievable only under Scenarios 1, 2, and A during PMF flooding. This study, the most comprehensive available at the time of writing, serves as the foundation for the FEMP.

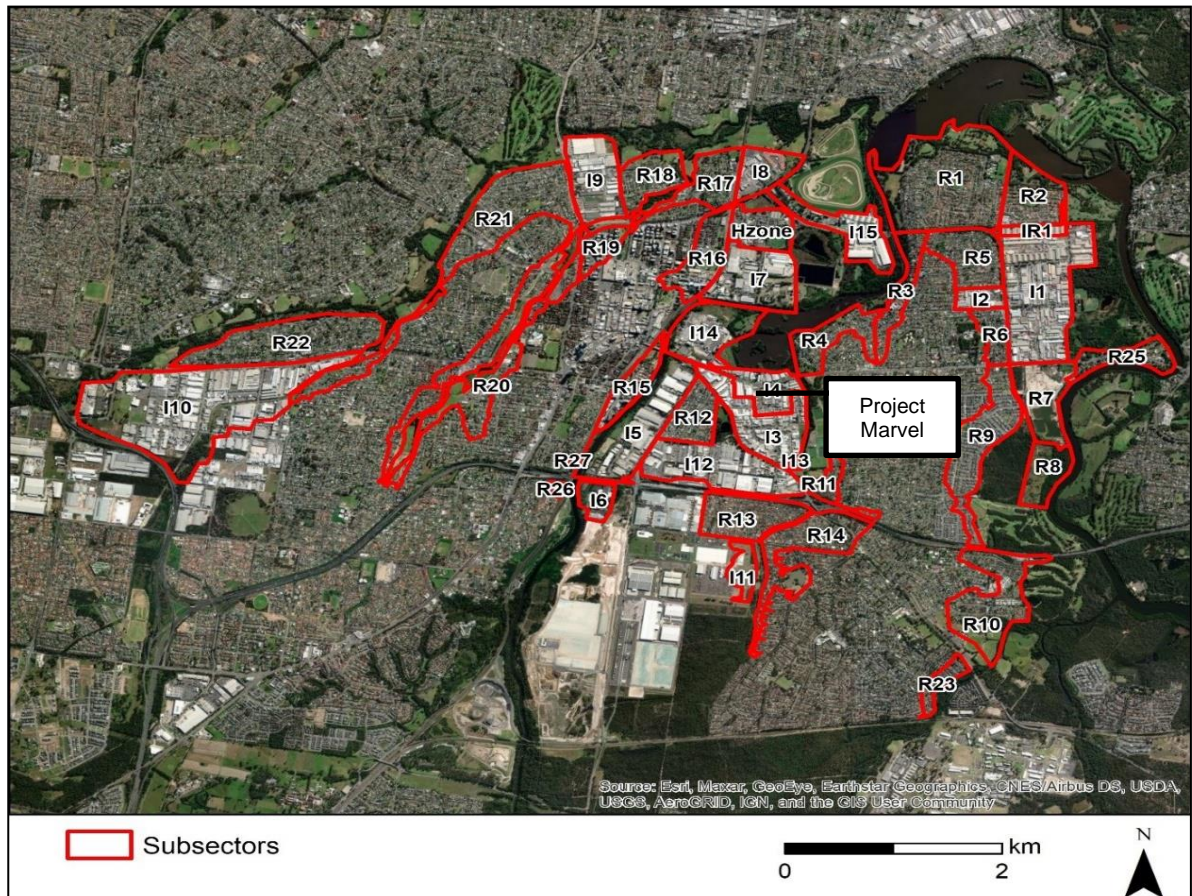


Figure 3: Subsectors Identified in Georges River Evacuation Modelling

2. Flood Behaviour

The flood behaviour and flood impact associated with the development is described in detail in the Flood Impact and Risk Assessment Report (FIRA) prepared by TTW (dated 21 Nov 2024) and submitted with this FERP.

TTW obtained Liverpool City Council’s TUFLOW model from the Anzac Creek Flood Study (May 2008) and updated the model to include new site survey and design information for the proposed development. The critical storm duration for the site was identified as 9-hours for the 1% Annual Exceedance Probability (AEP) event, which was modelled with a 25% blockage. Due to hydraulic instabilities, this model could not be used to assess the PMF.

TTW obtained the TUFLOW model for the Georges River Flood Study (2020) to assess flood behaviour in the PMF event and similarly updated the model to include new site survey and design information for the proposed development. Post-Development Flood Depths.

The peak flood depths and levels at the site in the 1% AEP event in post-development conditions is depicted in Figure 4. The flood modelling results indicate that the proposed flood level at the southern boundary of the site is RL 8.46m AHD, with depths reaching more than 1.7m along Seton Road.

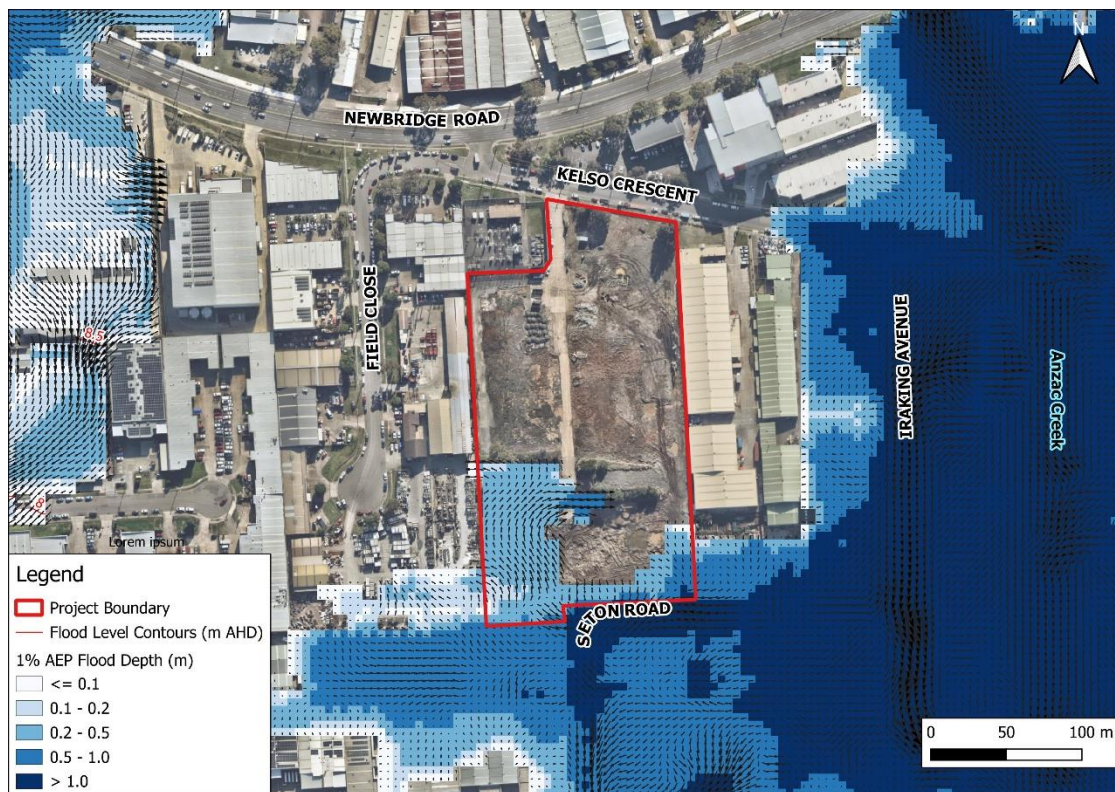


Figure 4: Post Development 1% AEP Flood Depths and Level

The findings indicate that the entire area is affected during the PMF flooding, with only a small flood island remaining to the northwest of the proposed development area. Flood depths are generally above 1 meter, with the flood level around 12.12 mAHD. Additionally, all access roads to the site are rendered impassable due to the floodwaters. The post development PMF flood depths and level is shown in Figure 5.



