infrastructure & development consulting

Westfield Penrith Living Centre

Flood Management Report

20 April 2021

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1 Introduction

This Flood Management Plan has been prepared by infrastructure & development consulting to support the Planning Proposal for Penrith Westfield Living Centre. It reviews previous flood studies, outlines the flooding conditions (both local and regional) expected on site and presents a high-level flood management plan that demonstrates that the development proposal can be safely managed during extreme flooding events.

It is not intended to be a detailed Flood Emergency Response Plan (FERP), but provide a high-level assessment this is expected to be confirmed and expanded upon at future, more detailed design phases.

2 Site Description & Proposed Works

The subject site is located directly to the south of the Penrith Train Station. It lies between Jane, Station, Henry and Reilly Streets just to the east of the existing Westfield Penrith building. It is shown in Figure 1 below.

Figure 1 - The Subject Site

The proposal includes the redevelopment of the site, into Penrith Westfield Living Centre which includes new retail/commercial facilities at Borec House and The Hub which includes Food & Beverage, Retail and Co-Working and Hotel spaces. In addition to this the development proposal includes public realm and pedestrian connectivity improvements.

Figure 2 - The Development Proposal

The proposal includes one level of basement at RL. 24.10 (AHD), Ground Floor level of approximately RL. 27.25 (AHD) as shown below.

Figure 3 – The Hub Development Site Cross Section

3 Water Sensitive Urban Design

It is anticipated that the site finishes and surface treatments will consist mainly of roofed and paved surfaces at ground level. Whilst the concept designs for Water Sensitive Urban Design (WSUD) will be undertaken in future, it is likely that the treatment train will include rainwater re-use (using BASIX as a minimum standard), passive irrigation/tree pits and gross pollutant trap/s where needed.

This will be confirmed with MUSIC modelling once future concept designs of surface finishes, landscape, etc. have rogressed.

4 Site Flooding Conditions

The Site is subject to flooding in both the localised catchment flood event and the Regional Hawkesbury Nepean River event. Generally speaking, the localised PMF flood has a faster rate of rise, shorter warning time, lower flood level and lower duration of inundation when compared to the regional flooding. These flood events are discussed in more detail below.

4.1 Local Flooding

The localised flooding is caused from runoff from the mostly urbanised catchment to the east and south of the Site. This catchment is shown in Figure 4 below.

Figure 4 - Localised Flooding Catchment

Source - Molino Stewart (2020)

The 2020 Molino Stewart Penrith CBD Floodplain Risk Management Study and Plan has analysed this flooding, with some of the key information shown below. This confirms that the site is NOT affected by localised flooding for events up to and including the 0.5% AEP flood event (Figure 6).

It does confirm that the site is subject to flooding in the PMF event. This inundation, at it's worst is approximately 1.2m deep (Figure 7) in Station St with a peak level of approximately RL. 28.20 (AHD) and has a duration in the order of 60 to 90 minutes (Table 1).

Figure 5 - Road Inundation Locations

Source - Molino Stewart (2020)

