Penrith Stadium Redevelopment

Flood Emergency Management Sub-Plan

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Date: 28/02/2025

Rev	Date	Prepared By [Name & Signature]	Reviewed By [Name & Signature]	Approved By	Remarks
A	12/02/2025	D Prijantono	S Maxwell		
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00	28/02/2025	S Maxwell	T Rodrigues	M Males	Issued for Construction

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Compliance Matrix

State Significant Development (SSD) Application Conditions

REQUIREMENT REFERENCE	CONDITION DESCRIPTION	WHERE ADDRESSED
B22	The Construction Flood Emergency Management Sub-Plan must address, but not be limited to, the following: (a) be prepared by a suitably qualified and experienced person(s); (b) address the provisions of the Flood Risk Management Manual (DPE, June 2023) and the Flood Risk Management Toolkit; (c) include details of: (i) the flood emergency responses for all construction phases of the development; (ii) details of flood risk environment, including expected flood levels for different frequency events; (iii) flood warning time and flood notification; (iv) assembly points and evacuation routes; (v) work cancellation and evacuation and refuge protocols; and (vi) awareness training for employees and contractors, and users/visitors. Note: The Flood Risk Management Toolkit is a set of resources including guidelines, explanatory notes, technical methods and data provided to complement the Flood Risk Management Manual. The toolkit can be found here: https://www2.environment.nsw.gov.au/water/floodplains/flood-risk-management-toolkit.	Section 15 and Section 16
B28	Prior to the commencement of construction, the Applicant describe the measures that must be implemented to manage stormwater and flood flows for small and large sized events, including, but not limited to 1 in 1-year ARI, 1 in 5-year ARI and 1 in 100-year ARI.	Section 5 and Section 6
B29	Prior to the commencement of construction, the Applicant must prepare and implement for the duration of construction: (a) flood warning and notification procedures for construction workers on site; and (b) work cancellation and evacuation and refuge protocols.	Section 15 and Section 16

Planning Secretary's Environmental Assessment Requirements

REQUIREMENT REFERENCE	SEARS DESIRED PERFORMANCE OUTCOMES	WHERE ADDRESSED
15 Flooding Risk	The EIS shall include a flood impact and risk assessment (FIRA) in accordance with the Flood Risk Management Manual Flood Impact and Risk Assessment Guideline (2023). As a minimum the FIRA must: • Identify any flood risk on-site having regard to adopted flood studies, the potential effects of climate change, and any	Section 5 and Section 6 Section 15 and Section 16

	relevant provisions of the NSW Flood Risk Management Manual (2023) and EPI. • Assess the impacts of the development, including any changes to flood risk on site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required. • Identify flood behaviour, flood constraints and risks on the site and its surrounding including the potential impacts of climate change for the full range of events i.e., up to and including the probable maximum flood (PMF) event. • Propose management measures required to minimise the impacts of flooding on the development and minimise flood risk to the community, including an Emergency Management Plan considering access to and from the site, and evacuation issues during significant flood events including the PMF, from both local catchments and/or regional catchments.	

Glossary of terms

Definitions and abbreviations to be applied to this Environmental Management Plan are listed in the following table.

Term/ abbreviation	Definition
AEP	Annual Exceedance Probability
Principal	Infrastructure NSW
Principal's Representative	Bruno Zinghini
CoA	Conditions of Approval
PSR	Penrith Stadium Redevelopment
PMF	Probable Maximum Flood
DPHI	Department of Planning, Housing and Infrastructure
EIS	Environmental Impact Statement
ECP	Environmental Control Plan – defines management measures for a specific environmental aspect
CEMP	Construction Environmental Management Plan
EMS	John Holland's Environmental Management System
OEM	Operations Environment Manager
WH&S	Workplace Health and Safety
SQE	Safety, Quality and Environment
Subcontractor	Any company, body or person who is contracted to John Holland for the purpose of supplying plant and/or services
System Element	The administrative activities that need to be implemented and controlled to ensure that the product or service meets environmental requirements
The Project	Penrith Stadium Redevelopment
CTPMP	Construction Traffic Pedestrian Management Plan
TRA	Task Risk Assessment – Specific risk assessment based on day-to-day tasks, facilitated by supervision and involving consultation with workforce before task is undertaken. Signed off by all people undertaking the task.

WRA	Workplace Risk Assessment – High-level strategic risk assessment conducted on workplace and broken down into work components for the purpose of identifying system, training and legislative requirements, and identifying the need for further detailed planning and risk assessment activities. The WRA also fulfils the function of an aspects and impacts register.

1 Revisions and distribution

1.1 Revisions

Draft issues of this document shall be identified as Revision A, B, C, etc. Upon initial issue (Contract Award) this shall be changed to a sequential number commencing at Revision 0. Subsequent revision numbers shall be Rev. 1, 2, etc.

1.1.1 Distribution list

Representative	Electronic copy via Aconex
Project Director	Access to electronic copy in Aconex
Project Manager/s	Access to electronic copy in Aconex
HSEQ Manager	Access to electronic copy in Aconex
Project Environment Representative	Access to electronic copy in Aconex
Environmental/Sustainability Manager	Access to electronic copy in Aconex
Project Personnel	Available on Request
Principal's Representative	Electronic copy via Aconex
Public	Available online Project website.

2 Introduction

2.1 Purpose and Scope

This Flood Emergency Management Sub-Plan (FEMP) forms part of the Construction Environmental Management Plan (CEMP) for the Penrith Stadium Redevelopment Project. The FEMP details the key mitigation measures that will be implemented during construction by John Holland to minimise and manage any flood impacts during the construction phase.

This FEMP addresses the relevant requirements of the Project Approval and all applicable guidelines and standards specific to emergency management during flooding. It has been developed based on the findings of the Environmental Impact Statement (EIS) which provided an assessment of the likelihood of floods and associated impacts during construction.

The FEMP is consistent with the State Emergency and Rescue Management (SERM) Act 1989 and John Holland's Environment Policy (refer Appendix 1 of the Project CEMP).

The CEMP and Construction Monitoring Programs will be submitted to the Certifier and publish it on the Applicant's website in accordance with conditions A22.

In accordance with CoA B18, construction will not commence until the CEMP and all CEMP Sub-plans have been submitted to the Certifier. The CEMP and CEMP Sub-plans must be implemented for the duration of construction. Where the SSD is being staged, construction of that stage is not to commence until the terms of the SSD consent that apply or are relevant to the works or activities to be carried out in a specific stage are complied.

The key objective of this FEMP is to ensure that all CoAs, Amended Mitigation Measures (AMMs) and licence / permit requirements relevant to flooding are adhered to, thus protecting environmental values. Supporting objectives and targets to achieve this are outlined below.

For the purposes of this FEMP, construction is defined as:

All physical work to enable operation including (unless specifically excluded by a condition) but not limited to the demolition and removal of buildings, the carrying out of works for the purposed of the development including bulk earthworks, and erection of buildings and other infrastructure permitted by this consent but excluding the following:

- *Building and road dilapidation surveys*
- *Investigative drilling or investigative excavation*
- *Establishing temporary site offices (in location identified by the conditions of this consent)*
- *Minor adjustment to services or utilities*

However, where heritage items, or threatened species of threatened ecological communities (within the meaning of the Biodiversity Conservation Act 2016) are affected or potentially affected by any physical work, that work is construction, unless otherwise determined by the Planning Secretary in consultation with relevant NSW government agencies.

This FEMP is the key document for managing and minimising risk associated with flooding during the construction phase of the Project.

2.2 Objectives and targets

The following flood emergency management objectives will apply to construction (as defined in Section 2.1):

- To manage site works and prepare and respond to flood events to reduce the risk to human life, property and the environment;
- To reduce the financial and program impact on the project as a result of flood events;
- To reduce the severity of flood events as a result of construction works;
- Minimise the impact of severe weather on the works under construction on the Penrith Stadium Redevelopment Project;
- Reduce the risk profile of the project as a result of sound preparedness for flood events; and
- Ensure a consistent approach to preparing for flood events.

The following flood emergency management targets will apply to construction:

- Ensure sites are suitably prepared prior to a flood event to ensure the Project's activities or physical works do not exacerbate the flood impact to human life, property or the environment;
- Ensure that effective flood risk identification and evaluation occurs that might impact the site;
- Proactively mitigate or minimise the impact of flood-related damage to the project during construction;
- Be properly prepared for, effectively respond to, and recover from all flood events;
- Ensure that flood-related damage risk to plant, equipment and other temporary facilities is eliminated or minimised;
- Apply the appropriate rectification methods to damaged construction works and infrastructure after an event; and
- Ensure that all parties who should be notified of an impending event, or of the actual consequences of an event, are notified.

