

Flood Impact Assessment and Flood Emergency Response Plan for 110 George Street, Parramatta

RF CorVal
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Flood Impact Assessment and Flood Emergency Response Plan for 110 George Street, Parramatta

Project:	Flood Impact Assessment and Flood Emergency Response Plan for 110 George Street, Parramatta
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1.	Introduction	5
1.1.	Site Description	5
1.2.	Proposed Works.....	6
2.	Site Flooding Assessment	7
2.1.	Site Flood Liability Introduction	7
2.2.	Required Scope of Flood Assessment	8
2.3.	Overview of Work Undertaken	8
2.4.	Policies And Guidelines	9
2.5.	Flood Hazard Mapping.....	9
2.6.	Riverine Flooding Behaviour	10
2.7.	Overland Flow Flooding Behaviour	11
2.7.1.	TUFLOW Modelling.....	11
2.8.	Existing Condition Modelling	14
2.8.1.	Overland Flow Flood Depths and Levels – Existing Condition	14
2.8.2.	Flood Hazard – Existing Condition	14
2.9.	Proposed Development Modelling	20
2.9.1.	Proposed Development Schematisation Notes	20
2.9.2.	Flood Impact Assessment – 1% AEP – Developed Minus Existing Condition	20
2.9.3.	Flow Rates – Developed Condition	20
3.	Flood Planning Levels	27
3.1.	Flood Levels	27
3.2.	Flood Planning Levels.....	28
3.3.	Flood Planning Level Assessment.....	30
3.4.	Basement Flood Protection	32
4.	Flood Emergency Response Plan.....	34
4.1.	The Scope of this Flood Emergency Response Plan	34
4.2.	The Local Context and Location	34
4.2.1.	The Emergency Response Context	34
4.3.	The Proposed Development’s Flood Risk Mitigation Capability.....	36
4.3.1.	The Proposed Development’s Flood Preparedness	36
4.3.2.	The Development’s Response to Flood Risk	37
4.4.	Evacuation Planning and Procedures.....	47
4.4.1.	Working with the State Emergency Service.....	47

4.4.2.	Flood Emergency Responsibilities for all Personnel and Occupants.....	48
4.4.3.	Flood Emergency Preparation and Response Procedures	49
4.4.4.	Evacuation in the Event of Simultaneous Flood and Fire.....	51
4.4.5.	Supporting Signage and Flood Emergency Planning Materials.....	51
5.	Compliance with Flood-Related Planning Controls	55
5.1.	Compliance with the Parramatta LEP (2023)	56
5.2.	Compliance with the Parramatta DCP (2023)	60
6.	Summary	74

1. Introduction

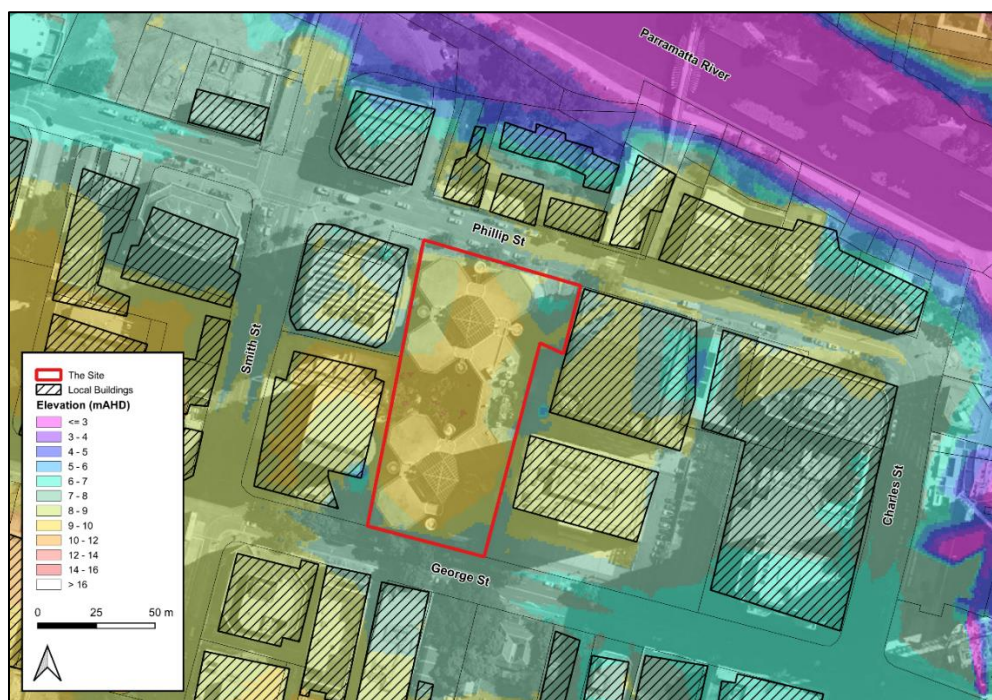
This Flood Impact Assessment Report has been prepared by GRC Hydro to support a Development Application (DA) for the redevelopment of 110 George Street, Parramatta (the Site), comprising the construction of two new mixed-use developments. The proposal will deliver a new Build-to-rent (BTR) residential accommodation tower with a retail and commercial podium fronting Phillip Street ('Northern Building') and a new commercial tower, with a retail and commercial podium fronting George Street ('Southern Building'). The proposal also includes the creation of an active ground plane through well-connected north-south pedestrian links, a central plaza and associated landscaping.

1.1. Site Description

The site is located at 110 George Street, Parramatta, in the City of Parramatta (Council) Local Government Area (LGA). It is strategically located in the heart of the Parramatta Central Business District (CBD), approximately 420 m north of the Parramatta Train Station and 180 m northeast of the future Parramatta Metro Station.

As illustrated in Figure 1, the site comprises one generally rectangular lot, legally described as Lot 101 DP 789839. The site has a total site area of approximately 7,097 m² and features a southern frontage to George Street and a northern frontage to Phillip Street. It also features an eastern and western frontage to existing commercial developments. The site is currently occupied by a seven-storey commercial building known as the 'Octagon'.

Figure 1: Site Location and Elevations



1.2. Proposed Works

This DA seeks development consent for:

- The subdivision of Lot 101 DP 789839 to create two lots, one for the Northern Building and the other for the Southern Building.
- Site preparation works, including;
 - Demolition
 - Tree removal
 - Earthworks
- Partial retention, reconfiguration and extension of the site's existing 2-storey basement to create a 3-storey basement containing supporting vehicle parking, bicycle parking and end of trip facilities.
- Construction of the Northern Building being a mixed-use development fronting Phillip Street, comprising:
 - A podium containing retail premises and residential amenities.
 - A tower above containing BTR apartments.
- Construction of the Southern Building being a mixed-use development fronting George Street, comprising:
 - A podium containing retail, commercial premises and childcare centre.
 - A tower above containing commercial (office) premises.
- Site landscaping and public domain works, including new through-site links between George Street and Phillip Street, a central plaza and a north-western plaza.
- Utility and services augmentation (as required).

A further detailed description of the proposal is contained in the supporting Statement of Environmental Effects prepared for the DA by Ethos Urban.

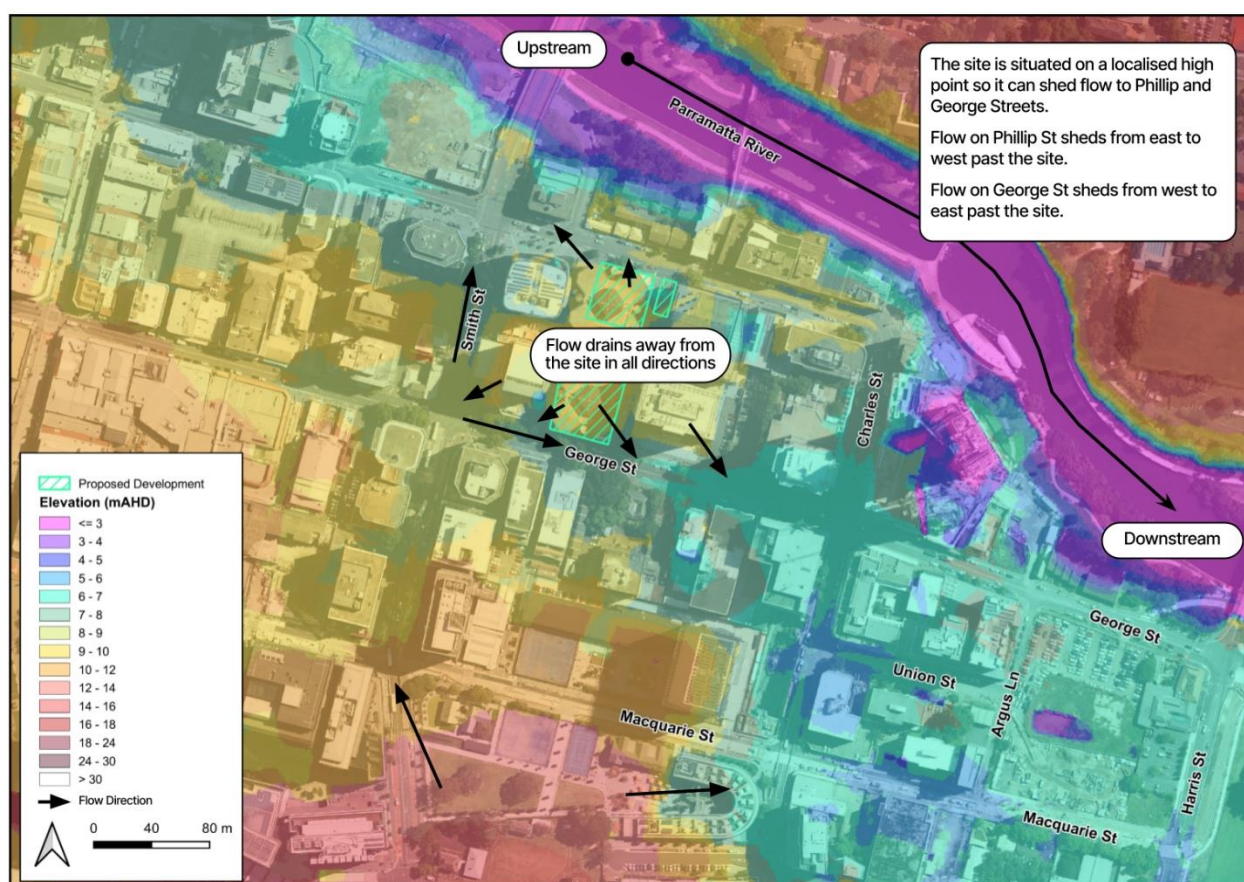
2. Site Flooding Assessment

2.1. Site Flood Liability Introduction

The site is located in the Parramatta River catchment and lies approximately 100 m south of the Parramatta River. The site is elevated at approximately 8 mAHD and the river bank nearest to the site lies at approximately 2.2 mAHD. According to Council-provided flood mapping, the Parramatta River 1% AEP riverine flood level sampled upstream of the site is 5.83 mAHD, more than 2 m lower than the subject site. As such in a local 1% AEP rainfall event, the subject site is affected by overland flow only. Riverine flooding impacts the site for rarer events, but not in the 1% AEP. This is further elaborated upon in Section 2.6.

The site is situated on a local high point and the local topography indicates that local overland flow will shed off and away from the site to Parramatta River via George and Phillip Streets – see Figure 2 below.

Figure 2: Local Topography and Flow Direction (Approximate)



Therefore, the governing flood mechanism impacting the site in a 1% AEP event is overland flow and GRC has undertaken overland flood modelling at Council's request to confirm flood affectation at the site in both the existing and proposed scenarios.

Note all modelling work reported upon herein refers to overland flow modelling. Riverine flood levels are defined by Council. The subject site is not impacted by the 1% AEP Riverine event. As such no Riverine impact modelling of the site was required and overland flow is the focus of modelling work herein.

2.2. Required Scope of Flood Assessment

During a pre-lodgement meeting on 13/05/2022, Council advised that a Flood Impact Assessment was required to identify the overland flow flood levels for the site. This was reiterated in a meeting with Council on 14/12/2023 where additional requests were made for GRC to:

- Conduct overland flood modelling of a 1% AEP event with an additional 19% rainfall for calibration with 100% blockage of the stormwater network as per ARR 2019 method;
- Conduct overland flood modelling of a 1% AEP event with an additional 19% rainfall for calibration and an additional 20% rainfall to emulate future Climate Change impacts with 100% blockage of the stormwater network as per ARR 2019 method;
- Model the flood level impacts of the proposed development in both of the above scenarios; and
- Submit a Flood Emergency Response Plan for the proposed development.

A hydraulic model has been established to understand the overland flow flood behaviour in a range of flood events, and to assess overland flow flood risk at the site. The model has also been used to carry out a flood impact assessment for proposed development of the lot. The proposed plan (Date: 31/01/2025) has been assessed.

Lastly, the report presents flood planning controls applicable to the site based on Parramatta Council Development Control Plan (DCP).

2.3. Overview of Work Undertaken

The following work scope has been executed.

- Build a rainfall-on-grid TUFLOW hydraulic model to derive water levels, depths, velocities, and hazard for the existing and proposed scenarios for the following design rainfall events:
 - 5% AEP;
 - 1% AEP with a 19% rainfall calibration factor (as requested by Council in a 14/12/2024 meeting);
 - 1% AEP with a 19% calibration factor and an additional 20% for climate change (also requested by Council); and
 - PMF of the existing conditions.
- ARR2019 methodologies are used for the 1% AEP including 100% blockage of stormwater infrastructure.
- Assess the flood conditions and risks of existing and proposed conditions and review model results.
- Review pertinent planning documentation for applicable flooding controls.
- Develop flood maps which present flood depths, levels, velocities, and hazards for each event.
- Produce a letter style report detailing the analysis.
- Undertake an internal peer review.

2.4. Policies And Guidelines

The following policies and guidelines are applicable for any development within a floodplain in Parramatta Council:

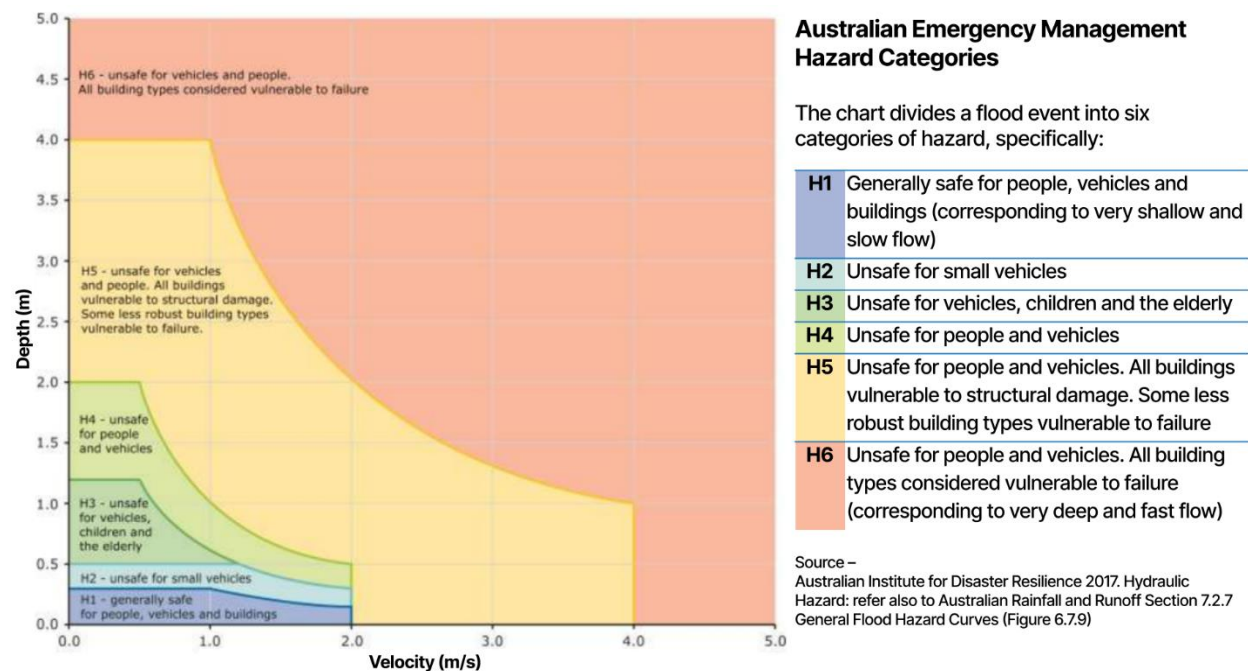
- NSW Floodplain Development Manual (FDM) (2005)
- City of Parramatta Local Environment Plan (LEP) (2023).
- Parramatta Development Control Plan (DCP) (2023).

The subject site is situated on a lot designated as flood-labile within the Parramatta CBD. As such, specific controls apply to this site and these are detailed in Section 9.7 of the DCP.

2.5. Flood Hazard Mapping

In terms of assessing flood hazard, the latest floodplain management practices use the hazard categories identified in the Australian Disaster Resilience Guideline 7-3 Flood Hazard (AIDR 2017) – see Chart 1. These are identified in the DCP as the appropriate categorisation to adopt when classifying flood hazard for proposed development in the Parramatta LGA. GRC has modelled and documented flood hazard in this assessment in accordance with these categories. Note GRC have done such mapping for overland flow only.

Chart 1- Hazard Categories Description



2.6. Riverine Flooding Behaviour

Council have provided flood levels for the site via a flood certificate. The information Council have provided is summarised below:

- The certificate purports to describe mainstream flood behaviour;
- The certificate notes the following 1% AEP levels at the site:
 - 7.8 mAHD on its George St frontage; and
 - 8.1 mAHD on Phillip St at the site's north-eastern corner.
- The certificate provides a map of inundation and tabulated data for mapped cross-sections which describe specific chainages of the Parramatta River;
- From the map Council provided in the certificate, at XS 2652 the 5% AEP level is 5.3 mAHD and the 1% AEP level is 5.83 mAHD (see below);
- In conflict with this the 1% AEP level provided for the site is 7.8 mAHD (George Street);
- As such it seems clear that the Council data provided includes overland flow modelling and indeed the provided 5% and 1% AEP levels relate to overland flow flood levels, not mainstream flood levels;
- Whilst this is the case, Council specifically state that the effect of overland flow (on the site) is subject to detailed investigation.

The flood levels provided by Council for the site are identified in the excerpt below.

Image 1: Council-provided Flood Levels for 110 George Street.

Mainstream Flooding	
Is this property affected by mainstream flooding? 110 George Street, Parramatta	
Flood Levels	Closest Cross Sections: (Please refer to Flood Study): Refer to Flood Map
☒ 1:20 year ARI	Varies – RL7.8m AHD at George Street frontage to RL8.1m AHD at North Eastern corner adjacent Phillip Street
☒ 1:100 Year ARI	Varies – RL7.8 m AHD at George Street frontage to RL8.1m AHD at North Eastern corner adjacent Phillip Street
☒ PMF	RL11.7 m AHD
☒ Refer to flood maps provided for detailed flood levels.	
Flood information is obtained from the following flood study report:	
1. Upper Parramatta River Flood Study – Draft 8 (UPRCT)	
2. Lower Parramatta River Floodplain Risk Management Study (SKM)	

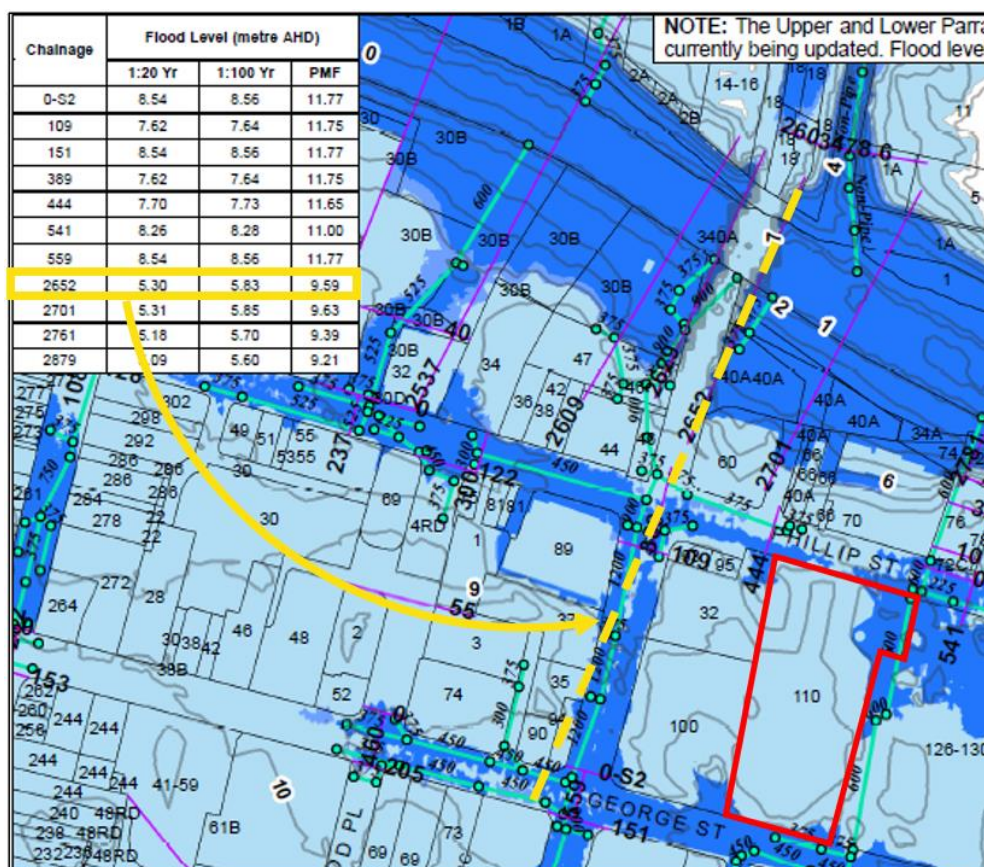
The site and the surrounding properties are not then subject to mainstream flooding from the Parramatta River in the 1% AEP event. This is confirmed by Council's provided flood certificate which indicates that the Parramatta River 1% AEP flood level upstream of the site is more than 2 m lower than the subject site (a 1% AEP river level of 5.83 mAHD sampled upstream of the site, compared with a ground elevation at the site of 8 mAHD)– see Figure 3 below.

Given the lack of mainstream flood liability at the subject site in the 1% AEP event, GRC have used their own overland flow modelling (as required by Council) to define applicable design flood levels (for sub PMF events) at the subject site.

The Parramatta River PMF event sets the maximum flood height that can occur at the subject site, this being 11.7 mAHd.