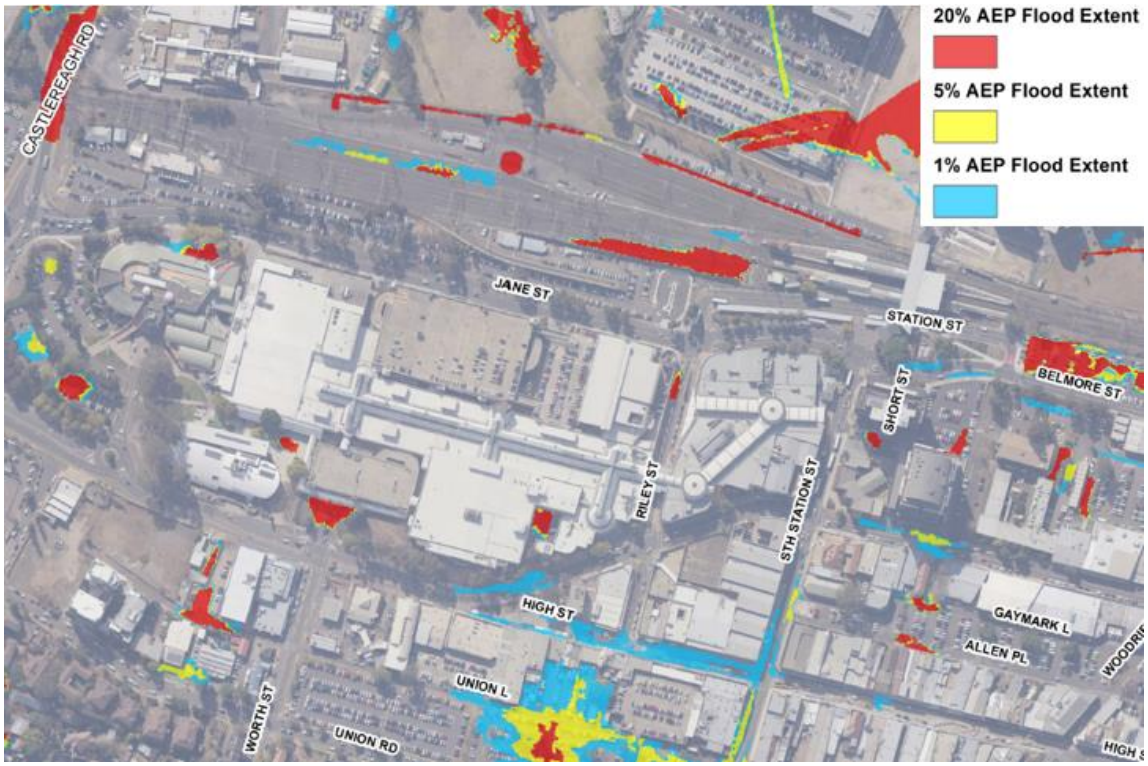
Table 1 - Road Inundation Duration

	Duration of Flooding Hazard > 2 (i.e. unsafe for small vehicles) (Hours)				
Id Number	**PMF**	**0.5% AEP**	**1% AEP**	**5% AEP**	**20% AEP**
23	***1***	***0***	***0***	***0***	***0***
24	***1.5***	***0***	***0***	***0***	***0***
25	2	0	0	0	0
43	3	0	0	0	0
58	0.5	0	0	0	0
59	2.5	0	0	0	0
60	***2***	***0***	***0***	***0***	***0***
61	***1***	***0***	***0***	***0***	***0***

Source - Molino Stewart (2020)