The implementation of the mitigation measures will ensure the performance targets are achieved. This will be managed through project inductions, specialised training, toolbox talks, inspections, and environmental monitoring and auditing. Project inductions will inform John Holland personnel (including subcontractors) of the management measures, while toolbox talks, and specialised training will ensure they are reinforced throughout the construction program.

2.3 Environmental Policy

John Holland believes that respect for the Project location, its surroundings and the communities in which it operates is essential for project success, as well as compliance with all environmental, sustainability and community requirements. This commitment is described in John Holland's Environment Policy which can be found in Appendix 1 of the CEMP.

2.4 Project Description

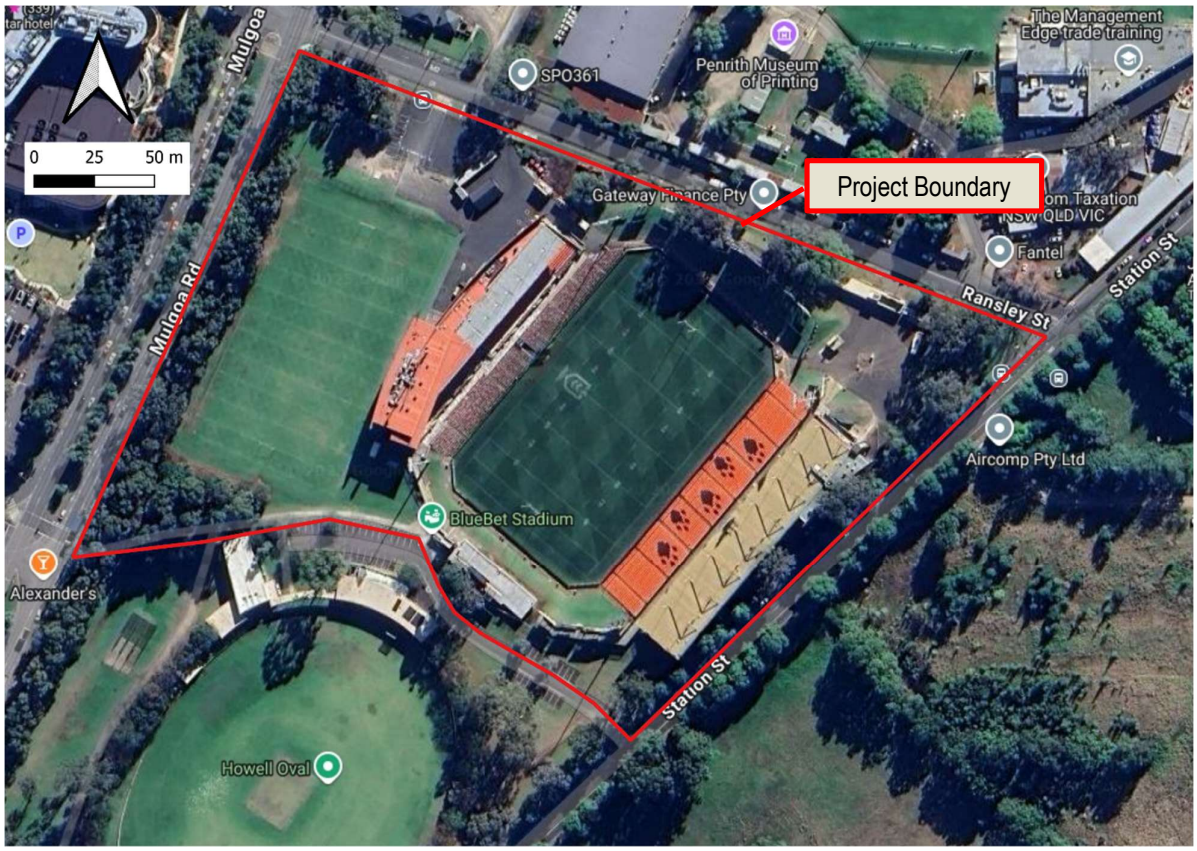
The Penrith Stadium Redevelopment Project is the redevelopment of the existing BlueBet Stadium to support the growing population of Western Sydney and improve sporting infrastructure. This redevelopment will improve existing BlueBet Stadium facilities to cater better to existing NRL matches as well as NRLW fixtures. The project will take place on the site of the current stadium and improve both the visitor and player experience.
Penrith Stadium is situated upon the lands of the Darug people. It is located within Penrith City Council Local Government in Western Sydney.

Located at 143 Station Street, the site comprises Lot 1DP 1147219 and part Lot 2 DP 1147219. The site contains a small at-grade car park to the north and a training filed to the west. Figure 1 shows the project site.

The site is bordered by:

- Station street in the east
- Howell Oval in the south
- Mulgoa Road in the west
- Ransley Street in the north

Figure 1 Penrith Stadium Redevelopment Site



There are two major waterways near the site, the Nepean River and Peach Tree Creek. Both are located within 1km radius and are on the west side of the Stadium. These waterways sit within the Hawkesbury River Basin (BoM Basin No: 212).

The flood warning times have been estimated for the site wherever gauged flow and rainfall data is available. It is noted that the Penrith Stadium Redevelopment works do not encroach into any waterways.

3 Community and Stakeholder Engagement

John Holland's Community and Stakeholder Engagement Management Plan (CSEMP) provides a clear framework for active communication and stakeholder engagement management. The Plan outlines how John Holland will meet best practice community and project outcomes by keeping the community and other stakeholders informed, minimising potential impacts and responding to the needs and requirements of stakeholders. The CSEMP contains procedures and strategies to manage community and stakeholder engagement activities as they align to the Project delivery program. To the extent practicable, John Holland will provide stakeholders with open and transparent consultation.

4 Legal and Compliance Requirements

This section details the relevant legal and compliance requirements for the Penrith Stadium Redevelopment project including the Minister's CoA and where they are addressed within this Plan.

4.1 Legislation

Legislation considered during the development of the FEMP includes:

- State Emergency and Rescue Management Act (1989)
- Protection of the Environment Operations Act (1997)
- Environmental Planning and Assessment Act (1979)
- Water Management Act (2000)
- Water Act (1912)

4.2 Guidelines

Guidelines and standards relating to flood emergency management associated with construction of the project include:

- Penrith Football Stadium Refurbishment DA – Flood Study, Aurecon, 30 April 2024
- Hawkesbury – Nepean Valley Flood Emergency Plan Version 2020-1.0, NSW-SES, NSW Government, June 2020
- Nepean River Flood Study, Advisian for Penrith City Council, 16 August 2017
- Peach Tree and Lower Surveyors Creek Flood Study, Catchment Simulation Solution, April 2019
- Penrith CBD Detailed Overland Flow Flood Study, Cardno, 7 July 2015
- Flood Risk Management Manual: The policy and manual for the management of flood liable land, Department of Planning & Environment (DP&E) 2023
- Australian Disaster Resilience Handbook 7: Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia, Australian Institute for Disaster Resilience (AIDR), on behalf of the Australian Government Attorney-General's Department 2017

4.3 Conditions of approval, Mitigation Measures and Performance Outcomes

As discussed in Section 1 of Penrith Stadium EIS, the Penrith Stadium Redevelopment is classified as State Significant Development (SSD) pursuant to Section 13(1) of Schedule 1 of State Environmental Planning Policy (planning Systems) 2021. The Project has been approved with conditions by both the NSW Minister for Planning and Public Spaces and the Director of Social Infrastructure Assessments.

This Flood Emergency Management Plan (FEMP) has been prepared by a suitably qualified and experienced Engineer in accordance with Condition B22, B28 and B29 of the State Significant Development Application (SSDA) Conditions. The flood emergency management and mitigation measures outlined in this FEMP enable Penrith Stadium construction site to achieve compliance with Condition B22, B28 and B29 of the SSDA and Section 6.1.3 and Appendix CC of the EIS. These conditions of approval relevant to the construction phase and where they have been addressed in this FEMP can be found in the Compliance Matrix at the beginning of this document.

Based on the assessment in the EIS, the Penrith Stadium Redevelopment Project has satisfactorily met the requirements outlined in the SSDA and EIS, regarding flood risk, impacts, and public safety. It should be noted that the construction site is positioned well above the 1 in 100-Year ARI (1% AEP) regional and local flood levels, therefore maintaining flood immunity to the building during the construction phase.

5 Environmental Risk Assessment

5.1 Construction Phase Flood Risk Assessment

During construction, a crane pad will be built approximately 600mm above the existing (RL 28.1). The extent of the crane pad is shown in Figure 2.