In summary then the Parramatta River PMF level and rate of rise is of relevance to the evacuation provisions for the subject site, but design levels (based on less rare events such as the 1% AEP) will refer to overland flow flood levels.

Figure 3: Council-Provided Flood Level Data and Mapping



2.7. Overland Flow Flooding Behaviour

2.7.1. TUFLOW Modelling

TUFLOW is a 2D numerical hydraulic modelling package. This software is widely used and is considered best practice under the NSW Floodplain Risk Management Program.

For this overland flow study, the flood depths, levels, velocities, and hazards were modelled as per Council's request to understand how flooding would impact the site in both the existing and proposed development scenarios.

The following events were modelled as per Council's request:

- 5% AEP;
- 1% AEP with a 19% rainfall calibration factor (this will function as the 1% AEP event for this assessment),
- 1% AEP with a 19% rainfall calibration factor and a further 20% for Climate Change; and
- PMF

These design flood events were modelled using a conservative method as follows.

1. As per standard ARR2019 methodology, design rainfall was sourced from the ARR2019 Data Hub and applied to the TUFLOW model, with ground levels informed by publicly available LiDAR data (Date: June 2019). This data has a typical accuracy of ± 0.15 m (1st confidence interval). The extent to which rainfall was applied is shown in Figure 2, which also details the elements of the developed TUFLOW model as well as the overland catchment of the subject site in question. Rainfall was applied beyond the site's estimated catchment to ensure all contributing catchment was captured.
2. A Manning's roughness coefficient of 0.05 was applied to represent the urbanised catchment in the model. Roughness sensitivity was assessed by running options using a 0.025 (concrete surface) roughness coefficient and a 0.05 (recreation) roughness coefficient. The results of these runs were similar however the results using the 0.05 value were selected as these represented the more conservative (higher) values.
3. 0 mm Initial loss and 1 mm/h continuing loss were applied to design rainfall to contribute towards the conservative estimate.
4. Buildings can block flood paths and therefore significantly impact flood behaviour. As such, existing buildings in the vicinity of the subject site were blocked out of the TUFLOW model.
5. Pits and pipes system were not included in order to simulate a 100% blockage of the local stormwater network for the overland flow assessment as requested by Council.
6. Tailwater levels were derived from the mainstream flooding levels obtained from Council's certificate. GRC's modelling adopted the 5% AEP mainstream level as the tailwater.

Critical duration and critical storm assessment were undertaken in TUFLOW for the location of the subject site. For the 1% AEP event, the critical duration and storm were found to be 25min storm #6. For 5% AEP, the critical duration and storm were found to be 30min storm #8.

PMF was done using Generalised Short-Duration Method (GSDM). 15min, 30min, 45min and 1hour durations have been modelled in TUFLOW, and 15min was found to be critical.

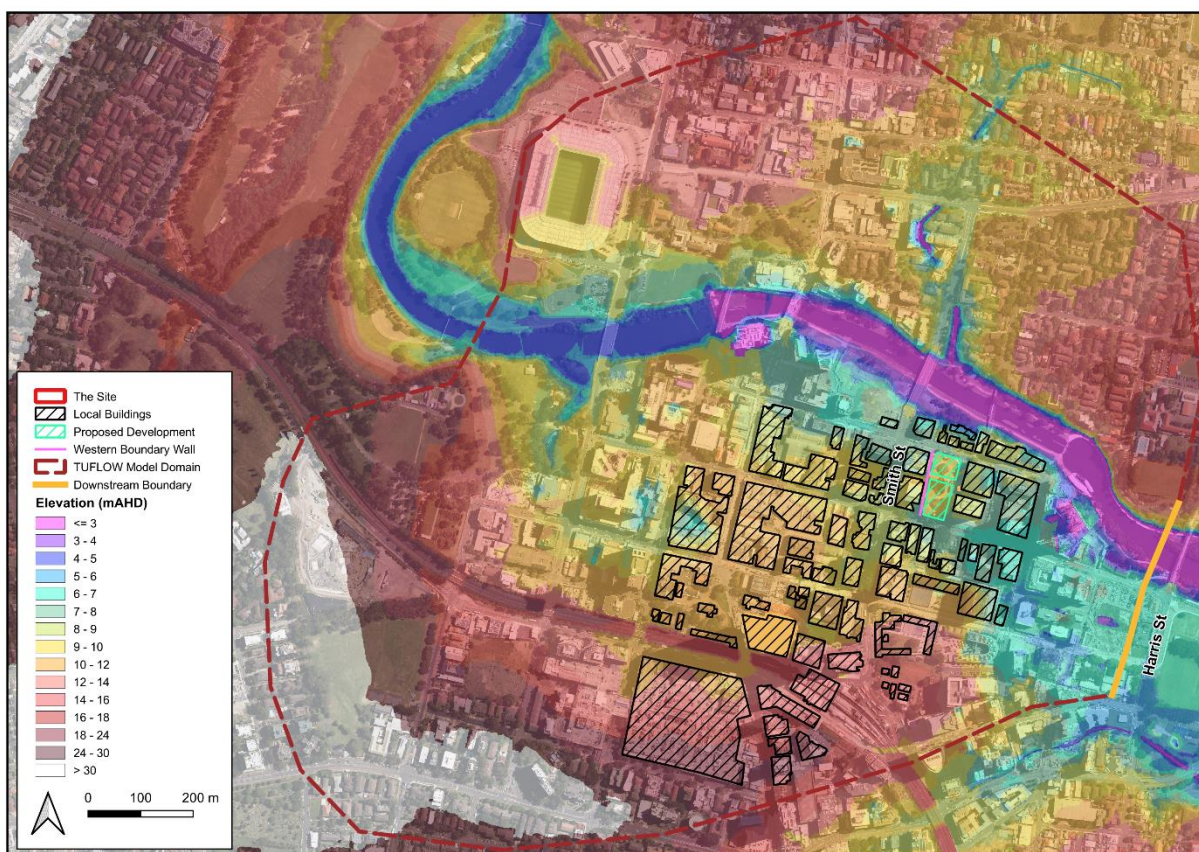
The direct rainfall (rain-on-grid) modelling results has been undertaken in accordance with the guidance outlined in Council's Flood Modelling Flood Impact Risk Assessment and Management Plans Guide (April 2022). The filtering process undertaken were as follows:

To avoid the whole study area shown as inundated and/or isolated ponding as a result of Rain on Grid modelling, filtering of data is required. Simple filter methods, such as removing areas with depths below a certain value, are not appropriate. The following filtering steps can be taken to prepare flood maps for Rain on Grid models:

1. Remove areas where the depth is less than 0.01m AND the depth x velocity (dV) product is less than 0.125 m²/s.
2. Remove areas where the dV product is less than 0.02 m²/s.
3. Retain areas where depth is greater than 0.3 metres, even if the dV product is low.
4. Where appropriate, remove islands less than 50m².

The TUFLOW model layout is documented in Figure 4 below.

Figure 4: TUFLOW Model Layout



2.8. Existing Condition Modelling

2.8.1. Overland Flow Flood Depths and Levels – Existing Condition

For all events up to the PMF, flood depths along George St remain largely lower than 0.3 m with some minor pockets up to 0.5 m in the 1% AEP with a 19% Calibration Factor.

Modelled flood affectation in the existing condition is documented from Figure 5 to Figure 8.

In all events up to the PMF, Phillip St, where it borders the site, has no modelled inundation with the first portion of modelled inundation being observed just west of the site's western boundary. At this point the flood depth is lower than 0.3 m.

Modelled flood levels at the site were as follows:

Table 1: Modelled Flood Levels (Existing Condition)

Event/Location	Phillip St (NW corner – west of site boundary)	George St (SW corner)	George St (SE corner)
5% AEP	7.62 mAHD	7.82 mAHD	7.43 mAHD
1% AEP (with 19% Calibration Factor)	7.65 mAHD	7.85 mAHD	7.51 mAHD
1% AEP (with 19% Calibration Factor and 20% Climate Change)	7.68 mAHD	7.87 mAHD	7.55 mAHD
PMF Overland	9.2 mAHD	9.2 mAHD	9.2 mAHD

2.8.2. Flood Hazard – Existing Condition

Modelled flood hazard in the existing condition is documented from Figure 5 to Figure 8.

For all events up to the PMF, existing flood hazards along George St remain limited to H1 and H2 – low hazard. In the overland modelled PMF event this increases to H4 and H5. Riverine PMF hazard is between H5 and H6.

Figure 5: Peak Flood Depth, Level and Hazard – Overland Modelled 5% AEP – Existing Condition

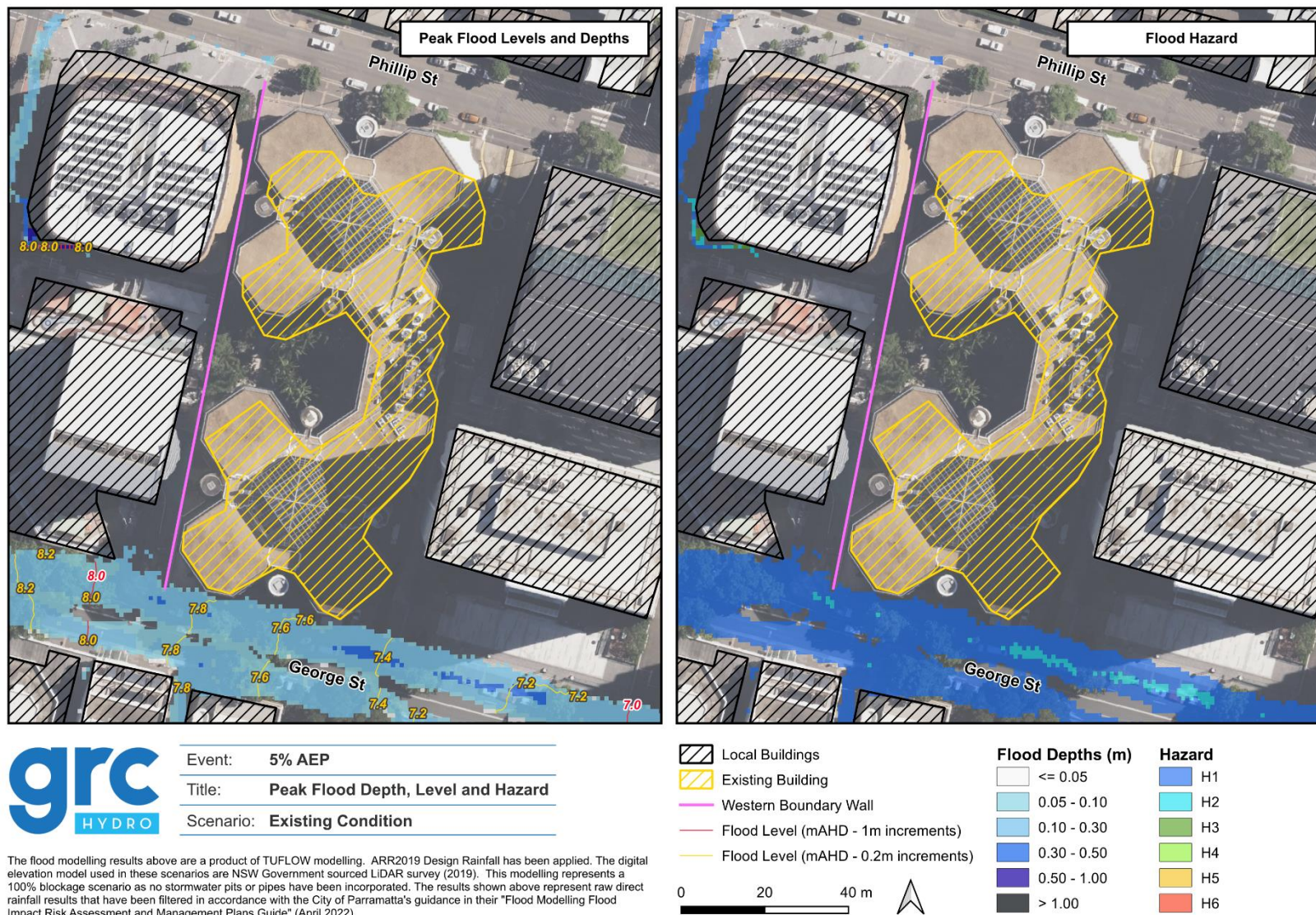


Figure 6: Peak Flood Depth, Level and Hazard – Overland Modelled 1% AEP with 19% Calibration – Existing Condition

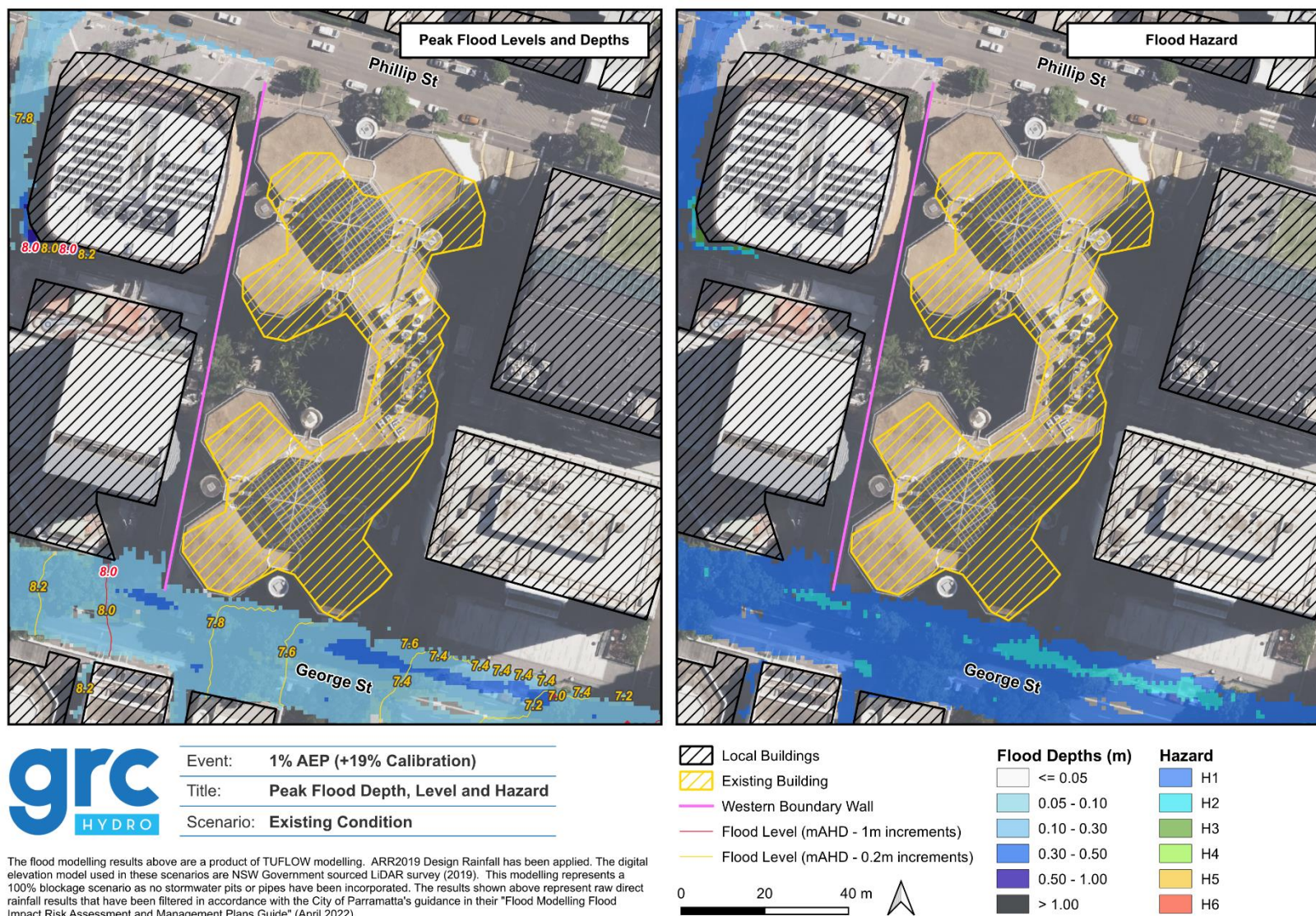


Figure 7: Peak Flood Depth, Level and Hazard – Overland Modelled 1% AEP with 19% Calibration and 20% Climate Change – Existing Condition

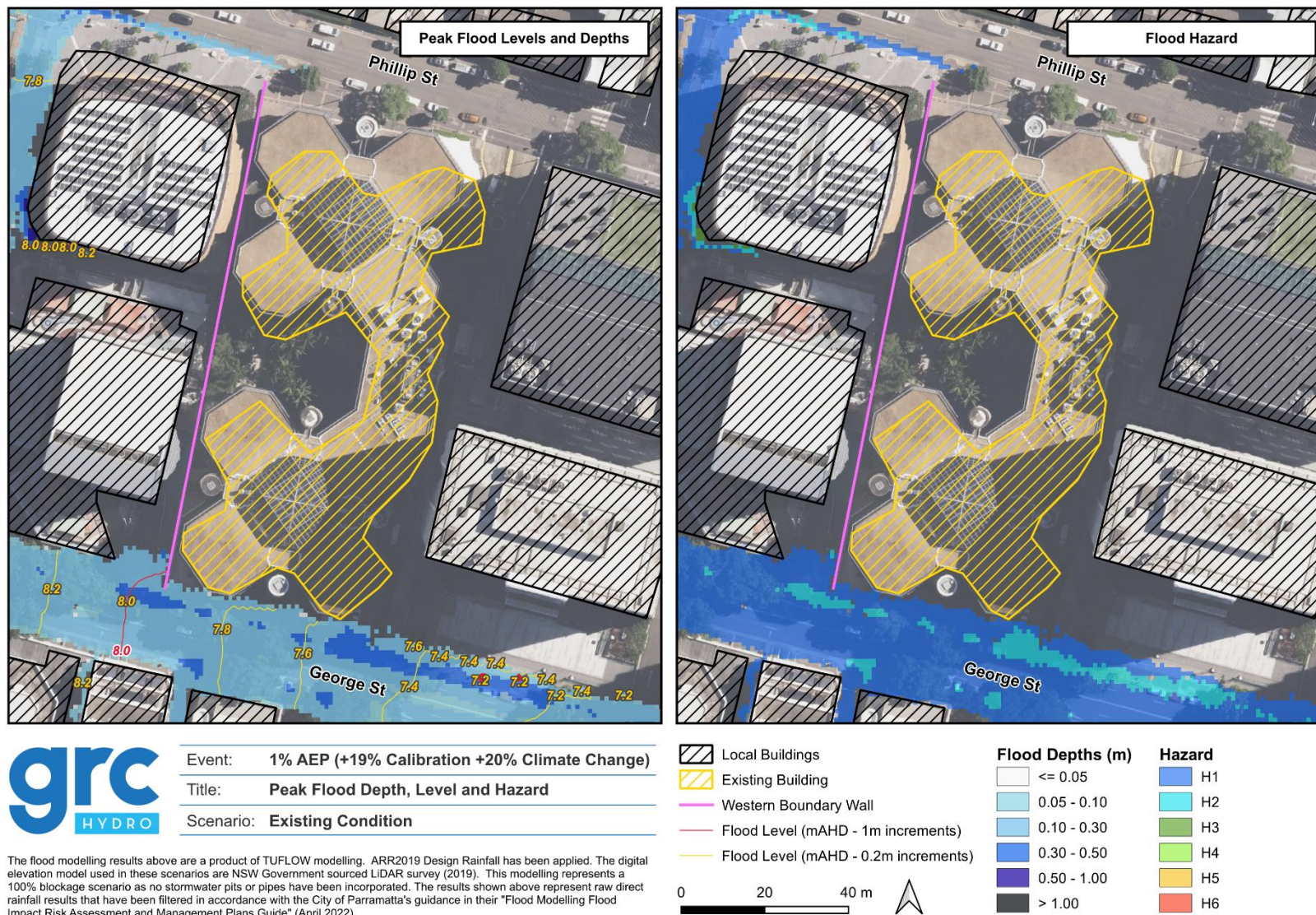


Figure 8: Peak Flood Depth, Level and Hazard – Overland Modelled PMF – Existing Condition