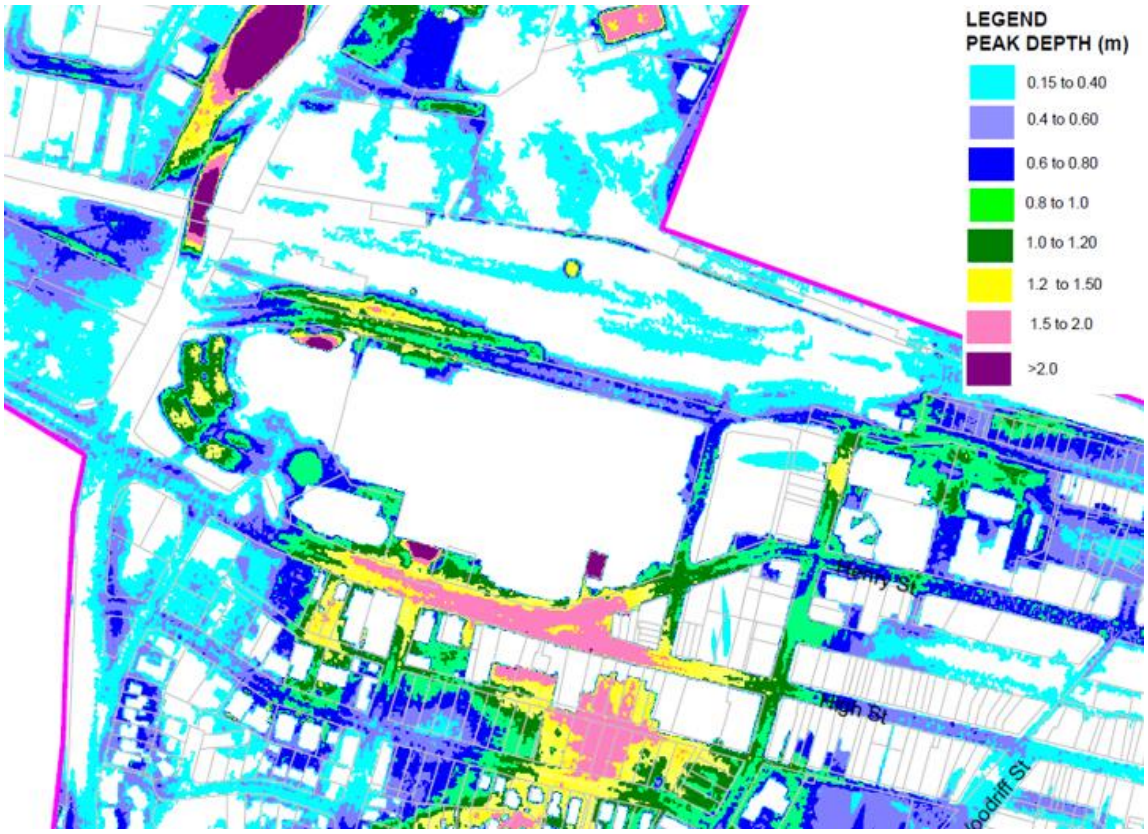
Key locations are shown in ***bold italics***.

Figure 6 - Flood Inundation in the Vicinity of the Site



Source - Molino Stewart (2020)

Figure 7 – PMF Flood Depths in the Vicinity of the Site



Source - Molino Stewart (2020)

