

15 Feb 2022

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Sent via email

## Modification 7 Precinct Village and Carpark (SSD-9835-Mod-7)

### Technical Note on Flooding in Response to DPE Comments

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This technical addresses the comments provided by the Department of Planning and Environment (DPE) to the Response to Submissions (RtS) for Modification 7 of SSD 9835. The flooding related comments made by the DPE are replicated below:

#### ***Flooding considerations***

EES has reviewed the revised information regarding flooding assessment and considers that RtS has not adequately addressed all of the flooding considerations raised in EES' submission, dated 18 November 2021 (ref: DOC21/992934). EES notes that:

- the figures in Appendix G of the RtS need titles and it is not clear what they represent
- there are only three figures presented in Appendix G, presumably showing hazard. The RtS states afflux figures were provided, but they are not available at Appendix G. Figures as per the original report should be updated, including depth/level and afflux
- the RtS does not demonstrate that "no worsening of hazard on the central driveway" has been achieved, but in fact indicates the opposite. EES therefore strongly recommends that clear documentation is provided to justify this conclusion.

EES does not agree that the required design solutions to manage and mitigate the impacts of flooding should be delayed until the detailed design of the proposal is finalised.

It is standard practice to provide evidence that the design solution achieves the required objectives. EES considers that an updated report should be produced, documenting the new design solution, and including updated figures, is required to appropriately assess the potential for and severity of flood impacts.

EES does support the deletion of flood gates from the proposal and notes this will provide a significantly improved outcome.

## 1.0 Responses to DPE Comments

- the figures in Appendix G of the RtS need titles and it is not clear what they represent

Additional figures have been presented throughout this report, that supersede those in Appendix G of the RtS. These figures each have a title to show what the figure represents.

- there are only three figures presented in Appendix G, presumably showing hazard. The RtS states afflux figures were provided, but they are not available at Appendix G. Figures as per the original report should be updated, including depth/level and afflux

Additional figures have been included in section 4.0 that show flood levels, depths, hazard and afflux associated with the proposed development.

- the RtS does not demonstrate that “no worsening of hazard on the central driveway” has been achieved, but in fact indicates the opposite. EES therefore strongly recommends that clear documentation is provided to justify this conclusion.

Section 4.0 confirms that the hazard across the precinct is similar to the existing condition, with a slight improvement in hazard along the central driveway in the 5% and 1% AEP events.

EES does not agree that the required design solutions to manage and mitigate the impacts of flooding should be delayed until the detailed design of the proposal is finalised.

It is standard practice to provide evidence that the design solution achieves the required objectives. EES considers that an updated report should be produced, documenting the new design solution, and including updated figures, is required to appropriately assess the potential for and severity of flood impacts.

Section 4.0 provides details of the proposed flood mitigation design solution and confirms that there are no significant impacts associated with the development. Additional figures have also been incorporated throughout this report to show the existing and proposed flooding together with any impact associated with the development.

EES does support the deletion of flood gates from the proposal and notes this will provide a significantly improved outcome.

Section 4.0 confirms that flood gates have now been removed from the proposed flood mitigation measures with floor levels and basement crest levels amended to achieve the required Flood Planning Levels.

## 2.0 Existing Flooding

The development site is located within the Centennial Park Catchment, and City of Sydney Council have completed the Centennial Park Catchment Flood Study and Centennial Park Floodplain Risk Management Plan and Study (WMA 2016).

A flood study was completed for Stage 1 of SFS; Stormwater and Flooding Assessment Rev.3 Arup 2018, and a subsequent Stage 2 study for the SFS; Sydney Football Stadium Redevelopment Stormwater Management Plan (SWMP), Aurecon 2019.

A flood study was also completed for the proposed Precinct Village and Car Park development which was approved under the SSDA : Precinct Village and Car Park (MOD 7) Stormwater and Flooding Assessment (Arup 2021). This flood study and model was provided to TTW and used as the basis for developing the detailed design of the flood mitigation for the development.

TTW have been provided with both the CoS original Flood Study and the Arup 2021 Precinct and Car Park. The flood modelling presented in this report is based on the progression of the above flood studies with following three scenarios represented:

- **Existing City of Sydney Flood Study**

Flood modelling prior to the development of the Rugby Union, Rugby League and SFS developments. (*WMA 2016 Study*)

- **Updated Existing SFS Flood Study**

This modelling is based on the original CoS study but also includes the Rugby Union, Rugby League and SFS developments and detailed site features (*Aurecon 2019 study, updated for the Arup 2021 study*). This is the base case model that was used for flood impact assessment in the Concept Flood strategy for this development (*Arup 2021 Study*).

- **Updated Precinct Village Flood Study**

This modelling is based on the Arup 2021 concept flood study but also includes the latest concept Precinct Village and Carpark Development proposals and refined flood mitigation measures as outlined in this report.

For the pre-development and post-development flood impact associated with the Precinct Village and Car Park, the base case scenario used is the Updated Existing SFS Flood Study results which includes the Rugby Union, Rugby League and SFS developments, as used as the base case scenario in the Arup 2021 Study.

### 1.1 Existing CoS Flood Study Results

The flood results completed for the CoS Centennial Park Flood Study show that overland from the upstream catchment flows toward the low point of Moore Park Road, north of the proposed western car park. A ridge of trees on between Moore Park Road and the development site reduces the overland flow entering the car parks, but this ridge line is overtopped in the 20-year flood and above. The existing CoS flood study also shows flow through the UTS/Rugby Australia building and the Rugby League building as these buildings were not completed prior to CoS flood study, refer to figure 1 for the 1% AEP flood extent and figure 2 for the PMF flood extent.



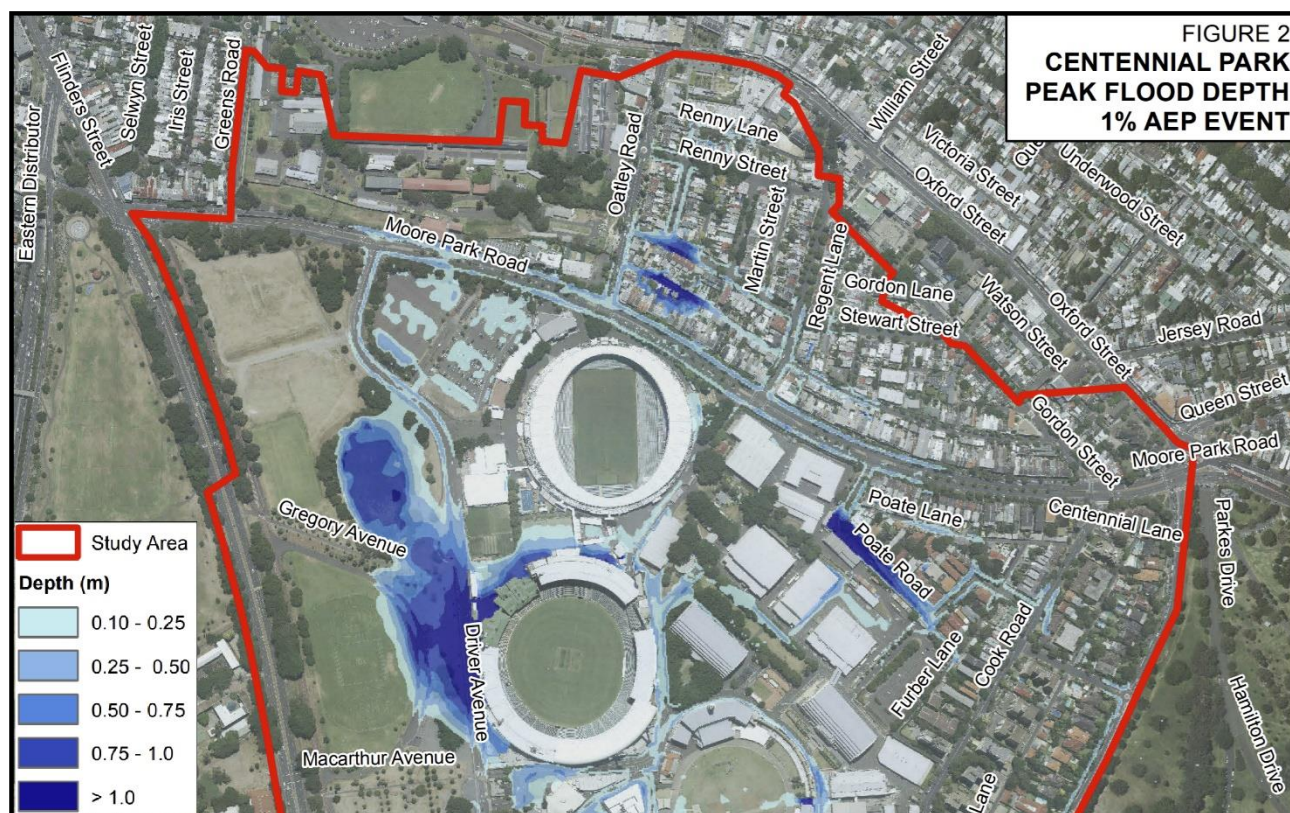


Figure 1. 1% AEP Flood Extent (Extract of CoS Flood Study) - Depths below 100mm not shown.