Figure 5- Post Development PMF Flood Depths and Level

2.1 Post-Development Flood Hazard

A hazard assessment was conducted using the flood hazard vulnerability curves set out in 'Handbook 7 – Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia' of the Australian Disaster Resilience Handbook Collection (2017).

These curves assess the vulnerability of people, vehicles and buildings to flooding based on the velocity and depth of flood flows. The flood hazard categories are outlined in Figure 6, ranging from a level of H1 (generally safe for people, vehicles and buildings) to H6 (unsafe for vehicles and people, with all buildings considered vulnerable to failure).

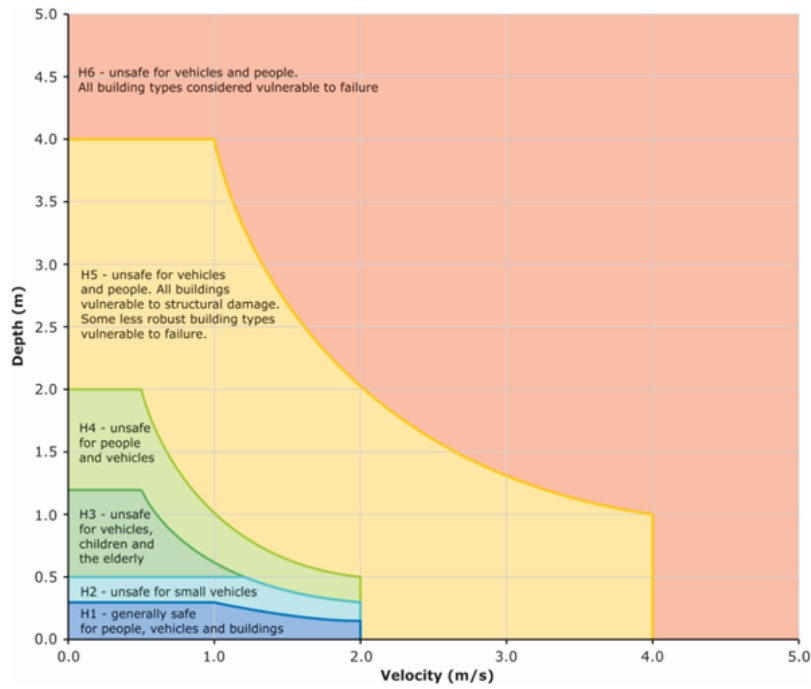


Figure 6: Flood hazard vulnerability curve (Source: Flood Risk Management Guide FB03 - Flood Hazard, NSW Department of Planning and Environment, 2022)

Figure 7 presents the flood hazard categorisation around the site in post-development conditions in the 1% AEP event, with hazards largely between H3 (unsafe for vehicles, children and the elderly) and H4 (unsafe for people and vehicles) along the southern boundary of the site at Seton Road.

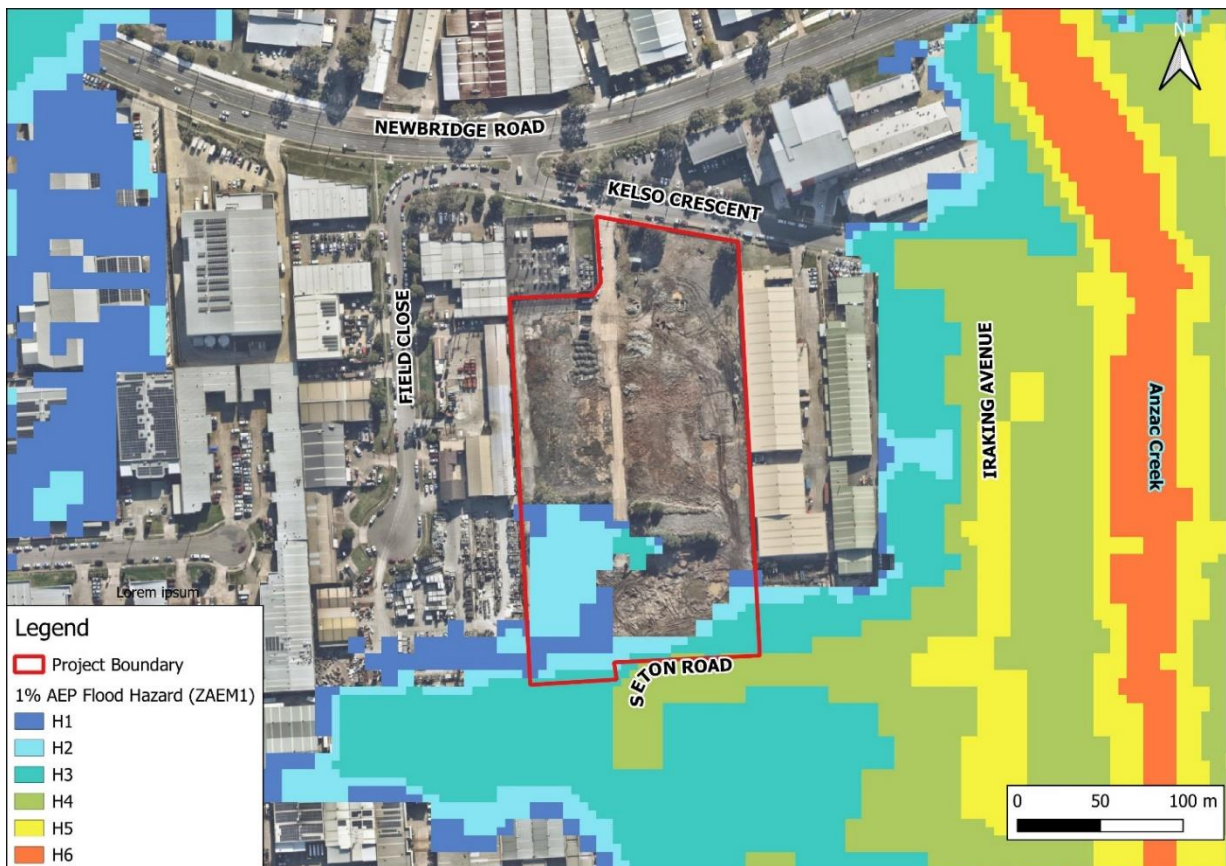


Figure 7: Post Development 1% AEP Flood Hazards

During the PMF event, the flood hazard around the site is predominantly categorized as H4 and H5, indicating areas with a high to very high potential for flood damage. Figure 8 shows the post development PMF flood hazard map.