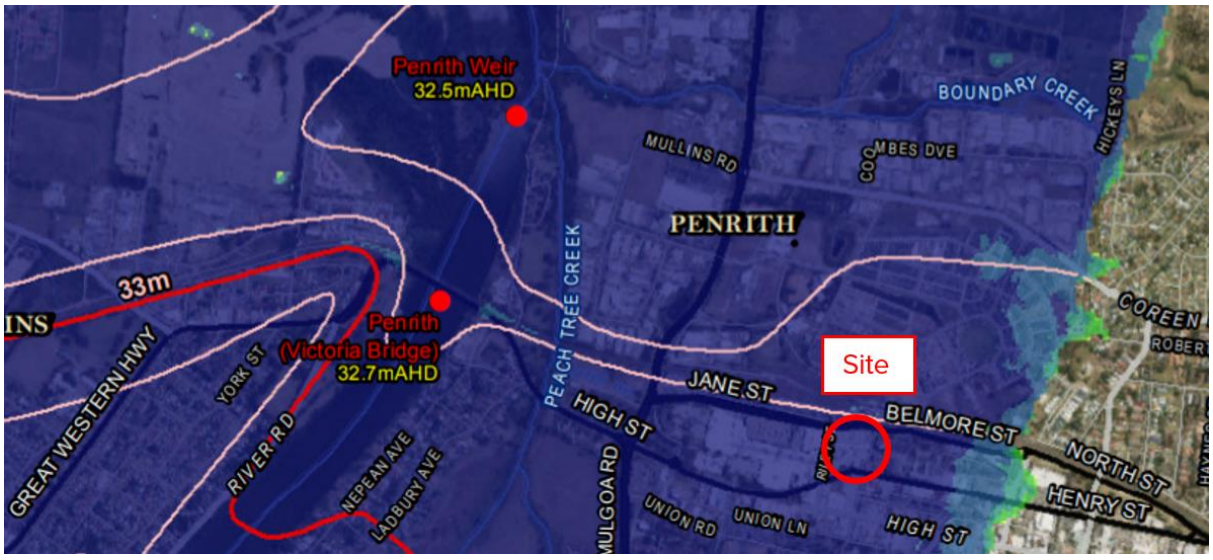
4.2 Regional Flooding

In 2019, WMA Water completed the Hawkesbury-Nepean River Regional Flood Study for Infrastructure NSW which covers the Site. This study confirms that the Site is not affected by the regional 1 in 100 chance per year flood event, but that it is affected in the PMF.

Figure 8 below shows that the PMF Flood Level applicable to the site is in the order of RL. 32.7 AHD. This is considerably higher than the local PMF flood level (RL. 28.2 AHD). They key regional PMF attributes are shown in Table 2, Table 3 and Table 4 below. Although no specific data is presented for the PMF event, we can use this information to provide estimates for key flooding information.

These indicate that the rate of rise of flood waters would be in the order of 0.5m/hr, the time to rise 20 hours and time above critical level 60 hours. Please note that these numbers are intended to provide an indication of the flood behaviour and not precise values.

Figure 8 - Regional PMF Flooding



Source – WMA Water/Infrastructure NSW (2019)

Table 2 - Rate of Water Rise

Location	Rate of rise (m/hour)																	
	1 in 20 AEP			1 in 50 AEP			1 in 100 AEP			1 in 200 AEP			1 in 500 AEP			1 in 1000 AEP		
	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th
Spencer	NA	NA	NA	NA	NA	NA	0.019	0.045	0.061	0.029	0.056	0.073	0.029	0.060	0.47	0.029	0.063	0.44
Gunderman - Singletons Mill	NA	NA	NA	0.068	0.12	0.19	0.076	0.15	0.33	0.079	0.17	0.37	0.081	0.19	0.45	0.082	0.20	0.50
Wisemans Ferry	0.058	0.086	0.16	0.073	0.14	0.30	0.075	0.16	0.38	0.082	0.18	0.45	0.089	0.19	0.48	0.095	0.20	0.50
Leets Vale	NA	NA	NA	0.13	0.20	0.36	0.14	0.22	0.42	0.16	0.26	0.48	0.16	0.29	0.54	0.17	0.32	0.59
Lower Portland	NA	NA	NA	0.16	0.24	0.41	0.18	0.27	0.49	0.21	0.31	0.55	0.21	0.34	0.62	0.21	0.36	0.68
Sackville	0.13	0.20	0.26	0.19	0.28	0.42	0.22	0.33	0.48	0.23	0.34	0.55	0.25	0.36	0.61	0.25	0.39	0.66
Ebenezer	0.19	0.27	0.37	0.24	0.33	0.48	0.27	0.39	0.55	0.28	0.41	0.60	0.28	0.42	0.64	0.27	0.45	0.66
Cattai Creek / Gronos Point	0.18	0.26	0.35	0.25	0.34	0.49	0.28	0.39	0.56	0.29	0.42	0.61	0.29	0.43	0.65	0.29	0.46	0.68
South Creek at Richmond Road	NA	NA	NA	0.16	0.21	0.29	0.17	0.23	0.32	0.18	0.25	0.35	0.19	0.26	0.37	0.20	0.27	0.38
Windsor	NA	NA	NA	0.23	0.33	0.46	0.26	0.37	0.53	0.28	0.40	0.57	0.30	0.42	0.61	0.31	0.44	0.65
Rickabys Creek at Blacktown Road	NA	NA	NA	0.16	0.21	0.29	0.18	0.24	0.33	0.19	0.26	0.35	0.19	0.26	0.38	0.20	0.27	0.39
North Richmond	NA	NA	NA	0.24	0.36	0.55	0.29	0.42	0.74	0.30	0.46	0.81	0.33	0.49	0.86	0.34	0.51	0.93
Yarramundi Bridge	NA	NA	NA	0.27	0.43	0.77	0.30	0.49	0.89	0.32	0.54	0.93	0.34	0.56	0.98	0.35	0.57	1.08
Penrith	NA	NA	NA	0.17	0.26	0.45	0.18	0.30	0.49	0.19	0.36	0.51	0.20	0.34	0.58	0.20	0.34	0.58
Blaxlands Crossing	NA	NA	NA	0.31	0.54	0.82	0.35	0.64	1.05	0.36	0.76	1.16	0.39	0.75	1.21	0.42	0.84	1.24
Bents Basin	NA	NA	NA	NA	NA	NA	0.27	0.45	0.64	0.28	0.52	0.75	0.30	0.58	0.85	0.31	0.63	0.91