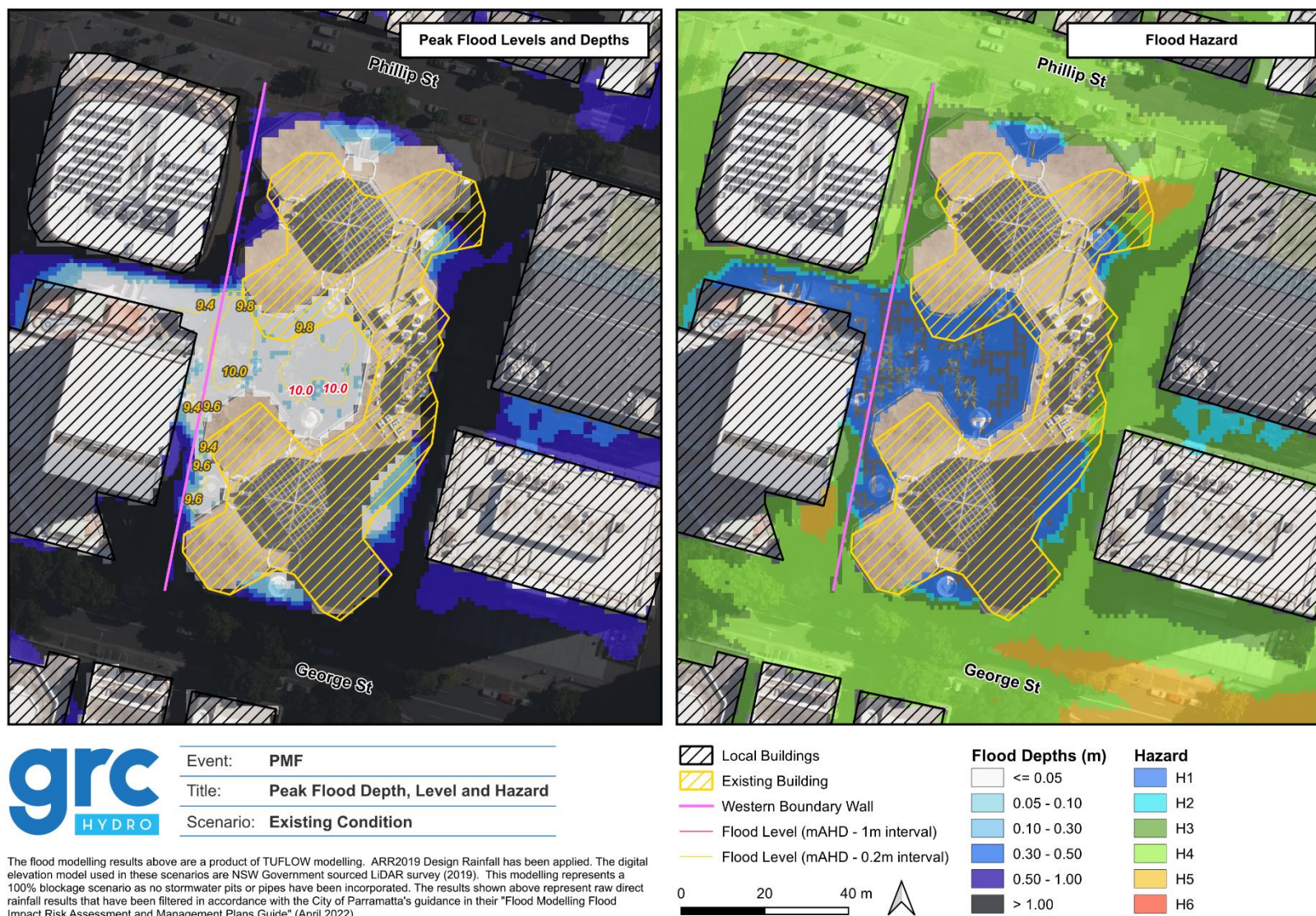
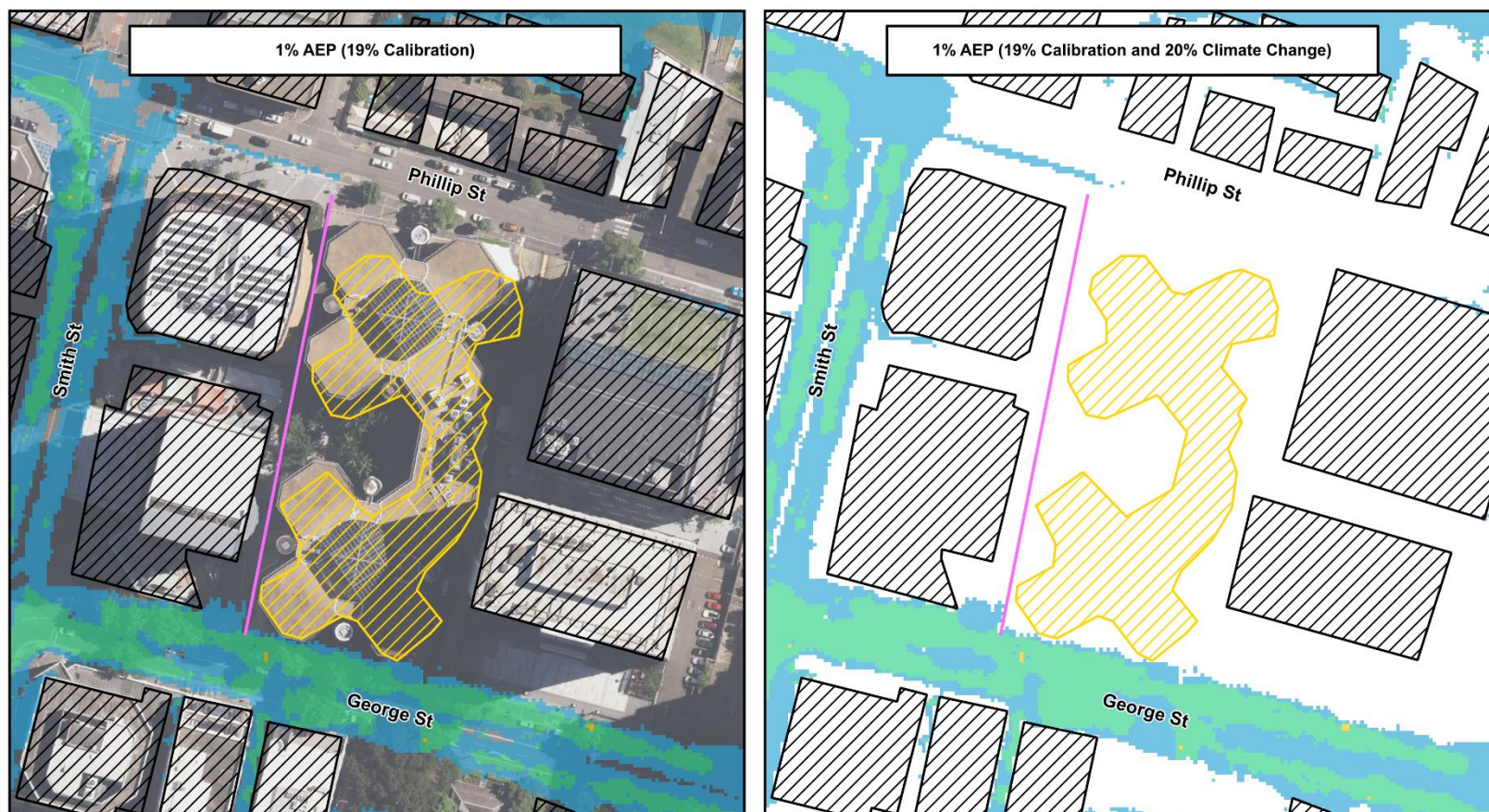
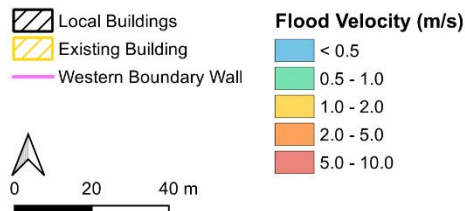


Figure 9: Flood Velocity – Overland Modelled 1% AEP (19% Calibration) and 1% AEP (19% Calibration + 20% Climate Change) – Existing Condition



Event: **1% AEP (19% Calibration) and (19% Calibration + 20% Climate Change)**
 Title: **Flood Velocity**
 Scenario: **Existing Condition**

The flood modelling results above are a product of TUFLOW modelling. ARR2019 Design Rainfall has been applied. The digital elevation model used in these scenarios are NSW Government sourced LIDAR survey (2019). This modelling represents a 100% blockage scenario as no stormwater pits or pipes have been incorporated. The results shown above represent raw direct rainfall results that have been filtered in accordance with the City of Parramatta's guidance in their "Flood Modelling Flood Impact Risk Assessment and Management Plans Guide" (April 2022).



2.9. Proposed Development Modelling

2.9.1. Proposed Development Schematisation Notes

The proposed development's footprint (as per the plans provided on 31/01/2025) has been represented as an impermeable boundary in GRC's TUFLOW modelling, effectively a footprint that does not allow flow to pass through it.

The surrounding ground levels remain as per the existing case.

Conservatively it is assumed there is no drainage system. That is, pits and pipes which drain the roadway are not included in the modelling work and as such flood metrics are conservative (overestimated).

2.9.2. Flood Impact Assessment – 1% AEP – Developed Minus Existing Condition

In accordance with the provided architectural drawings (Date: 31/01/2025), the proposed development modelled is comprised of two buildings (Tower A – George St and Tower B – Phillip St).

The buildings are modelled as perfect obstructions to floodwaters.

The resulting flood depths and levels for the 5% AEP, 1% AEP (with 19% Calibration Factor), 1% AEP (with 19% Calibration Factor and 20% Climate Change) and PMF events are presented from Figure 10 to Figure 13.

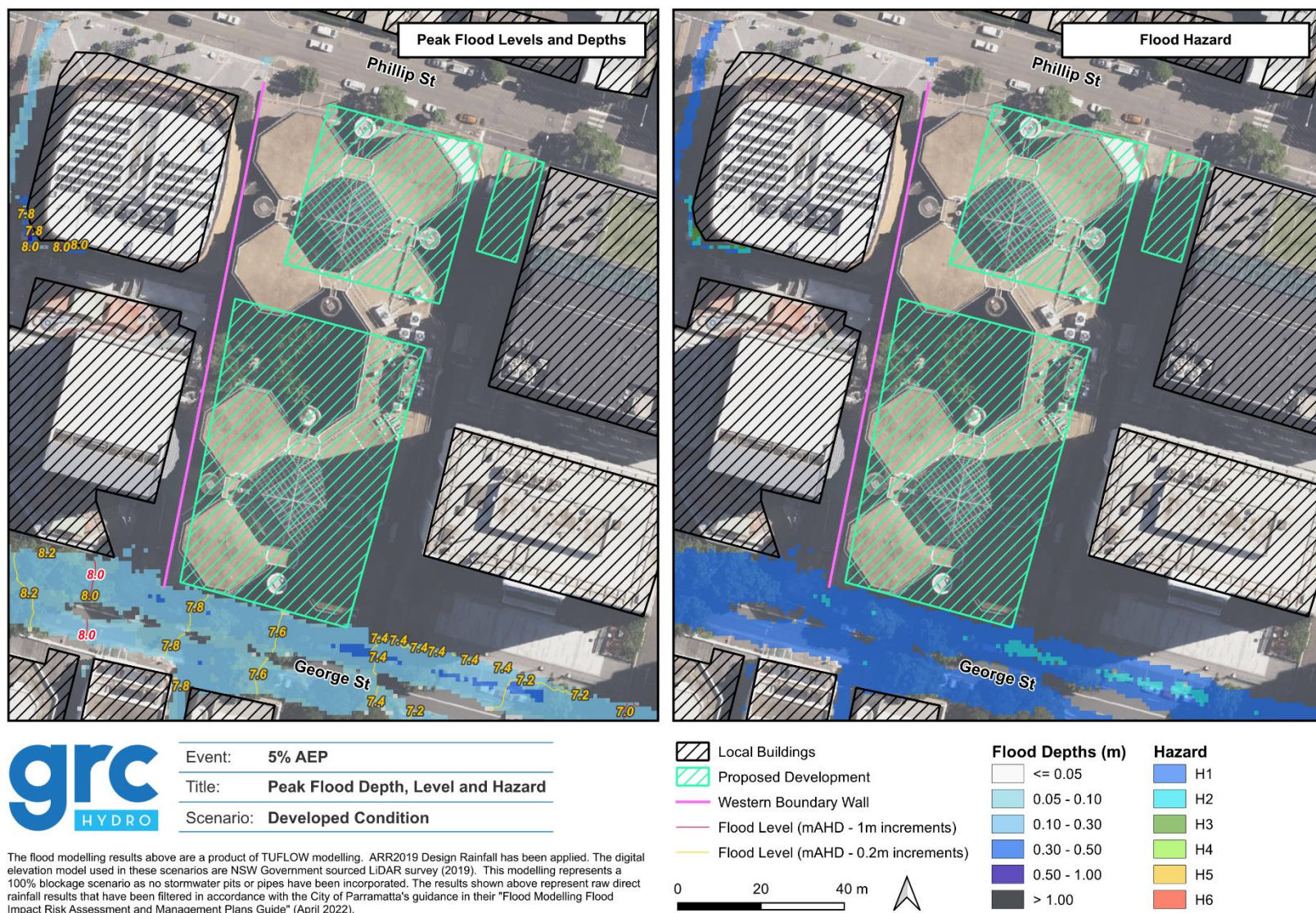
Overall, the flooding behaviour at site is minimally altered with no adverse impacts predicted as a result of this modelling. Figure 15 presents the potential impacts on 1% AEP flood levels caused by the proposed development.

With no impacts on flood levels there was also no impact on hazard.

2.9.3. Flow Rates – Developed Condition

Flow rates at the subject site have been considered in accordance with the DCP controls. There is no flow crossing the site in the 1% AEP event with all flow moving past the site on George Street.

Figure 10: Peak Flood Depth, Level and Hazard – Overland Modelled 5% AEP – Developed Condition



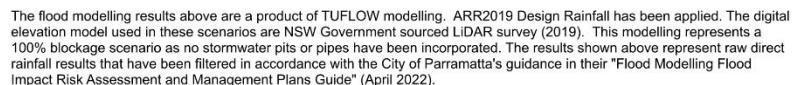


Figure 12: Peak Flood Depth, Level and Hazard – Overland Modelled 1% AEP with 19% Calibration and 20% Climate Change – Developed Condition

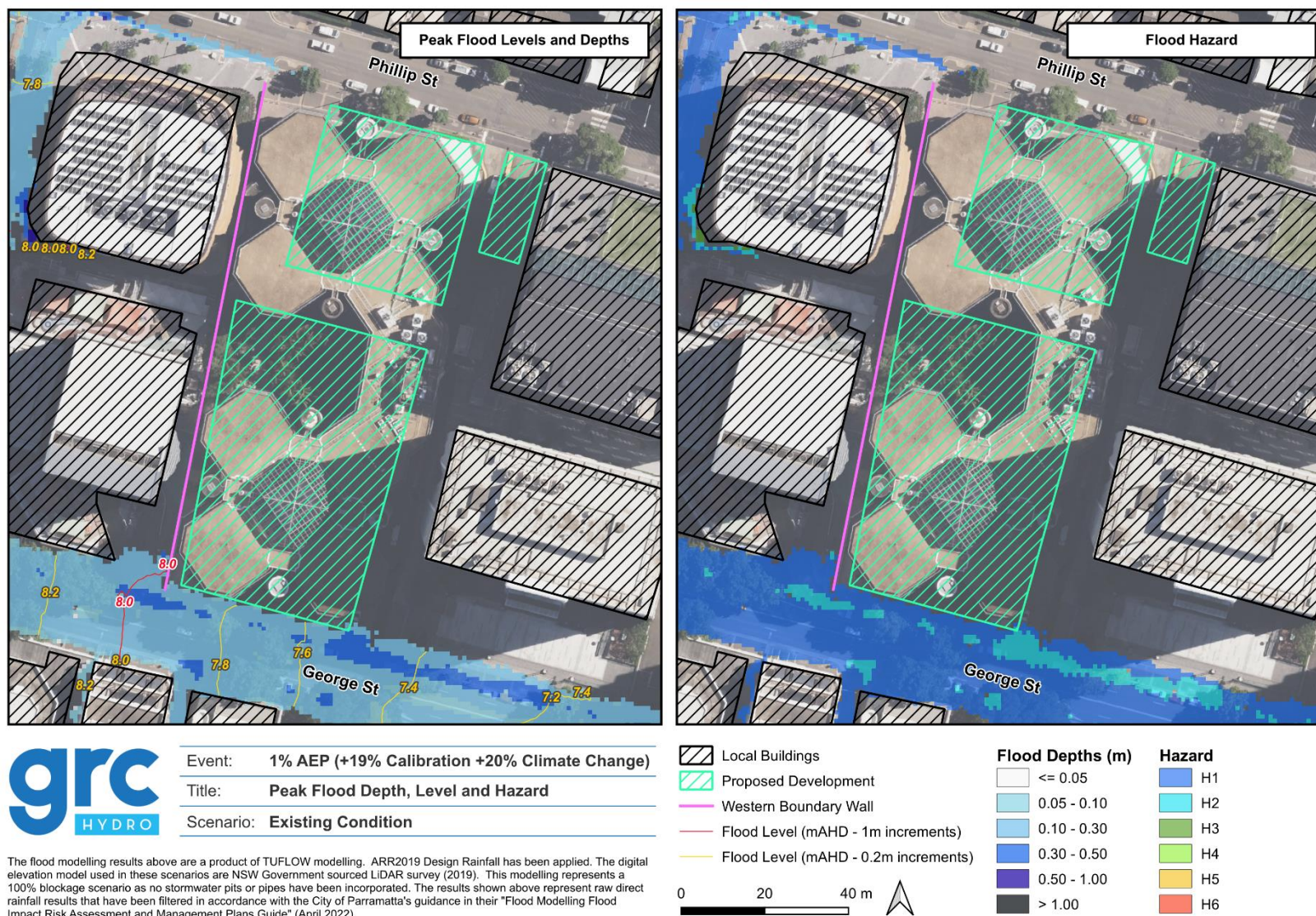


Figure 13: Peak Flood Depth, Level and Hazard – Overland Modelled PMF – Developed Condition

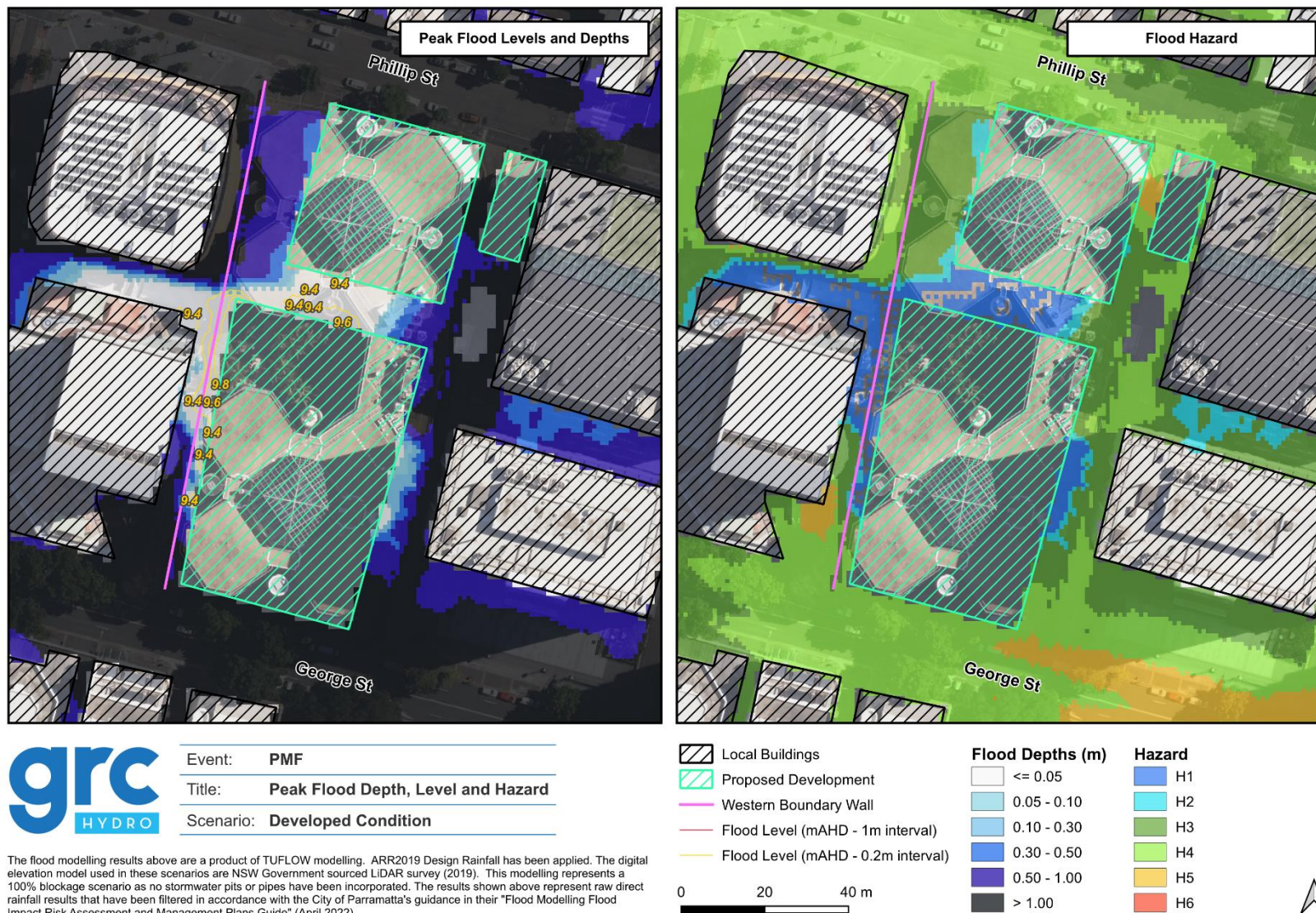
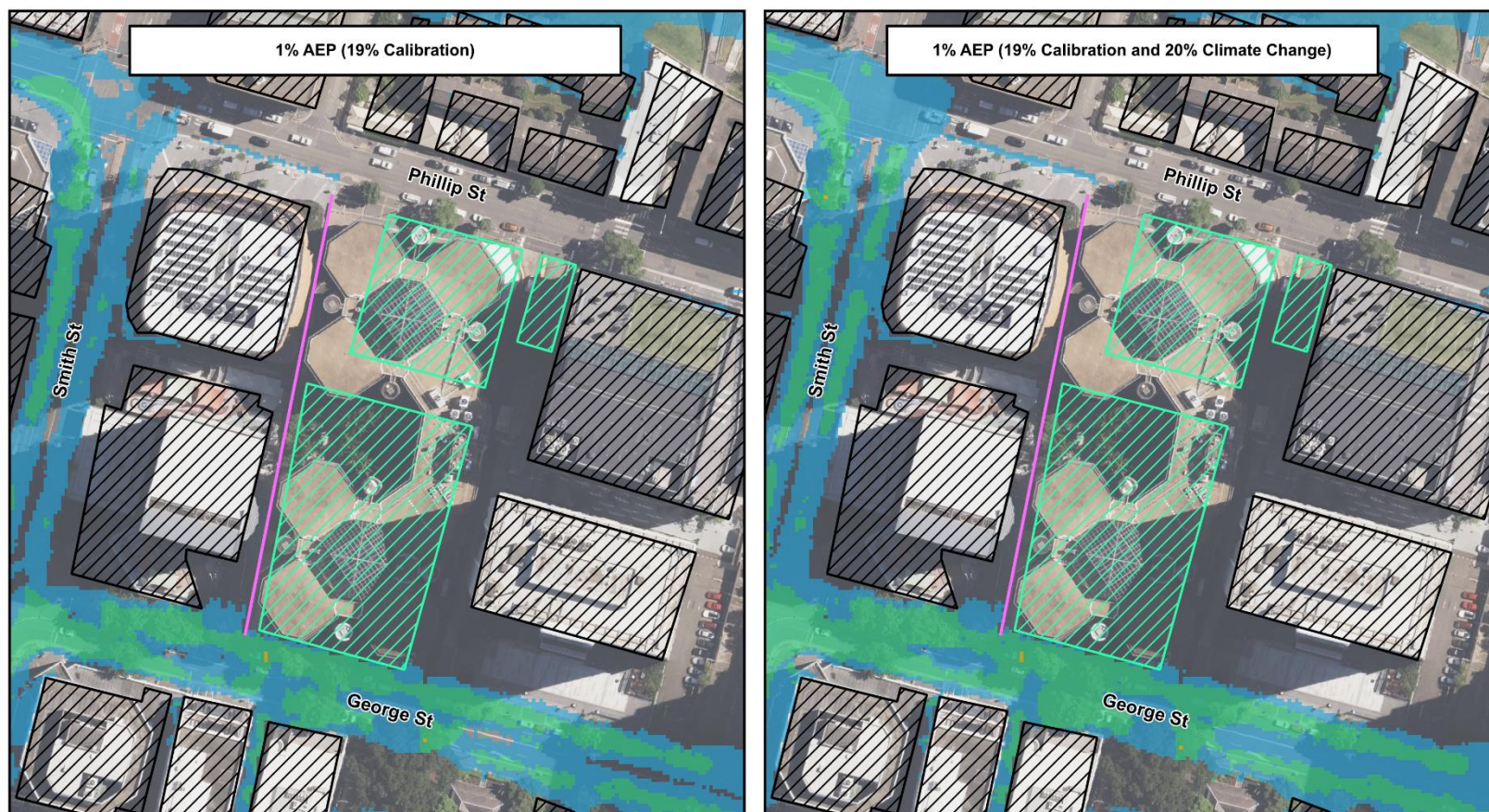


Figure 14: Flood Velocity – Overland Modelled 1% AEP (19% Calibration) and 1% AEP (19% Calibration + 20% Climate Change) – Developed Condition



Event: **1% AEP (19% Calibration) and (19% Calibration + 20% Climate Change)**
 Title: **Flood Velocity**
 Scenario: **Developed Condition**

The flood modelling results above are a product of TUFLOW modelling. ARR2019 Design Rainfall has been applied. The digital elevation model used in these scenarios are NSW Government sourced LIDAR survey (2019). This modelling represents a 100% blockage scenario as no stormwater pits or pipes have been incorporated. The results shown above represent raw direct rainfall results that have been filtered in accordance with the City of Parramatta's guidance in their "Flood Modelling Flood Impact Risk Assessment and Management Plans Guide" (April 2022).