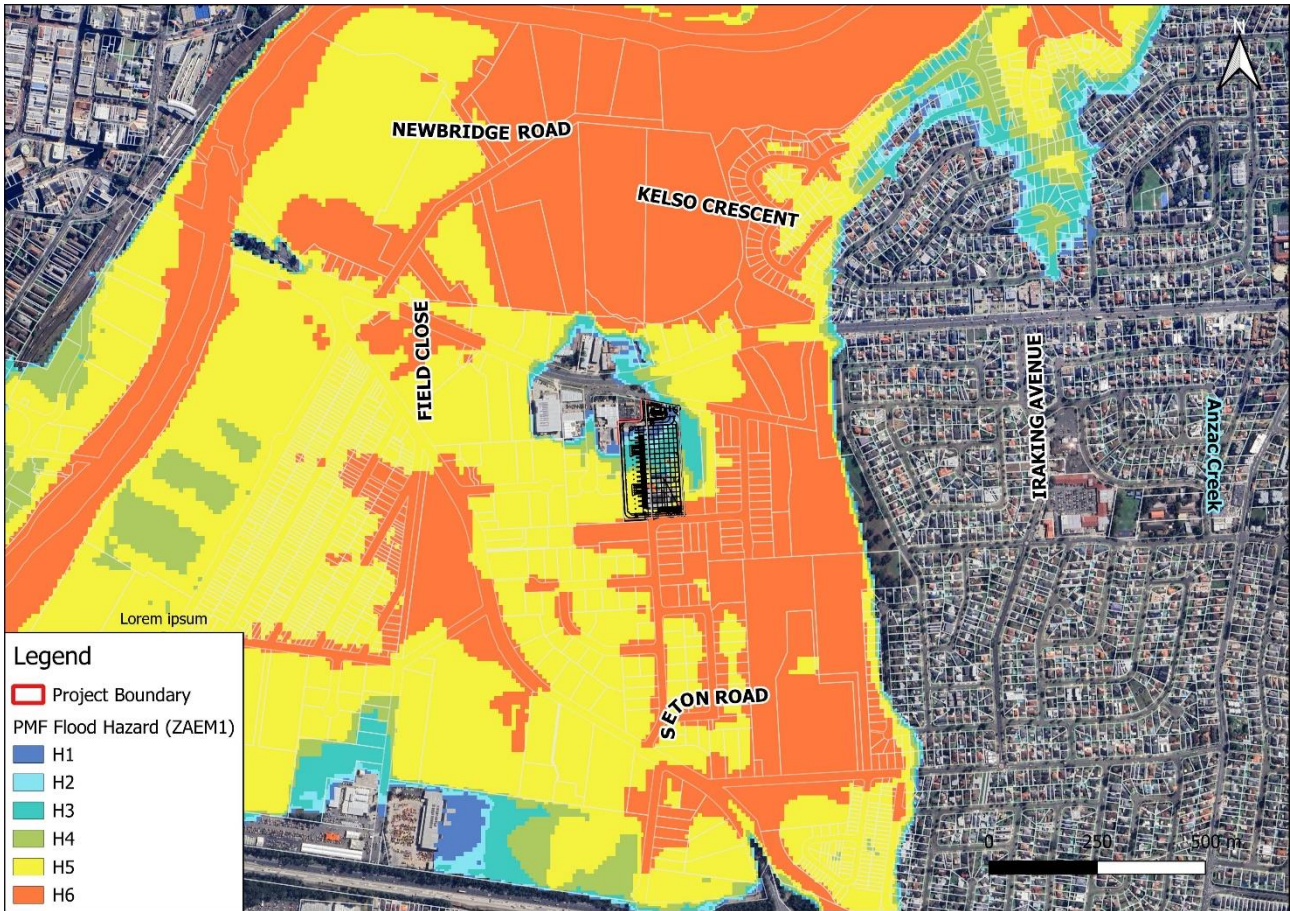


Figure 8- Post Development PMF Flood Hazards

2.2 Time to Inundation

In the 1% AEP event, the site becomes inundated within 25 hours of the onset of the storm. Seton Rd is affected by H3 and H4 flows (unsafe for people and vehicles) after 22.5 hours. During a PMF event, the site is affected by flooding within 7.5 hours of the onset of the critical-duration storm, and key roads connecting to the site become inundated as quickly as 5 to 5.5 hours. This is shown in Figure 9.

The site is almost fully flooded after 9 hours of onset of the storm and only small part of the northern part of it is not impacted during the PMF event. All surrounding roads including Seton Rd and Kelso Crescent and Iraking Ave are impacted by H5 hazard after 20 hours of the onset of the PMF storm.

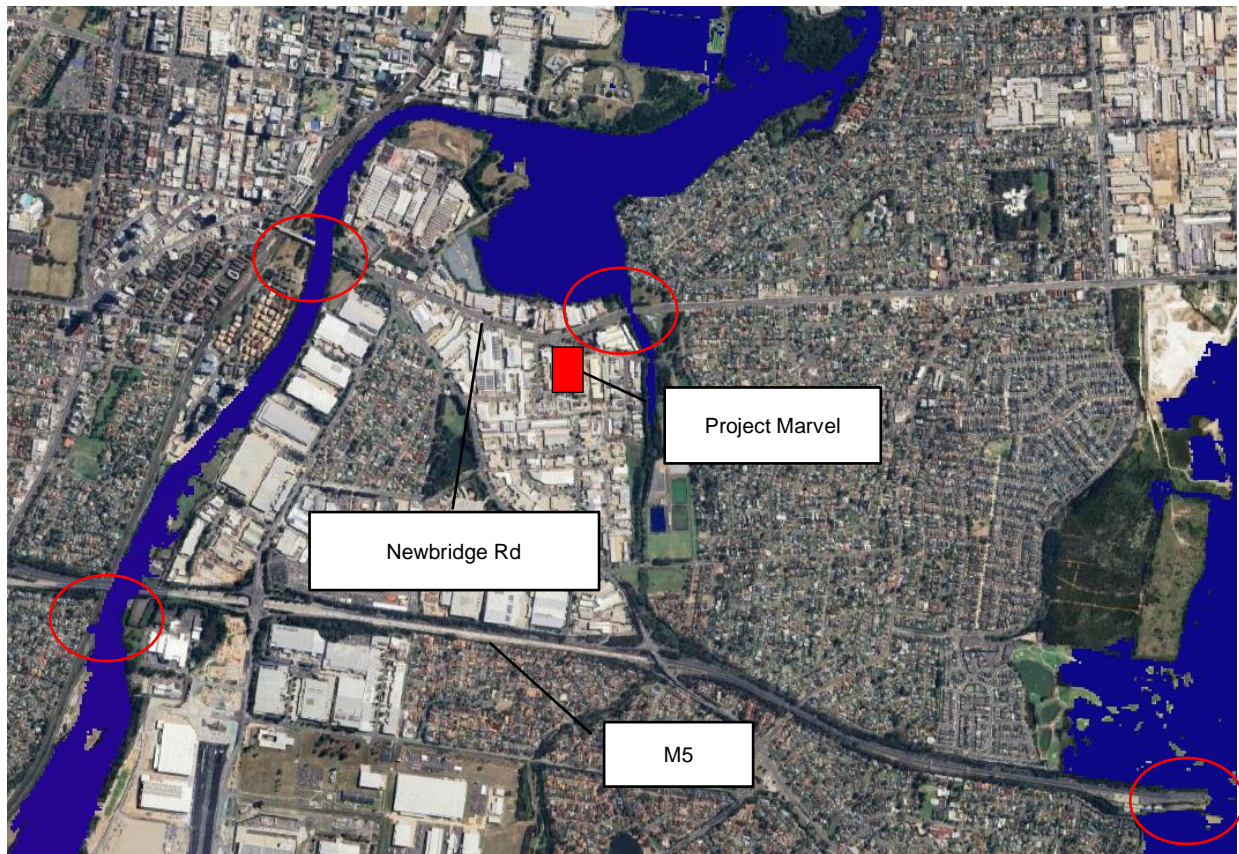


Figure 9: PMF flood map at the 5.5 hour timestep

2.3 Recession Time

The site's location suggests that it may be isolated for an extended period. Analysis of hydraulic model outputs shows that floodwaters reach their maximum level 32 hours after the onset of the PMF storm, then begin to recede following the peak. The recession process will take approximately 18 hours. Figure 10 illustrates the changes in flood levels near the site at Seton Rd during the PMF event.