Source – WMA Water/Infrastructure NSW (2019)

Table 3 - Time to Rise (hours)

Location	Time to rise (hour)																	
	1 in 20 AEP			1 in 50 AEP			1 in 100 AEP			1 in 200 AEP			1 in 500 AEP			1 in 1000 AEP		
	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th
Spencer	NA	NA	NA	NA	NA	NA	12.07	16.84	37.25	9.10	12.58	23.72	1.05	11.65	24.39	1.51	11.07	24.52
Gunderman - Singletons Mill	NA	NA	NA	10.58	17.71	29.43	6.04	13.46	26.50	5.48	11.49	25.35	4.41	10.68	24.68	3.96	10.14	24.39
Wisemans Ferry	12.07	22.94	34.33	6.58	14.53	27.49	5.22	12.75	26.96	4.44	11.20	24.03	4.10	10.32	22.88	4.12	10.02	20.59
Leets Vale	NA	NA	NA	14.09	25.38	37.74	11.81	22.46	35.14	10.35	19.17	31.58	9.32	17.06	31.74	8.41	15.65	29.68
Lower Portland	NA	NA	NA	17.21	29.28	42.91	14.33	25.65	38.09	12.90	23.03	34.04	11.37	20.37	33.14	10.12	19.38	32.71
Sackville	30.67	40.73	59.50	19.30	28.48	41.52	16.53	24.59	36.89	14.66	23.65	34.25	13.24	22.15	32.25	12.13	20.82	31.59
Ebenezer	26.87	37.11	53.87	20.64	29.95	42.42	18.17	25.99	37.58	16.82	24.16	35.88	15.54	23.58	35.43	15.29	22.18	36.81
Cattai Creek/Gronos Point	31.38	43.00	60.38	22.35	32.05	44.73	19.68	28.16	39.72	18.03	26.25	37.80	16.95	25.47	38.02	16.17	24.03	37.96
South Creek at Richmond Road	NA	NA	NA	35.08	47.73	61.96	31.26	42.95	57.35	28.91	39.91	54.13	27.03	38.77	53.87	26.46	37.37	50.89
Windsor	NA	NA	NA	21.77	30.34	43.14	18.99	26.83	38.71	17.46	24.81	36.12	16.40	23.59	33.42	15.47	23.05	32.84
Rickabys Creek at Blacktown Road	NA	NA	NA	34.09	46.85	61.08	30.53	42.17	56.52	28.24	39.20	53.54	26.39	38.17	53.45	25.96	36.85	50.46
North Richmond	NA	NA	NA	20.13	30.89	46.00	14.94	26.56	38.52	13.61	24.19	36.11	12.85	22.36	33.15	11.86	21.75	32.32
Yarramundi Bridge	NA	NA	NA	14.42	25.82	40.62	12.47	22.66	36.28	11.70	20.41	34.90	11.20	19.65	32.52	10.27	19.42	31.27
Penrith	NA	NA	NA	15.48	26.84	41.98	14.19	23.93	38.04	13.85	19.45	36.62	12.13	20.86	34.80	11.83	20.90	34.99
Blaxlands Crossing	NA	NA	NA	13.34	20.34	35.00	10.43	17.16	31.06	9.52	14.57	30.86	9.11	14.86	28.33	8.91	13.08	26.25
Bents Basin	NA	NA	NA	NA	NA	NA	15.62	22.26	37.16	13.34	19.58	36.42	11.77	17.18	33.11	10.98	15.69	32.48