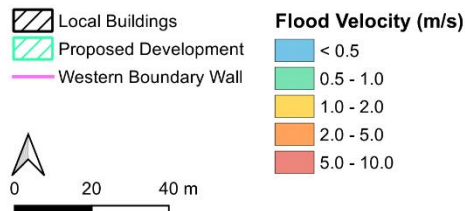
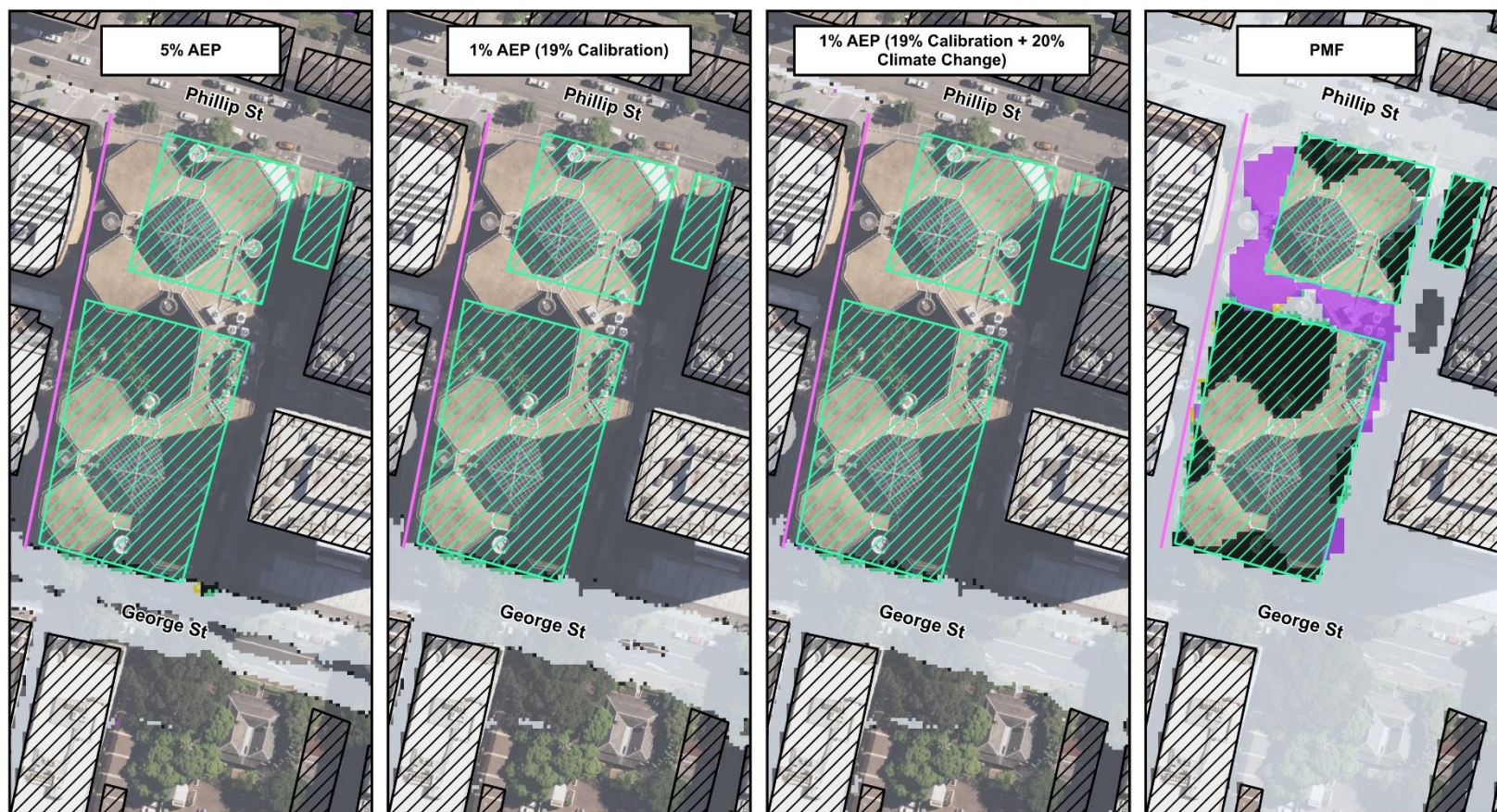
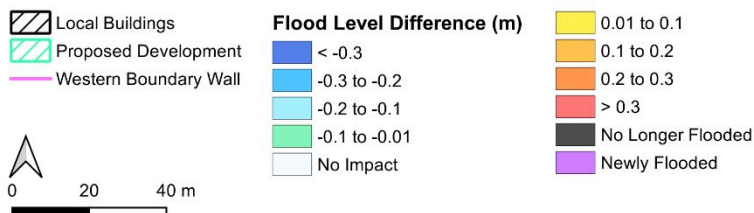


Figure 15: Flood Level Impact – Overland (Proposed Minus Existing Condition)



Event: **5% to PMF**
Title: **Flood Level Impact**
Scenario: **Developed Minus Existing Condition**

The flood modelling results above are a product of TUFLOW modelling. ARR2019 Design Rainfall has been applied. The digital elevation model used in these scenarios are NSW Government sourced LIDAR survey (2019). This modelling represents a 100% blockage scenario as no stormwater pits or pipes have been incorporated. The results shown above represent raw direct rainfall results that have been filtered in accordance with the City of Parramatta's guidance in their "Flood Modelling Flood Impact Risk Assessment and Management Plans Guide" (April 2022).



3. Flood Planning Levels

3.1. Flood Levels

In determining appropriate flood levels upon which to dictate flood planning levels for the site, GRC has considered the following:

- The mainstream 1% AEP flood levels Council provided in their flood certificate; and
- The modelled overland 1% AEP (inclusive of a 19% calibration factor) flood levels as modelled by GRC in accordance with Council's request.

As discussed previously the site is unaffected by riverine flooding in the 1% AEP event, leaving overland flow flooding as the only flood mechanism impacting the site in a 1% AEP event. As such, the flood levels that have resulted from GRC's overland flood modelling (using Council's requested conditions) are the levels upon which flood planning levels should be derived for this proposed development.

Discussion of these levels has taken place with Council in the course of developing this application.

Communication and responses from Council have confirmed acceptance of a flood planning level along Phillip St based on GRC's modelling.

Furthermore, a review of Council's Draft Parramatta Flood Study 1% AEP flood extent indicates that Council's most recent modelling for this area, whilst not formally adopted by Council at the time of this report's submission, largely matches the extent of GRC's 1% AEP (including a 19% calibration factor) modelled flood extent. This provides further confidence that GRC's modelling work can be relied upon.

3.2. Flood Planning Levels

Flood levels for the site are detailed in Table 2 below. The modelled 1% AEP (including a 19% calibration factor) flood levels have been adopted as the 1% AEP level upon which to add a 0.5 m freeboard. Council's provided Riverine PMF level has been adopted as the appropriate PMF level for the purposes of assessing this development.

The locations at which these levels were sampled are identified in Figure 16 below.

Table 2: Flood Levels and Flood Planning Levels

Location	1% AEP Flood Level (Council Certificate)	1% AEP (including a 19% calibration factor) Flood Level (GRC Modelling – Overland)	Flood Planning Level (1% AEP with 19% Calibration Factor + 0.5m Freeboard)	PMF Level (Council – Riverine)
Phillip St (NW corner of site)	8.1 mAHD ¹	7.65 mAHD	8.15 mAHD	11.7 mAHD
George St (SW corner of site)	7.8 mAHD	7.85 mAHD	8.35 mAHD	11.7 mAHD
George St (Southern border of site)	-	7.69 mAHD	8.19 mAHD	11.7 mAHD
George St (SE corner of site)	-	7.51 mAHD	8.01 mAHD	11.7 mAHD

¹ As discussed on the previous page, the provided level for Philip Street has been revised based on GRC's modelling.

Figure 16: Flood Planning Levels based on adopting the 1% AEP with 19% Calibration as its basis

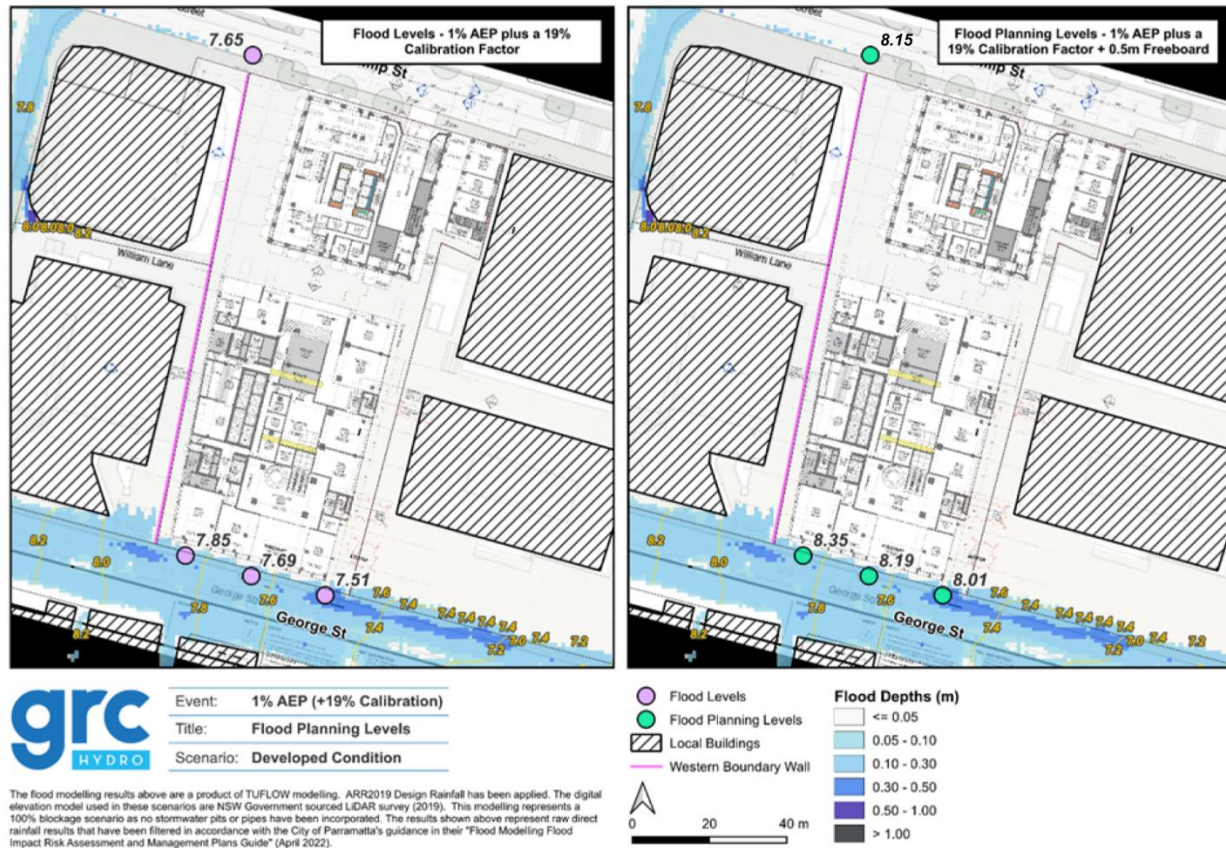
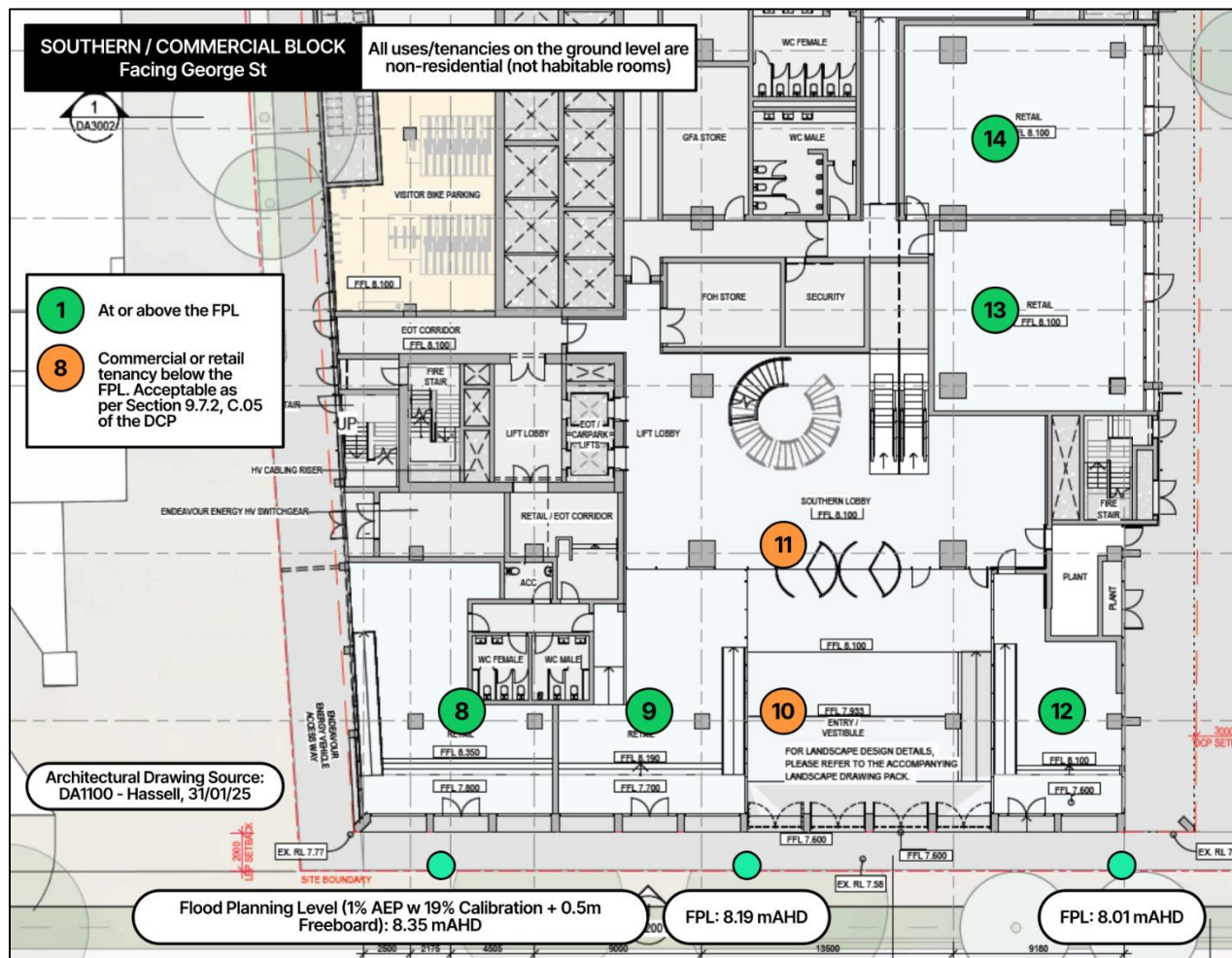


Figure 18: Proposed Ground Floor Levels Relative to Flood Planning Levels (Southern/George St)



3.4. Basement Flood Protection

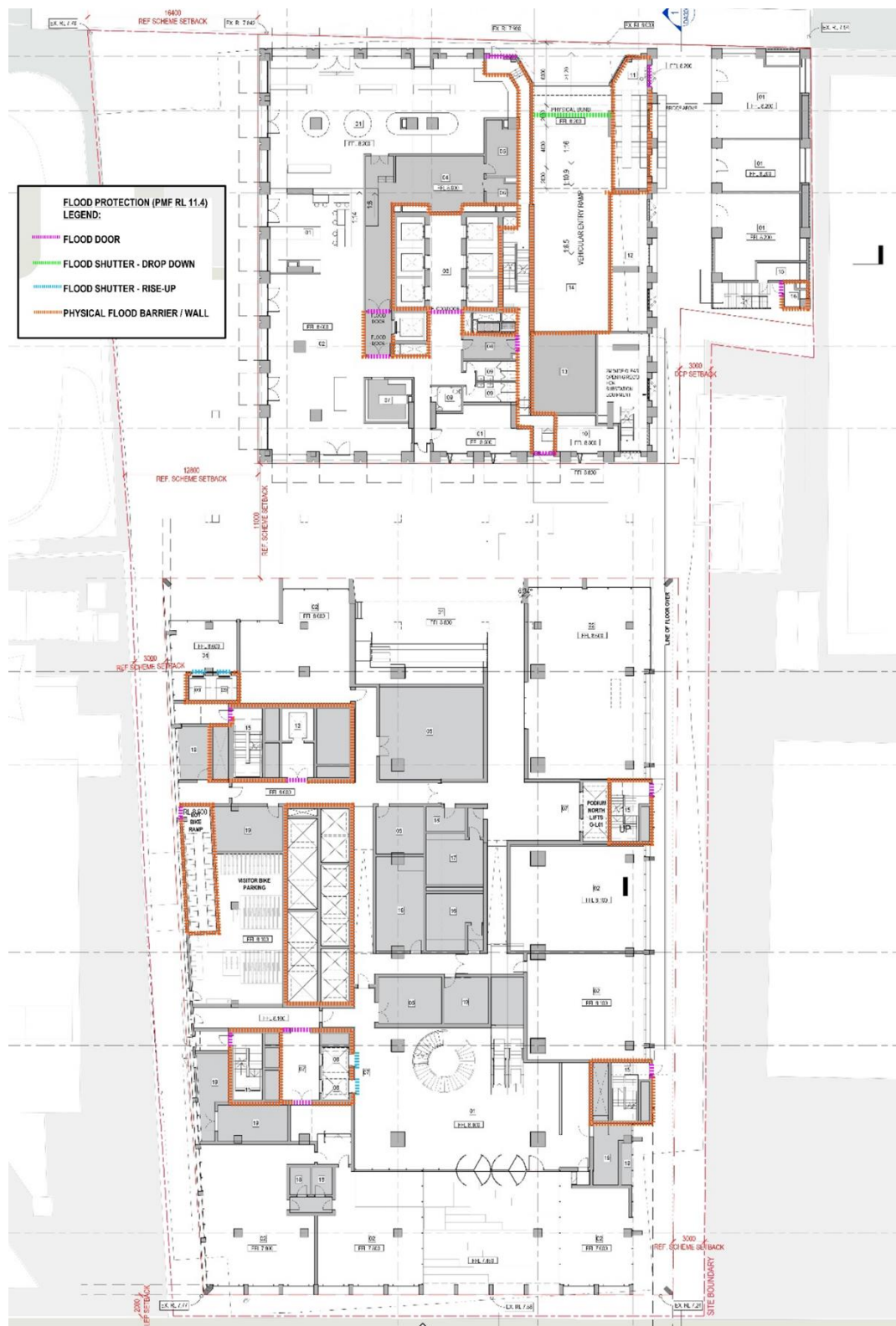
All stair, ramp and lift connections to the basement car park are protected to the PMF level by self-operating mechanical flood doors on the ground level. These flood doors are designed to block any flow inundating the ground level from entering the basement car park.

The driveway connecting Phillip St with the basement car park is protected by a physical bund with a crest of 8.1 mAHD and is further protected by a self-operating mechanical flood barrier.

The locations of these flood protection mechanisms are identified in Figure 19 below.

The flood barriers, shutters and doors proposed for this development are primarily self-operating and electricity-free to reduce any potential complications of having no power supply in the event of a flood emergency. However powered flood shutters have been specified for a number of locations as identified in Figure 19. These will be able to operate powered by the back up emergency electricity supply proposed for this development.

Figure 19: Location of Flood Protection Mechanisms



4. Flood Emergency Response Plan

4.1. The Scope of this Flood Emergency Response Plan

This Flood Emergency Response Plan (FERP) has been prepared for the proposed development at 110 George St, Parramatta in accordance with the following planning controls within the:

- Parramatta LEP (2023) Section 7.11
- Parramatta DCP (2023) Section 9.7.1: Assessment and Minimisation of Flood Hazards, Risks and Potential for Harm; and
- Parramatta DCP (2023) Section 9.7.4: Flood Warning and Emergency Response Planning

This Flood Emergency Response Plan contains the following:

- A description of the local flooding context and location (Section 4.2):
- A review of the proposed development's flood risk mitigation capabilities (Section 4.3) including emergency back-ups, active flood protection, refuge areas above the PMF and warning systems; and
- Guidance on evacuation planning and procedures (Section 4.4) including:
 - Key emergency management considerations;
 - Actions to be undertaken before, during and after a flood emergency to keep everyone safe. This includes a list of triggers, a description of the staff roles/responsibilities and an emergency checklist;
 - A template list of flood emergency items that should be kept in the flood refuge on site; and
 - A template list of emergency contact details should a flood occur.