Since the site will be fully evacuated, the longest duration of inundation during a PMF event was not determined in this study. Additionally, a 1% AEP inundation assessment was not conducted, as the FEMP is required only for the PMF event, given that this is the worst-case scenario.

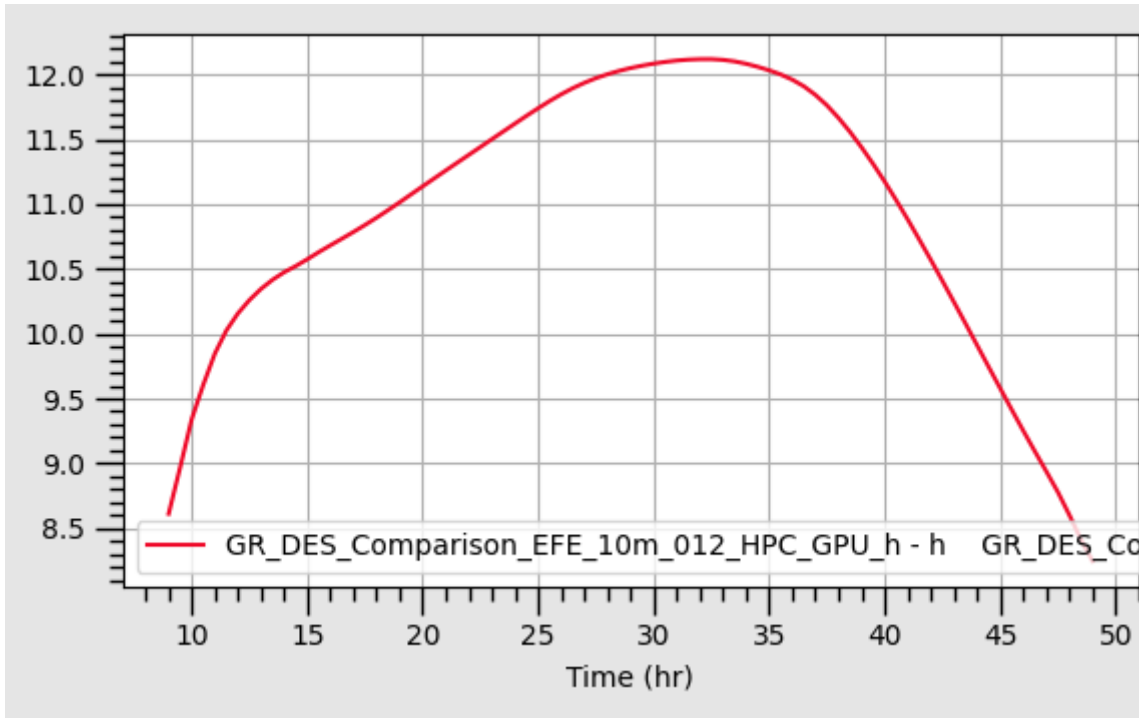


Figure 10: Flood level during the PMF event at Seton Road.

3. Flood Emergency Response Strategy

3.1 Emergency Planning Context

The NSW SES is the designated combat agency for floods, and has roles in prevention, preparedness, response and recovery. This includes protecting dangers to people, protecting property from destruction or damage, and preparing for the eventuality of severe to extreme floods in the Georges River. The NSW SES Metro Zone is the unit dealing with Georges River flooding.

The NSW SES has developed the Georges River and Woronora River Valley Flood Emergency Sub Plan. This is the most up-to-date document relevant to Georges River flooding. This sets out the responsibilities for all organisations involved in flood planning, as well as preparation, response and recovery measures in place. The purpose of this document is to outline roles and responsibilities of support agencies specific to cross boundary arrangements during the Prevention, Preparedness, Response and Recovery (PPRR) phases. Volume 1 of the Georges River and Woronora River Valley Flood Emergency Sub Plan (Endorsed April 2023) is currently available, which maps out the emergency management arrangements and is accessible to the public: [[Vol 1 LGA Flood Emergency Sub Plan - Master template Aug 2020](#)]

According to the Georges River Evacuation Modelling Report (March 2022), Volume 1 of the plan currently lacks information on evacuation triggers, proposed routes, local evacuation centres, and the scale of operations required for the existing population. This information is expected to be included in Volume 3, which is not publicly available. As a result, Molino Stewart held several meetings with the SES, during which the following criteria were established for the evacuation strategies for the Georges River:

- The NSW SES requires modelling for the "**worst-case scenario**" evacuation, which involves the simultaneous evacuation of all residential and non-residential properties, although only non-residential vehicles originating from outside the floodplain are included in the evacuation traffic count.
- The methodology for estimating non-residential vehicles will be based on Infrastructure NSW's approach utilized in the Hawkesbury-Nepean Valley.
- Vehicles in the study area are expected to evacuate primarily south on the Hume Highway or west on the M5, then northwest onto the M7, ahead of any flooding that would trigger evacuation of the precinct, in accordance with NSW SES provisions.
- There will be a **12-hour warning** period before flooding reaches levels that necessitate evacuation, as outlined in the Provision of and Requirements for Flood Warning (NSW SES, 2019).
- The NSW SES will mobilize before an evacuation order is necessary, allowing the entire warning period for precinct occupants to respond to the evacuation order.
- Evacuations will be conducted on a **subsector-by-subsector** basis, with the subsectors used in modelling being modifications of the original boundaries provided by the NSW SES, adjusted to account for roads that may be cut off by flooding. These adjusted boundaries were shared with the NSW SES for transparency and feedback, though none was received by the time of writing.

3.2 Warning Systems

Within the study area on the Georges River, the Bureau of Meteorology has identified two key gauges—the Liverpool and Milperra Gauges—as essential for downstream flood predictions and quantitative flood forecasting. Table 2 provides information on these gauges, as outlined in *The Provision and Requirements for Flood Warning in New South Wales* (NSWSES, 2019) and the Bureau of Meteorology's *Service Level Specification for Flood Forecasting and Warning Services* in New South Wales and the Australian Capital Territory (BoM, 2013).

Table 2- Flood gauges used for flood warning System

Bureau number	AWRC number	Forecast location	Station owner	Flood classification (m)			Target warning lead time		70% of peak forecasts within
				Minor	Moderate	Major	Time (hrs)	Trigger height (m)	
566054	213400	Liverpool	Sutherland Shire Council NSW OEH	2.0	3.0	4.5	6 hrs 12hrs	>2.0 m >4.0 m	+/- 0.3 m
66168	213405	Milperra	MHL*	2.0	3.3	4.2	6 hrs 12hrs	>2.0 m >4.0 m	+/- 0.3 m

According to the Georges River Evacuation Modelling Report (March 2022), the Georges River study area would be inundated during a PMF event, except for the high ridge on the Moorebank peninsula and the elevated terrain in the western Liverpool area. Figure 11 shows the extent of PMF flooding.