Source – WMA Water/Infrastructure NSW (2019)

Table 4 - Time Above Critical Level (Hours)

Location	Time above critical level (hour)																	
	1 in 20 AEP			1 in 50 AEP			1 in 100 AEP			1 in 200 AEP			1 in 500 AEP			1 in 1000 AEP		
	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th	10th	50th	90th
Spencer	NA	NA	NA	NA	NA	NA	4.83	17.47	33.17	19.07	35.60	49.08	29.08	43.51	61.53	33.47	53.12	65.25
Gunderman - Singletons Mill	NA	NA	NA	20.66	30.42	40.91	34.97	47.18	60.33	42.66	56.29	70.75	43.47	62.53	80.49	49.77	67.56	85.06
Wisemans Ferry	25.19	31.65	39.69	44.70	56.27	67.18	54.71	67.34	81.67	59.09	73.34	89.35	61.35	80.12	97.37	68.58	83.45	101.51
Leets Vale	NA	NA	NA	27.14	37.06	44.49	40.65	52.35	63.06	46.56	60.34	73.33	47.65	66.31	84.42	54.86	72.73	89.28
Lower Portland	NA	NA	NA	22.99	32.22	38.99	38.29	49.41	59.02	43.99	58.17	70.00	46.21	64.37	82.00	53.48	70.35	86.93
Sackville	4.79	7.54	10.65	42.16	45.98	55.03	53.61	58.57	69.23	61.27	68.82	80.94	67.53	79.51	92.90	73.60	86.12	101.19
Ebenezer	20.00	22.75	29.51	46.13	50.49	61.27	56.48	61.91	73.74	64.87	71.78	85.28	74.28	83.32	96.50	77.85	89.65	104.04
Cattai Creek/Gronos Point	9.27	11.84	16.22	42.15	46.15	56.29	52.84	58.08	69.38	61.47	68.10	81.16	71.01	79.67	92.57	74.47	85.96	100.33
South Creek at Richmond Road	NA	NA	NA	36.57	40.10	49.25	48.10	52.99	63.61	57.10	63.36	75.66	66.74	74.87	87.32	70.25	81.37	95.80
Windsor	NA	NA	NA	36.82	40.39	49.58	48.25	53.17	63.80	57.21	63.52	75.88	66.79	74.99	87.52	70.31	81.49	95.97
Rickabys Creek at Blacktown Road	NA	NA	NA	37.51	41.18	50.43	48.83	53.82	64.49	57.68	64.05	76.57	67.23	75.52	88.10	70.84	81.99	96.48
North Richmond	NA	NA	NA	24.57	26.91	33.00	41.39	45.06	52.16	51.07	56.50	65.97	60.93	67.81	79.52	64.84	74.77	87.84
Yarramundi Bridge	NA	NA	NA	21.05	25.61	30.83	37.70	42.20	49.11	47.48	53.41	63.69	57.00	64.45	77.29	60.98	71.53	85.95
Penrith	NA	NA	NA	17.51	21.44	27.29	28.52	32.40	42.31	34.79	40.20	52.97	41.79	48.93	63.60	44.43	54.32	65.78
Blaxlands Crossing	NA	NA	NA	23.02	26.98	36.47	30.75	35.29	48.76	35.85	41.46	56.05	41.31	49.91	62.56	44.18	53.84	66.21
Bents Basin	NA	NA	NA	NA	NA	NA	17.04	19.54	25.50	24.10	27.59	37.91	31.04	35.88	46.04	34.77	40.99	51.36