Figure 2: Temporary Works Crane Platform at Penrith Stadium Construction Site

Table 1 shows that the proposed crane pad level is higher than the 1% AEP flood levels (both for local and regional flood) which means the construction site and the equipment are not subject to flooding in events up to and including the 1 in 100-year ARI (1% AEP).

Table 1: Flood Levels based on Regional and Localised Flood Modelling

Flood Event	Flood Level at Site (m AHD)	
	Regional Flood	Local Flood
1% AEP	26.4	27.41
0.5% AEP	27.7	27.45
0.2% AEP	28.61	NA
PMF	32.55	27.92

5.2 Likelihood of Flooding during Construction Phase

As summarised in the EIS, the proposed design of Penrith Stadium only has a marginal change to the existing building footprint and negligible changes to site level that would impact flooding. This is because the Penrith Stadium construction site sits outside of the regional 1% AEP (1 in 100 AEP) floodplain.

From the regional flooding perspective, the site is not inundated in the 1% AEP (1 in 100 AEP), however it is partially inundated in the 0.5% AEP (1 in 200 AEP) and completely inundated in events less frequent than the 0.2% AEP (1 in 500 AEP), as shown in Figure 3 to Figure 5 below. These figures were extracted from the Penrith

Stadium Refurbishment DS Flood Study by Aurecon (April 2024).

Figure 3: Nepean River Regional Flood Depth Map – 1% AEP (1 in 100 AEP)

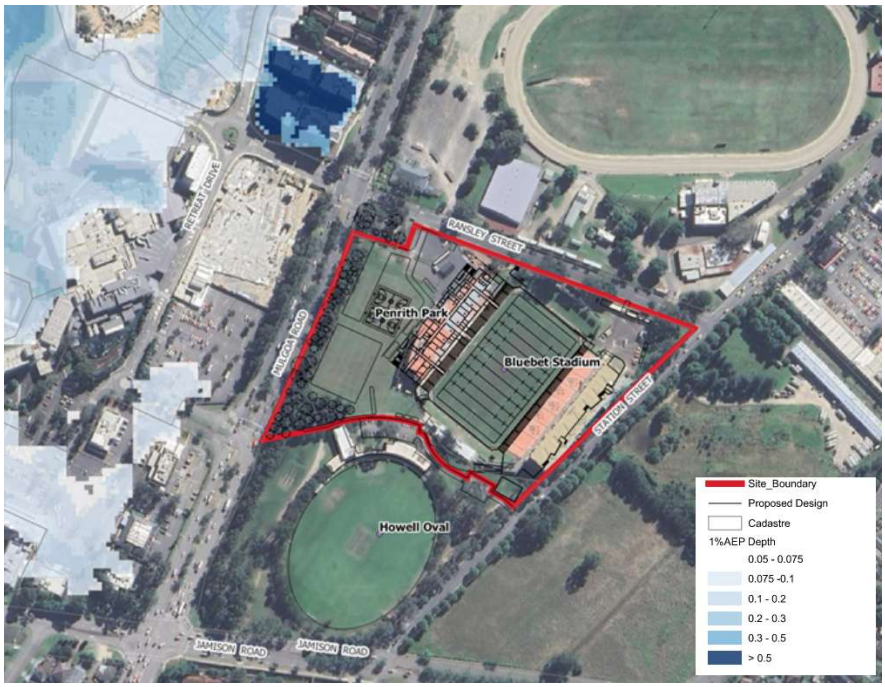


Figure 4: Nepean River Regional Flood Depth Map – 0.5% AEP (1 in 200 AEP)

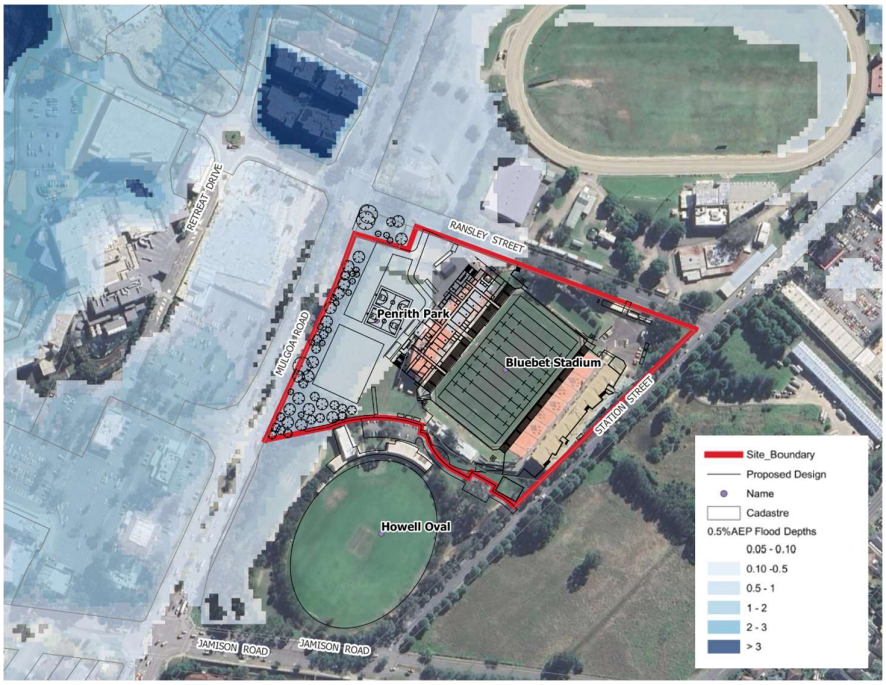
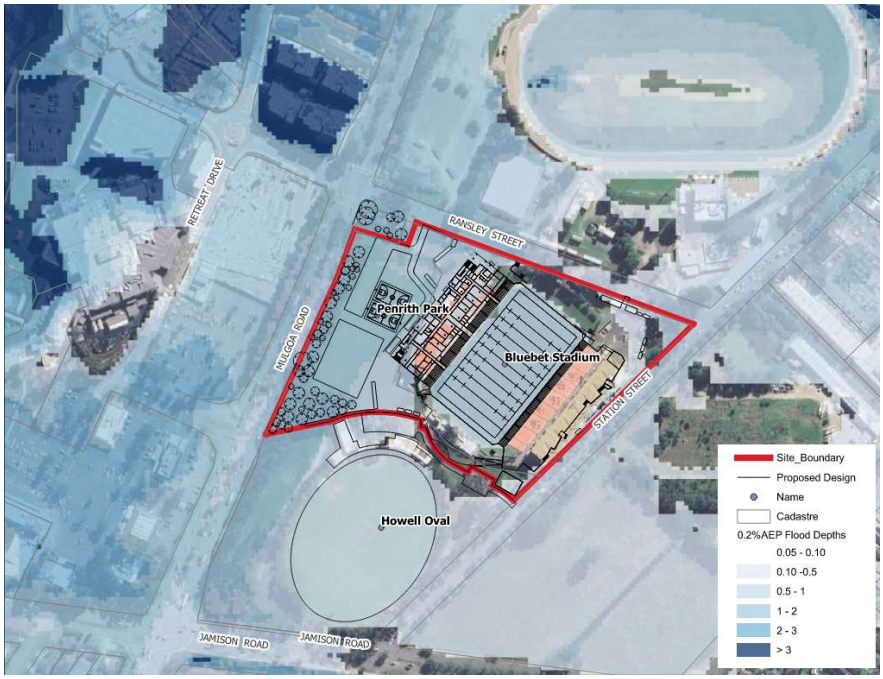


Figure 5: Nepean River Regional Flood Depth Map – 0.2% AEP (1 in 500 AEP)



6 Risk Assessment and Management

The Penrith Stadium Refurbishment DS Flood Study by Aurecon (April 2024) described the proposed Penrith Stadium Construction works has having a potential minor impact on flooding. This includes only a marginal increase in the building footprint and no significant proposed changes to site levels. This, coupled with the work being outside of the regional and local 1% AEP flooded extents, means that no adverse impacts on surrounding properties are expected in this event. In summary, no adverse impact on flooding to adjacent properties are expected (Section 3.3 EIS). **Error! Reference source not found.** provides the summary of qualitative flood impact assessment extracted from the EIS.