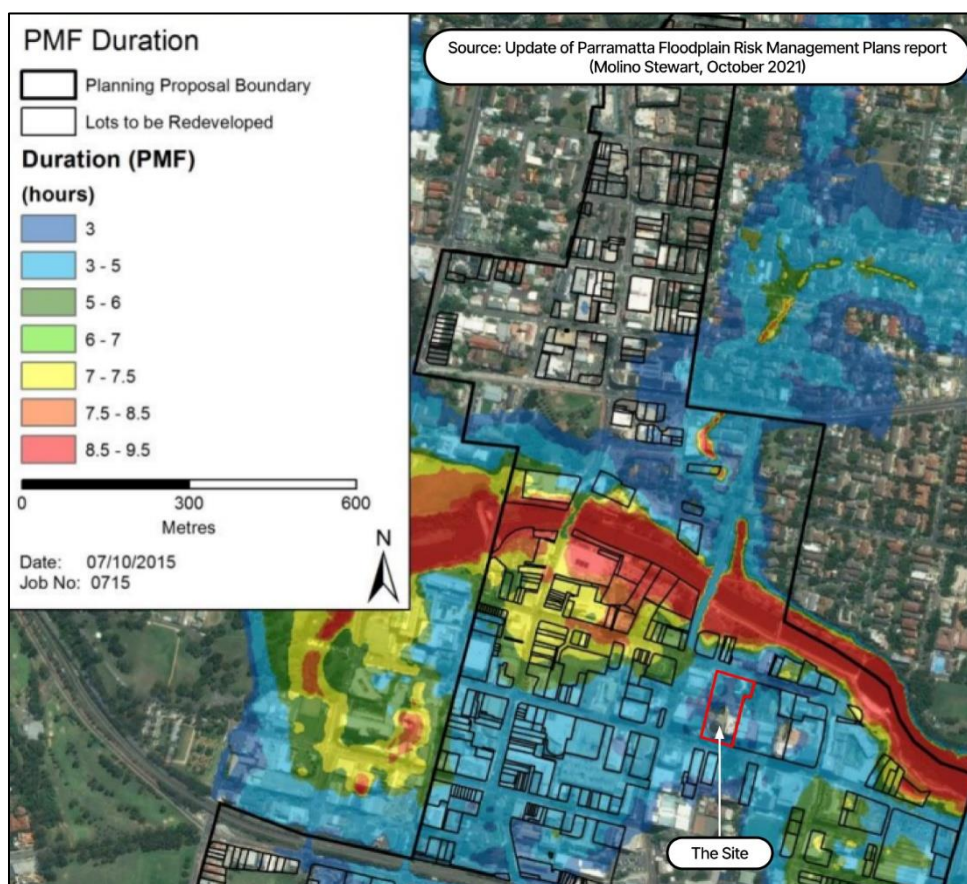
4.2. The Local Context and Location

4.2.1. The Emergency Response Context

As documented above, the site remains largely flood-free in all events up to and including the 1% AEP overland event (inclusive of a 19% calibration factor) with flood depths less than 0.3 m inundating George St along the site's southern boundary. GRC's modelling showed that increases in rainfall above the overland 1% AEP (inclusive of a 19% calibration factor) design event resulted in only marginal increases in flood level however this site, and the Parramatta CBD in general, is subject to riverine flows during a PMF event.

Whilst GRC has modelled the overland flow PMF, GRC defers to Council studies for guidance on Riverine PMF behaviour in this catchment. According to the *Update of Parramatta Floodplain Risk Management Plans* report (Molino Stewart, October 2021) the proposed development is located in an area that is subject to a 3-5 hour inundation period in a PMF event – see Figure 20.

Figure 20: PMF Durations (Source: Molino Stewart, October 2021)



In addition to this mapping, two PMF water level charts in this same Molino Stewart report indicated how the river level rose and fell throughout the modelled PMF event. These charts were interpolated to derive equivalent PMF riverine levels at the site and this analysis suggested a potential duration of inundation of 6 hours.

A shelter-in-place strategy is commonplace for developments in the Parramatta CBD in order to limit the exposure of evacuating persons to rapidly rising floodwaters.

The proposed development will provide flood protection, safe refuge above the riverine PMF flood level on Level 1 and above, internal vertical evacuation opportunities, back-up power, water, food provision and facilities to safely facilitate shelter in place for at least 7 hours. The proposed development's flood preparedness is identified below.

4.3. The Proposed Development's Flood Risk Mitigation Capability

4.3.1. The Proposed Development's Flood Preparedness

The proposed development consists of two buildings:

- A mixed-use Northern Building situated to front Phillip Street comprising of:
 - A podium containing retail premises and residential amenities
 - A tower above containing multiple floors of BTR apartments.
- A mixed-use Southern Building situated to front George Street comprising of:
 - A podium containing retail, commercial premises and a childcare centre .
 - A tower above containing commercial (office) premises.

These buildings largely lie above the Flood Planning Level and the 1% AEP (inclusive of a 19% calibration factor) flood level. Only the commercial tenancies along the Phillip St and George St frontages remain at or near the 1% AEP (inclusive of a 19% calibration factor) flood level to facilitate accessibility with the streetscape and these tenancies are all proposed to have internal pedestrian connection to higher ground within the building including a refuge area above the PMF level.

4.3.1.1. Refuge Space above the PMF Level

The proposed development contains ample refuge space above the PMF level. This includes publicly accessible areas on the First Floor of both buildings in addition to multiple floors of apartments and commercial office space which can comfortably shelter the number of residents and workers for which this building is designed to cater for. The proposed childcare centre also lies above the PMF level and it can safely accommodate its occupants in the event of an emergency.

The public refuge space on the first floor is approximately 930 m² in the northern building and approximately 1,860 m² in the southern building

The predicted occupancy of the publicly accessible commercial/retail components of the development at any one time are 115 for the northern building and 383 for the southern building.

Should an emergency occur, refuge on the first floor could be comfortably achieved with a density of:

- 1 person per 8.3 m² in the northern building; and
- 1 person per 4.85 m² in the southern building

Both buildings have male, female and accessible restrooms and facilities in addition to access to emergency supplies and support in the event of a flood emergency.

4.3.1.2. Emergency Electricity and Water Supply

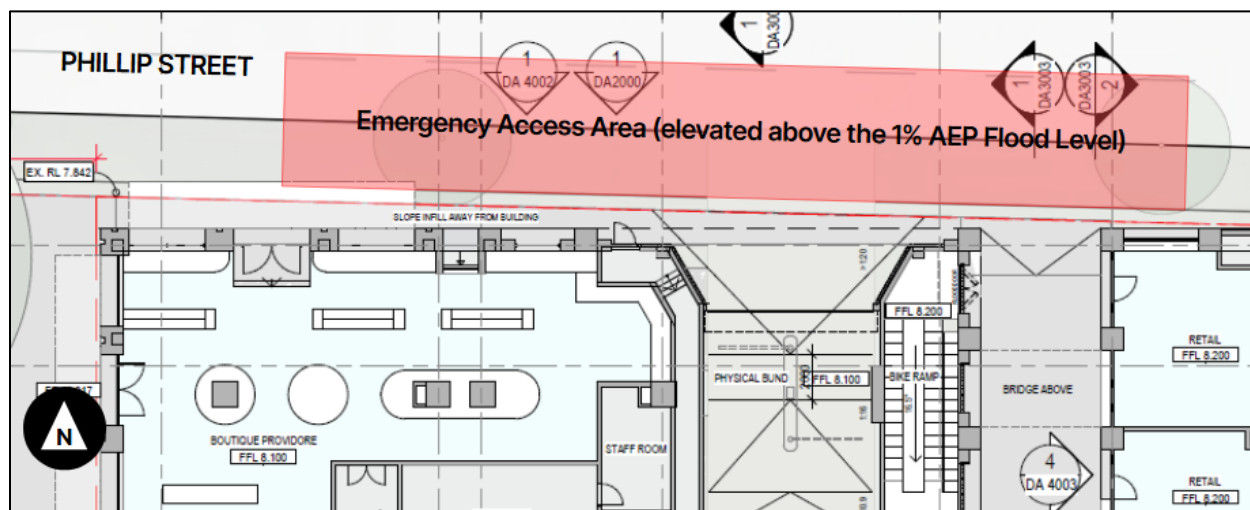
The proposed development will be connected to an emergency electricity and water supply.

4.3.1.3. Emergency Access to Land Above the 1% AEP Level

The proposed development has an emergency access point to land above the 1% annual exceedance probability event.

In the event of a secondary medical emergency, the proposed development's frontage on Phillip St remains flood free in the overland 1% AEP event and can therefore function as an emergency services access point. This area is identified in Figure 21 below.

Figure 21: Emergency Access Area on Phillip Street



4.3.2. The Development's Response to Flood Risk

4.3.2.1. Flood Risk Mitigation

Overland flow flood hazard has been modelled and mapped for the developed case for the:

- 5% AEP;
- 1% AEP (including a 19% calibration factor);
- 1% AEP (including a 19% calibration factor and an additional 20% for climate change); and
- PMF design events.

The results of which are discussed and documented in Section 2.9. Including the discussion of Riverine flooding in Section 0.

The proposed development has been designed to accommodate safe refuge above the PMF level (overland and mainstream) and this refuge area is safely accessible to occupants via internal evacuation pathways that lead occupants to higher floor levels on the ground floor and then up one floor to the designated refuge areas on the first floor and above at a height of 14.6 mAHd.

4.3.2.2. Response to Flood Risks

The site's flood affectation in the developed case is discussed and documented in Section 2.9 above.

Flood levels, flood extents, flow rates, depths and velocities and hazard conditions for the modelled overland flow floods are identified in Section 2.9.

The modelled extents for all events up to the PMF do largely not encroach on the proposed footprint. The flood hazards, velocities and flow rates are low in the 1% AEP (with 19% calibration factor) event so the potential for harm in this event is low.

The modelling of a variety of events indicated that the site, due to its location at a localised high point approximately 2 m higher than the riverine flood level in the 1% AEP event, only experienced minor increases in flood level. Flood levels at the site are likely to remain low until the Parramatta River starts to flood or backwater the site. Council has provided no assessment of what probability of Riverine flood event achieves approximately 8 mAHD adjacent the site, but it is likely to be in the order of the 0.1% AEP event.

Overall then with regard to flood risk the site is little affected until extremely rare events occur and even then the risk such as it is can be easily dealt with by evacuating in place until egress is available.

4.3.2.3. Warning Times and Duration of Flooding

Flash flooding generated from rainfall falling on local roads have the potential to develop rapidly however the levels are unlikely to impact the site until Parramatta River rises above the 1% AEP riverine flood level.

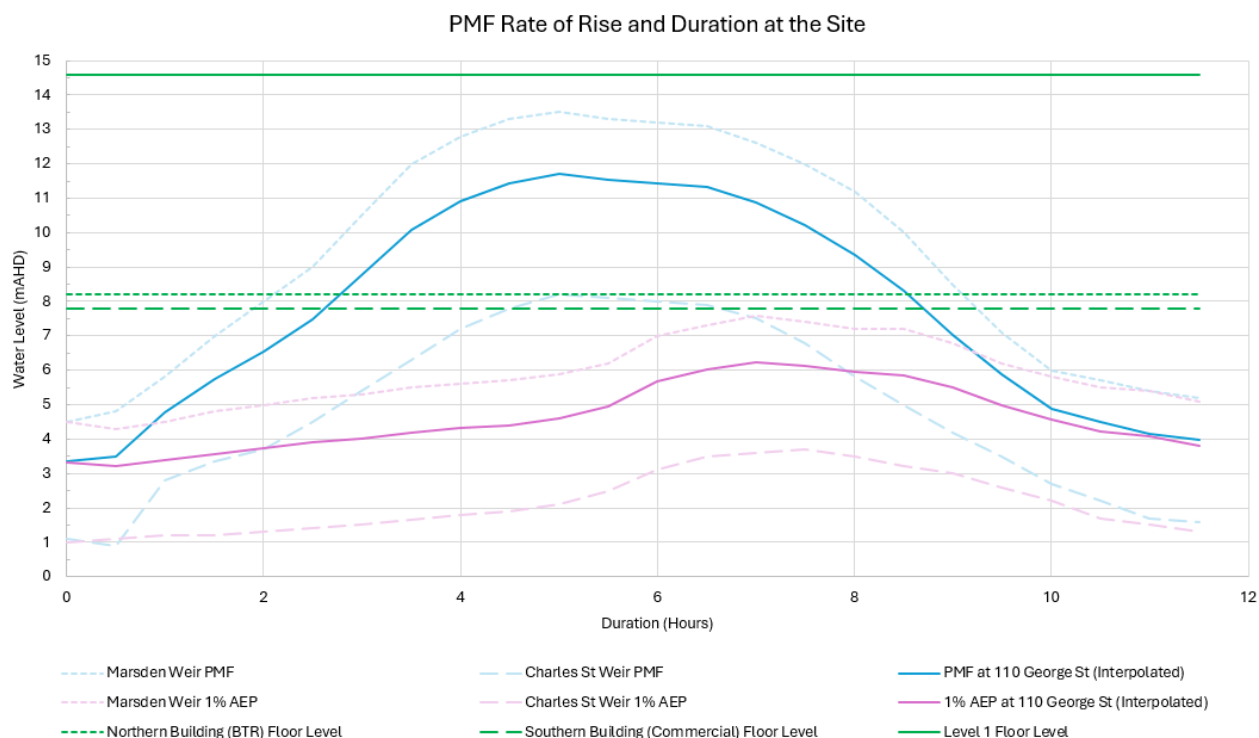
The *Update of Parramatta Floodplain Risk Management Plans* (Molino Stewart, October 2021) documents two hydrographs that identify how the modelled Parramatta River PMF water level is predicted to rise throughout a potential PMF event. These hydrographs represent levels at the Marsden Weir (upstream of the site) and the Charles St Weir (downstream of the site). These locations relative to the subject site are identified in Figure 22 below.

Figure 22: PMF Hydrograph Sampling Locations



These hydrographs were interpolated to derive an appropriate PMF hydrograph for the site. This interpolation was based on how the PMF levels at either location compared with Council's provided PMF level of 11.7 mAHD and this proportional relationship was applied across the storm duration. The same has been done for the provided riverine 1% AEP water levels. These are documented in Chart 2 below.

Chart 2: PMF Hydrograph for the Site



The proposed ground floor levels for each building are identified in Chart 2 above. The proposed floor levels are approximately 1.7 to 2 m higher than the 1% AEP riverine flood level at its peak as per Council's provided flood mapping and levels.

4.3.2.4. Rate of Rise - PMF

In a PMF event, the rate of river rise is predicted to be approximately 1.85 metres per hour. During a PMF event, the site's proposed ground floors are predicted to be inundated approximately 2 hours and 40 minutes after the beginning of the event. It is realistically not possible for occupants or safety wardens to discern whether a PMF event is occurring in real time.

Wardens and occupants at the site should refer to the river level gauge at Parramatta River (Riverside Theatre) which can be viewed at the following link:

<http://www.bom.gov.au/fwo/IDN60233/IDN60233.567112.plt.shtml>

When the river level nears 6.5 mAHD at this gauge, it is prudent to start moving all occupants to floors 1 and above to shelter-in-place. This includes any occupants in the basement. Where possible this should be done via stairwells but lifts can remain operational during this time as the building's lift wells will likely be free of inundation when this occurs.

This instruction should be clearly conveyed to all occupants via a Public Announcement (PA) system.

4.3.2.4.1. Duration of Flooding

In a PMF event, the site is predicted to be inundated for approximately 6 hours. The proposed development will possess back up power, water, food and emergency first aid supply to support occupants for a 7 hour period.

4.3.2.5. Available Flood Warning Systems

4.3.2.5.1. Bureau of Meteorology (BOM) Severe Weather Warnings

When severe weather is occurring or expected in a particular area, BoM issues Severe Weather Warnings.

The warnings describe the area under threat, the expected hazards and advice on how to stay safe in the event of emergency.

The BOM Severe Weather Warning site can be accessed here for real-time updates:

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

Depending on the situation, warnings are issued with varying lead-times, ranging from just an hour or two to greater than 24 hours.

Regarding the site's vulnerability to flood emergency, users should look out for flood warnings for the Parramatta River and flash flooding warnings for the Sydney Metropolitan Area in general.

4.3.2.5.2. BOM Forecast Rainfall Maps

The BoM also issues forecast rainfall maps which can be useful in estimating the amount of rain expected in the days ahead.

These forecast rainfall maps can be viewed at the following website:

<http://www.bom.gov.au/jsp/watl/rainfall/pme.jsp>

4.3.2.5.3. BOM Rain Radar Service

The radar service on the BoM website also shows real-time rainfall locations and intensities.

The Sydney Terrey Hills Radar is the appropriate station to look at to gain an understanding of whether rain is on its way to Parramatta and at what magnitude. The link to this radar map is as follows:

<http://www.bom.gov.au/products/IDR714.loop.shtml#skip>

4.3.2.5.4. FloodSmart

In addition to the information provided by the BoM, the City of Parramatta Council has its own flood warning system, called FloodSmart which is available for anyone to use for free.

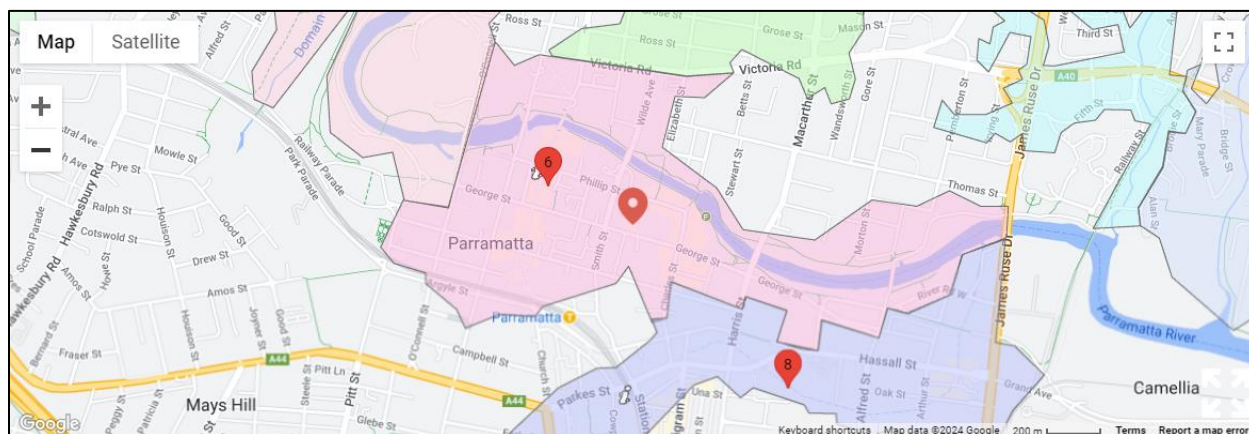
Users can sign up to the service at the following website:

<https://www1.ewn.com.au/parramatta/register.aspx>

FloodSmart provides flood early warning messages via text, email, or automated voice message.

The system includes seven different warning areas covering Parramatta LGA. The warning area that applies to this site is the Parramatta CBD. This area and the site's location are identified in Figure 23.

Figure 23: The Parramatta CBD FloodSmart Warning Area



4.3.2.6. Characteristics and Vulnerabilities of Future Occupants

This proposed mixed use development will include a mix of retail, commercial office space, build-to-rent residential and a childcare facility. The childcare facility represents the most vulnerable of the proposed uses in terms of occupants however this facility will be situated on the third floor, high above the PMF level so no movement of these vulnerable occupants will be required in the event of a flood emergency.

The occupants are likely to be representative of society and include the full spectrum of health conditions or impairments.

No designated aged care facility is proposed for this development.

4.3.2.7. Likelihood of Multiple Storms and Multiple Flood Peaks

In a flooding situation, more than one flood event can occur. Following a flood event, there is no requirement for a lull. A second event could occur prior to the first event totally dissipating. As such, it will be necessary to continue observing weather conditions and considering the possibility of further flooding following abatement of the primary event.

Deciding on an appropriate time at which occupants may safely leave the building following flooding may be determined via two methods:

- A visual observation that flooding has abated fully outside the building which should be further informed by finding out whether the Parramatta River level is falling and whether further storms are predicted for the local area; and
- Communicating with the SES to ascertain whether it is safe to leave the building either by virtue of a general instruction (evacuate when able to) or a more specific instruction pertaining to the building or local area.

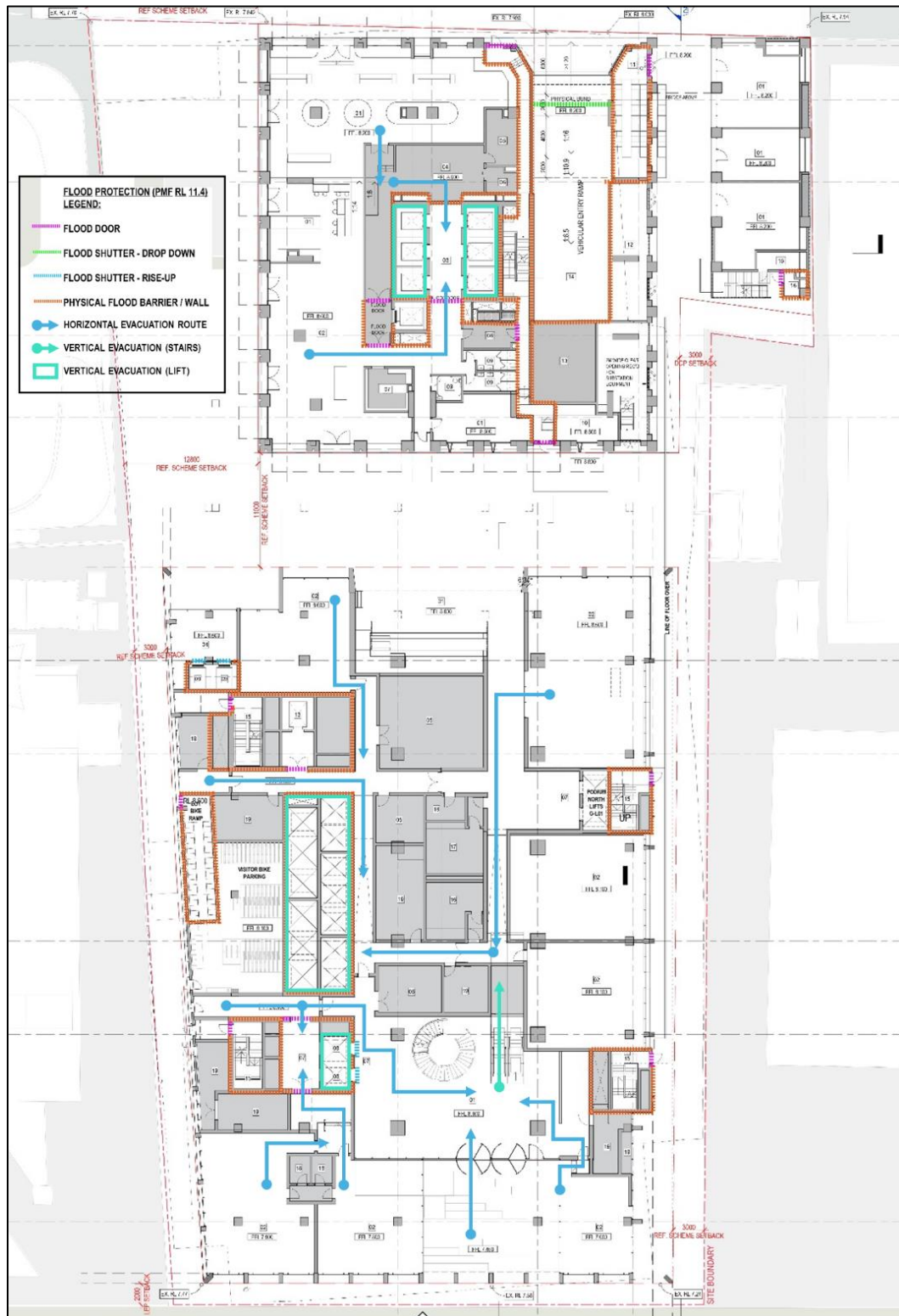
Given the probability of subsequent flood peaks is low, clear observation of the flood-prone street to be used for pedestrian egress is still possible, and the high probability of SES involvement in eventual egress, the threat of subsequent flood peaks is managed.