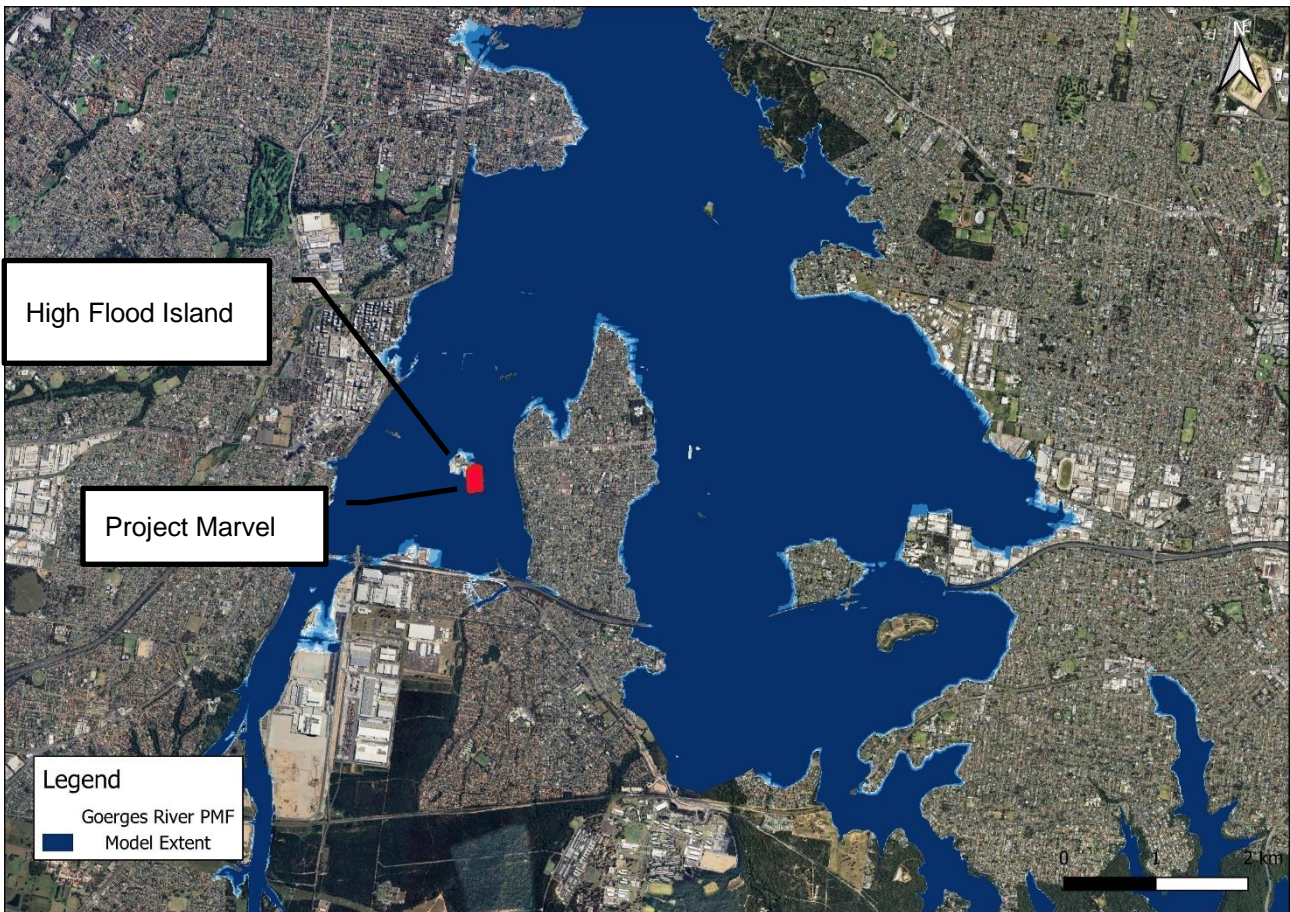


Figure 11: Extent of the Georges River PMF

3.3 Flood Response Strategy

The NSW SES’s primary strategy for managing flood-risk populations is evacuation. Due to the significant and prolonged impact of flooding in and around the site during a PMF event, the preferred response strategy for this project is to close the site well in advance of flooding (pre-emptively) and relocate people to a safe area away from the hazard.

Section 5.8.4 of the Liverpool City Flood Emergency Sub Plan details the protocols to follow during a pre-emptive evacuation strategy, and states that NSW SES will control and co-ordinate the evacuation of affected communities.

- a) The NSW SES Incident Controller will warn communities to prepare for a possible evacuation, where circumstances allow such lead time.
- b) The NSW SES Incident Controller will order any necessary evacuation and provide information to the community about when and how to evacuate.
- c) Support to evacuation operations may be requested from other emergency service and supporting agencies using arrangements in the local EMPLAN and supporting plans.
- d) People who are reluctant or refuse to comply with any Emergency Warning will be referred to the NSW Police Force.

If there is advanced notice of a significant flood event, evacuation in advance of the storm event can decrease the pressure on critical systems or agencies that may be affected during a significant flood emergency.

For this site, each individual or worker should evacuate based on their intended destination, whether it is their own residence or the home of friends or relatives. Those requiring emergency accommodation or disaster welfare assistance will be directed to designated evacuation centres, with Homebush Evacuation Centre serving as the designated location in this case (Head north on the M7 towards the M4 to Homebush). If an evacuation is ordered, the preferred route from the site is via Seton Road to Heathcote Road, then onto the M5 Highway, allowing for eastbound travel on the M5 and westbound travel via Camden Valley Way. For those heading north or south, the M5 connects to the Hume Highway, providing access in both directions. Figure 12 and Figure 11 show the proposed evacuation routes for the site.