Table 2: Summary of qualitative impact assessment (EIS)

Event	Flood Behaviour Regional Flooding	Potential Impact
1% AEP	Site not flooded	No impact expected
0.5% AEP	The area west of the stadium experiences low hazard flooding (shallow depths)	No flood impact expected on adjacent properties
0.2% AEP	The inundation west of the stadium increased in extent. Depths in the order of 1 meter. The hazard increased to 'medium' category. Flood function would be classed as fringe.	Negligible flood impacts are expected. Likely to be localised due to the flood fringe nature of flooding. Unlikely to impact adjacent properties.
PMF	Flood depth in the order of 4 to 5 meters across the region	The proposed minor change in building footprint is unlikely to change flood behaviour that would impact emergency management or critical

Event	Flood Behaviour Regional Flooding	Potential Impact
		infrastructure. No change to hazard is expected.
Localised Flooding		
1% AEP	Flooding localised to the western boundary.	No impact expected.
0.5% AEP	Flooding localised to the western boundary.	No impact expected.
0.2% AEP	NA.	NA.
PMF	Flooding west of the stadium predicted. The depth of flooding is in the order of 0.3 meters. Low flood hazard expected.	Negligible flood impacts are expected. Likely to be localised due to the flood fringe nature of flooding. Unlikely to impact adjacent properties.

Note:

- Hazard category is in accordance with Australia Rainfall and Runoff 2019
- Low Hazard is equivalent to hazard classification H1 or H2 = Generally safe for people and cars
- Medium Hazard is equivalent to H3 or H4 = Unsafe for people and cars
- High Hazard is equivalent to H5 or H6 = unsafe for people, cars and potential damage to buildings

No specific management measures are proposed in the EIS, as the final floor level is sufficiently high enough above the regional FPL and the proposed development works would unlikely influence flooding to adjacent properties. Should there be any modifications to the proposal, a review of the impact of flooding should be undertaken.

A key consideration for flooding during the Construction Phase, is to ensure that the locations of construction compounds, site offices, laydown areas, piling pads, temporary waterway crossings and other temporary works are positioned not to exacerbate the existing flooding issues. Another key consideration is that plant, equipment and other construction materials do not increase or worsen the impacts associated with flooding, nor does the permanent works, as constructed at the time of flood.

John Holland is mindful of the increased risk of temporary works elements becoming destabilised, damaged or dislodged during a flood event, and as such have implemented a flood warning strategy as detailed in Section 7.

7 Environmental Management Framework

7.1 Penrith Stadium Redevelopment Environmental Management System

John Holland will be utilising an Environmental Management System (EMS) (which is certified to ISO AS/NZS14001) to enhance its' environmental performance. This is discussed in detail in Section 3 of the CEMP.

7.2 Roles and Responsibilities

Section 3 of John Holland's CEMP details roles and responsibilities for environmental management (including flood emergency management). John Holland's Environment Manager has overall responsibility for the implementation of environmental matters on the Project and the John Holland Safety Manager is responsible for field implementation of flood emergency control measures.

7.3 Competence, Training and Awareness

All personnel performing environmental management activities for and on behalf of John Holland will be trained, qualified and competent. Personnel performing specified assigned tasks shall be qualified on the basis of appropriate education, training, skills and/or experience, as appropriate. Section 3.4 of the CEMP details competence, training and awareness and includes:

- Inductions;
- Tool box talks;
- Daily pre-start meetings;
- Resource planning; and
- John Holland's Environment Training Program.

7.4 Environmental and Sustainability Inspections

Section 5.1 of John Holland's CEMP details environmental and sustainability inspections, including inspections related to the FEMP. Table 3 lists the details of each type of environmental and sustainability inspection to be undertaken on the Project.

Table 3: Summary of Inspection Frequency

Activity	Frequency	Responsibility	Record
Site inspection	Daily	Supervisor/s	Site Diary
Environmental and sustainability	Weekly	Environmental Coordinator/s	Environmental and sustainability checklist
High Risk Activity Inspections	As required	Construction Manager	High risk activity inspection checklist
Subcontractor HSEQ Deliverables	Pre-mobilisation and monthly thereafter	Commercial Representative	Subcontract Management Pack

7.5 Compliance Monitoring and Reporting

The John Holland Environment Team and Site Supervisors will undertake environmental inspections, audits and reporting to develop and evaluate the effectiveness of flood emergency controls. This will include:

- General observations for flood emergency controls shall be documented in site dairies by the Site Supervisor.
- Regular inspection of flood emergency controls shall be undertaken by the Environmental Coordinator and Site Supervisor using the Weekly Environmental Management Inspection Checklist and uploaded to

Project Pack Web.

- Effectiveness of flood emergency controls shall be regularly reviewed by the Environmental Coordinator for adequacy having regard for changing circumstances.
- Six monthly independent audits by a suitably qualified professional.
- ER regular monitoring of the implementation of the documents listed in the CoA; and
- The broader EMP auditing process is discussed further in Section 5.3 of John Holland's CEMP.

7.6 Reporting and Communication

Reporting will include monthly internal project reports and Construction Monthly Environmental Reports to the client. Compliance monitoring and reporting are discussed in further detail in Section 5.2 of John Holland's CEMP.

7.7 Environmental Control Maps

John Holland will use Environmental Control Maps (ECMs) to aid in the identification and protection of significant environmental features associated with the project. The ECMs will include:

- Specific measures included in the relevant work method statements to prevent adverse environmental impacts; and
- Relevant drawings showing
- Location and scope of works to be managed,
- Environmental constraints and 'no go' zones,
- Location and nature of environmental controls,
- Nature and frequency of monitoring for identified potential adverse impacts, and
- Procedures for notification of incidents or hazards.

ECMs are further discussed in Section 4.7 of the CEMP.

7.8 Environmental Management Procedures, Forms and Other Documents

The Project's EMS procedures, project specific procedures, forms and other documents provide instructions and records related to both environmental and non-environmental activities throughout the Project. These are discussed in detail in Section 4.2 of the CEMP.

7.9 Communication and Complaints Management

John Holland's Community and Stakeholder Engagement Management Plan (CSEMP) and Section 4.6 of the CEMP details communication and complaints management processes and procedures. The CSEMP identifies key stakeholder groups that will be consulted and engaged with during the Project and outlines the communication tools that will be used to consult and engage with these groups.

During construction, any comments, feedback or complaints relating to biodiversity will be addressed in line with our complaints handling framework.

7.10 Incidents, Emergencies and Non-Conformity

In the event of an environmental, social performance, sustainability heritage or other incident, an Incident and Emergency Response Plan will be implemented. Environmental incidents will be required to be reported to the Client's Project Manager and Environmental Manager and managed in accordance with the Client's event management system. Incidents, emergencies, response plans and non-conformities are discussed in detail in Section 5.4 of the CEMP.

7.11 FERP Review and Revision Process

This FEMP is a 'live' and 'working' document. As required by John Holland's EMS requirements, the Environment Manager will conduct regular reviews of the FEMP in accordance with CEMP Section 5.6. The CEMP and sub-plans review, and revision process is discussed in detail in Section 5 of the CEMP.

8 Flood Characteristics

A summary of the flood characteristics associated with the Nepean River floodplain around Penrith Stadium is contained within the Penrith Stadium Redevelopment Development Application (DA) Flood Study Report prepared by Aurecon (2024) on behalf of Infrastructure NSW. Based on the regional flooding assessment, the Penrith Stadium lies outside of the 1% AEP (1 in 100 AEP) flooded extent and becomes partially affected by flooding in events less frequent than the 0.5% AEP (1 in 200 AEP) event. In this event, the flood function is classified as 'flood fringe' since it is located on the outer edge of the floodplain. The flood hazard category in the flood fringe zone is generally considered as 'Low Flood Hazard' when compared to a primary floodway or flood storage area. The flood characteristics associated with the Nepean River floodplain in the location of Penrith may be summarised as follows (Table 4).

The council flood study indicates the playing field is at risk of localised flooding caused by surcharge of the council drainage network (or intense rainfall events occurring directly over the site). Based on current EIS assessment this does not sound to be unrealistic as the modelling undertaken does not include the local field drainage that would otherwise drain the field. Therefore, as part of the Temporary Works and Permanent Works drainage designs, it is recommended to update the drainage design model to include adequate drainage of the playing field area within the Penrith Stadium.

Table 4: Flood Characteristics associated with Nepean River floodplain at Penrith

Waterway Name	Catchment Area	Flood Warning Time (Estimate)	1% AEP Flood Level at Site (m AHD)
Nepean River	11,000 km^2	Less than 24 Hours	26.4 m AHD
Note: Flood warning time ('Time to Peak') was evaluated based on water level data from the hydrograph data at 212201 Nepean River at Penrith gauging station for the 2021 flood event.			

9 Streamflow Monitoring Stations

There is one streamflow gauging stations near the site that may be used to monitor flood levels and anticipate flood warning signals, this is 212201 Nepean River at Penrith. The station is owned by Water NSW and has been recording water level data since December 12th, 1968.

John Holland will utilise the data recorded to inform flood warning trigger levels across the region. Details of the available gauging station is summarised below in Table 5 below. Real-time water level recordings are available online from the following website: https://realtimedata.waternsw.com.au/.