Source – WMA Water/Infrastructure NSW (2019)

Table 5 – Flooding Summary

Flood Event	PMF Flood Level RL (AHD)	PMF Flood Depth at Station Street RL (AHD)	Duration Above Critical Level (Hours)	Rate of Rise (m/hour)
Localised Flood	28.20	1.20	1.5	unknown
Regional Flood	32.70	5.70	60+	0.5

Approximate Values from Literature Reviews

5 Flood Management Plan

This Section of the report outlines the strategies recommended to be employed during flooding events to safely evacuate the public to safety. It does not go into detailed evacuation plans, which are expected to be produced in future, more detailed applications once designs have progress further.

Although this part of the report is mainly focused on safe evacuation from the centre, thought should be given to basement entry points to ensure that they are as high as practical to maximise the time until flood waters begin to enter the basement.

5.1 Flood Watch

In the first instance, the centre team should carry out flood monitoring via the Bureau of Meteorology (BoM) website and ABC weather broadcasts.

5.2 Flood Warning

The facilities team are to be placed on alert for all emergency call outs, security team briefed on all vehicular/pedestrian entry closures.

The Centre Manager, Facilities Manager and Risk/Security Manager to consider discussing closure of the basement car park and de-energise switchboards in affected areas.

All teams briefed on full alert for emergency installation if key flood levels are breached. Increased security patrols and facilities patrols required of basement entry ramps and constant monitoring of ABC weather and BoM Flood Watch website.

5.3 Flood Warning Systems

It is expected that the following measures will be implemented to issue flood and evacuation orders:

- TV news broadcasts and screen crawlers
- Radio bulletins via commercial and community radio stations
- Fax/E-mail to targeted audiences who are registered with emergency data bases
- Automatic telephone dialling with pre-recorded messages
- Local Wardens
- Public Address Systems
- Door knocking
- Any other viable warning system.

Further detailed flood warnings are contained in the SES Sydney Western Region Flood Plan.

5.4 Evacuation Considerations

Importantly, both the local and regional 1% AEP flood events do not impact on the site. However, the local and Regional PMF events cause flooding that will inundate the basement and in the case of the regional PMF, the first floor.

5.4.1 Localised PMF Flood

As outlined above, the localised PMF is a relatively short, sharp event with little warning time and a duration of inundation of approximately 60 to 90 minutes. In addition to this it is possible that a