4.3.2.8. Horizontal and Vertical Evacuation Pathways Including Accessibility Considerations

The proposed development has been designed to facilitate internal horizontal evacuation pathways that rise from the perimeter up to an elevated level as occupants travel further inside the building toward stairwells, escalators or lifts that can allow occupants to vertically evacuate to Level 1 and above at an elevation above the PMF. Access is possible from every tenancy on the ground floor and most of these evacuation pathways include ramps to facilitate accessible evacuation.

These horizontal and vertical evacuation pathways are identified in Figure 24 below.

Figure 24: Horizontal and Vertical Evacuation Opportunities



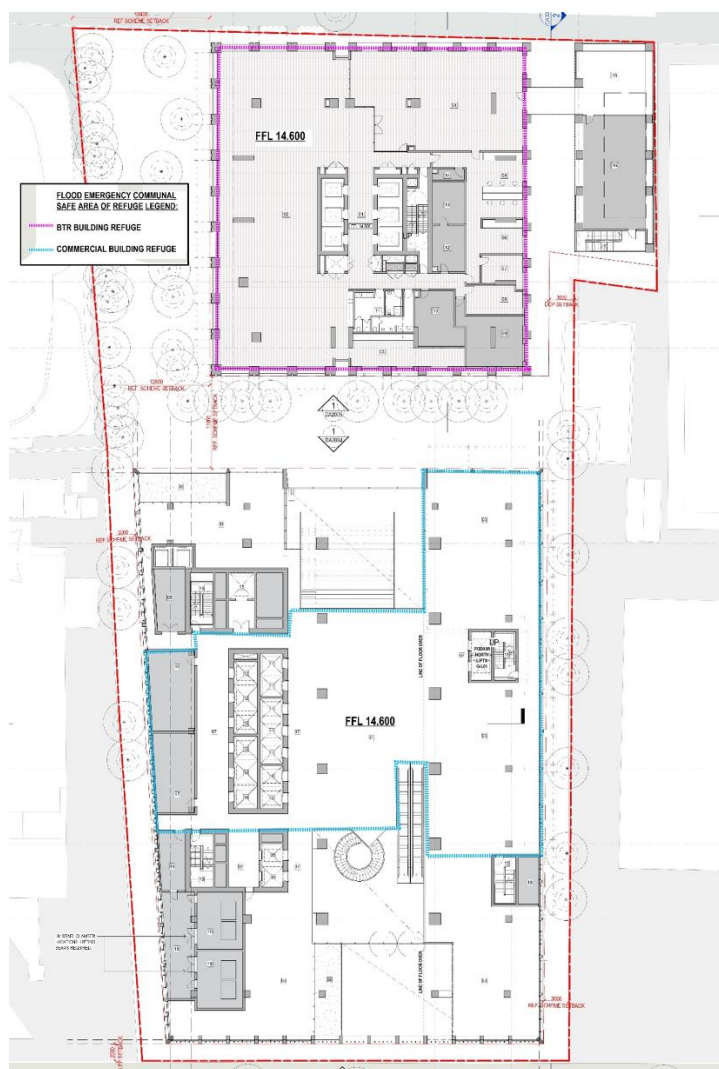
4.3.2.9. Shelter in Place Facilities Above the PMF

The proposed development possesses ample Shelter-in-Place facilities above the PMF level. Levels 1 and above lie above the PMF level. All residents and commercial occupants (office workers) can safely and comfortably shelter in place making use of their own restrooms and kitchens which will continue to operate due to the provision on back-up power and water in the event of an emergency.

Level 1 is the designated refuge area for occupants using and working at the tenancies on the ground floor. The ability for Level 1 to safely support the predicted Ground Floor occupancy numbers is documented above in Section 4.3.1.1. Level 1 has adequate bathroom facilities and will be furnished with emergency supplies that will be maintained by responsible wardens and/or building managers. Level 2 is also publicly accessible and will allow for additional shelter space if desired.

The Level 1 refuge spaces for each of the two buildings is documented in Figure 25 below.

Figure 25: Level 1 Shelter-in-Place Refuge Area

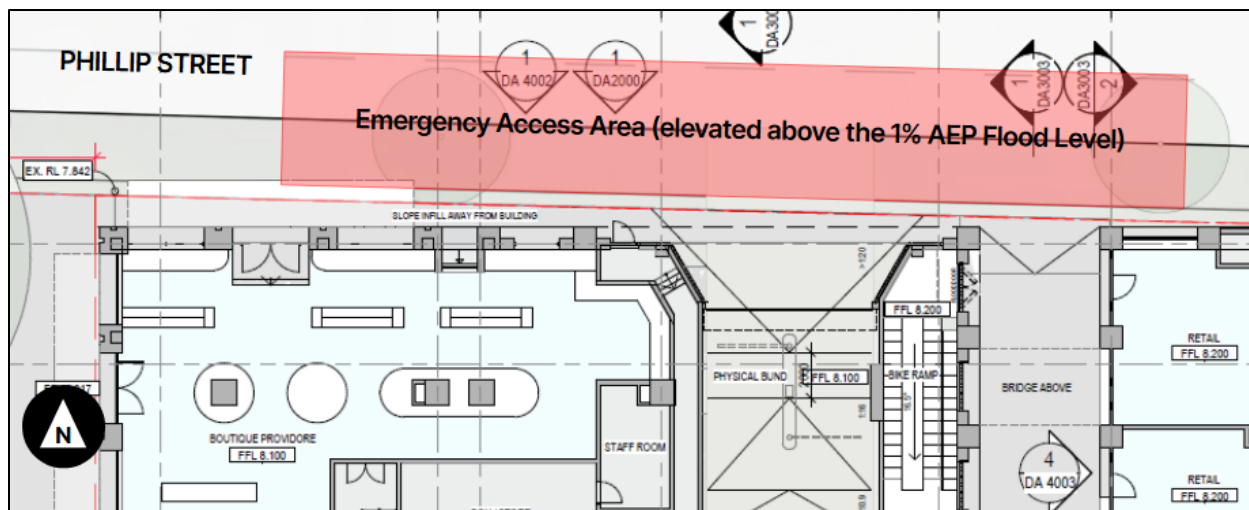


4.3.2.10. Emergency Services Access Availability

The proposed development has an emergency access point to land above the overland 1% AEP event.

In the event of a secondary medical emergency, the proposed development's frontage on Phillip St remains flood free in the 1% AEP event and can therefore function as an emergency services access point. This area is identified in Figure 26 below.

Figure 26: Emergency Access Area on Phillip Street (elevated above the overland 1% AEP Flood Level)



4.3.2.11. Local Terrain

The proposed development is situated on a local high point (see Figure 2) and therefore offers the best local refuge point in the event of flooding. Therefore evacuation by foot or vehicle is not recommended.

4.3.2.12. The Development in Context

The proposed development is in keeping with the established typology and density in this area. Given the site's location at the top of a local high point or ridge and the limiting of usage on the ground floor to retail/commercial uses, the development has been designed so as to align with both the architectural and flooding context at this site.

4.3.2.13. The Proposed Use and Occupation of the Development

The proposed development has a variety of proposed uses. The approximate operating/occupation times of these varying uses are as follows:

- Retail: 07:00 to 22:00 – 7 days a week
- Commercial (Office): 07:00 to 21:00 – Mon to Fri
- Childcare: 07:00 to 18:00 – Mon to Fri
- Residential: 24 Hours – 7 days a week
-

4.4. Evacuation Planning and Procedures

This Flood Emergency Response Plan has been designed in accordance with the appreciation that the protection of life is of critical importance and all recommended actions below are in aid of safely protecting the life of the development's occupants.

In terms of priority, the protection of all lives is the first priority, the comfort of residents, staff and visitors is second, and protection of site property is third.

Evacuation off site is not recommended for the proposed development because many local roads are likely to be inundated by overland flooding in the 5% AEP and 1% AEP events and entering into these floodwaters on foot or in a vehicle can pose a disastrous risk.

Therefore, evacuating off site is not an appropriate flood emergency response strategy for the development. Sheltering on site above the PMF level is a more appropriate strategy and one that is commonplace in the Parramatta CBD given its exposure to hazardous riverine flooding.

Preparing for a flood emergency involves all of a building's stakeholders and relies on planning and checks to take place prior to events occurring.

The flood emergency responsibilities for all stakeholders are outlined in Section 4.4.2.

The flood emergency preparation and response procedures are outlined in Section 4.4.3.

Supporting signage, evacuation instructions, emergency contact information and an emergency supplies checklist is included in Section 4.4.5.

4.4.1. Working with the State Emergency Service

The NSW SES is the primary combat agency for flooding in NSW. It can command resources from other government organisations including local councils, Transport for NSW and the Police to assist in flood operations under its command.

Under the State Emergency and Rescue Management Act, 1989, the NSW SES has the power to direct any citizen or organisation to take actions in response to flooding. This includes the power to order evacuations.

Any flood response directive issued by the NSW SES or by delegated authority to others acting on its behalf must be followed by site management and staff. This includes any order to evacuate the site or not evacuate the site regardless of which building-specific decisions have been made by management in accordance with this FERP.

4.4.2. Flood Emergency Responsibilities for all Personnel and Occupants

Planning for and responding to a flood emergency is the responsibility of all managers, regular occupants and guests in order to prioritise the preservation of life in the event of a flood emergency.

The responsibilities of each of the above-listed groups before, during and after a flood event are listed in Table 3 below.

Table 3: Flood Emergency Responsibilities for all Personnel and Occupants

BUILDING OWNERS

- The building owners (either individual or body corporate) will be responsible for ensuring that:
- Body Corporate By-laws (if applicable) have adequate provisions for implementation of the FERP.
 - All flood management measures are consistent with this report including the maintenance and operation of building design features to mitigate flood risks.
 - An annual audit is to be undertaken to ensure the resources necessary to implement the FERP are secured.
 - The building's flood risks and FERP are to be communicated to all residents and commercial tenants.
 - The building's alarm and public address system are to be kept in full working order.
 - Flood signage is to remain visible and legible.
 - Flood signage is to be displayed throughout the building. The signage will indicate:
 - When the flood alarm sounds:
 - Residents should proceed directly to their apartments via the stairs.
 - Business occupants should proceed directly to their offices via the stairs
 - All other site occupants should proceed directly to Level 1 via the staircases and/or escalators.
 - If you require assistance, please make yourself known to someone who works at the facility and they will help escort you to Level 1 via a lift.
 - Owners are to ensure the alarms are tested every six months to ensure they are operational at all times
 - This FERP is to be reviewed every five years, or following a flood to ensure the FERP is kept up to date.
 - Fire Wardens are to be appointed as Flood Wardens, given flood risk management responsibilities and sufficient training to implement this FERP.
 - The Building Manager and Flood Wardens are to be subscribed to the BoM App and Parramatta FloodSmart system to automatically receive weather and flood alerts and warnings.
 - There is to be an adequately trained Flood Warden on site at all times. This may include residents.
 - The Building Manager and Flood Wardens are to be supported in their duties
 - All building management staff are to be given induction and training into their flood emergency response responsibilities
 - Owners are to ensure post-flood site clean-up and recovery is carried out promptly and thoroughly.
 - Owners are to ensure there are sufficient financial, human and other resources to maintain and implement the FERP.

BUILDING MANAGER (CHIEF WARDEN)

- The Building Manager will be the Chief Flood Warden and will:
- Must be familiar with all the flood emergency management procedures set out in this document, rainfall and river level data, BoM warnings, the on-site flood alarm system and the Parramatta FloodSmart warning products.
 - Ensure that all management staff are aware of the flood warning system and the flood emergency response procedures set out in this FERP.
 - Ensure all Flood Wardens know how to monitor severe weather warnings, rainfall forecasts and external water levels.
 - Organise training for themselves and Flood Wardens to maintain the flood warning system and implement the flood emergency management procedures set out in this FERP.
 - Make sure they and the Flood Wardens are subscribed to the BOM App and FloodSmart to receive severe weather warnings direct to their mobile devices.
 - Provide all staff with a copy of this FERP and brief them on the flood emergency management procedures.
 - Supply and maintain all of the equipment necessary to implement the FERP other than the flood alarm system.
 - Organise the testing and maintenance of the flood alarm and PA system
 - Ensuring that flood signage is visible and legible.
 - Keep a fully charged and functional mobile phone on site at all times and a laptop or tablet with 4G/5G internet access (in addition to wi-fi) and at least 24 hours of battery charge on site at all times.
 - Maintaining a register of emergency contact details for all residents and commercial tenants.
 - Ensure there is an adequately trained Flood Warden on site at all times
 - Monitor weather forecasts and flood warnings through the BoM website
 - Keep a soft and hard copy of the FERP on site and readily accessible to the Flood Wardens at all times.
 - Implement this FERP in the event of a flood or delegate that task to an on-duty Flood Warden
 - Direct other staff to implement various aspects of this FERP, as required.
 - Liaise with emergency service organisations and other external stakeholders, as required
 - Organise a review of the FERP every 5 years or following a flood which triggers a flood emergency response
 - Report annually, and as requested, to the building owners on the implementation and maintenance of the flood warning system and FERP.
 - The Building Manager may delegate tasks to others but bears ultimate responsibility for their implementation.

FLOOD WARDENS

There will be 1-2 capable and willing residents nominated as Flood Wardens. If the Chief Flood Warden is not on site, the tasks allocated to the Chief Flood Warden are to be carried out by a Flood Warden.

All Flood Wardens will:

- Ensure that they are aware of the flood warning system and the flood emergency response procedures set out in this FERP
- Ensure they know how to monitor severe weather warnings, rainfall forecasts and external water levels
- Ensure a soft and hard copy of the FERP is on site and to report absences to the Chief Flood Warden
- Implement the procedures in this FERP during and after a flood.
- Flood Wardens may delegate any of the actions set out in this FERP that need to be taken during or after a flood but bear ultimate responsibility for their implementation.

COMMERCIAL TENANTS

All tenants will:

- Provide the Building Manager with their most up to date contact details.
- Follow the advice of the Building Owner, Body Corporate, Building Manager or Flood Wardens.
- Report any concerns to the Body Corporate, Building Manager or Building Owner.
- Induct all staff in flood emergency response.
- Communicate building closure to staff or expected visitors who are not in the building when flooding occurs.

BUILDING STAFF

- Will become familiar with the flood emergency response procedures set out in the FERP.
- Follow the procedures set out in the FERP in the event of a flood.

RESIDENTS

- Provide the Building Manager with their most up to date contact details.
- Follow the directions of the Building Owner, Body Corporate, Building Manager or Flood Wardens during a flood emergency.

GUESTS, PATRONS AND VISITORS

- Guests, customers and visitors are to follow the directions of staff during a flood emergency.

4.4.3. Flood Emergency Preparation and Response Procedures

The flood emergency response operations are divided into four phases:

- **Prepare** – this concerns the ongoing maintenance of flood mitigation measures (back-up power, flood gates, emergency supplies) and flood emergency response knowledge
- **Alert** – this occurs when a flood alert is triggered by one of several means which indicates flooding may be a possibility. It may be possible to revert to *Prepare* without the following two phases being triggered
- **Respond** – this occurs when a flood response is triggered by one of several means which indicates flooding is likely.
- **Recover** – this occurs following a flood response operation of any scale and lasts until operations have been returned to normal in which case it reverts to *Prepare*.

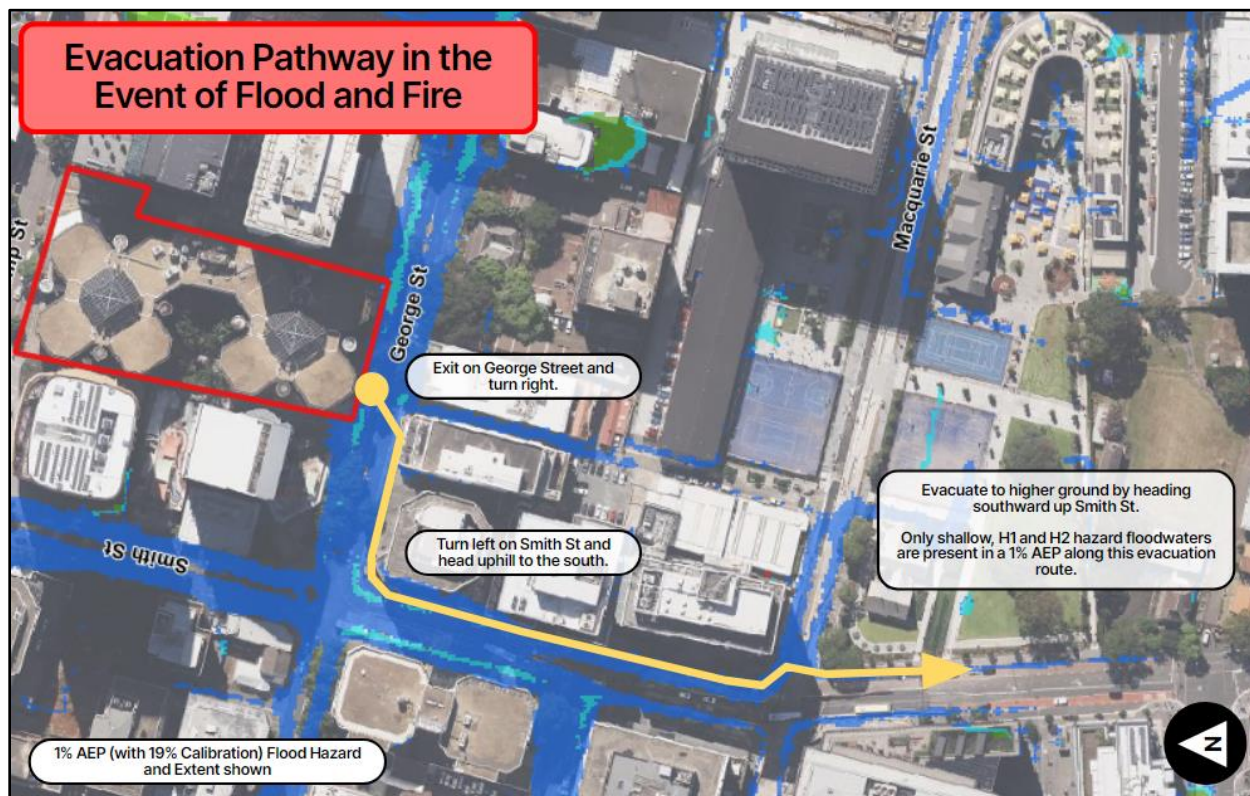
Table 4: Flood Emergency Preparation and Response Procedures