Table 5: Nepean River at Penrith stream flow gauge details

Gauge Name	WaterNSW Gauge Number	BOM Gauge Number	Gauge Location	Upstream Catchment Area	Data Owner	Gauge Zero Level
Nepean River at Penrith	212201	567047	Lat: -34.75 Long: 150.68	11,000 km2	WaterNSW	14.139 m AHD

Figure 6: Location of Water Level Gauging Station (Nepean River at Penrith)

10 Flood Warning Time

Flood warning times are evaluated as the lag time between a peak rainfall intensity and a peak flood level occurrence for gauged catchments. For the Nepean River however, flood warning times are controlled by the Warragamba Dam upstream which releases stored flood waters when at capacity.

In this instance, the time it takes for flood water levels to peak within the Nepean River at Penrith has been evaluated based on gauged water level data from Nepean River at Penrith station during the 2021 flood event and was evaluated to be less than 24 hours. Further detail regarding flood warning times, has also been extracted from the Hawkesbury-Nepean Flood Emergency Sub Plan Report by NSW SES (2024) Annex B – Flood Warning Gauges. This report indicates that following warning times for respective water level heights at Penrith:

- Flood Warning Time is 6 hrs when trigger height is >8.9 m (RL. 23.036 m AHD)
- Flood Warning Time is 8 hrs when trigger height is >11.3m (RL. 25.436 m AHD)

The Bureau of Meteorology (BoM) Flood Watches, Flood Warnings and Severe Weather Warnings are generally issued 2-4 days in advance which would allow precautionary action to be taken on site prior to a flood event. Therefore, the emphasis should be on implementing precautionary actions based on BOM Rainfall Forecasts and Warnings rather than responding during the actual events. BoM Flood Warning signals for the site may be accessed from the following website:

http://www.bom.gov.au/nsw/warnings/

A Flood Warnings are issued when the BoM is more certain that flooding is expected, often when rainfall has started to fall. Flood Warnings are more targeted and are issued for specific catchments or even sub-catchments in some of the larger river basins. Flood Warnings will generally include specific predictions of the severity of expected flooding.

There will be occasions when a Flood Warning is issued without it being preceded by a Flood Watch, largely due to the complexities of forecasting rainfall accurately. Weather models are excellent at identifying broader scale weather patterns but are not always able to represent the smaller scale features that can cause heavy rainfall, particularly in tropical areas. For this reason, there will be times when heavy rainfall leading to flooding occurs but forecast models were not able to accurately identify this beforehand.

10.1 Flood Watch

A BOM Flood Watch is issued when forecast rainfall information suggests that local and/or riverine flooding is possible across the Flood Watch area. A Flood Watch may cover a large area due to uncertainty associated with the location and amount of forecast rainfall. A flood watch may also refer to the type of flooding that may be experienced in the catchment being highlighted. The types of flooding that may be referred to include:

- Local flooding – For areas without a well-defined river, describes situations where intense rainfall is expected to cause high run-off volumes in small catchments or localised areas with minimal impact on main streams. The areas outlined in a Flood Watch may not be currently covered by a formal flood warning service.

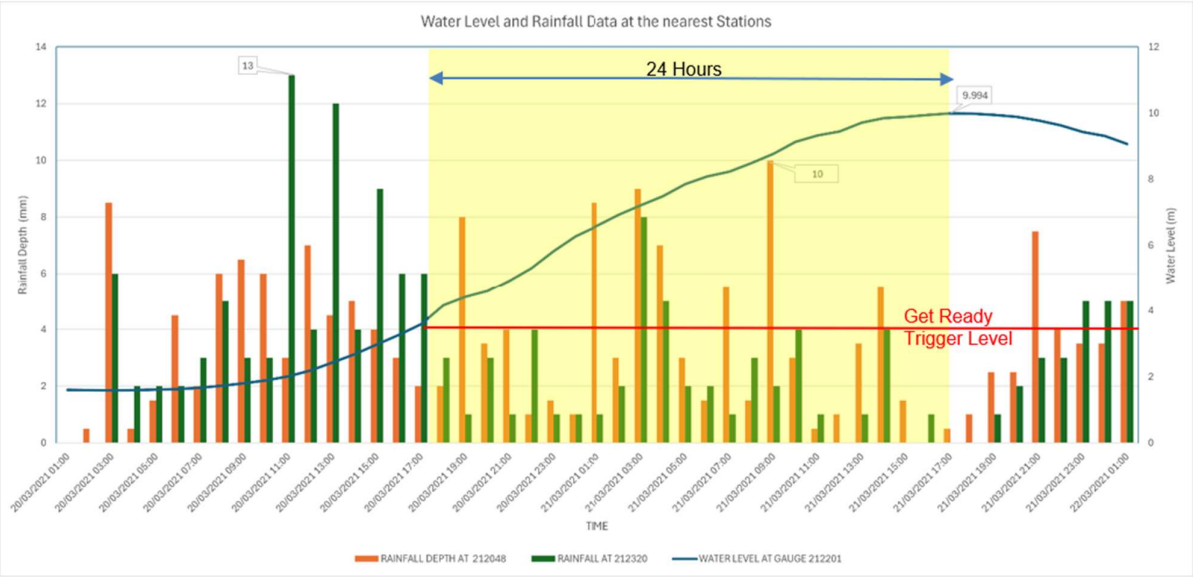
- Local and Riverine flooding - For areas with a well-defined river, describes situations where intense rainfall is expected to cause high run-off volumes in small catchments or localised areas with significant impact on the water levels in main rivers and streams.

The areas outlined in a Flood Watch may not be currently covered by a formal flood warning service.

10.2 March 2021 Flood Event

A major flood event occurred in March 2021 where an average of 265 mm mm of rain fell within a 7-day period in the upper reaches of the Nepean River catchment. A peak flood depth of 9.994 m (RL. 24.133 m AHD) was recorded at Nepean River at Penrith Gauge (212201) on 21st of March 2021 at 5 pm. The peak water level occurred within less than 24-hours of peak rainfall intensity being recorded at several nearby rainfall gauging stations as show in Figure 7.

Figure 7: March 20th to 22nd 2021 Hourly Nepean River levels and Rainfall



11 Rainfall Monitoring Stations

There are several open rainfall monitoring stations located within the Nepean River drainage basin, including 13 (thirteen) rainfall stations that are owned by BoM, and 7 (seven) rainfall stations that are owned by Water NSW. The list of these stations is presented in

Table 6: Rainfall Monitoring Station within the Hawkesbury Nepean Basin

7.

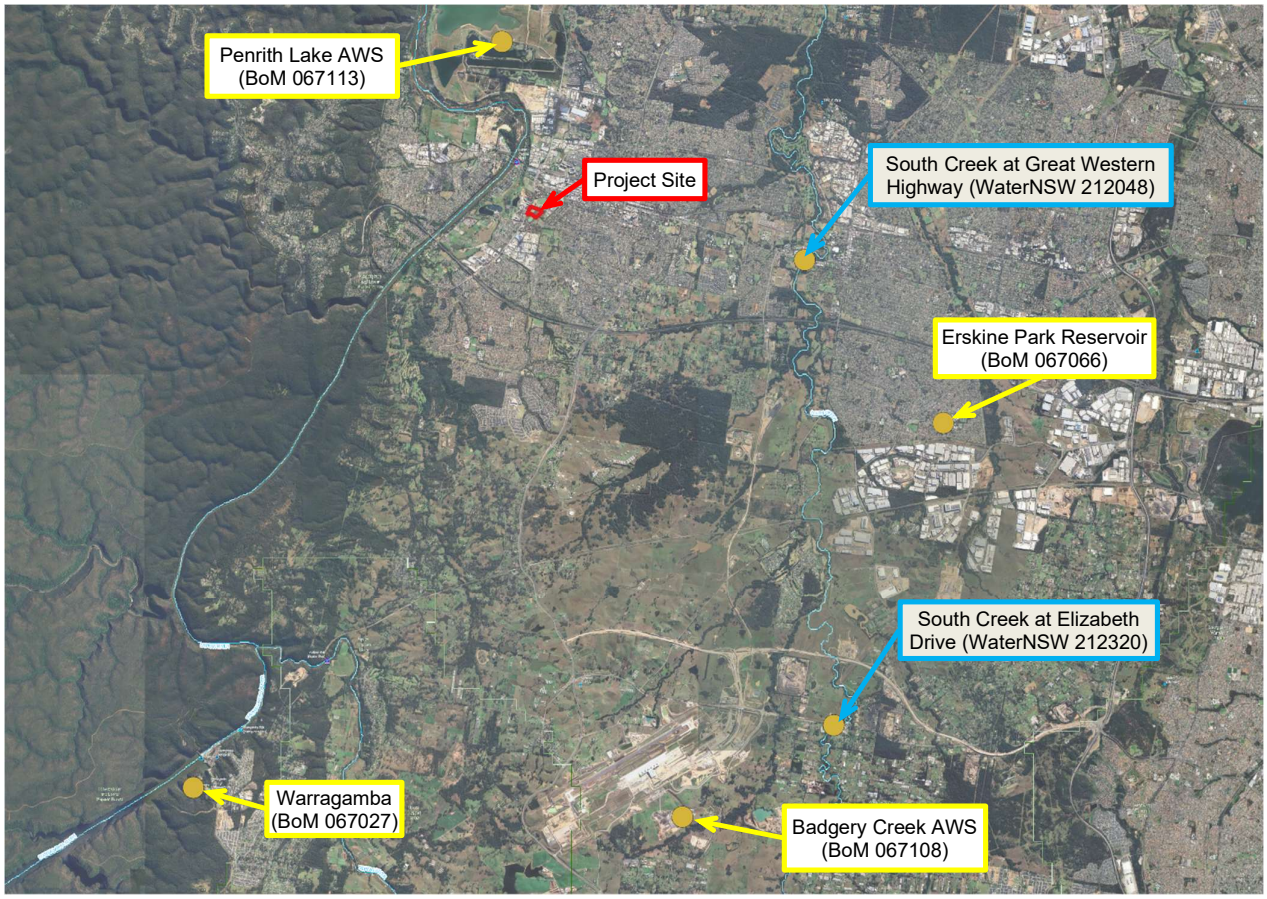
The flood forecasting rainfall gauging station that John Holland will use for flood forecasting is included in the BOM Flood Watch Product and are summarised below. The latest rainfall observations for this site is accessed from the following website: Sydney Rainfall