Figure 12: Project Marvel Evacuation Routes

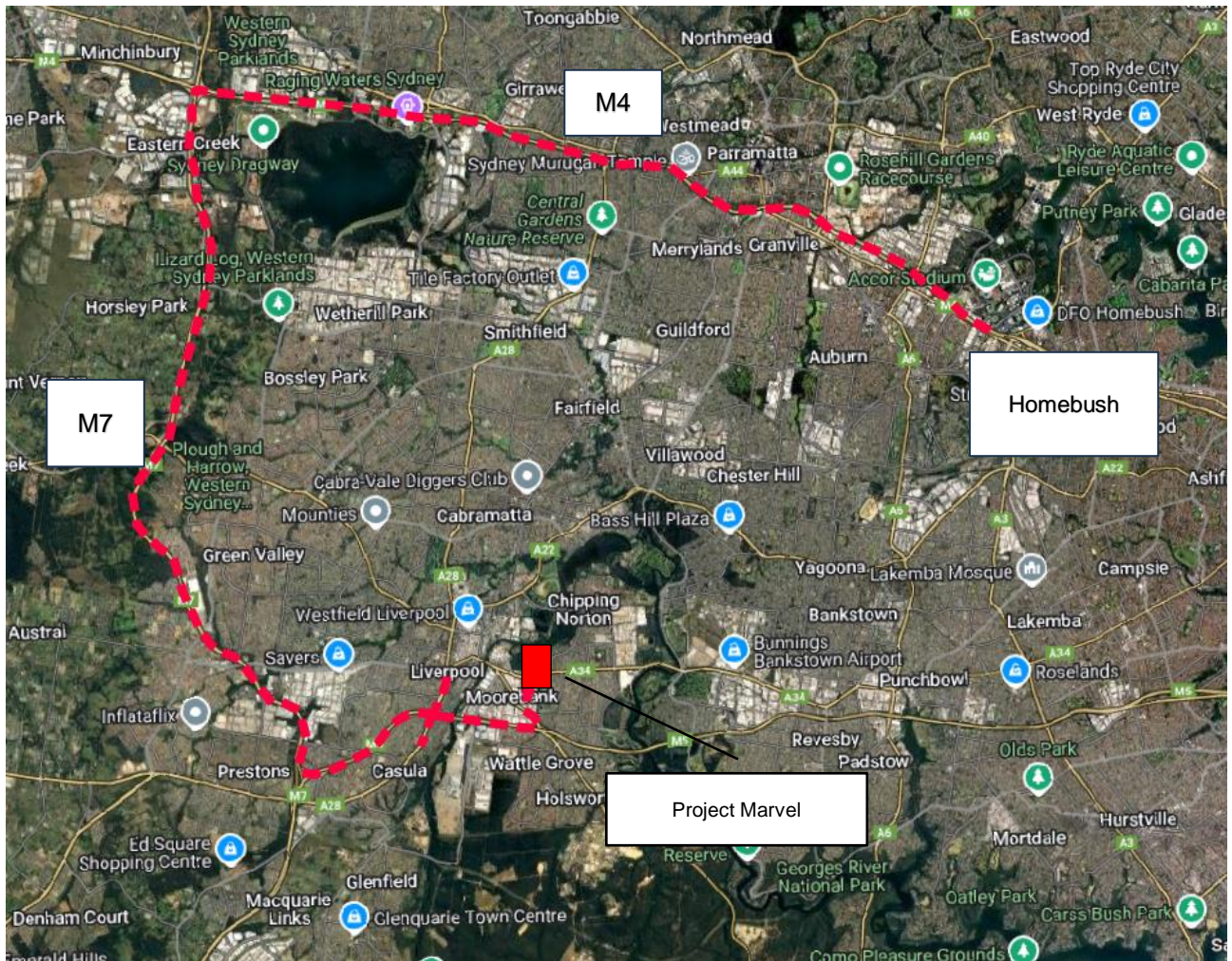


Figure 13: Evacuation route to Homebush evacuation Centre

4. Flood Warnings and Notifications

4.1 Bureau of Meteorology

Severe weather and thunderstorm warnings are issued by the Bureau of Meteorology (BoM). These warnings are continually updated with descriptions of the likely conditions, including predicted extreme rainfall depths. Flood warnings are issued by the BoM when flooding is occurring or is expected to occur in an area. Warnings may include specific predictions of flood depths dependent on real-time rainfall and river level data. These warnings are distributed by BoM to councils, police and the relevant local SES, as well as being available on the BoM website.

- A **Flood watch** is issued by the BoM up to four days prior to a flood event. A watch is generally updated daily and may be issued before, during, or after rainfall has occurred.
- **Flood warnings** are issued by the BoM when flooding is occurring or expected to occur in a particular area. Warnings may include specific predictions of flood depths dependent on real-time rainfall and river level data. These warnings are distributed to Council, Police, and the relevant local SES, as well as being available on the BoM website, through telephone weather warnings and radio broadcasts.

4.2 Australian Warning System

NSW SES has recently implemented the Australian Warning System (AWS) which replaces their previous evacuation orders and warnings system. The AWS is a new national approach to information and 'Calls to Actions' for hazards including flooding. The System uses a nationally consistent set of icons, with three warning levels: Advice, Watch and Act, and Emergency Warning. The flood warnings are described in Figure 14.



Figure 14: Australian Warning System - Three Warning Levels

The NSW SES utilises a range of sources to build detailed flood intelligence within local communities, including information from flood studies and historical flood data. As part of the transition to the Australian Warning System, the NSW SES has increased flexibility to tailor warnings at the community level, based on the expected consequences of severe weather events.

The Chief Warden is responsible for monitoring information from the AWS. NSW SES warnings will not come directly from one person but are instead provided through a number of official channels, rather than a single point of contact. Impacted communities will continue to receive flood warnings through the NSW SES website, NSW SES social media channels and by listening to local ABC radio stations. The NSW SES has also developed an all-hazards warning platform, Hazard Watch, to provide an additional channel for communities to access important warning information.

Each warning has three components:

- 1) **Location and hazard:** The location and the type of hazard impacting the community.

- 2) **Action statement:** For each warning level there are a range of action statements to guide protective action by the community. These statements evolve as the warning levels increase in severity. Statements range from 'stay informed' at the Advice level, to 'prepare to evacuate' at the Watch and Act level, to 'evacuate now' in the Emergency Warning level. As the situation changes and the threat is reduced, the level of warning will decrease accordingly.
- 3) **The warning level:** The severity of the natural hazard event based on the consequence to the community.

While the Chief Warden is responsible for monitoring information from the AWS, NSW SES recommend that all site users and wardens refer to the **HazardWatch** website and the Hazards Near Me app.

It is important to note that the warnings outlined above may not be available or occur with advanced warning. It is therefore crucial to monitor the Bureau of Meteorology website for severe weather warnings in the first instance, as the site is at risk of flooding with a short time to onset of inundation.

4.3 Triggers

According to the *Provision and Requirements for Flood Warning in New South Wales* (NSWSES, 2019), the Bureau of Meteorology has set a target minimum warning lead time of 12 hours for floods exceeding 4.0 m and 6 hours for floods above 2.0 m at both the Liverpool and Milperra Bridge Gauges. Since evacuation from the Georges River floodplain is only required for floods exceeding 4.0 m at these gauges, at least 12 hours of warning will be available. Modelling results in Appendix C of the *Georges River Flood Evacuation Modelling Report* indicate that the site requires 4.75 hours for evacuation in Scenario 1, providing a 7.25-hour surplus if 12 hours' notice is given. The site manager is responsible for monitoring these flood triggers.

4.4 Emergency Signals

The site should be equipped with a Public Announcement (PA) system that enables the Chief Warden to promptly communicate the selected response strategy to all staff in the event of a flood emergency. This immediate communication is crucial, as it ensures that staff with designated responsibilities outlined in the Flood Emergency Management Plan can promptly initiate their tasks, minimizing response time and enhancing overall safety. By providing clear and direct instructions, the PA system helps maintain order and ensures that all personnel are informed of evacuation procedures, shelter locations, or other necessary safety measures without delay.

5. Flood Response Team

5.1 Staff Responsibilities

In the event of a severe flood, various staff members will be responsible for specific tasks as detailed in Table 2. Before the site is in operation, these roles must be delegated to specific staff members.

Table 3: Staff Flood Responsibilities

Role	Responsibilities
Site Manager	<ul style="list-style-type: none"> - Decide if pre-emptive relocation is required prior to warnings from NSW SES - Monitor flood warnings and notifications from BoM and AWS - Inform staff of flood risk - Coordinate flood evacuation drills - Delegate emergency response actions if necessary – e.g. to designated “Building Warden” who are responsible for a specific building.
First Aid Officer	<ul style="list-style-type: none"> - Coordinate assistance for less able residents and staff - Prepare a Flood Emergency Kit that includes a portable radio, torch, spare batteries, first aid materials, emergency contact numbers, candles, waterproof matches, waterproof bags and required medications.