PHASE	PREPARE: PRIOR TO AN EVENT	ALERT	RESPOND	RECOVER
TRIGGER	Ongoing	BoM issues a Severe Weather Warning with chance of flooding for Sydney; OR BoM issues a Flood Watch for the Parramatta River; OR Intense rainfall is observed.	Floodwaters are observed ponding on George St to the east of the site or on Phillip St to the west.	Emergency Services or Council give the all clear; OR Flood waters have receded from both George and Phillip Streets
ACTIONS:	- The Building Owners and Building Manager will ensure that flood signage is visible, legible and displayed throughout the building. - The Building Owners and Building Manager will ensure that the back-up power supply, water supply, PA system and alarm system within the building and in the basement levels are kept in working order and is tested at least every six months, including activation of the flood barriers. - The Building Manager will ensure the following are to be kept on Level 1 (the communal refuge area): - An emergency kit, - First aid kit, - Portable radio with batteries, - Torches with spare batteries, - Shelf-stable food/snacks, - Sufficient bottled water for the number of building occupants that may need to shelter for up to 24 hours. - The Building Manager will maintain a register of emergency contact details for all residents and commercial tenants and all residents will provide and confirm updated contact details on an annual basis These contact details will also include emergency services and utility providers. - The Building Owners and Building Manager will review the FERP every five years or following a flood and ensure an annual audit is undertaken of the resources necessary to implement the FERP. - The Building Owners will ensure all residents and commercial tenants are made aware of the flood risks and the FERP - The Building Manager will ensure all staff will be made aware of the possibility of flooding and the procedures to be followed if a flood were to occur. This will be done during staff inductions. - The Building Manager and all Flood Wardens will become familiar with this FERP and learn how to monitor severe weather warnings, flood warnings, rainfall forecasts and external water levels and have FloodSmart and the BoM app on their phones. - The Building Manager will supply and maintain all of the equipment necessary to implement the FERP other than the flood alarm system. - The Building Manager will keep a fully charged and functional mobile phone on site at all times - The Building Manager will keep a laptop or tablet with 4G/5G internet access (in addition to wi-fi) and at least 24 hours of battery charge on site. - The Building Manager will develop detailed emergency procedures for fire and other emergencies that take on board the recommendations presented in this report and that will consider any additional risk factors. - The Building Manager will ensure that all commercial tenants understand their responsibilities in the event of a flood and will induct all staff in flood emergency response - All commercial tenants will follow the advice of the Building Owner, Body Corporate, Building Manager or Flood Wardens. - The Building Owner and Building Manager will ensure there is a trained acting Flood Warden on site at all times.	- The Building Manager or delegate will monitor the Bureau of Meteorology flood warnings and forecasts, NSW SES website, and Parramatta FloodSmart website every 8 hours and tune into ABC Radio 702. - The Building Manager will notify the Flood Wardens of the possibility of flooding and remind them of actions and procedures to follow should a sheltering-in-place process be required. - The Building Manager will email all commercial tenancies with a written notice that there is a possibility of local flooding and remind them of the actions and procedures to follow should a sheltering-in-place process be required. - The Building Manager or delegate will visually monitor water levels on George St to the east of the site and on Phillip St to the west of the site.	- The Building Manager will initiate sheltering on site. - The Building Manager or delegate will activate the signs at the entrance to the driveway and in the basement indicating that the driveway, car park and loading dock are closed. - The Building Manager or delegate will make an announcement over the public address system communicating that: - Local streets may be flooding and it is not safe to leave the building and attempt to evacuate. - Everyone should stay inside the building - The basement car park has been closed and vehicles are not to leave the site. - Vehicles parked in the basement will be protected from flood waters. - The Building Manager will notify commercial tenants that the carpark and loading dock have been closed due to flooding - No vehicles are to enter the basement or loading dock. - No vehicles are to exit the basement car park. - All commercial tenants, staff, residents, guests, patrons and visitors will follow the advice of the Building Owner, Body Corporate, Building Manager or Flood Wardens. - All building occupants will remain within the building. - Commercial tenants will communicate car park closure to staff or expected visitors who are not in the building when flooding occurs. - Commercial tenants will postpone receipt of deliveries.	- Once flood waters have receded and the ground floor is flood free the Building Manager will ensure the flood shutters, gates and doors are reopened. - The Building Manager and Flood Wardens will advise building occupants that it is safe to leave the building by foot - If there is no flood debris blocking the driveway, the Building Manager will ensure the flood gate is reopened and will advise building occupants that they may leave by vehicle. - If there is flood debris blocking the driveway the Building Manager will organise for the debris to be removed before the flood gate is reopened - Once the flood gate across the driveway has been reopened the Building Manager will turn off the sign in the basement indicating that the driveway is closed and advise building occupants it is safe to leave by vehicle. - The Building Manager and commercial tenants will ensure that no staff, residents, guests, patrons or visitors return to the site while flooding is still occurring or has recently occurred. - Residents and staff can return to site only after permission has been given by emergency services. The Building Manager and commercial tenants will ensure that staff do not return to site until that time - Where necessary, the Building Owners will ensure a hazard assessment is undertaken for the clean-up, safe work methods statements are prepared and personal protective equipment supplied consistent with the known hazards which can be associated with floods: - Slips, trips and falls - Sharp debris - Venomous animals - Contaminated water and sediments. - A de-brief will be held with key management staff and may involve emergency services and/or Council staff. The flood event and response, including the use of this Plan and any emergency procedures will be reviewed. - Changes may be made to this Plan and the requirements for future emergency response may be updated as a result of this review. - The Building Owners will ensure that plumbing and gas is checked by a licensed plumber and any defects rectified. - The Building Owners will ensure that electricals are checked by a licensed electrician and defects rectified prior to use recommencing.
			Parramatta FloodSmart issues a Major flood warning for Parramatta CBD; OR Riverside Theatre Gauge (567112) reads 6.75 mAHD or greater; OR Floodwaters are observed rising along the George St frontage. - The Building Manager will initiate sheltering on site - If the flood alarm has not already been activated, the Building Manager or delegate will automatically activate it - The Building Manager or delegate will make an announcement over the public address system communicating that: - Residents should immediately shelter in their apartments - Visitors and staff should immediately make their way to the refuge areas on Level 1 to shelter from flooding. - Nobody is to stay in the basement or on the ground floor. Everybody on these floors needs to head upstairs immediately. - No vehicles or people are to enter the basement or ground floors and no vehicles are to exit the basement car park. - All commercial tenants, staff, residents, guests, patrons and visitors will follow the advice of the Building Owner, Body Corporate, Building Manager or Flood Wardens. - Residents will head to their apartments via the lifts. If the main power supply has been disrupted, back-up power will allow lifts to remain operating. - All other building occupants will head to Level 1 via the lifts or stairwell. - The Building Manager and Flood Wardens will sweep the ground and basement floors, starting with the ground floor, clearing them to ensure that everyone has left these levels and turn off the electricity to the basement and ground floors - Once the Flood Wardens have cleared the ground floor the Building Manager or delegate will activate the internal flood barriers protecting the lift and stairwells	

4.4.4. Evacuation in the Event of Simultaneous Flood and Fire

In the very rare event that a building fire coincides with a flooding event, flood wardens should immediately check the online, real-time river level gauge at Riverside Theatre. If the river level remains below 6.8 mAHD, wardens should start escorting occupants to higher ground on Smith Street via the evacuation route shown in Figure 27. The higher ground marked on the figure below has an elevation higher than 13 mAHD, more than 1.3 m higher than the PMF level in this area.

Figure 27: Evacuation Route in the Event of a Simultaneous Flood and Fire



4.4.5. Supporting Signage and Flood Emergency Planning Materials

To communicate the site's flood liability to occupants and arm wardens and occupants with close-to-hand information to facilitate an organised emergency procedure, the following templates have been included in this report to form a basis for more site-specific, detailed flood emergency tools:

- signage,
- shelter-in-place mapping,
- emergency contact information and
- an emergency supplies checklist

Figure 28: Instructional Signage Example

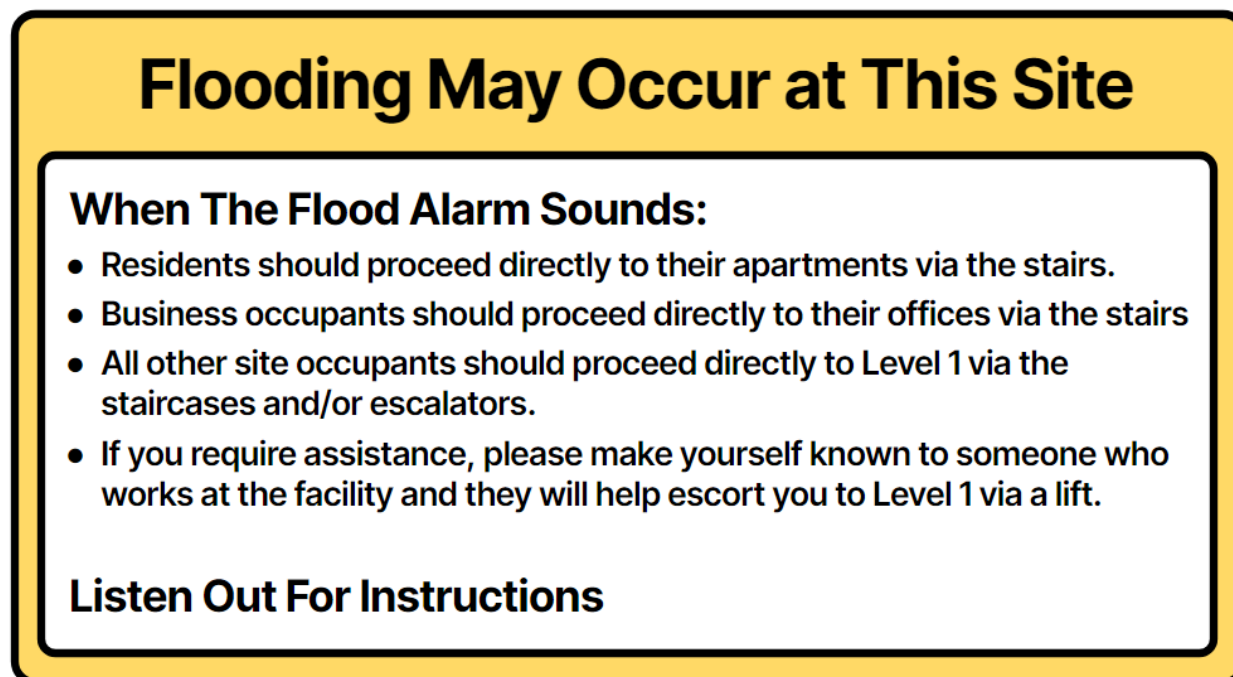


Figure 29: Shelter-in-Place Mapping

Flooding May Occur At This Site
Listen Out For Instructions
If a Flood Alarm Sounds, Do Not Evacuate!

When instructed, move to Level 1 or above via stairs, escalators and lifts.

Lifts have back-up power to support them in the event of an emergency.

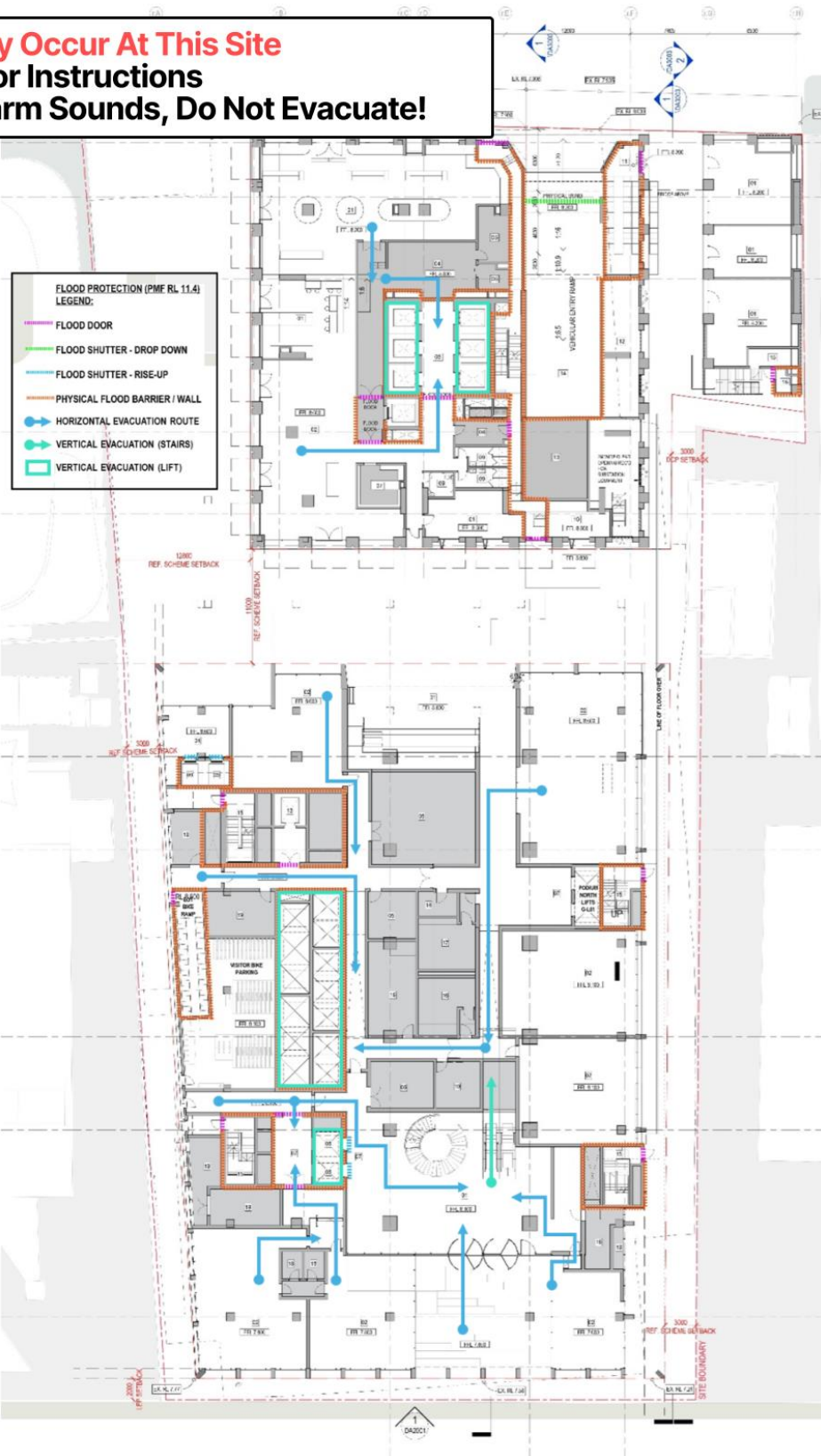


Table 5: Emergency Contact Information Template

ORGANISATION/ROLE	CONTACT DETAILS
SES Local Controller	132 500
Fire / Ambulance / Police	000
Bureau of Meteorology – NSW Flood Warning Centre	02 9296 1511
City of Parramatta Council – Customer Service Centre	02 9806 5050
Westmead Hospital – Medical Assistance	02 8890 5555
Sydney Water – Water and Sewage	132 090
Building Manager	
Flood Warden(s) – List All	
Plumbing Service	
Electrician	
Electricity Supplier	
Gas Supplier	
Telecommunications Provider	
Waste Collection	

Table 6: Emergency Supplies Checklist

ITEM	DATE CHECKED
Fully charged mobile phone or tablet with 4G/5G internet access capabilities	
A desktop or tablet with 4G/5G internet access and at least 24 hours independent power supply (may include back up batteries)	
Emergency Contact List (to be updated regularly)	
Flood Emergency Kit (housed in a waterproof plastic container) - Printed copy of the updated FERP - Two battery operated torches with in-date batteries in each with plenty of spare batteries. - A battery operated radio to listen to local flood warnings. Batteries must be in date and there must be spares.	
First Aid Kits (6)	
Shelf stable food, snacks and bottled water to supply all the potential occupants that could be sheltering in place for 7 hours.	

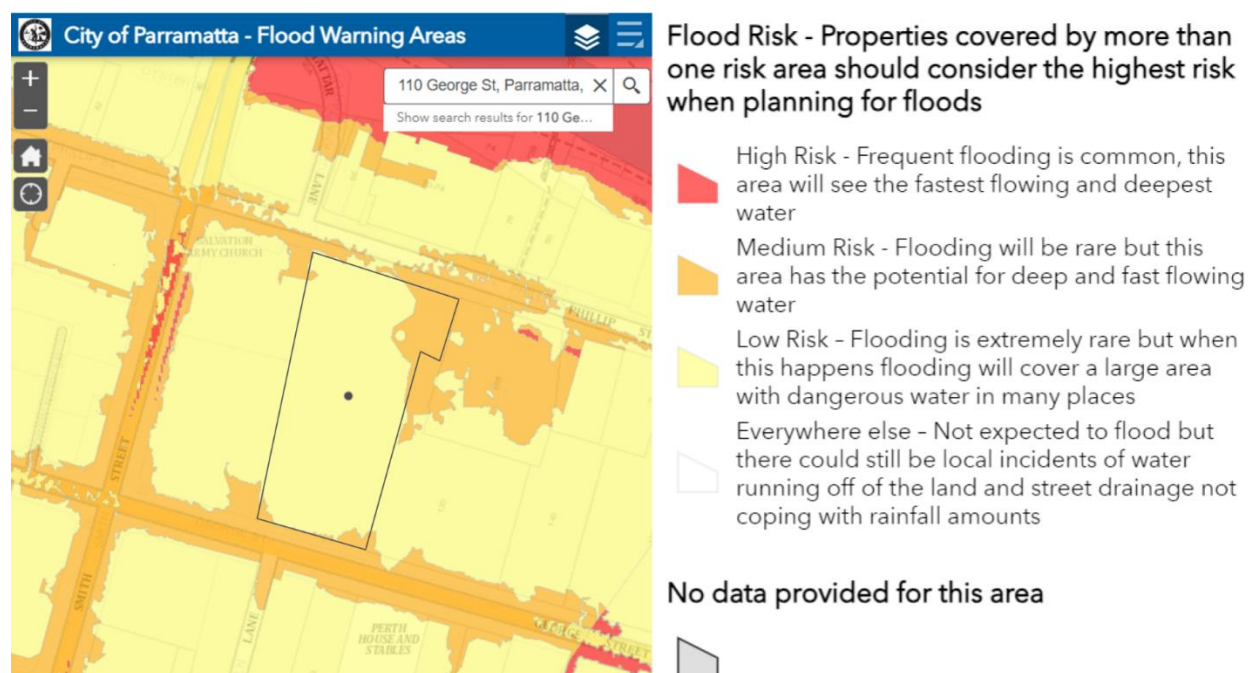
5. Compliance with Flood-Related Planning Controls

The relevant design standards that apply to the proposed development are determined in accordance with the following planning controls:

- The Parramatta Development Control Plan (DCP) (2023); and
- The Parramatta Local Environment Plan (LEP) (2023).

The site is mapped by Council as primarily inundated by the PMF only which equates to a Low Flood Risk Precinct, however the southern and north-eastern fringes of the site are classified as a Medium Flood Risk Precinct (see Image 2 below). As per Council's guidance, GRC will consider the site as subject to Medium Flood Risk.

Image 2: Flood Risk Mapping Taken from Council Online Portal



The proposed land use is a mix of Commercial and Residential with the ground floor of both proposed buildings being primarily comprised of Commercial tenancies. As such, GRC will consider the proposed development as a Commercial land use for the purposes of determining compliance with the relevant planning instruments for the site.

The site is situated within the Parramatta CBD and is therefore subject to the flood-related controls outlined in:

- Sections 5.21 and 7.11 of the Parramatta LEP (2023); and
- Section 9.7 of the Parramatta DCP (2023).

These are documented and discussed below.

5.1. Compliance with the Parramatta LEP (2023)

5.21: FLOOD PLANNING

Objectives

- 1 The objectives of this clause are as follows—
 - (a) to minimise the flood risk to life and property associated with the use of land,
The proposed development has been positioned and designed in a section of land not flood affected in a 1% AEP event. Special effort has been made to facilitate shelter-in-place above the PMF level in a manner that is consistent with local flood emergency response.
 - (b) to allow development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change,
The proposed development has been positioned on land that is compatible with the flood function and behaviour on the land and this assessment has incorporated in additional rainfall to emulate Climate Change impacts as directed by Council.
 - (c) to avoid adverse or cumulative impacts on flood behaviour and the environment,
GRC has modelled the site's flood level impact and no adverse impacts have been predicted for the 1% AEP event (including a 19% calibration factor and 20% for climate change).
 - (d) to enable the safe occupation and efficient evacuation of people in the event of a flood.
Shelter-in-place is safely accommodated at the proposed development. Evacuation is not recommended in keeping with the guidance outlined in City of Parramatta's *Update of Parramatta Floodplain Risk Management Plans* report (Molino Stewart, October 2021)
- 2 Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development—
 - (a) is compatible with the flood function and behaviour on the land, and
The development is located on a flood free lot (for all modelled events excluding the PMF) and does not adversely impact flood behaviour at or adjacent to the site.
 - (b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and
The development has been represented in flood modelling and this modelling has shown it would not adversely impact flood behaviour at or adjacent to the site.
 - (c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and
The development would not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the

event of a flood as ample capacity above the PMF has been afforded to facilitate the safe shelter-in-place of all occupants.

(d) incorporates appropriate measures to manage risk to life in the event of a flood, and
In addition to ample refuge above the PMF level, provision has been made to supply the development with back-up power and water supply to support all residents and occupants for more than the predicted 5 hour PMF inundation period.

(e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

The proposed development is not located on or near a natural water body and it will not adversely affect adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.

3 In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters—

(a) the impact of the development on projected changes to flood behaviour as a result of climate change,

The proposed development has been modelled under climate change conditions and no adverse impacts on flood behaviour are predicted.

(b) the intended design and scale of buildings resulting from the development,

The intended design and scale of the development appears in keeping with the existing scale and density in the Parramatta CBD

(c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood,

The proposed development has been designed in keeping with Council's Flood-related DCP controls. This includes appropriate floor levels, a mix of active and passive flood protection to protect the basement car parking in a PMF event, ample shelter-in-place area, ample horizontal and vertical evacuation opportunities to reach the shelter-in-place refuge area, back-up power, water and emergency supplies and an emergency access point above the 1% AEP flood level.

(d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.

The proposed development has not been designed for modification, relocation or removal.

7.11 FLOODPLAIN RISK MANAGEMENT

- 1 The objective of this clause is to enable occupants of buildings in certain areas subject to floodplain risks—
 - (a) to shelter in a building above the probable maximum flood level, or

An accessible public space on the first floor (and above) of both buildings is elevated higher than the PMF level and provides ample space to facilitate shelter in place.

Complies.

- (b) to evacuate safely to land above the probable maximum flood level.

Evacuation to land above the PMF level is possible with early warning, however the *Update of Parramatta Floodplain Risk Management Plans* report (Molino Stewart, October 2021) compiled for the City of Parramatta indicates that shelter-in-place is the preferred flood emergency strategy as evacuation is not recommended in the Parramatta DCP for a number of reasons, with one primary reason being:

“The recently developed Parramatta River Flood Warning System is likely to only provide about two hours warning of CBD flooding and possibly less in large, rare flood events in the River. However, the rapid rate of rise of extreme floods means that many of the roads in the CBD would be too dangerous to use before it is known exactly which areas will need to evacuate.”

Complies given local flood emergency response guidance.

- 2 This clause applies to land identified as “Floodplain Risk Management Area” on the Floodplain Risk Management Map.

Yes, identified as a predominantly Low Risk area with small areas of Medium Risk within the “Floodplain Risk Management Area” according to Council’s mapping.

-
- 3 Development consent must not be granted to the erection of a building on the land unless the consent authority is satisfied the building—
- (a) contains an area that is—
 - (i) located above the probable maximum flood level, and

The proposed development has ample internal area above the PMF level.
Complies.

- (ii) connected to an emergency electricity and water supply, and

The proposed development will be connected to an emergency electricity and water supply.
Complies.

- (iii) of sufficient size to provide refuge for all occupants of the building, including residents, workers and visitors, and

The available refuge area above the PMF – including publicly available spaces on the first floor and above, and the apartments and office space above that – will be of a sufficient size to cater to all occupants of the building, including residents, workers and visitors.
Complies.

- (b) has an emergency access point to land above the 1% annual exceedance probability event, and

The emergency access point – at the designated driveway entrance on Phillip St – is situated on land above, and connects to roadway above, the 1% annual exceedance probability event.
Complies.

- (c) is able to withstand the forces of floodwaters, debris and buoyancy resulting from a probable maximum flood event.

The capacity for the proposed design to withstand the forces of floodwaters, debris and buoyancy resulting from a probable maximum flood event should be assessed by a suitably qualified structural engineer.