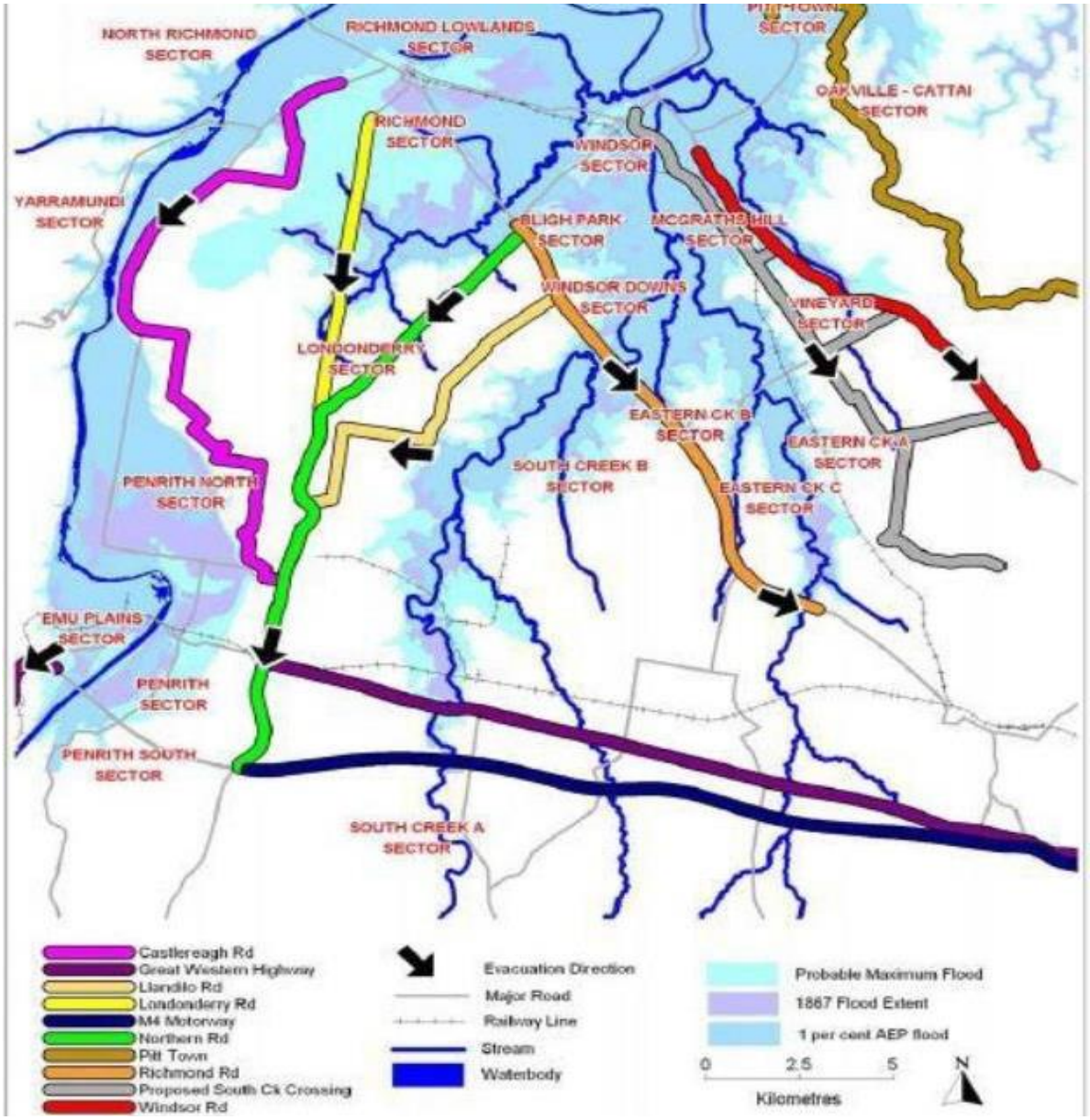
vehicle that is able to safely exit the site could be trapped in rapidly rising flood waters in the surrounding road network. It is therefore proposed at this stage, that the strategy be to remain in place and wait for waters to recede before safely evacuating the site.

5.4.2 Regional PMF Flooding

In contrast, the regional PMF flood event is slowly rising (from the Nepean River to the West) and considerably higher than the localised event. There will be adequate time to prepare and evacuate people from the site in advance of floodwaters and vehicles that exit the site will be able to safely navigate to high ground.

Based on the local topography and need for a continually rising evacuation route, it is recommended that all evacuation occur along Henry Street to the east to higher ground. Once here evacuated people should follow the regional evacuation advice as per Figure 9 below.

Figure 9 - Regional Evacuation Routes



We anticipate that once concept designs are progressed in future stages of the project, that more detail will be provided on this plan, in particular at Development Application phase. This will include:

- Key Centre Contacts & Roles and Responsibilities
- Flood depths at which:
    - basement access and egress will be locked
    - entry to the site will be locked
    - initial flood warnings will be issued
    - evacuation orders provided
- The viability of structural measures, such as hydraulic flood gates to prevent waters from entering the basement
- Detailed hydraulic hazard analyses of evacuation routes
- Location of entry ramps, fire egress doors, etc.
- Detailed evacuation route mapping

To illustrate this and provide relevant information related to the existing centre to the west, a copy of it's current Flood management Plan is Appended to this report.

Appendix A

Penrith Westfield Flood Emergency Response Plan