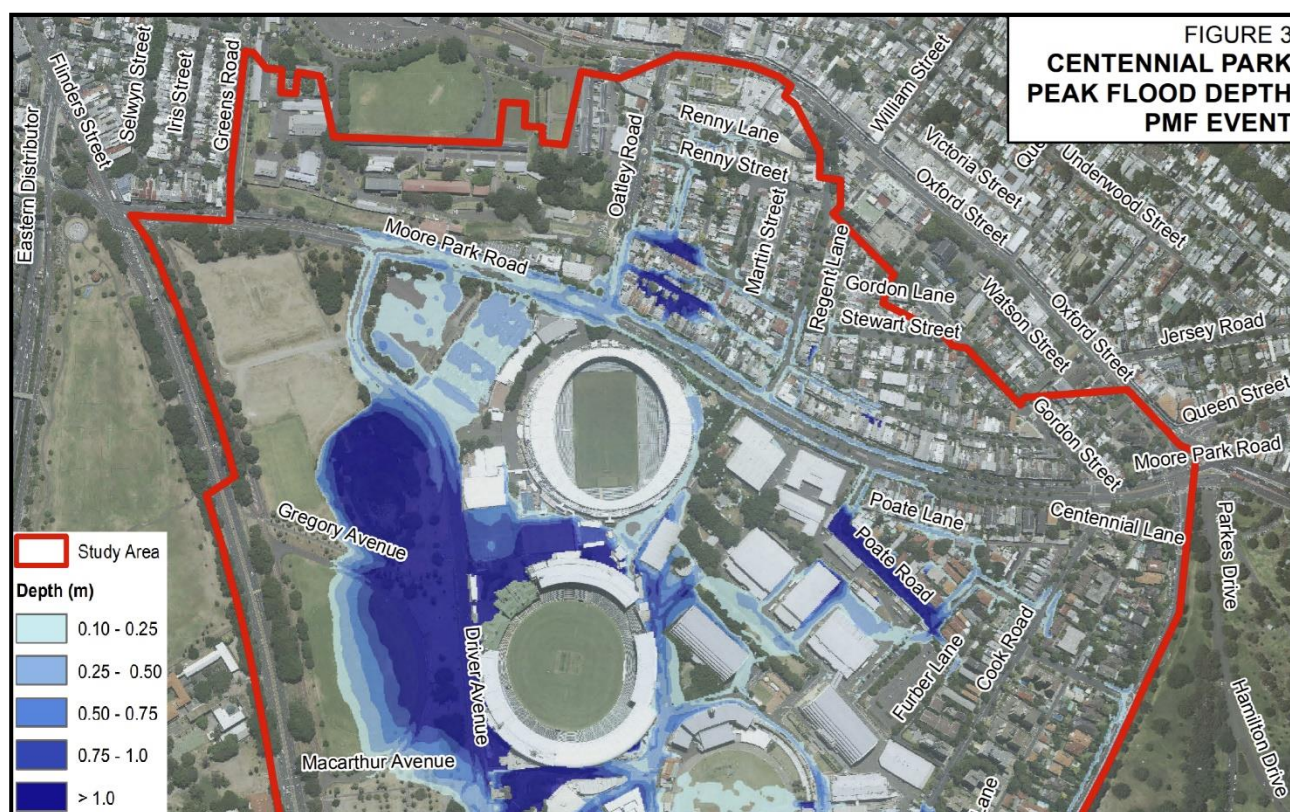


Figure 2. PMF Flood Extent (Extract of CoS Flood Study) - Depths below 100mm not shown.



## 1.2 Updated Existing SFS Flood Study

Flood modelling was completed for the SFS *Sydney Football Stadium Redevelopment Stormwater Management Plan (SWMP)*, Aurecon 2019. This modelling was based on the original CoS Centennial Park Flood model, with updates to the model including the UTS/Australian Rugby building, the National Rugby League building and the Sydney Football Stadium development.

The report concluded that:

*“...changes to the site as a result of the football stadium redevelopment, has not demonstrated significant additional flood risks to the SCGT precinct and very minimal changes to the existing case hydraulic behaviour of the area. There has been no worsening to the upstream and downstream catchments or adjacent properties”*

The report confirmed that there are slight increases in flood levels of up to 50mm on both Moore Park Road and Driver Avenue and that there was no impact to existing private properties.

The flood modelling results following the SFS development (with inclusion of the Australia Rugby and Rugby League building) for the 5% AEP, 1% AEP and PMF events are shown in Figures 3, 4 and 5 respectively. Flood Hazard results for the same events are shown in figures 6, 7 and 8.

The flood results show that there is greater ponding in Moore Park Road due to the UTS/Rugby Australia building blocking overland flow from entering the on-grade carpark. The results also show that overland flow enters the Rugby League building basement ramp the south of the development site in the 5%, 1% and PMF events.



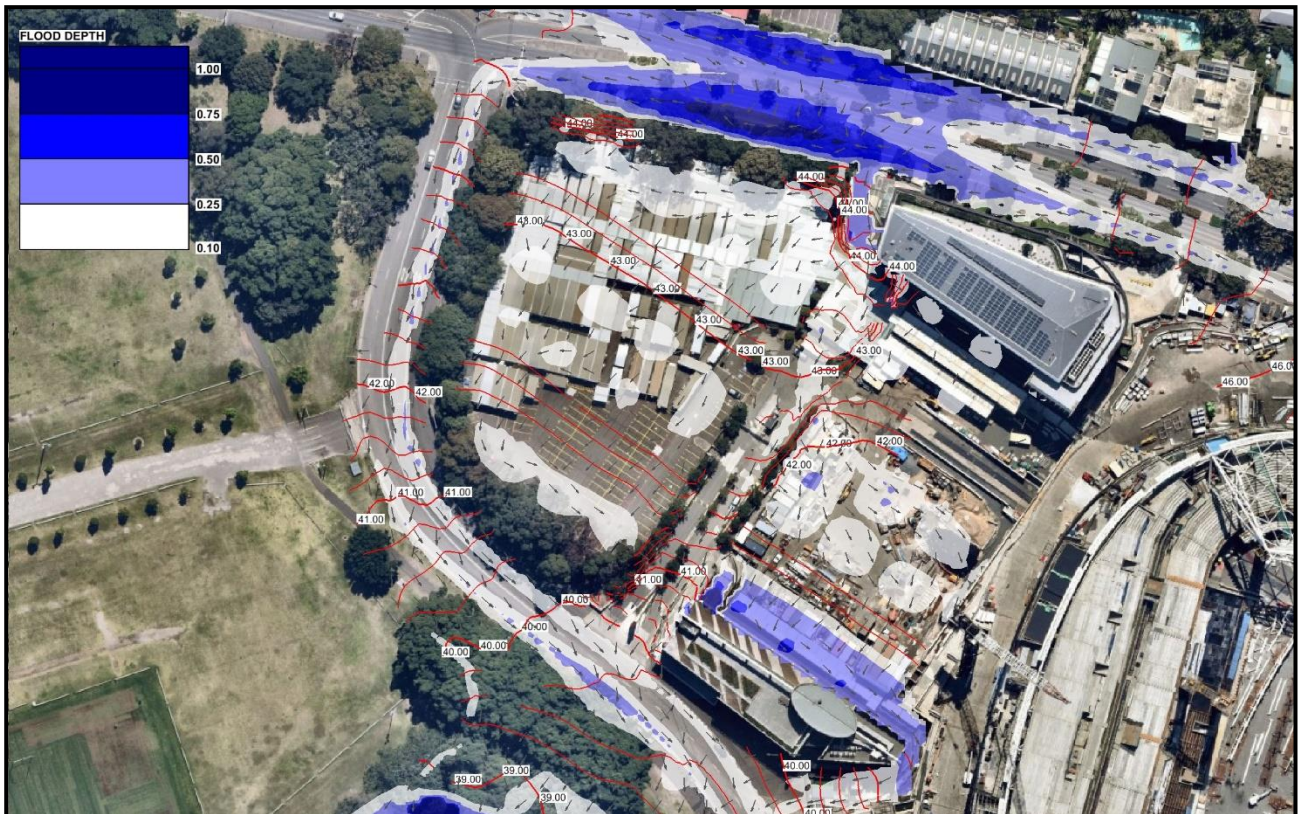


Figure 3. 5% AEP Flood Extent (Existing SFS flood model) - Depths <100mm not shown