7-Day rainfall forecasts and significant weather events are mapped by the BoM MetEye Product which can be accessed here: MetEye

Table 6: Rainfall Monitoring Station within the Hawkesbury Nepean Basin

Station ID	Station Owner	Station Name
067113	Bureau	Penrith Lakes AWS
067084	Bureau	Orchard Hills Treatment Works
067081	Bureau	Shanes Park
067002	Bureau	Castlereagh
067116	Bureau	Willmot (Resolution Avenue)
067066	Bureau	Erskine Park Reservoir
063081	Bureau	Faulconbridge (Great Western Hwy)
067021	Bureau	Richmond - UWS Hawkesbury
063028	Bureau	Faulconbridge (Great Western Hwy)
067108	Bureau	Badgery Creek AWS
067027	Bureau	Warragamba
067105	Bureau	Richmon RAAF
067119	Bureau	Horsley Park Equestrian Centre AWS
212018	Water NSW	Capertee River at Glen Davis
212021	Water NSW	MacDonald River at Howes Valley
212042	Water NSW	Farmers Creek at Mount Walker
212048	Water NSW	South Creek at Great Western Highway
212053	Water NSW	Stonquarry Creek at Picton
212063	Water NSW	Lake Nerrigorang at Thirlmere Lakes
212320	Water NSW	South Creek at Elizabeth Drive

Figure 8: Rainfall Stations nearby the project site



12 Forecast Rainfall Depths and Trigger Levels

The rainfall depths for the project site have been extracted from the BOM website with reference to the approximate midpoint of the site at Longitude 150.686 and Latitude -33.759. The rainfall depths associated with critical storm durations (i.e. the storm duration that produces the worst-case flooding) are summarised in Table 7. The table below indicates that forecast rainfall totals of 121 mm or more is expected to generate flooding within the Nepean River catchment.

Table 7: BoM Forecast Rainfall Depths that are expected to generate Flooding

Storm Duration	1% AEP	0.5% AEP	0.2% AEP
6-Hour	121	130	147
9-Hour	144	155	174
12-Hour	164	177	199
18-Hour	199	215	243
24-Hour	229	248	281
30-Hour	254	285	327
36-Hour	275	314	362
48-Hour	310	354	409
72-Hour	355	398	455

13 Flood Warning Strategy

Weather conditions in the vicinity of the site will be monitored with sufficient warning time of impeding flood producing rain. Weather warnings will need to be disseminated to all construction personnel on site so they can implement precautionary measures and relocate any mobile equipment stored on site outside of the waterways wherever possible.

The following flood warning approach will be implemented:

1. WaterNSW is responsible for the collection and monitoring of flood data along waterways (including the Hawkesbury Nepean Basin) and provides the BOM and NSW SES real-time or near real-time river height data for the development of official flood warnings. Access to real-time water level data for the respective gauging station is available at *Real-time water data*. This website will be checked daily by the Environment Manager, Environment Coordinators, Construction Managers and Site Supervisors for rainfall events predicted to be >100mm in a 24hour period.

   https://realtimedata.waternsw.com.au/water.stm

2. Manly Hydraulics Laboratory (MHL) provide a freely downloadable app 'Floods Near Me' which provides access to water level data from a mobile phone. Users can set up 'push notifications' sent straight to their home screen for updates on timely water level information. The push notifications are provided within 30 minutes of the data being recorded at the gauge and may be set up to notify the user of any specified trigger levels. The Floods Near Me app is available at http://floodsnearme.manly.hydraulics.works/ The Safety Manager, Environment Manager, Environment Coordinators, Construction Managers and Site Supervisors will have this app on their mobile phones

   http://floodsnearme.manly.hydraulics.works/

3. The Hawkesbury Nepean Catchments are included in the BOM Flood Watch / Flood Warning product. This product is issued when flooding is expected in NSW. Lead time for this warning product is usually 2 - 4 days (or sometimes even longer), with less accuracy the further away from the predicted rainfall event. Early warning messages with flood predictions for the region are disseminated directly to the NSW SES, other State and Local Government Agencies and are published at: New South Wales Warnings Summary. This website will be checked daily by the safety Manager, Environment Manager, Environment Coordinators, Construction Managers and Site Supervisors for rainfall events predicted to be >10mm in a 24hour period.

   http://www.bom.gov.au/nsw/warnings/

4. Rainfall forecasts up to 6-days in advance are mapped by the BoM MetEye Product which can be accessed here: MetEye. This site will be checked on a daily basis by the Environment Manager. The BOM also provide a rainfall radar for the Project area referred to as the 64 km Sydney (Terrey Hills) Radar Loop. This site provides a very accurate image of the storm cloud that is occurring over the region at the point in time

   http://www.bom.gov.au/australia/meteye/?loc=NSW_FA001

5. Freely available online flood maps showing the extents of flood inundation is available from the SES website: Hawkesbury-Nepean Valley flood map | NSW SES

   https://www.ses.nsw.gov.au/hawkesbury-nepean-floods

14 Flood Classifications and Flood Trigger Levels

At available flood warning river height gauging station, the severity of flooding may be described as minor, moderate or major according to the effects caused in the local area or in the nearby downstream areas. Terms used in Flood Warnings are based on the following definitions.

Minor Flooding: Causes inconvenience, low-lying areas next to watercourses are inundated. Minor roads may be closed and low=level bridges submerged. In urban areas inundation may affect some backyards and buildings below the flood level as well as bicycle and pedestrian paths. In rural areas removal of stock and equipment may be required.

Moderate Flooding: In addition to the above, the area of inundation is more substantial. Main traffic routes may be affected. Some buildings may be affected above the flood level. Evacuation of flood effected areas may be required. In rural areas removal of stock is required.

Major Flooding: in addition to the above, extensive rural areas and/or urban areas are inundated. Many buildings may be affected above the flood level. Properties and town are likely to be isolated and major rail and traffic routes are closed. Evacuation in flood affected areas may be required. Utility services maybe impacted.