5.2 Key Contact Details

In the event of a severe flood, key telephone numbers have been listed in Table 3 below.

Table 4: Key Contact Numbers

<u>IMPORTANT TELEPHONE NUMBERS</u>	
Site Manager	tba
Deputy Manager	tba
Safety/First Aid Officer	tba
<u>External Contacts</u>	
Police/Ambulance	000
NSW State Emergency Services (SES)	132 500
Fire and Rescue NSW Liverpool Fire Station	02 9493 1008
Fire and Rescue NSW Cabramatta Fire Station	02 9493 1049
Liverpool Hospital	02 8738 3000
Cabramatta Community Health Centre	02 8717 4000

6. Preparation for Flood Response

6.1 Education

Community awareness of flooding is a critical concern within the floodplain, largely because severe floods are rare, which can lead to a lack of familiarity with flood risks among residents, visitors, and even some staff. Additionally, when severe floods do occur, they are expected to reach significant depths, potentially impacting safety and access to and from the area. This makes it essential to enhance awareness and preparedness throughout the community, despite the infrequent nature of severe flood events.

To address these concerns, all facility staff will be briefed on the flood risks specific to this location, including their management responsibilities during a flood event. This briefing will cover essential information such as recognizing early warning signs, understanding safe evacuation routes, and assisting residents and visitors in an emergency. This critical information will also be integrated into the mandatory site inductions, which all staff are required to complete before starting work on site. Through these inductions, staff will be trained not only on their specific roles during a flood event but also on broader site-wide protocols to ensure coordinated, safe responses.

The FERP will be made readily accessible to all new staff, managers, and site visitors. This document will provide detailed instructions on the flood safety procedures, including actions to take during a flood warning, designated safe locations, and communication protocols. Access to the FERP ensures that everyone on site has a reference guide on how to respond during a flood emergency, reinforcing awareness and confidence in the site's flood safety measures.

The Site Manager will be responsible for ensuring that both existing and new staff complete their site induction and safety training. This includes not only overseeing initial inductions for new staff but also conducting ongoing training sessions and periodic safety drills to reinforce knowledge and readiness. The Site Manager will also manage updates to the induction program as flood safety procedures evolve, ensuring that all staff remain informed and prepared to handle potential flood risks effectively.

6.2 Communication with Users of Site

Staff must be informed via SMS by the Site Manager prior to the start of their shift if there is a risk of flooding on the site or on access/egress routes for the site, to minimise the risk of people entering floodwaters. Similarly, expected visitors should be informed if there is a risk of flooding on the site or on access/egress routes for the site.

It is important to consider human behaviour, and that individuals may choose not to remain isolated from their social network in the event of an extended flood situation. The flood risk at the site and actions taken to reduce risk to life should be communicated to all site users as a means of mitigating this risk (includes increasing risk awareness, community connections, preparedness actions, appropriate signage and emergency drills) as well as design consideration such a one-way doors, preventing people from entering flood waters .

6.3 Signage

Ensuring the site has adequate flood warning signage is essential, including clear protocols and procedures to follow during the onset of a flood event. The NSW SES also recommends introducing floodway warning signage, similar to that shown in Figure 12, in specific areas of the site, such as the southern section near Seton Rd. A copy of a detailed FERP which includes emergency response procedures will be made available at communal areas within the site as well as the main office.



Figure 15: Floodway warning signage

6.4 Flood Drills

It is recommended that flood drills be held by staff annually to ensure all staff workers are familiar with the sound of the alert and their subsequent flood response actions. It is the responsibility of the Site Manager to ensure that evacuation drills are organised and that any issues with these drills are attended to, and if necessary, rerun.

These drills are required to test the suitability of the plan, identify gaps and to provide staff the opportunity to put into practice their specific responsibilities. If issues arise, this plan should be reviewed and updated. The Block Warden will also ensure that all site drills are recorded in an appropriate records book and any non-conformities reported and responded to.

6.5 Flood Emergency Kit

A Flood Emergency Kit should be prepared prior to a flood event taking place and regularly checked to ensure that supplies within the kit are sufficient and in working condition. This check could occur after the evacuation drill takes place to provide a regular schedule. The Kit should include:



- Radio with spare batteries;
- Torch with spare batteries;
- First aid kit and other medicines;
- Candles and waterproof matches;
- Waterproof bags;
- A copy of the Site Emergency Management Plan; and
- Emergency contact numbers.

This Emergency Kit should be stored in a waterproof container, and it is the responsibility of the First Aid Officer to make sure that this kit is maintained and available during an emergency.

7. Flood Response Actions

The flood response actions are detailed in Table 4. These actions must be implemented promptly upon receiving flood warnings and notifications from the relevant authorities. It is essential that all personnel are aware of these actions and ready to execute them efficiently, ensuring a coordinated response to the flood threat.

Table 5: Flood Emergency Response Actions for the Project Marvel site

Flood Emergency Response Plan	
Flood Warning and Notification Procedures	Evacuation and Refuge Protocols
<p>1) BoM issues a FLOOD WATCH or NSW SES issue a yellow “ADVICE” warning</p> <div style="text-align: center;">  </div> <p>or a severe weather warning is issued by BoM</p>	<p>The following actions must be undertaken:</p> <ol style="list-style-type: none"> 1) Ensure the emergency kit is ready to use. 2) Listen to the local radio station for updates on forecasted flood heights and timings. Monitor updates on NSW SES platform Hazard Watch. 3) Provide facility and key personnel contact details to the emergency service. Determine the level of risk posed to the facility and care recipients. 4) Notify all staff and residents of the flood watch and confirm availability of staff to assist with emergency actions if required. 5) Ensure staff are familiar with their responsibilities. 6) Inform staff via SMS prior to the start of their shift if there is a risk of flooding on the site or on access/egress routes for the site, to minimise the risk of people entering floodwater. 7) Communicate with staff and expected visitors if there is a risk of flooding on the site or on access/egress routes for the site. 8) Explain the evacuation procedures clearly to the staff, ensuring they understand each step involved.
<p>2) BoM issues a FLOOD WARNING or NSW SES issue an amber “WATCH AND ACT” or red “ACT NOW” warning</p> <div style="text-align: center;">  </div>	<p>If the flood event is not anticipated to impact the site (either directly or indirectly), the Site Manager is to continue hourly check-ins and postpone high risk activities.</p> <hr/> <p>If flood event is anticipated to impact the site, the Site Manager must undertake the following actions:</p> <ul style="list-style-type: none"> • For life-threatening emergencies phone 000 immediately. • A headcount should be conducted to ensure all staff and visitors are accounted for. • Employees gather essential belongings and secure workstations • An alert and warning message should be broadcast over the PA system confirming a significant flood event, notifying all staff and site users to begin evacuation procedures. • The Site manager shall arrange transportation to the evacuation centre for individuals who do not possess a vehicle • The Site Manager is to follow any action statements provided via the AWS. <p>NOTE: Avoid driving or walking through floodwaters. These are the main causes of death during flooding.</p>

- 3) Alerts and warnings have been rescinded or downgraded by the relevant authorities and any flood event that occurred has passed.