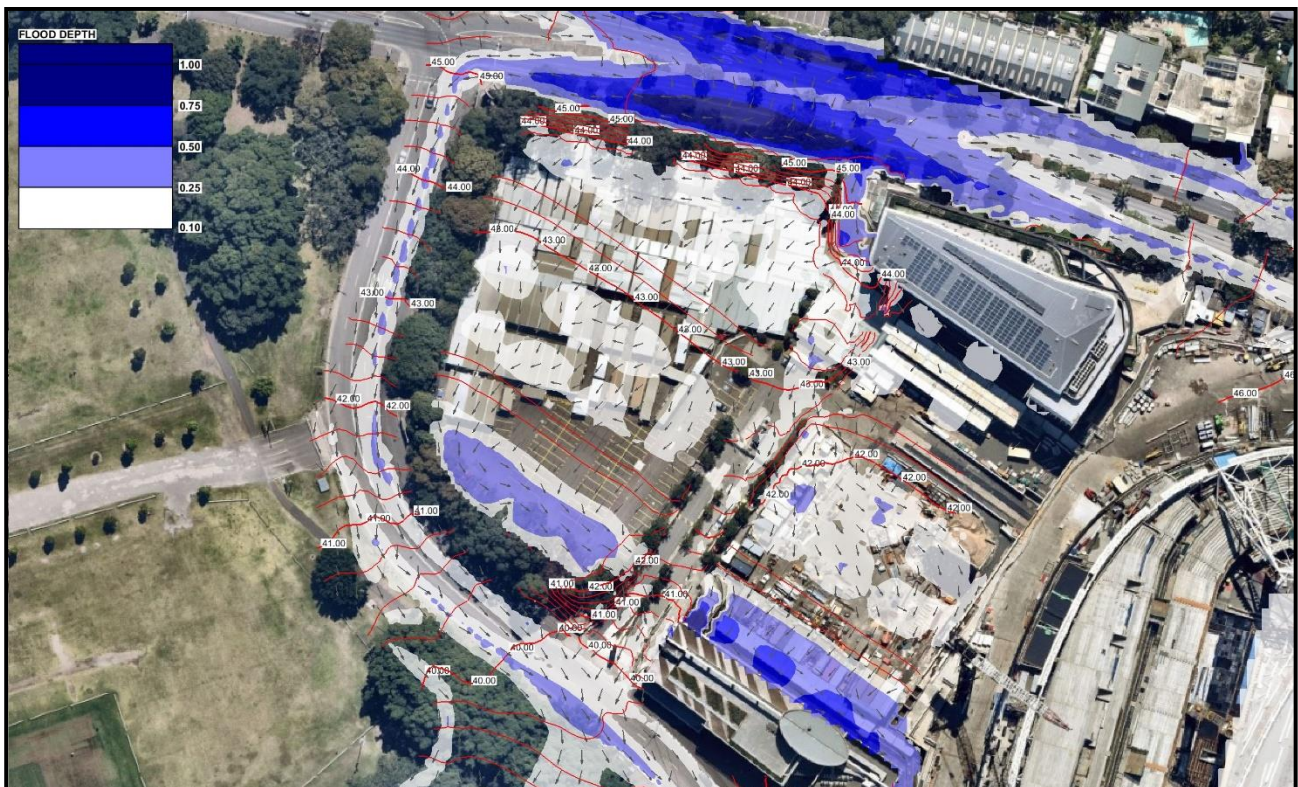


Figure 4. 1% AEP Flood Extent and Overland Flow (Existing SFS flood model)) - Depths <100mm not shown



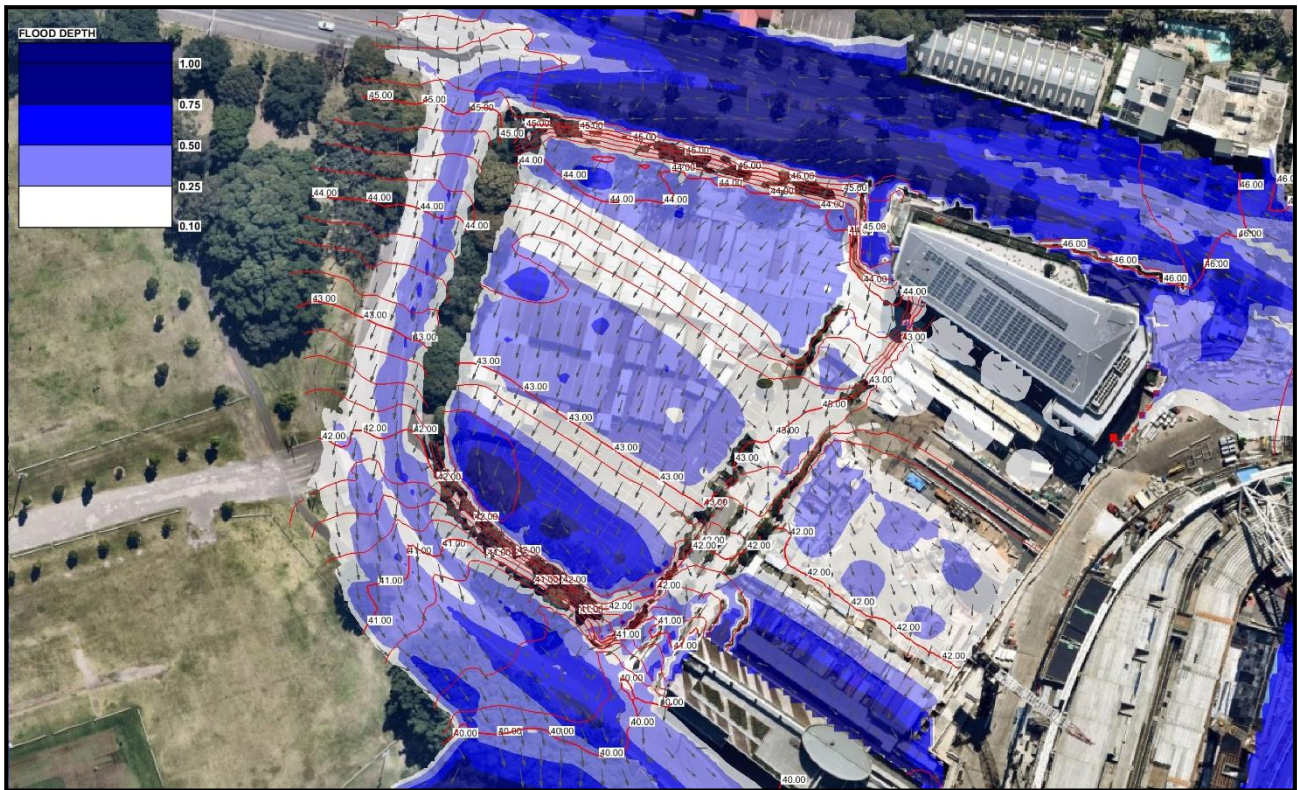


Figure 5. PMF Flood Extent and Overland Flow (Existing SFS flood model)) - Depths <100mm not shown

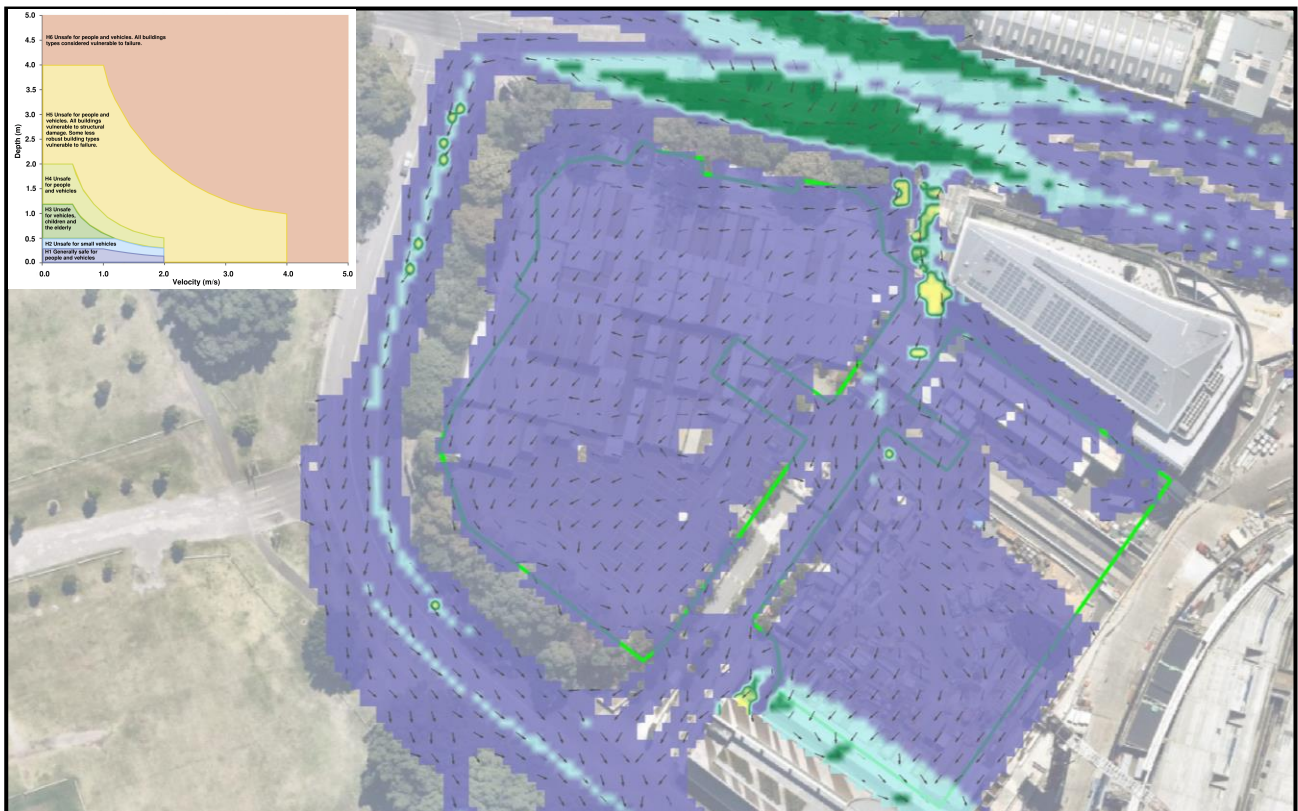


Figure 6. 5% AEP Flood Hazard (Existing SFS flood model)