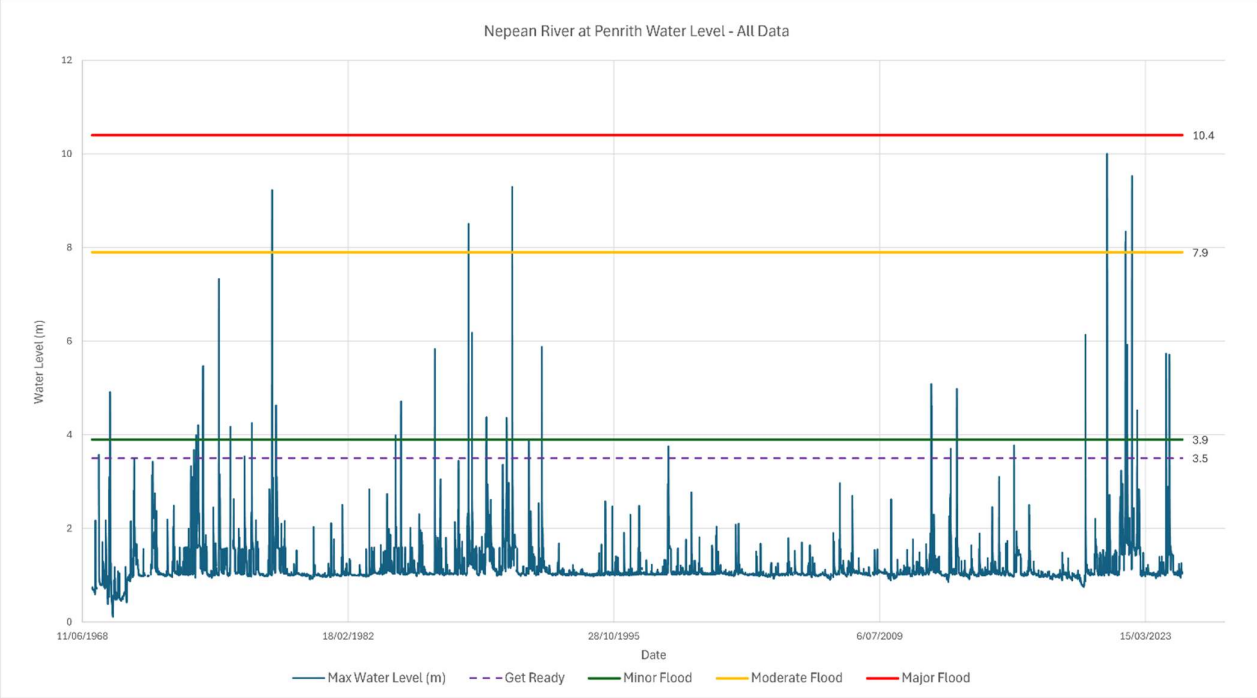
The table below shows the flood classifications at Nepean River at Penrith (BoM gauge ID 567047).

Table 8: Temporary Works Elements Flood Failure Probabilities

STATION	BOM Gauge No	**Get Ready**	**Minor Flood**	**Moderate Flood**	**Major Flood**
Nepean River at Penrith	567047	3.5 m	3.9m	7.9m	10.4m

The graph of the entire water level records at this station and plotted against the flood probabilities levels are shown in Figure 9.

Figure 9: Nepean River at Penrith Water Level All Record (1968 to 2025)



15 Project Personnel Emergency Response and Evacuation

Penrith City Council has a Local Flood Plan, which is supplemented by the Hawkesbury-Nepean Valley Flood Emergency Plan.

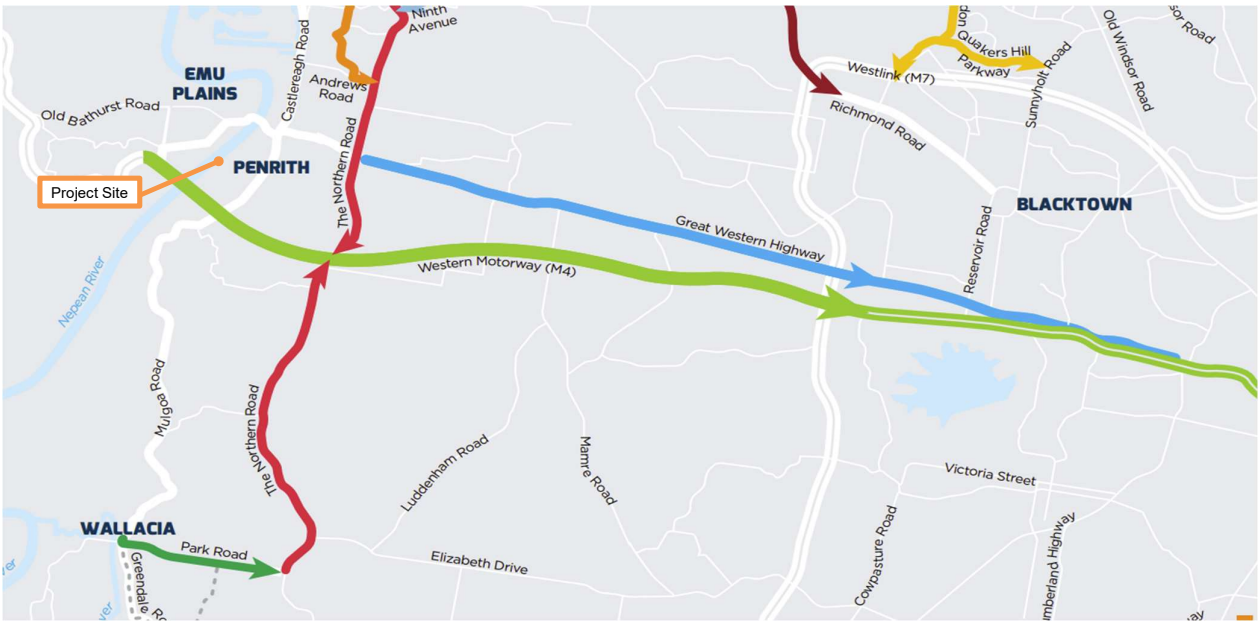
This plan identifies flood risks in the region and presents preparedness, response, co-ordination, and operations for all levels of flooding throughout the region. The Plans each identify evacuation routes based on available flood information. The Construction Team have utilised these plans to develop response measures and evacuation routes for Project personnel and will comply with these plans and the directions of the local emergency services should a regional flood event occur. These plans will be consulted on an annual basis and any changes will be incorporated into this Plan. The local evacuation routes relevant to the Project are summarised in Table 9.

Table 9: Flood Evacuation Routes

LOCATION	FLOOD WARNING TIME	EVACUATION TRIGGER	INDICATIVE EVACUATION ROUTE	INDICATIVE EVACUATION LOCATION
Penrith Stadium Construction Site	Less than 1 Day	Expectation of Major Regional Flooding	Great Western Highway traveling east OR Western Motorway (M4) travelling east	• Richmond Club (103) • North Richmond Community Centre (102) • Castle Hill RSL (93 • Bringelly Community Centre • Cecil Hills

The evacuation of the site would be towards the east via the connecting roads. The Great Western Highway or the Western Motorway are the closest designated evacuation routes (refer 10).

Figure 10: Flood Evacuation Routes (NSW SES, 2024)



16 Flood Emergency Response Plan

A range of environmental requirements and management measures are identified in the Conditions of Approval (CoA), AMMS and Environmental Protection Outcomes (EPOs). Environmental controls will be implemented to avoid, minimise and manage flood impacts on construction and the community. Controls to address the construction impacts of the Project on flood risk are summarised in Table 10 together with details on resourcing, timing and responsibility.

This Flood Emergency Response Plan (FEMP) has been prepared by an experienced flood emergency response specialist in accordance with the NSW Floodplain Development Manual and to satisfy the requirements of CoA B22(a) – (c). NOTE: This FEMP has been prepared for the construction phase of Project only.

Table 10: Construction Phase Flood Emergency Response Plan and Actions

Stage	Construction phase flood response plan	Responsibility
Preparation (Get Ready)		
	Prepare Site-Specific Flood Response Plan: A site-specific flood response plan (refer Appendix A for template) will be developed for the work site. The Site-specific flood response plan are specific to the works occurring, the surrounding environmental constraints and the flood risk. The site-specific flood response plan will include any temporary works and flood preparation and response measures specific to those works. The site-specific flood response plan will address the methods, timeframes, and responsibilities for securing, removal, mobilisation to higher ground or protection of materials safely from work areas during a flood event. The site-specific flood response plan will include information on where to go (evacuation) in the event of a flood, who to call (NSW SES - 132 500) or emergency services (000), where to receive updates and advice (e.g. radio, social media) and triggers, warnings and natural signs of flooding. The site-specific flood response plan will include site specific information such as where plant and equipment (including site amenities and hazardous materials) and stockpiles should be located to minimise the impact of flooding and/or reduce timeframes for removal if required. Where plant and equipment cannot be moved, details of how it will be secured would be detailed in the site-specific flood response plan. Triggers will be included in each flood response plan so as supervisors know when these plans are to be implemented. The site-specific flood response plan will be kept at the activity sites, with the other site-specific documentation. These plans will be regularly reviewed and revised progressively throughout construction as activities and locations change to ensure the preparedness for flood risk.	Construction Manager WHS Manager
	Training and Awareness: Site-specific flood preparation plan will be the subject of toolbox talks to the work crews to educate the construction team about the site-specific flood response plan, and as required as part of emergency drills.	Construction Manager WHS Manager
	Weather Monitoring and Flood Warning Systems: Relevant Project team representatives shall sign up to the BoM Flood Warning Product for respective Flood Watch Area(s). Flood watch and flood warning notifications and water level trigger alerts shall be set-up on all staff Mobile Phones using the WaterLive App.	Construction Manager WHS Manager Communications Manager