-
- 4 Subclause (3)(a) does not apply if—
- (a) there is pedestrian access located between the building and land above the probable maximum flood level, and

Not applicable. Clause (3)(a) is satisfied.

- (b) the pedestrian access is located above the probable maximum flood level.

Not applicable. Clause (3)(a) is satisfied.

5.2. Compliance with the Parramatta DCP (2023)

9.7: FLOOD RISK MANAGEMENT

Objectives

- | | |
|------|--|
| O.01 | <p>The flood environment, its risks and consequences are to be understood and responded to accordingly.</p> <p>GRC has modelled the site's flood affectation in existing and proposed conditions for a variety of design flood events as per Council's request.</p> <p>Complies.</p> |
| O.02 | <p>Levels of flood risk and threats to personal safety and property present for particular developments are to be minimised or significantly reduced with appropriate responses to this environment.</p> <p>GRC's flood modelling results have informed the design's response to flooding at and surrounding the site in order to ameliorate flood risks and threats to personal safety and property for the proposed development.</p> <p>Complies.</p> |
| O.03 | <p>Council is to provide direction, guidance and regulation for the safe and sustainable development on all land affected by flooding.</p> <p>GRC has reviewed the relevant LEP and DCP for direction on what constitutes safe and sustainable development on flood-affected land. GRC has also been in dialogue with Council in this regard.</p> <p>Complies.</p> |
| O.04 | <p>Buildings and the uses they contain are to be compatible with the identified flood risk.</p> <p>The building has been sited and designed in order to respond to the identified flood risks. The proposed development has been designed in accordance with Council's Parramatta CBD-specific requirements regarding flood planning levels and protection. The development's capacity to withstand floodwaters is to be verified separately by a suitably qualified structural engineer.</p> <p>Complies pending advice from structural engineer.</p> |
| O.05 | <p>Early site planning and consideration of flood conditions is essential to achieve an integrated flood response that manages flood risk and provides optimum development design outcomes and interface with the public domain.</p> <p>GRC has worked with Hassell, the development's architect, to develop a design that is informed by, and responsive to the site's existing flood conditions.</p> <p>Complies.</p> |

-
- O.06 Adequate, safe flood conveyance and management of floodwaters is to be achieved, while providing for the rehabilitation, conservation and embellishment of floodways and other flood affected lands where appropriate.

The proposed development does not impact flood conveyance or any existing floodways.
Complies.

Controls

- C.01 Flood Hazard Modelling and hazard, risk and safety assessments for all development involving the construction of a new building or significant alterations to an existing building, and or intensification of a use is to address the PMF and floods greater than the 1% Annual Exceedance Probability (AEP) as part of the Development Application (DA), particularly where there is a potential risk to life.

GRC has undertaken flood hazard modelling and a Flood Emergency Response Plan has been developed to document how the building and its occupants can safely address flood events.
Complies.

- C.02 Where this information is available, Council requires an Applicant to make a Flood Information Enquiry. The information supplied to an applicant via a Flood Information Enquiry will form the basis of the DA flood assessment.

GRC has requested and received this information. The flood levels documented in this certificate have been assessed – in concert with the requested overland flood modelling Council has requested – to determine appropriate flood planning levels for the proposed development.
Complies.

- C.03 In some cases, Council may require an applicant to prepare an additional flood study, for example for special local conditions, or if the proposed development is of a form or type that requires more site-specific flood modelling. Where Council requires an applicant to submit an additional flood study, the applicant must use parameters provided by Council to prepare the flood study.

GRC has developed a flood study for the proposed development (this report) and this has involved conducting overland flood modelling using TUFLOW as per specific parameters provided from Council (as per GRC's 14/12/2023 meeting with Council).
Complies.

9.7.1: ASSESSMENT AND MINIMISATION OF FLOOD HAZARDS, RISKS AND POTENTIAL FOR HARM

Objectives

- O.01 Hazard, risk and safety assessments are required to demonstrate how risk and potential for harm to people, property, buildings, and the environment from floodwaters will be mitigated.

GRC has assessed hazard, risk and safety at various points throughout this report to demonstrate how risk and potential for harm to people, property, buildings, and the environment from floodwaters will be managed and mitigated.

Complies.

-
- O.02 A risk-based approach to floodplain development and mitigation of potential harm based on a merit assessment consistent with the Flood Plain Development Manual (2005 or as updated) is required.

GRC has adopted this approach to development in the floodplain and harm mitigation in Section 4 of this report.

Complies.

Controls

- C.01 All development involving the construction of a new building or significant alterations to an existing building, and or intensification of a use must be supported by flood hazard modelling that is:
- based on the 'General Flood Hazard Vulnerability Curves' for the 1% AEP flood and the PMF.
 - is assessed in terms of the following hazard categories and risks of harm:
 - H1 – generally safe for people vehicles and buildings.
 - H2 – unsafe for small vehicles.
 - H3 – unsafe for vehicles, children and the elderly. This includes all floodwaters greater than 0.5m depth.
 - H4 – unsafe for people and vehicles.
 - H5 – unsafe for vehicles and people. All buildings vulnerable to structural damage. Some less robust building types vulnerable to failure.
 - H6 – unsafe for vehicles and people. All building types considered vulnerable to failure.

Flood hazard modelling has been completed for the 1% AEP and PMF events in the proposed condition as required.

The proposed development is subject to only low hazard along its southern (George St) and northern (Phillip St) perimeters. In the 1% AEP event (inclusive of an additional 19% rainfall for calibration at Council's request), the predominant hazard in these two areas is H1, with some small areas in the middle of the road predicted to experience H2.

Complies.

- C.02 All development involving the construction of a new building or significant alterations to an existing building, and or intensification of a use is to be supported by a merit-based flood hazard and risk assessment that:
- Presents evidence-based analysis of the hazard, risk and harm to occupants and those in the surrounds and demonstrates how harmful factors will be mitigated.
 - Includes information on the following aspects as necessary, to enable Council to assess risk and potential for harm.
 - 1% AEP and 5% AEP and PMF flood levels, flood extents, flow rates, depths and velocities and hazard conditions for mainstream and overland flow floods.
 - Modelled hydraulic hazard levels, (H1-H6), extent and behaviour for 1% AEP mainstream and overland flow floods.
 - Warning times and duration of flooding.
 - Available warning systems (if any).
 - Characteristics and vulnerabilities of future occupants.
 - Likelihood of multiple storms – and multiple flood peaks.
 - ‘Horizontal’ evacuation pathways including accessibility considerations.
 - ‘Vertical’ evacuation opportunities and shelter in place facilities above the PMF.
 - Emergency services access availability.
 - Local terrain.
 - The development in context.
 - The proposed use and occupation of the development.

This merit-based flood hazard and risk assessment has been conducted and documented in Sections 4.3 and 4.3.2.

Complies.

9.7.2: LAND USE AND BUILDING LEVELS

Objectives

- O.01 Ensure the design of the building including floor levels and indoor and outdoor uses are appropriate for the flooding environment, particularly with regard to flood hazard and risks.

The floor levels and uses have been designed and selected in accordance with the guidance offered in the Parramatta DCP (2023) and LEP (2023) and the flooding environment identified as a result of modelling and Council's provided flood information.

Complies.

Controls

- C.01 To achieve a safe environment for occupants within a building, residential habitable rooms must be set at or above the Flood Planning Level (FPL), which is the adjacent 1% AEP flood level plus a 500mm freeboard safety factor.

All residential habitable rooms are set well above the Flood Planning Level (FPL), which is the adjacent 1% AEP flood level plus a 500mm freeboard safety factor.

Complies.

- C.02 The following uses within a building will not be supported below the FPL.

- Residential habitable rooms or uses, including those relying on flood gates, flood doors, barriers, crests, walls, windows or other physical barriers to exclude floodwaters up to the FPL.

No residential habitable rooms are proposed below the FPL.

Complies.

- Gathering places such as places of worship and classrooms.

No gathering places or classrooms are proposed below the FPL.

Complies.

- Uses such as child care centres, aged care facilities.

No child care centres or aged care facilities are proposed below the FPL.

Complies.

- Storage of valuable items including important records, archives and office files.

No storage of valuable items including important records, archives and office files is proposed below the FPL.

Complies.

C.03 Indoor, non-habitable floor space and corresponding uses may be permitted below the FPL, subject to a satisfactory flood hazard and risk assessment and appropriate flood mitigation measures. Such uses may include:

- Basement car parking and bicycle storage, with floodwaters excluded up to the PMF, subject to compliance with the controls in Section 9.7.8 – Car Park Basements in Flood Prone Areas.

Basement car parking and bicycle storage is situated below the FPL with passive flood protection offered by a driveway crest proposed at a level agreed with Council (8.1 mAHD) with an additional self-operating mechanical flood shutter situated at the crest to provide protection up to and above the PMF level.

Complies.

- Plant and equipment, pumps, generators, batteries (all flood proofed as necessary if relied upon for shelter in place purpose).

Plant and equipment, pumps, generators, batteries (all flood proofed as necessary if relied upon for shelter in place purpose) have proposed protection up to and above the PMF level via the use of passive bunds/crests and or self-activating mechanical floodgates.

Complies.

- Tanks, for water supplies, sewage holding, on site Detention, WSUD, liquid fuel, gas (all flood proofed as necessary relied upon for shelter in place purpose).

All proposed to have protection up to and above the PMF level via the use of passive bunds/crests and or self-activating mechanical floodgates.

Complies.

- Loading docks, solid waste facilities, garbage and recycling transfer.

Situated below the FPL as part of the basement car parking zone – protected by a passive crest to the FPL and to the PMF by a self-operating mechanical flood gate.

Complies.

- Short stay parking, taxis, deliveries, couriers etc.

Situated below the FPL as part of the basement car parking zone – protected by a passive crest to the FPL and to the PMF by a self-operating mechanical flood gate.

Complies.

- Storage and warehousing of ‘non-valuable items’ will be assessed on merit.

No uses of this nature proposed.

Complies.

C.04 Outdoor uses below the FPL may be permitted provided the design is flood risk responsive and will not unreasonably expose patrons to harm from high hazard conditions (Hazard Level H3 or greater). Development Applications for outdoor uses below the FPL must be supported by an effective Flood Emergency Response Plan and may include:

- outdoor cafes, restaurants, bars
- kiosks,
- clubs,
- display areas, and
- outdoor stages, cinemas and theatres.

An indoor/outdoor café is proposed for this development but this is situated above the FPL.

Complies.

C.05 Commercial and retail development at street level that is below the FPL within a building that occupies land subject to flooding in a PMF event may be permitted if:

- a satisfactory flood hazard and risk assessment is undertaken and appropriate flood mitigation measures are incorporated accordingly, and

A flood hazard and risk assessment has been undertaken and appropriate flood mitigation measures have been incorporated in the proposed design.

Complies.

- the development is designed to minimise damage to property and risk to life, and

Finished floor levels, internal traffic flow and a mix of passive and active flood protection has been incorporated into the proposed development to minimise damage to property and risk to life.

Complies.

- the development is not subject to or surrounded by high hazard flooding in the 1% AEP event, unless there is a flood free pedestrian access to a building (which could be another part of the same building) which is outside of the high flood risk precinct, and

The development is not subject to or surrounded by high hazard flooding in the 1% AEP event.

Complies.

- any storage of goods below the FPL is only permitted where they are protected from floods up to the FPL.

No goods storage proposed for the ground floor below the FPL. Any storage on basement levels is protected to the FPL by passive means and up to the PMF by an active flood gate.

Complies.

C.06 Commercial and retail development within a basement below the FPL is, in general, not permitted within a building that occupies land subject to flooding in a PMF event.

No commercial and retail tenancies or uses are proposed within a basement.

Complies.

C.07 Notwithstanding C.06, Council may at its discretion permit some types of commercial and retail development within a basement of a building below the FPL that occupies land subject to flooding in a PMF event if:

- a satisfactory flood hazard and risk assessment is undertaken and appropriate flood mitigation measures are incorporated, and
- occupants and visitors will not be subject to significant risk of harm caused by flooding at or near the site in a PMF event should any of the active flood barriers fail, and
- the basement is capable of withstanding riverine and overland flow PMF forces including the weight of floodwaters potentially ponding in the basement should any of the active flood barriers fail, and
- at least one access point from the basement to the shelter in place refuge is protected against a riverine PMF using passive, fail-proof barriers, and
- the Flood Emergency Response Plan:
 - i. includes the information detailed in Control C.02 in Section 9.7.4 – Flood Warning and Emergency Response Planning, and
 - ii. enables occupants and visitors of the development including those in the basement levels, to have direct flood-free access from the basement to the Shelter in place within the building that is above the PMF, and
 - iii. includes details of any physical flood exclusion measures in the development including procedures and practices for their operation, inspection and maintenance in perpetuity, and
- building access and egress does not require people to traverse hazardous floodwaters – that is Hazard Level H3 and above in the PMF, and
- any storage of goods below the FPL is only permitted where they are protected from floods up to the FPL.

No commercial and retail tenancies or uses are proposed within a basement so C.07 is not applicable to this proposal.

Complies.

9.7.4: FLOOD WARNING AND EMERGENCY RESPONSE PLANNING

Objectives

- O.01 Ensure flood warning and emergency response planning is undertaken for flood prone developments to assist in reducing risk of harm. This includes:
- Flood Emergency Response Plan (FERP)
 - Flood warning system
 - Evacuation planning (horizontal and vertical) and emergency access and Shelter In Place

A Flood Emergency Response Plan (FERP) has been included in this report. This FERP includes guidance on an on-site flood warning and evacuation process for this proposed development. **Complies.**

- O.02 To enable Shelter In Place, or vertical evacuation as an alternative to horizontal evacuation, for certain flood affected sites, enabling appropriate development to occur, while protecting occupants during floods.

The internal layout and pedestrian traffic flow has been designed to safely facilitate shelter-in-place and vertical evacuation to the first floor and higher above the PMF level. **Complies.**

- O.03 To minimise the risk to life and property for new and renewed developments in the CBD through Flood Emergency Response Plans that consider the feasibility of horizontal evacuation, appropriate vertical evacuation or shelter in place and recognise that the difficulty of evacuation and accessing the Parramatta City Centre as a whole during major floods, and the extent of the PMF from Parramatta River, means that Shelter In Place is likely to be the basis for most individual Flood Emergency Response Plans for new and renewed developments in the City Centre.

The internal layout and pedestrian traffic flow has been designed to safely facilitate shelter-in-place and vertical evacuation to the first floor and higher above the PMF level. **Complies.**

Controls

- C.01 All development involving the construction of a new building or significant alterations to an existing building, and or intensification of a use must be supported by a FERP.

A Flood Emergency Response Plan (FERP) has been included in this report. **Complies.**

-
- C.02 FERPs submitted with Development Applications must include:
- both warning and evacuation measures (horizontal or vertical) for all building occupants (residents, workers and visitors) that includes the most appropriate 'safe areas' and 'safe evacuation routes';

This has been included in Section 4.3.2.8.
Complies.
 - measures to prevent evacuation from the site by private vehicle;

This has been included in Section 4.3.2.8.
Complies.
 - the most appropriate emergency response for flood and fire events that occur together;

Directions on evacuation to higher ground in the rare event of simultaneous Flood and Fire at the building are outlined in Section 4.4.4.
Complies.
 - a building flood emergency response plan, similar to a building fire evacuation drill, and measures to ensure this is tested at least annually;

This plan and directions on the maintenance of this plan are detailed in Sections 4.4.2 and 4.4.3.
Complies.
 - a statement about the consistency of the submitted FERP with the FERP for the Parramatta City Centre; and

The FERP submitted for this development has been developed in keeping with the desired flood emergency response for the riverine flood liable Parramatta CBD in that it prioritises shelter-in-place so as to reduce the likelihood of deaths caused by pedestrians and vehicles entering floodwaters in the process of evacuation.
Complies.
 - evidence of consultation undertaken with relevant state and local agencies in the preparation of the FERP.

As a designated low flood risk site, this site specific FERP is based on sound principles and in compliance with Council policy. This FERP can then be reviewed by agencies if such review is deemed to be required by Council. This is believed to be a sensible approach based on the Writer's experience dealing with the NSW SES and their ability to comment on site-specific FERPs developed for sites of similar flood affectation.

- C.03 Horizontal evacuation measures are preferred for all building occupants (residents, workers and visitors) where the following can be satisfied:
- a) Pedestrians can evacuate safely from a building via a flood free pedestrian access on a 'rising road' to an area of refuge located above the PMF. The evacuation pathway must not require passage through deepening or high hazard (H3 to H6) floodwaters.
 - b) A pedestrian exit from a building is provided above the PMF that is accessible internally to all occupants.
 - c) Address requirements for accessibility and be available for all occupants (where possible)
 - d) If feasible and beneficial, provide a link to a neighbouring building by means of an internal access or a bridge, connecting buildings and leading occupants to an exit above the PMF.
 - e) Not rely on lifts, elevators etc.
 - f) Address access into the property during floods by Emergency Services such as SES, Ambulance, Fire and Rescue.

Accessible internal horizontal and vertical evacuation pathways have been outlined in Section 4.3.2.8. Shelter in Place on Level 1 and above, elevated higher than the PMF, is the preferred approach given the site lies within the Parramatta River PMF extent.

Emergency services access is provided above the 1% AEP flood level at the site's Phillip St entrance.

Complies.

- C.04 Where horizontal evacuation is not feasible, Shelter In Place or vertical evacuation must be provided for all building occupants (residents, workers and visitors) that offers access to a safe indoor area of refuge or 'shelter in place' above the PMF where they can remain until the flood event has passed and any subsequent disruption after the flood has been rendered safe and serviceable.

Ample shelter-in-place refuge space has been incorporated in the proposed design.

Complies.

- C.05 Shelter In Place or vertical evacuation measures must satisfy the following requirements:
- a) Refuge shelters must be adequate and fit for purpose (size, design, equipment, supplies) and maintained as such in perpetuity.

Ample shelter-in-place refuge space has been incorporated in the proposed design.
Complies.

- b) Unless otherwise advised by Council, facilities must be designed for a refuge stay of at least 72 hours, with longer time periods addressed in design, equipment and provisioning.

The PMF inundation duration at this location has been identified as being between 3-5 hours in a report prepared for Council by Molino Stewart. GRC has conservatively assessed that the proposed development's ground floor may be inundated for approximately 6 hours. Provision has been made to support shelter-in-place for 7 hours.
Complies.

- c) It is recommended, and may in some cases be required, that large and high-rise residential buildings be provided with emergency back-up power, water supply and sewerage for all residential units and common facilities including lifts. This must be provided in the context of an overarching Emergency Response Plan that includes flooding, power outages, extreme weather events and other incidents.

Emergency back-up power, water supply and sewerage for all residential units and common facilities including lifts will be incorporated into the proposed development.
Complies.

- d) Where the building design and back-up systems enable some residents to safely remain in their own apartments for extended periods during floods, all such residents must still have access to a communal refuge area of adequate size where support from other residents and emergency supplies are available.

The communal safe area of refuge must be permanently provided with as a minimum:

- o emergency electricity supply, and lighting,
- o clean water for drinking, washing and toilet flushing,
- o working bathroom and toilets,
- o suitable food,
- o personal washing facilities,
- o medical equipment including a first aid kit, and
- o a battery-powered radio and relevant communications equipment.

Provision of all of the above has been accounted for either in the proposed development or as directed by the Flood Emergency Response Plan.
Complies

- C.06 Requirements for the communal safe area of refuge must be detailed in the Flood Emergency Response Plan supporting the DA and must address:
- a) Numbers of people likely to need the facility and consequent size, equipment and provisioning requirements.
 - b) Means to ensure ongoing services such as power, water and wastewater disposal, communications.
 - c) Long term maintenance as part of the building management system.
 - d) Dual use of the refuge area for other non-emergency communal functions (if practical).

All of the above have been accounted for and discussed in Section 4.

Complies

-
- C.07 All safe areas of refuge (residents own apartment or a communal area) must have:
- a) fail safe access to the safe area of refuge from anywhere in the building including the basement (lift access is not allowed) that is protected from floodwaters up to the PMF by suitable flood doors, flood gates and the like; and

Flood gates and doors will shut off ground floor flood egress to the basement. This will preserve the stairwell connection between the basement and all levels aside from the ground floor during a flood emergency. Back-up power will result in the ongoing operation of lifts during a flood emergency. This will help facilitate the interior flow of occupants inside the building above Level 1 (the lowest point of safe refuge above the PMF).

Complies

- b) fail safe access to an exit/entry point located above the 1% AEP flood level plus 0.5m freeboard that enables people to exit the building during a fire and/or flood, and allows emergency service personnel to enter a building to attend to a medical emergency.

Both buildings can enable people and emergency personnel to connect with the Level 1 (and above) refuge area and the designated emergency access point on Phillip St and do so by remaining above the flood planning level (1% AEP flood level plus 0.5m freeboard).

Complies

6. Summary

Development is proposed at 110 George Street and GRC Hydro have carried out a detailed flood assessment documented herein.

The site whilst being on the southern floodplain of the Parramatta River is not flood liable due to mainstream flooding in the 1% AEP event. In a PMF event, the Parramatta River level is predicted to be 11.7 mAHd at the subject site with a flood depth of approximately 4 m on George Street adjacent to the subject site.

Overland flow flooding, minor in nature and low hazard, does impact George and Phillip Streets which lie south and north of the subject site respectively. 1% AEP flood liability is marginal with shallow depths in the roadways of less than 0.3 m in most cases.

The proposed ground floor levels for both buildings are compliant with the relevant flood planning controls as outlined in Council's DCP, as are the proposed passive and active flood protection measures to protect the basement from flooding up to the PMF level. As articulated herein, the works as proposed comply with all Council requirements with respect to flooding. Most notably:

- The development's proposed driveway crest is set at an elevation of 8.1 mAHd (as agreed with Council) and includes an active flood shutter for further flood protection up to and including the PMF level;
- The ground floor commercial and retail tenancies on the development's Phillip and George Street frontages are compliant with Council's DCP as per Section 9.7.2, C0.5;
- Ample refuge space above the PMF level has been integrated into the proposed design, as has back-up power, water and supplies in the event of a flood emergency;
- The development achieves the flood-related objectives and requirements of the LEP and DCP, as articulated in Section 5; and
- A flood emergency response plan has been prepared for the site.

The subject site for the proposed works is not overly flood prone except in the rarest of events and flood risk at the site can be managed by the use of appropriately elevated entrance levels, flood control structures (gates etc) and a strategy of evacuation in place as detailed in the enclosed FERP.

Yours Sincerely



Stephen Gray
Director