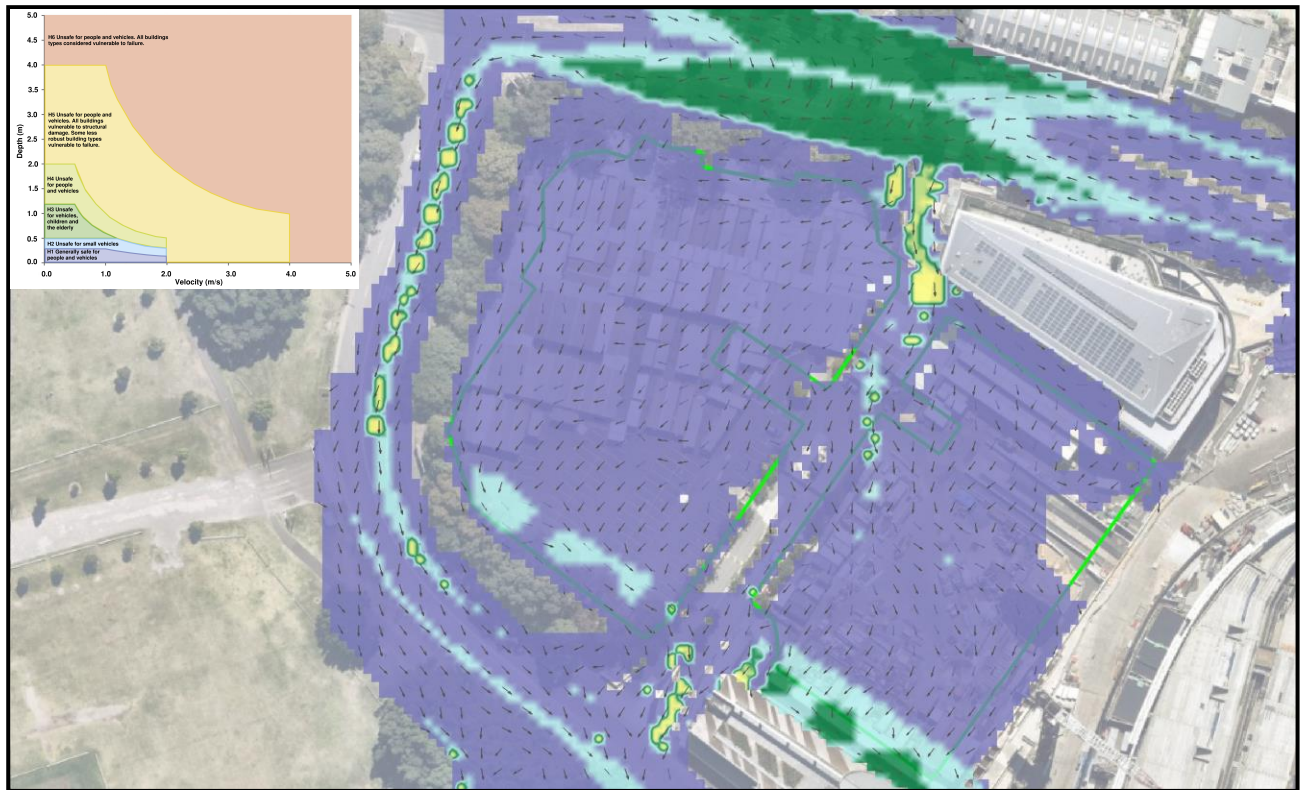


Figure 7. 1% AEP Flood Hazard (Existing SFS flood model)

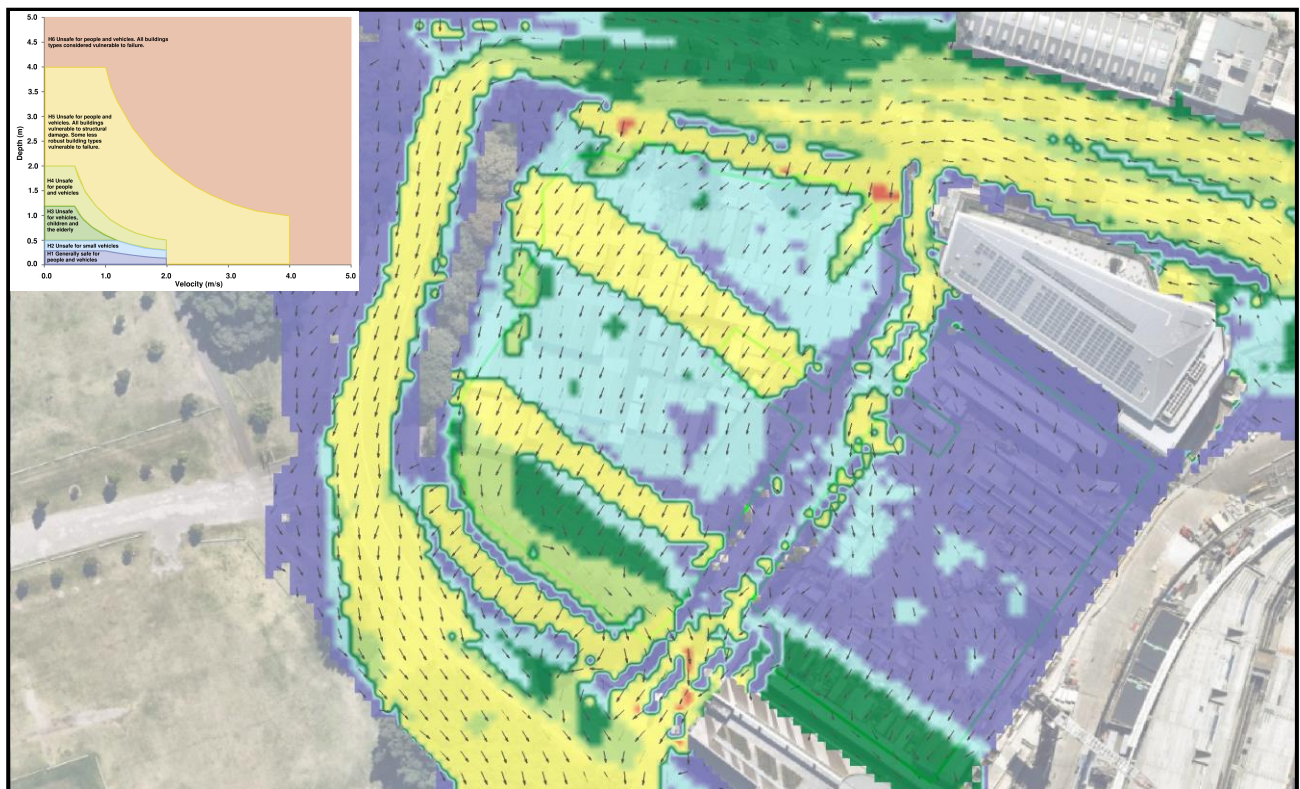


Figure 8. PMF Hazard (Existing SFS flood model)



### 3.0 Existing Precinct Village and Car Park Development Flood Study

A preliminary flood study was completed for the development for the SSDA submission *Precinct Village and Car Park (MOD 7) Stormwater and Flooding Assessment (Arup 2021)*. This study concluded that:

*“This assessment has demonstrated that the Precinct Village and Car Park does not result in material adverse flood impacts on the surrounding area.”*

The study provided flood and stormwater mitigation measures to control the flood behaviour and impacts associated with the development as follows and summarised in Figure 9:

- A central walled swale along the north-south access road
- New stormwater along the access road
- Diversion of a Sydney water stormwater pipe to the west of the development site
- Two flood storage tanks totalling 600m<sup>3</sup> that receives overland flow from the central access road via large grated inlets.
- Floodgates at the Car Park entrances to protect any basements from flooding up to the 1% +500mm or the PMF (whichever is higher).

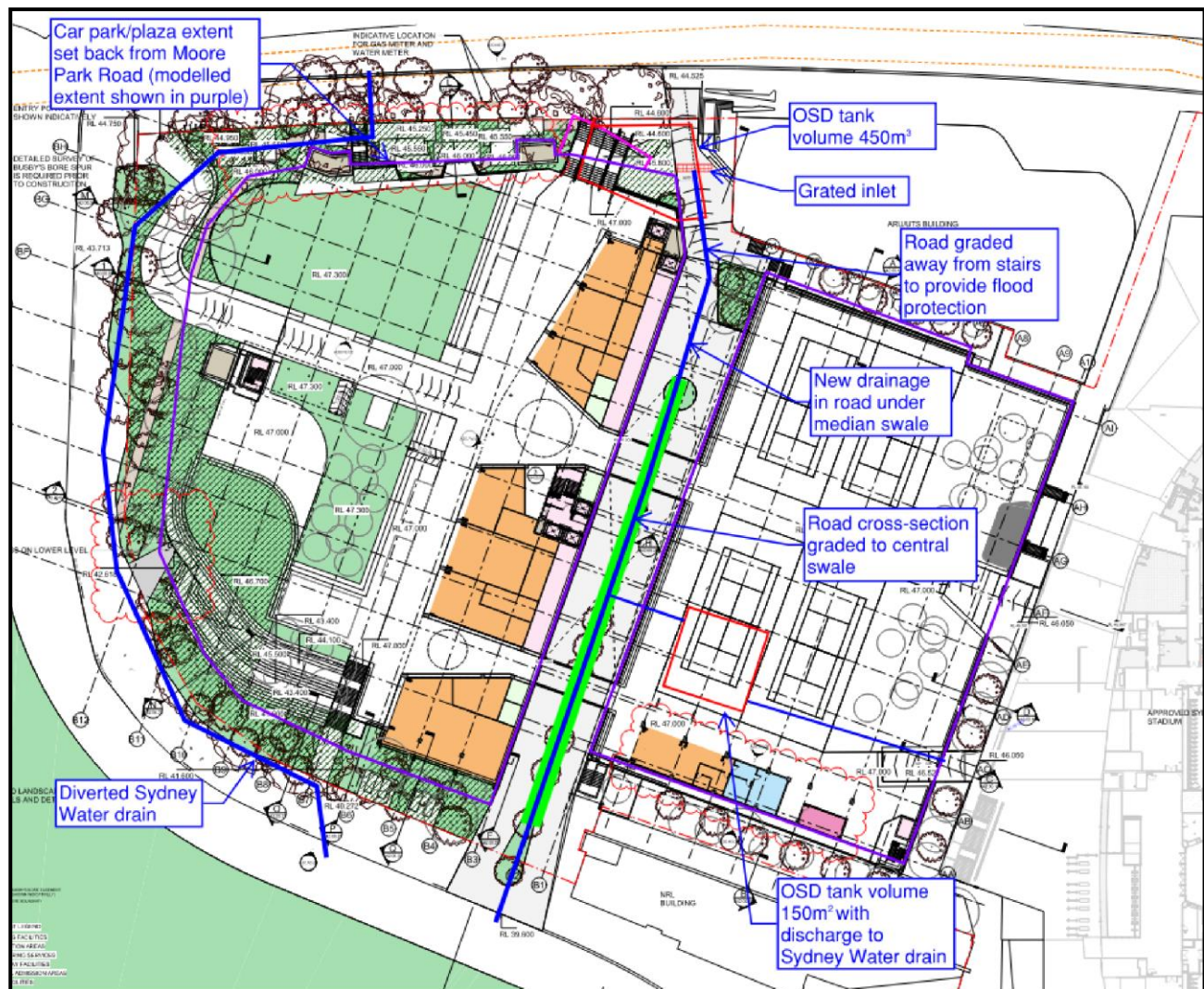


Figure 9. Extract of Flood Mitigation Strategy for SSDA (Arup, 2021)