Stage	Construction phase flood response plan	Responsibility
	Weather would be monitored daily for construction planning purposes to identify any risk of high rainfall and subsequent flooding events Long-term climatic modelling will be regularly reviewed to identify any potential risk of flooding. The contact details of local upstream land holders will be obtained and contacted when works are occurring in the area and when flood and / or severe weather is predicted to determine what flood preparedness works need to be undertaken. Live Traffic NSW (Live Traffic NSW | Incident Details) website and physical road closures will inform suitable and available evacuation routes for project personnel. In the event of self-evacuation or an evacuation order is issued by the authorities, personnel are to listen and adhere to the advice provided by the relevant authorities (i.e. NSW SES, OEM, LEMO, or Police) with regard to road closures and evacuation routes. Personnel's evacuation plans are to be discussed with the relevant Supervisor / Manager and / or member of the Project's Safety Team. A Journey Management Plan is to be completed for any journeys greater than 4 hours in length.	
	Temporary Works Measures: Site specific temporary works such as minor drainage realignments and diversions, bunding and raising of site platforms will be required at Ancillary Facilities. Design and implementation of temporary works flood mitigation measures shall be determined on a site-by-site basis by the Temporary Works Team. Assess all installed temporary works to determine the risk associated with these works and if the works require removal.	Construction Manager WHS Manager Temporary Works Manager
Response (During Flood)		
	Immediately Prior to a Flood Event: On-going monitoring of the BoM flood warning products will be undertaken for updated information and expected flood levels. General on-going monitoring of site flood conditions will be communicated to all personnel. NSW SES - The NSW SES issues Flood Bulletins during flood events. These are emailed out to key stakeholders and members of the community during flood events and contain important up to date information about the relevant flood event.	Construction Manager WHS Manager
	Monitoring During Flooding: On-going monitoring of the BoM flood warning products will be undertaken for acquiring up to date information and expected flood levels. General on-going monitoring of site flood conditions will be communicated to all personnel. NSW SES - The NSW SES issues Flood Bulletins during flood events. These are emailed out to key stakeholders and members of the community during flood events and contain important up to date information about the relevant flood event	Construction Manager WHS Manager
	Evacuation In the event of a flood, personnel are to gather at the designated muster points which are located outside of the flood prone land. The designated muster points including evacuation routes are to be detailed as part of Workplace Emergency Response Plan.	Construction Manager WHS Manager

Stage	Construction phase flood response plan	Responsibility
	Regarding evacuation arrangements, this shall be considered carefully together with NSW SES. Agreed arrangements shall be included in the local response plans with Site Officers trained to cover the additional sites/areas. The Workplace Emergency Response Plan shall be available at the site office and awareness raised amongst construction workers. All Project personnel will adhere to the evacuation advice of the NSW SES, with any remaining personnel (i.e. those who did not self-evacuate) utilising the accommodation facilities as detailed below or in the Local Flood Plan for the Shire. NSW SES (Ph. 132 500) are to be contacted for emergency assistance during a flood event. NOTE: Evacuation facilities (shelter) have been nominated in the Local Flood Plans developed by Councils as follows: Penrith City Council Flood Plan (Shelters): • Richmond Club (103) • North Richmond Community Center (102) • Castle Hill RSL (93 • Bringelly Community Center • Cecil Hills	
Recovery (After Flood)		
	Recovery Following a flood event, a safety walk will be undertaken to identify unstable or danger areas. The recovery team will need to take note of any flood damage to access roads, check for any relocated equipment, stock or debris moved by flood waters. The structural integrity of temporary flood mitigation measures (bunds, diversions, platforms, drains, pumps) are to be checked. Maintenance / repair actions are to be identified. Culverts under roads surrounding the site are to be inspected for blockages and potential damage. Flood markings on buildings or infrastructure are to be recorded wherever available for future reference and insurance purposes. Any water captured in areas of the site will be dewatered in accordance with the Project Soils and Water Management Sub-Plan. Any water Quality Monitoring required will be carried out in accordance with the Project Soils and Water Management. Post flood, a lesson's learnt workshop will be undertaken with all key Project personnel. Any findings and / or recommendations will be incorporated into this Plan. The Post Severe Weather / Flood Survey (Appendix B) will be distributed to key Project Personnel and requested these be completed. Any findings and / or recommendations will be considered and potentially incorporated into the Plan.	Construction Manager WHS Manager

Appendix A: Penrith Stadium – Site Specific Flood Preparation Plan (TEMPLATE)

Site Name: Chainage:

Drafted by (Area Supervisor): Date:

Approved by (Area Engineer):

Instructions: This Site-Specific Flood Preparation Plan is to be prepared prior to mobilisation to site and triggered following a Flood Warning or Flood Watch alert issued by BoM or as directed by the Project Director.

Site Layout Diagram *(Insert)* NOTE: This Site Layout Diagram must include key site features, temporary works, access routes, onsite flood refuge (elevated) ground, drainage features, etc		
Flood Evacuation Route *(Insert)*		
Key Personnel / Response Crew *(Insert)*	**Name:**	**Phone Numbers:**

Site Preparation Checklist

Task	Completed
Undertake actions in consultation with the Project Manager – environmental, safety risk assessment / WMS?	
Check perimeter of all building structures for any loose items that need to be secured.	
Secure/remove pumping station where possible – high ground designated area	
Empty and secure effluent tanks to ensure no leakages?	
Move plant/machinery or other equipment to designated 'high ground' areas and secure as necessary.	
Stored fire extinguishers inside buildings?	
Empty rubbish bins and store inside storage/shipping containers?	
Secure all windows on huts on sites?	
Close all air conditioner vents and tie down condensers?	
Empty fridges of all perishable goods?	
Close all internal doors?	
Clear and tidy all office desks?	
Cover all records, drawings and documents etc. in plastic (watertight)?	
Turn off and cover (or remove from site) all computers and hardware?	
Monitor phone and fax until site evacuation?	
Close and lock all external doors?	
Turn off all electrical equipment?	
Secure or store all loose items in office areas and laydown areas?	
Secure gas cylinders, oil and fuel drums?	
Raise materials and equipment that are vulnerable to water damage from the floor?	
Isolate, secure and store all fuel dispensing equipment?	
Bundle and secure all loose debris?	
Secure or remove signs and star pickets?	

Check all ties on buildings and objects?	
Check of high ground that is considered appropriate for holding machinery/material/hazardous substances/chemicals & other equipment in the event of flooding on the worksite – identified on site prior to commencement of works (environmental risk assessment)?	
Remove temporary traffic control devices where possible e.g. traffic cones?	
Ensure clear drainage paths on sites – to accommodate heavy rainfall?	
Site Specific Actions / Measures *(Insert) – Incl. Temporary Works Response Measures*	
1.	
2.	
3.	
4.	
5.	
6.	

Appendix B: Penrith Stadium – Post Sever Weather / Flood Survey (TEMPLATE)

Name: Date:

Position: Site:

Instructions: Please complete the following questions and return to your Supervisor, Area Manager or Project Manager. The answers (and any feedback provided) will assist in the review and improvement of the Project's FEMP.

Note: Please indicate N/A if a question does not relate to you.

1. Had you previously read and understood the Flood Emergency Management Plan? (Y /N)

2. Did you highlight any questions about the plan to your supervisor prior to the severe weather or flood event? (Y / N)

3. What was the outcome of your questions?

_____
_____
_____
_____

4. Were you given updates on the status of the severe weather / flood event before and during the event?
(Y / N)

5. If so, by whom?

_____
_____
_____

6. Were you given adequate time to carry out your duties in preparation for the severe weather / flood event?

_____
_____
_____

7. How did sub-Contractors cooperate with Contractor's instructions?

_____
_____
_____

8. Were you given adequate time to take care of your family and home prior to the severe weather / flood event (if applicable)?

_____
_____
_____

9. How effective was the communication in relation to severe weather or flood management / evacuation management process?

_____
_____
_____

10. Did procedures provide minimal disruption prior to and during the severe weather / flood event?

_____
_____
_____
_____

11. What are your suggestions on improving the Flood Emergency Management Plan, the Site Specific Flood Preparation Plan and associated procedures?

_____
_____
_____

12. What processes or innovations do you consider may be appropriate to assist in making this plan more effective and efficient?

_____
_____
_____

13. Were you a member of the Response Crew established for the site?

_____
_____
_____

14. Any other suggestions or comments?

_____
_____
_____