The **Site Manager** is to confirm with the NSW SES and relevant agencies whether it is safe to return to the site. This assessment should consider the flood impact on the following factors:

- Access and egress
- Communications
- Power supply
- Gas supply
- Infrastructure damage
- Hazardous materials
- Public health risks (including sewage)

The NSW SES will determine the level of access to affected communities, categorizing it as follows:

- Not suitable for entry
- Limited access for emergency services and response teams
- Limited access for residents and/or business owners
- Full access

After receiving the necessary approval, the **Site Manager** can arrange for employees to return to work gradually.

8. Limitations the Flood Emergency Response Plan

This FERP is based on the most current information available at the time of writing. The report relies on flood modelling results, which carry inherent uncertainties and may change over time as a result of climate change, potentially altering flood behaviour and site impacts. Furthermore, evacuating a large number of people during a rare, high-impact flood event poses significant challenges. Factors such as human behaviour under stress, potential traffic congestion, limited access to transport, and the possibility of communication breakdowns could complicate the evacuation process and delay timely response. Recognizing these complexities underscores the importance of clear planning, regular training, and coordination with local authorities to improve the resilience and effectiveness of the FERP.

9. Conclusion

This FERP for the logistics centre at 20 Kelso Crescent, Moorebank, provides a structured approach to managing flood risks and ensuring occupant safety in the event of severe flooding. Given the site's susceptibility to substantial flooding during PMF events, this FERP addresses critical risk factors identified by NSW SES, the Biodiversity Conservation Science (BCS) Group, and supporting flood management agencies. With the site's potential for prolonged isolation and significant inundation during a PMF event, this plan emphasizes the importance of pre-emptive evacuation as the primary strategy to mitigate the hazards posed by floodwaters.

The FERP includes detailed protocols and designated evacuation routes. If an evacuation is ordered, the preferred route from the site leads via Seton Road to Heathcote Road and then onto the M5 Highway, providing eastbound travel on the M5 and westbound travel via Camden Valley. Additionally, the use of the M5 and M7 enables safe evacuation to designated shelters, such as the Homebush Evacuation Centre. Coordination with the NSW SES and alignment with regional plans, including the Georges River and Woronora River Valley Flood Emergency Sub Plan, further strengthen the operational framework for evacuation.

Key site-specific preparations include mandatory induction and safety training for all facility staff, equipping them with the knowledge and responsibilities required to respond to flood events. Access to the FERP for all staff, managers, residents, and visitors reinforces awareness and preparedness. Furthermore, the 12-hour warning lead time from the Bureau of Meteorology provides a critical buffer to mobilize evacuation efforts effectively, as evacuation modelling confirms the feasibility of a full evacuation within 4.75 hours, providing a surplus margin to ensure thorough response measures.

In alignment with NSW SES guidance, this FERP leverages early warning and proactive evacuation to reduce pressure on emergency resources and prioritize safety. The Site Manager must monitor flood triggers closely, while NSW SES will oversee and control evacuation operations, coordinating with local emergency agencies to support seamless execution.

This FERP ensures the logistics centre can respond effectively to the challenges of flooding. Continuous review and updates to this plan, alongside collaboration with NSW SES and other stakeholders, will ensure its effectiveness in addressing the dynamic risks of the Georges River floodplain.

Prepared by
TTW (NSW) PTY LTD



Reviewed & Authorised By
TTW (NSW) PTY LTD

ALI VAHIDI
Senior Civil Engineer
CPEng, EA ID: 5293949

Appendix A

	Scenario 1: Base case ¹	Scenario 2: Intensified development under existing zoning ²	Scenario 3: Proposals currently under investigation ³	Scenario A: Modified Scenario 2 ⁴	Scenario B: Modified Scenario 3 ⁵
Description	The “present” or current status scenario	Residential and non-residential infill development under existing zonings and currently planned road capacity upgrades	Residential and non-residential infill development under existing zonings plus development associated with planning proposals currently under investigation and currently planned road capacity upgrades	Scenario 2 but with four non-residential vehicle destinations depending on the origin of the workers	Scenario 3 with updated planning proposals, adjusted vehicle yields for new development, changes to roads and capacities, and multiple non-residential vehicle evacuation destinations as per Scenario A
Timing	2016	2036	>20 years in future	2036	>20 years in future
Destinations	M7 northbound (single destination)	M7 northbound (single destination)	M7 northbound (single destination)	M7 northbound for all residential. Four non-residential destinations depending on origin of workers: 1) M7 northbound; 2) Hume Motorway southbound; 3) Camden Valley Way westbound and 4) M5 eastbound	M7 northbound for all residential. Four non-residential destinations depending on origin of workers: 1) M7 northbound; 2) Hume Motorway southbound; 3) Camden Valley Way westbound and 4) M5 eastbound
Road Capacity	600 vehicles/ lane/ hour	600 vehicles/ lane/ hour	600 vehicles/ lane/ hour	600 vehicles/ lane/ hour	600 vehicles/ lane/ hour except for the two on ramps from the Hume Highway and M5 onto the M7 will have their capacity increased to 900 vehicles/ lane/ hour
Road Network	As current	Additional planned road upgrades to Governor Macquarie Drive and M5 westbound	Additional planned road upgrades to Governor Macquarie Drive and M5 westbound	Additional planned road upgrades to Governor Macquarie Drive and M5 westbound	Additional planned road upgrades to Governor Macquarie Drive and M5 westbound, and additional third lane northbound on the M7 and improvements to M7 on ramp capacities through ramp metering
Dwelling Numbers⁶	Based on 2016 census data and Google Maps visual assessment: ~8,500 dwellings or ~27,000 people in evacuation study area	Additional dwellings based on existing zoning-dependent infill potential in Warwick Farm, Chipping Norton and Moorebank as estimated by Council (370 additional dwellings compared to Scenario 1)	Additional dwellings based on existing zoning-dependent infill potential in Warwick Farm, Chipping Norton and Moorebank as estimated by Council plus additional dwellings as per original Planning Proposal numbers from Council (21,765 additional dwellings compared to Scenario 2)	Same as Scenario 2	Modified dwelling numbers compared to Scenario 3, as per updated Planning Proposals numbers from Council
Vehicles per Dwelling	Based on 2016 census vehicle ownership rate	Based on 2016 census vehicle ownership rate	Based on 2016 census vehicle ownership rate	Based on 2016 census vehicle ownership rate	Based on 2016 census vehicle ownership rate but with a rate of one vehicle per dwelling for new apartments

Non-Residential Vehicles	Based on 2011 Journey to Work data for vehicle drivers commuting from outside of the study area (no double counting of those both living and working in the study area)	As per Scenario 1 with additional vehicles added to Liverpool Hospital location only (discounted to include only vehicle drivers originating from outside of the study area)	As per Scenario 2 with additional vehicles associated with additional jobs from original Planning Proposals numbers from Council (discounted to include only vehicle drivers originating from outside of the study area)	Same as Scenario 2	Modified commercial development areas and associated vehicle numbers compared to Scenario 3, as per updated Planning Proposals numbers from Council
Vehicles⁶	Base case: ~27,500 total	1,541 additional evacuating vehicles compared to Scenario 1	61,671 additional evacuating vehicles compared to Scenario 2	1,541 additional evacuating vehicles compared to Scenario 1	40,097 additional evacuating vehicles compared to Scenario 2, minus existing development in the locations of new development.