The proposed flood strategy presented in the Arup study confirms that the maximum post development flood depth within the access road is approximately 300mm in the 1% AEP and

approximately 750mm in the PMF, refer to figures 10, 11 and 12. The flood results also show that the Rugby League basement driveway is flooded in the 1% AEP and PMF.

The flood impact associated with the development is shown to increase flood levels by up to 100mm locally on Driver Avenue and adjacent to Kippax Lake, refer to Figure 13.

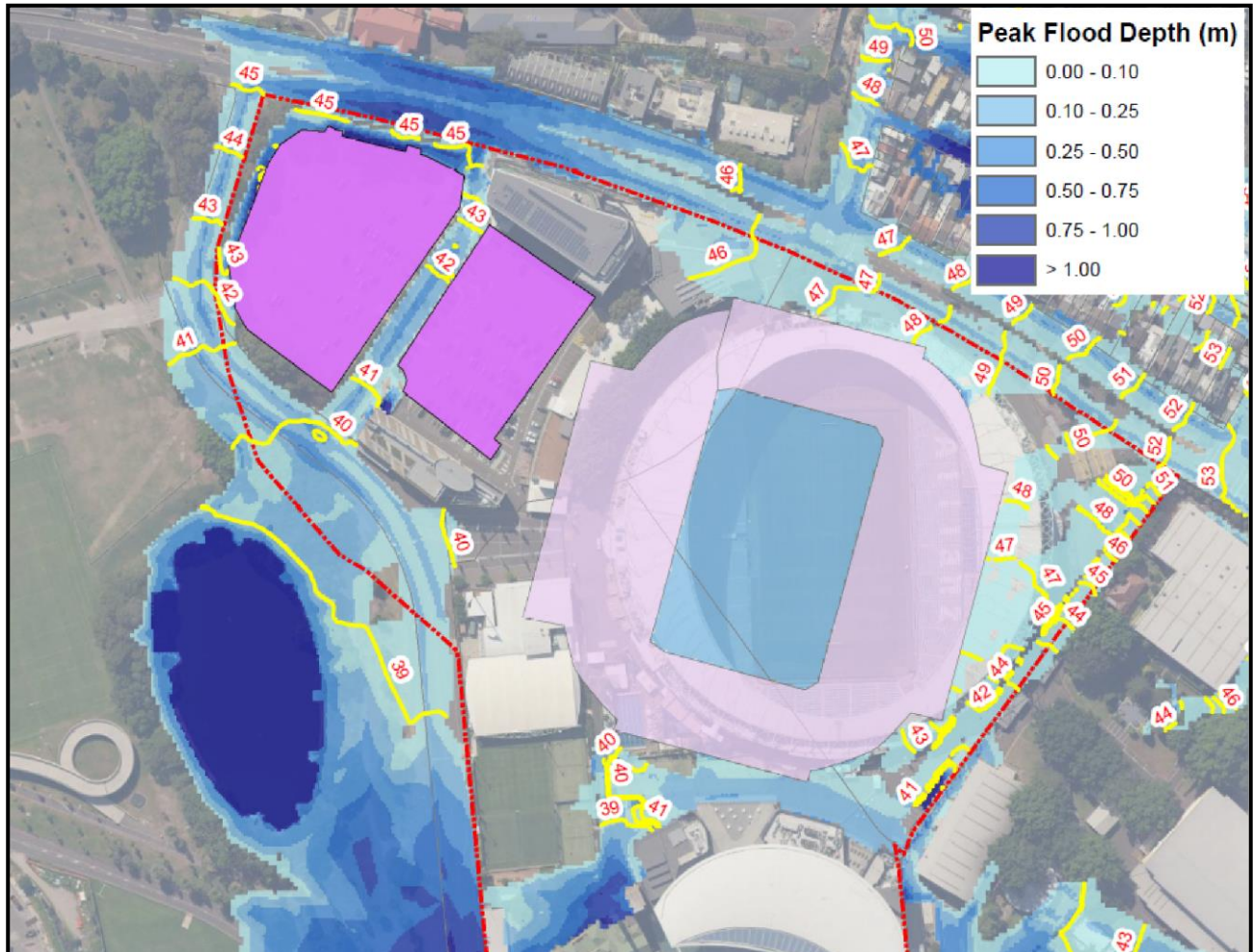


Figure 10. Extract of 1% AEP Post Development Flooding (Arup, 2021)



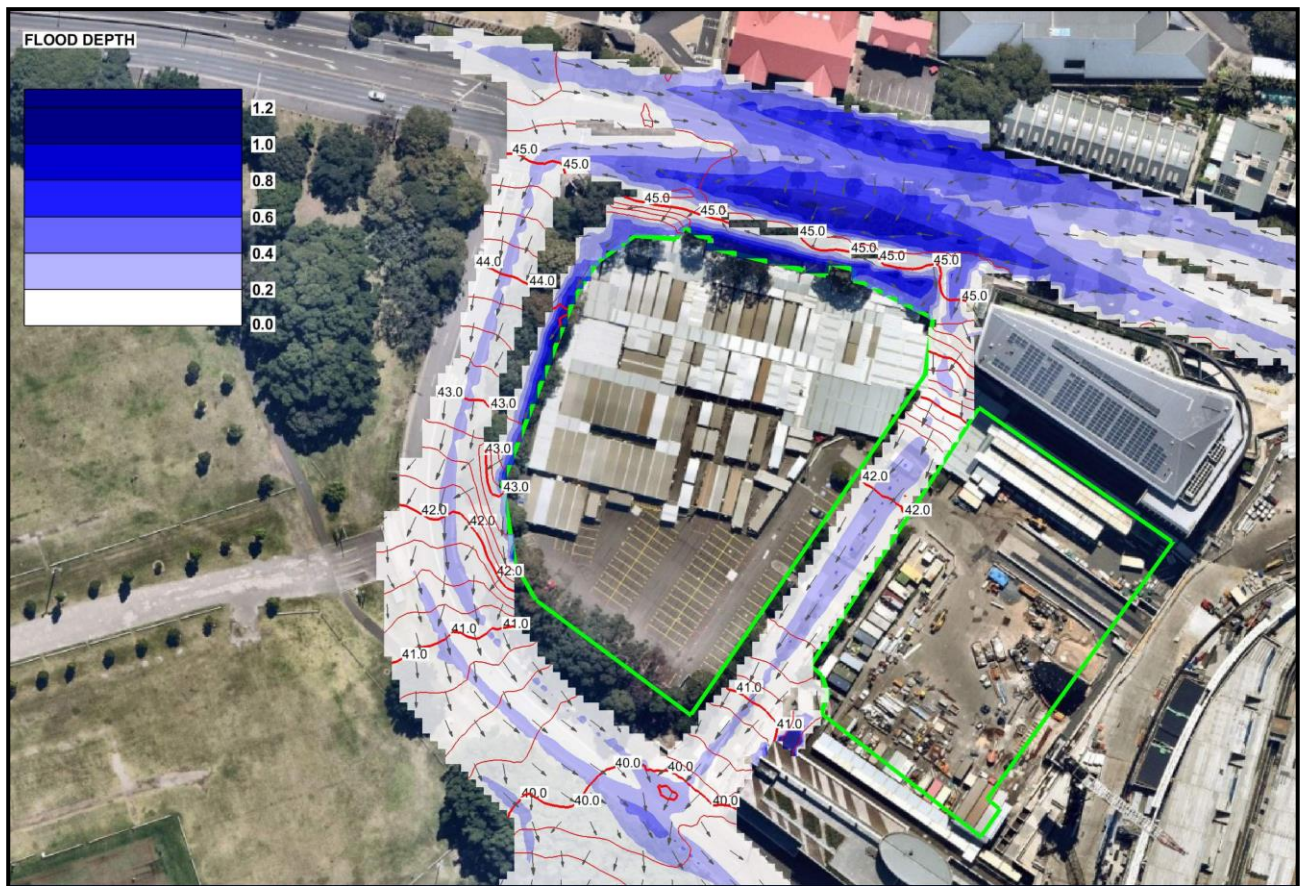


Figure 11. Detailed view of 1% AEP Post Development Flooding (Arup, 2021)

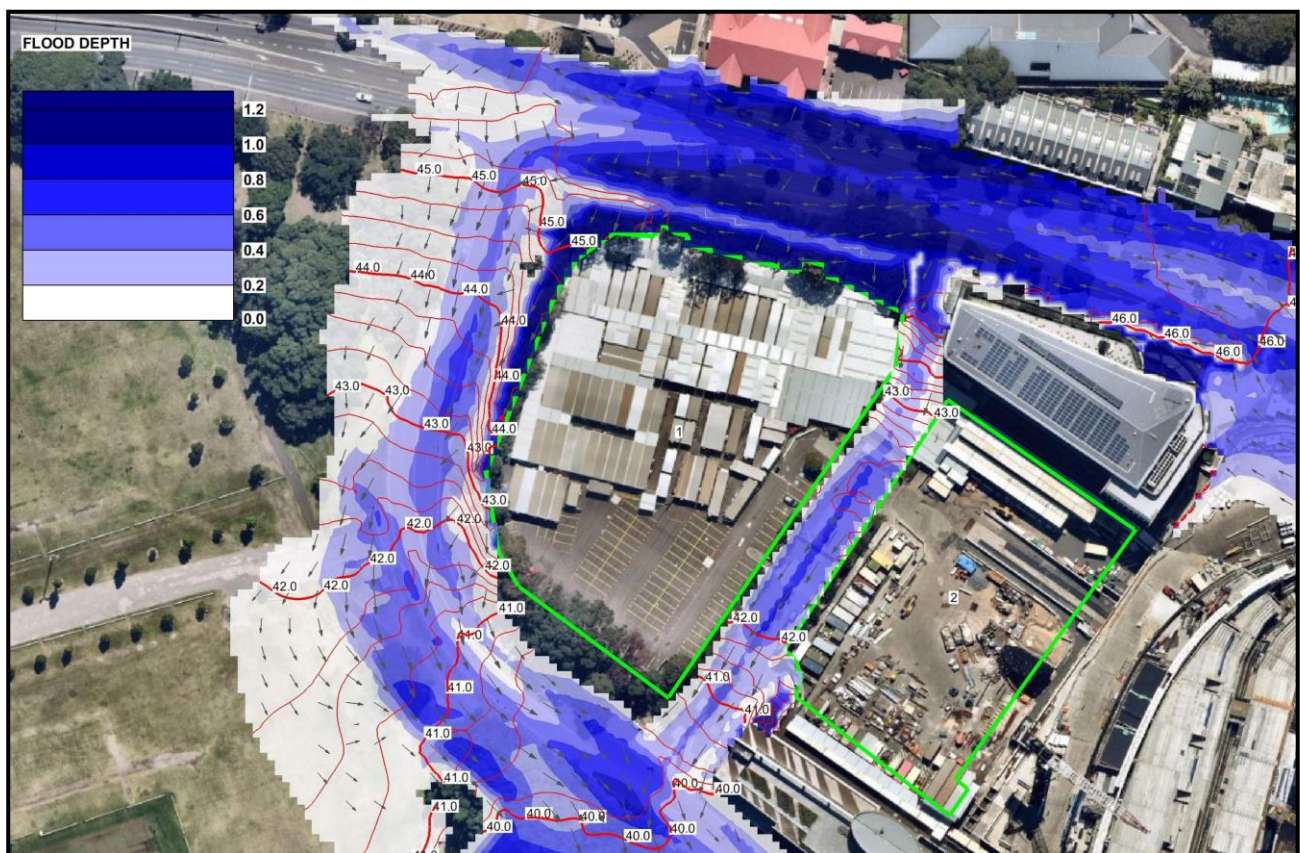


Figure 12. Detailed view of PMF Post Development Flooding (Arup 2021 model with PMF rainfall)



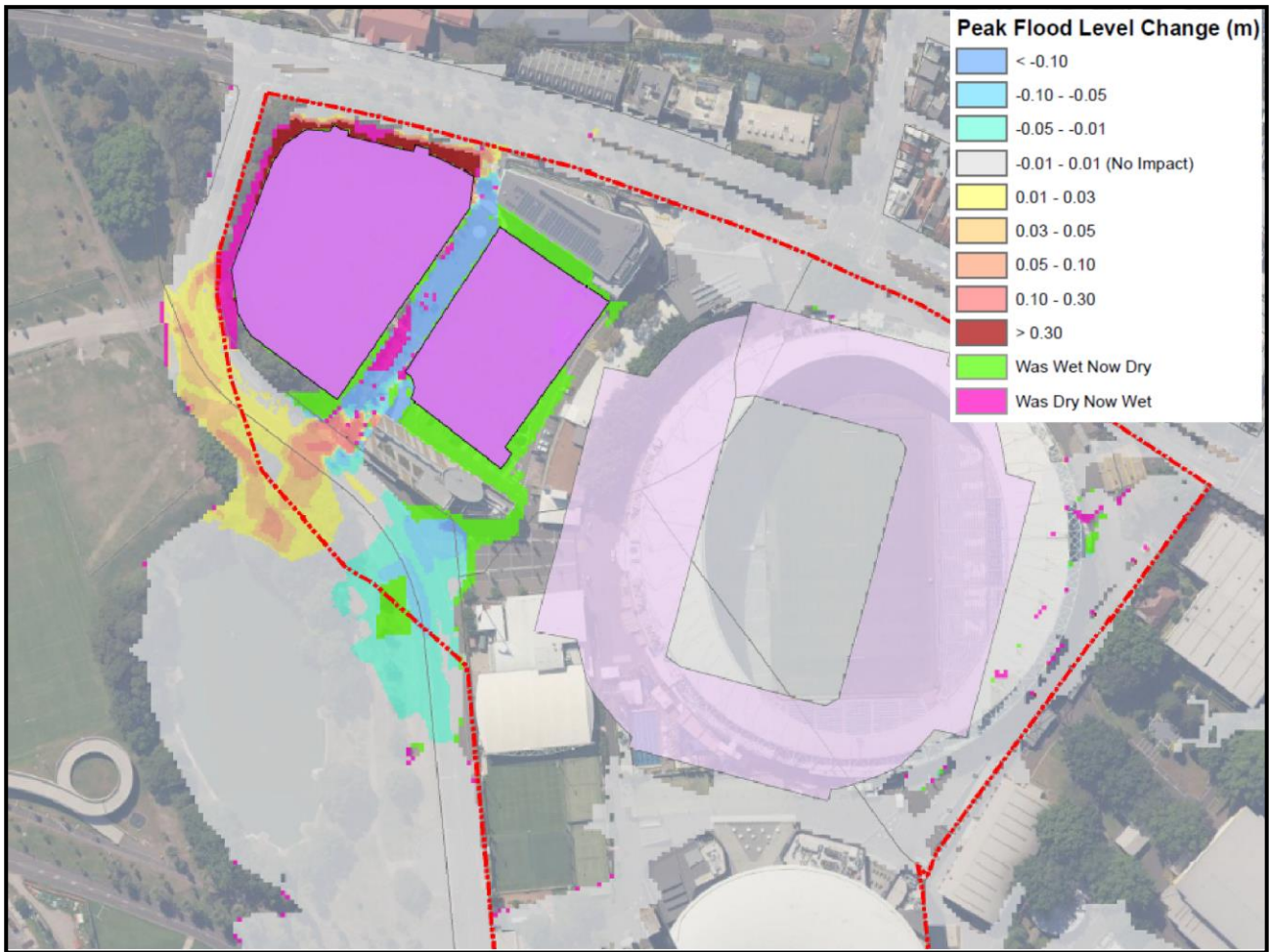


Figure 13. Extract of Post Development Flood Impact (Arup, 2021)



## 4.0 Updated Precinct Village and Car Park Development Flood Modelling and Impact

The development proposal and design stage has progressed since the original SSD submission and original Arup Stormwater and Flooding Assessment. The changes to the flood modelling include:

- Incorporation of updated architectural and landscape details and plans.
- Assessment of the PMF as well as the 1% AEP to determine which case is required for basement flood planning levels (higher of the 1% +500mm or the PMF)
- Aiming to reduce the depth of flooding and hazard within the access road.
- Aiming to reduce the flood level in the access road to below the car park RL 41.76m.
- Removal of the central grassed swale that prevents vehicles crossing from one side of the road to the other particularly at the joint entrance to both the east and west car parks.
- Review of the efficiency/benefit of the flood storage tanks that receive overland flow.
- Aiming to remove flood gates for basement flood protection which are not supported by CoS.
- Refining the proposed stormwater mitigation and diversions.
- Aim to reduce or remove flooding of the Rugby League basement driveway.

Several different options were tested during the design development to refine the proposed strategy with the above targets. The main objective is to convey more of the overland flow in a below ground pipe or culvert system to reduce the overland flow depth and hazard through the access road. The following options was found to provide the greatest balance of reduced flood risk, cost, and fitting in with the site and environmental constraints

The current design incorporates a new 1.5m diameter pipe that runs north and west of the western car park. Overland flow approaching the access road from Moore Park Road is conveyed into the 1.5m pipe by two large inlet pits located within and adjacent to the new access road off Moore Park Road. This option has two surcharge pits to the south of the western car park. The surcharge pits allow the piped flow to be conveyed as overland flow towards Driver Avenue and Kippax Lake, replicating the flood behaviour prior to development, refer to Figure 14. The current design no longer includes flood storage tanks.

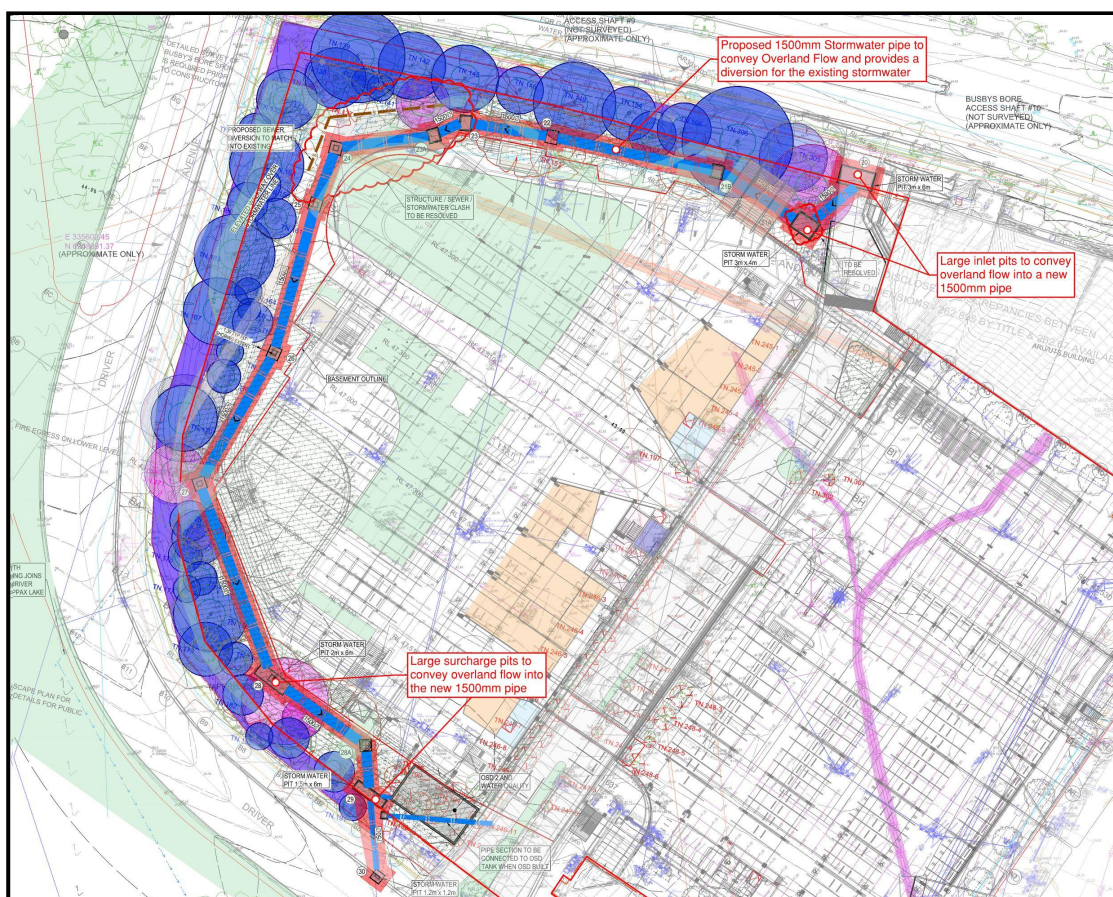


Figure 14. Proposed Stormwater for Flood Mitigation

This current design reduces the overland flow along the access road to a manageable flood hazard (Hazard Category H1 – safe for vehicles and pedestrian) and flood depth in the 5% and 1% AEP events which is no worse than the existing condition (figures 6 and 7). The proposed flood hazard along the central access road is high (H5) in the PMF which is similar to the existing condition (figure 8), but the hazard generally lower across the wider precinct compared with existing. Refer to figures 15, 16 and 17 for the 5% AEP, 1% AEP and PMF flood levels and depths, and figures 18, 19 and 20 respectively for flood hazard.

This option has negligible flooding at the vehicle entrances to the car parks in the 1% AEP (less than 10mm) with a maximum flood level of 41.60m. The maximum flood level is 41.75m in the PMF event. As the internal car park floor level is 41.76m with a crest to the basement level at RL 42.20m, this current design meets the CoS Flood Planning requirements of being above the higher of the 1% AEP +500mm or the PMF. A more detailed view of the flood levels and depths at the car park entrances is shown in figure 21, with the flood planning levels summary shown in Table 1.

Table 1 – Flood Planning Levels

	1% AEP	PMF	Car Park FPL	Basement FPL	Car Park Floor Level	Crest to Basement
<b>Flood Level at Central Access Road</b>	41.60m	41.75m	41.60m	42.10m	<b>41.76m</b>	<b>42.20m</b>

The proposed flood mitigation produces a slight increase in flood levels locally on Driver Avenue, south of the development site in the 1% AEP, with a maximum increase of 82mm, refer to figure 22. There is a general reduction in flood level of approximately 40mm at the low point of Moore Park Road. There is no increase in flood levels to existing properties, and the flood impact is generally improved for the wider precinct area particularly in Moore Park Road and at the NRL building.

This option does not require the use of flood storage tanks or flood gates, and removes the flooding of the Rugby League basement driveway in the 1% AEP and PMF events.





Figure 15. Proposed 5% AEP Depths and Levels (Depths less than 50mm not shown)

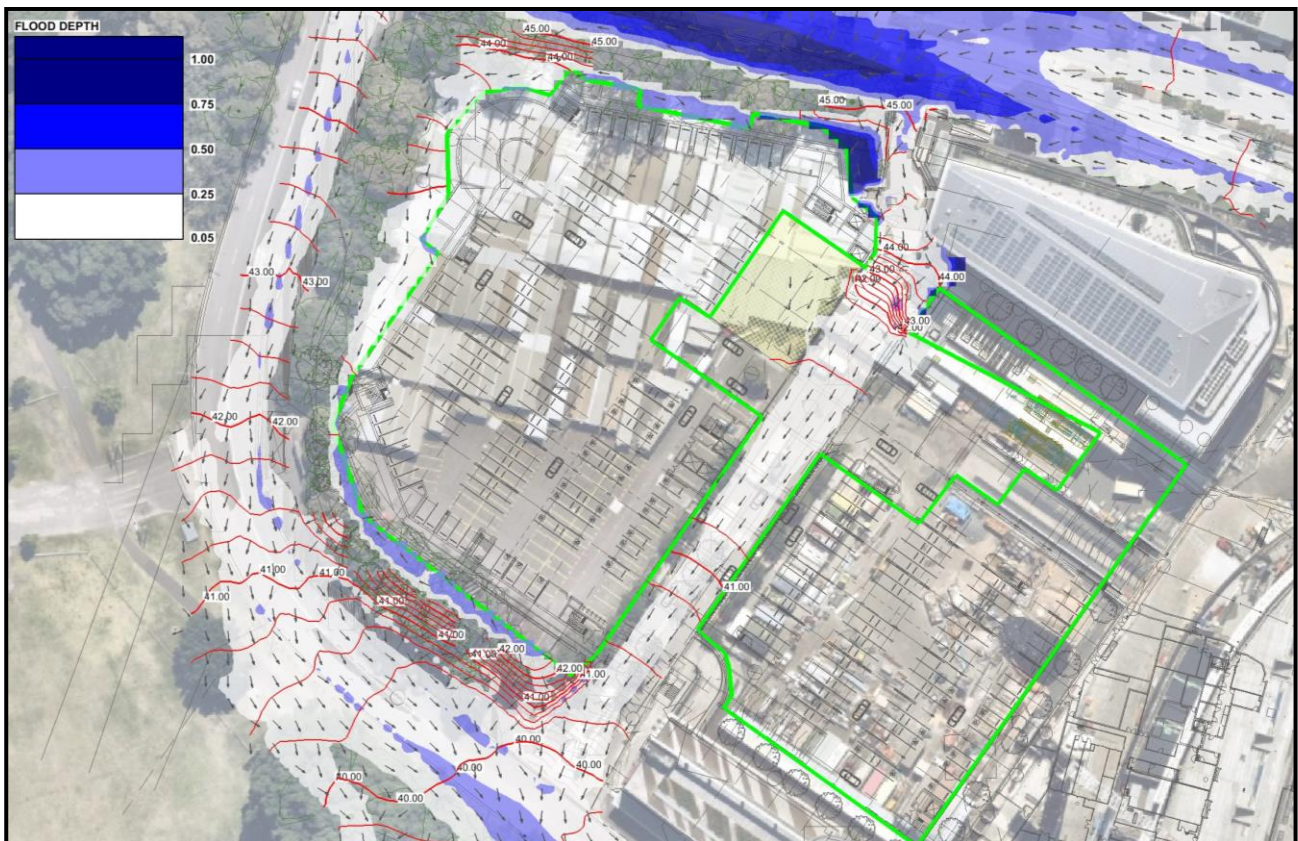


Figure 16. Proposed 1% AEP Depths and Levels (Depths less than 50mm not shown)



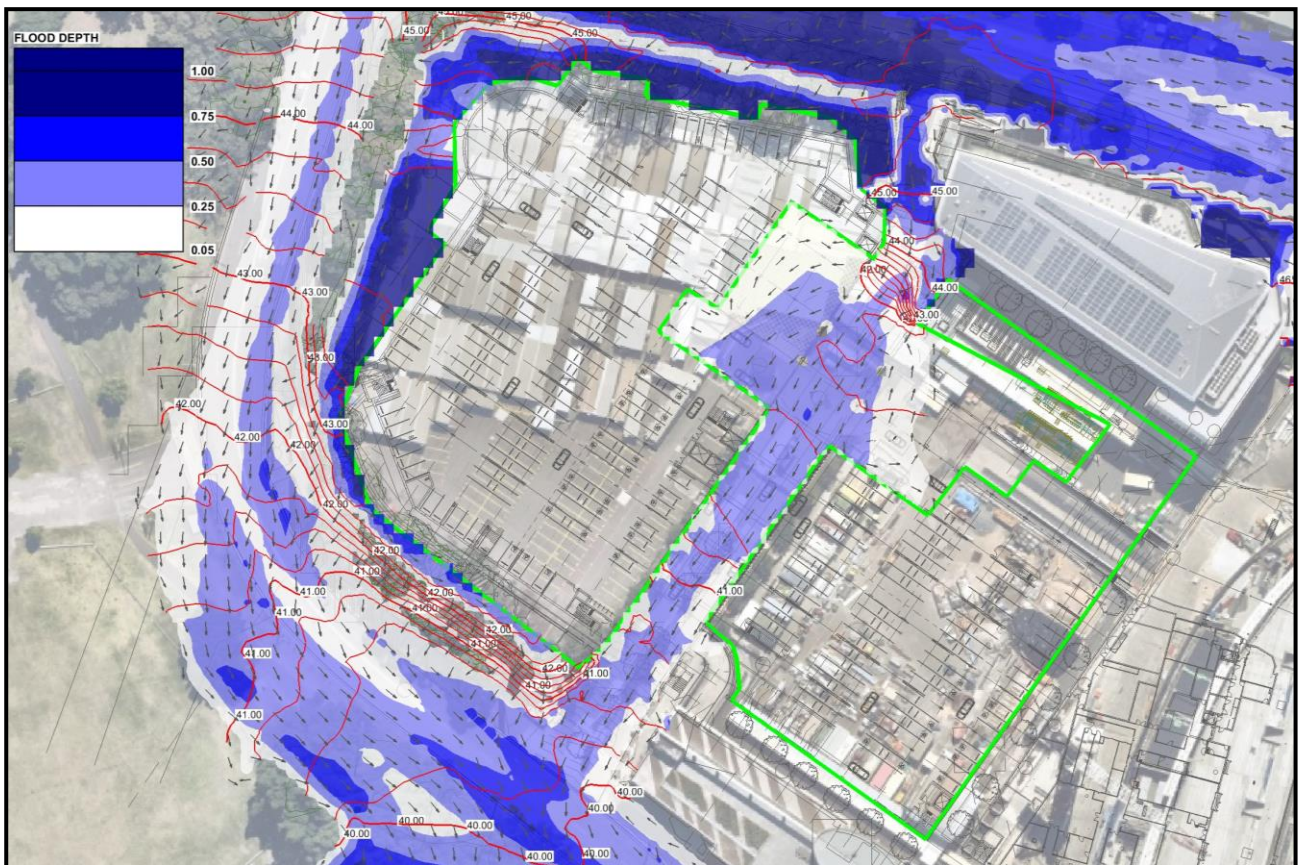


Figure 17. Proposed PMF Depths and Levels (Depths less than 50mm not shown)

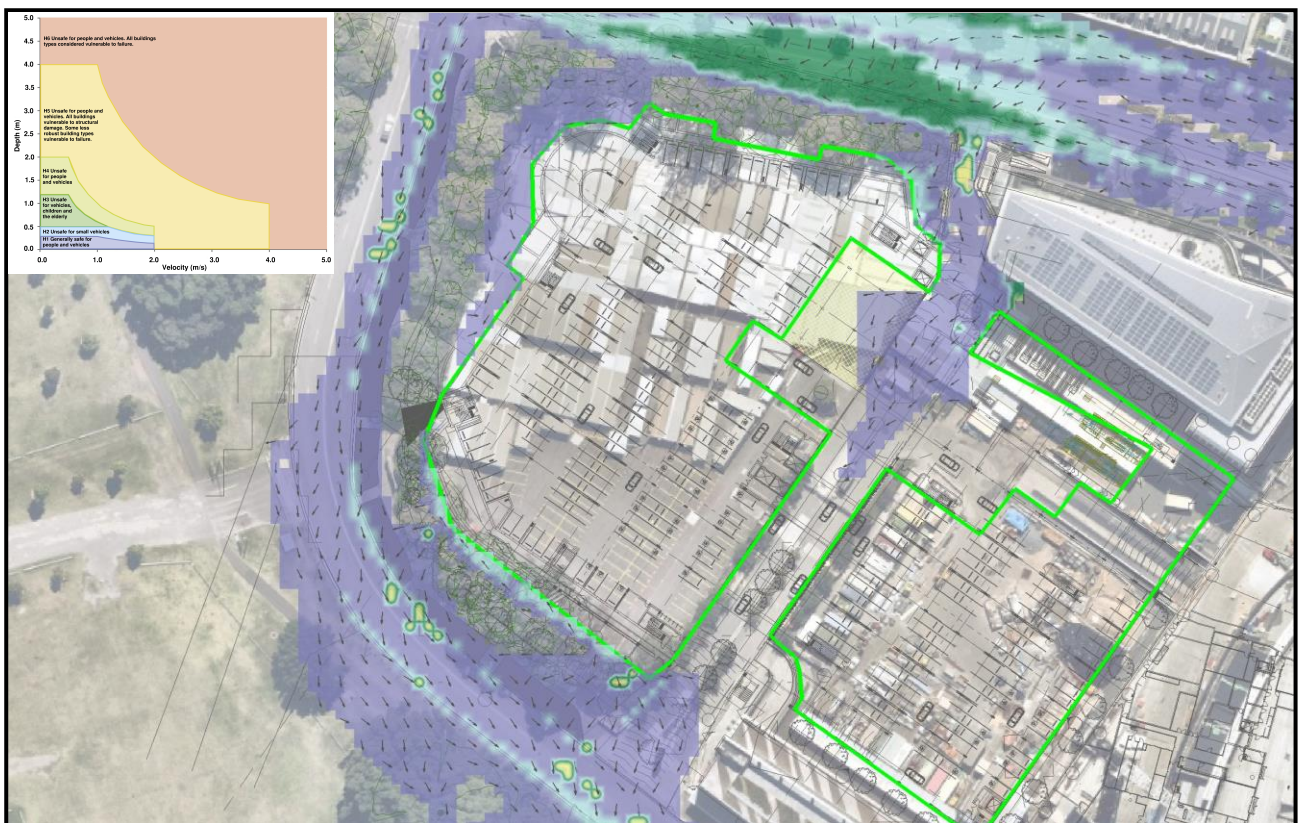


Figure 18. Proposed 5% AEP Hazard



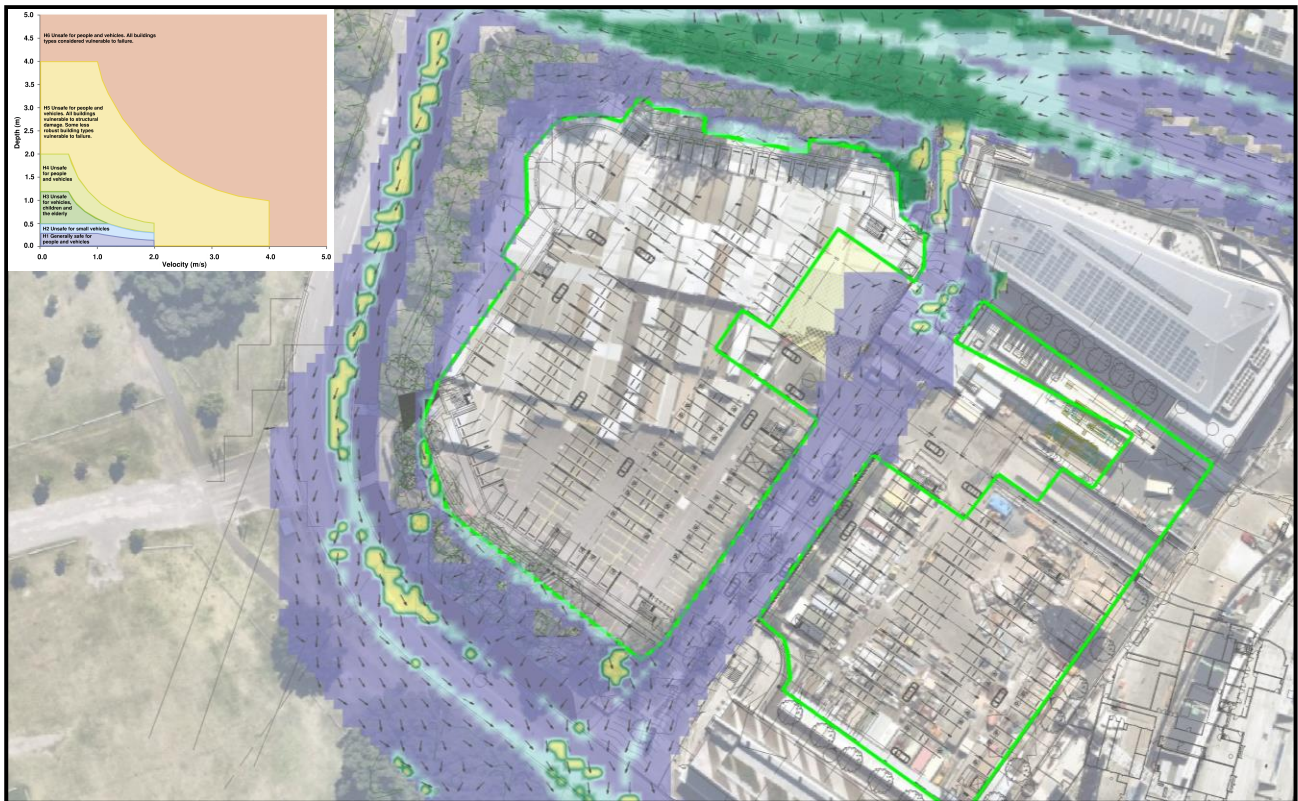


Figure 19. Proposed 1% AEP Hazard

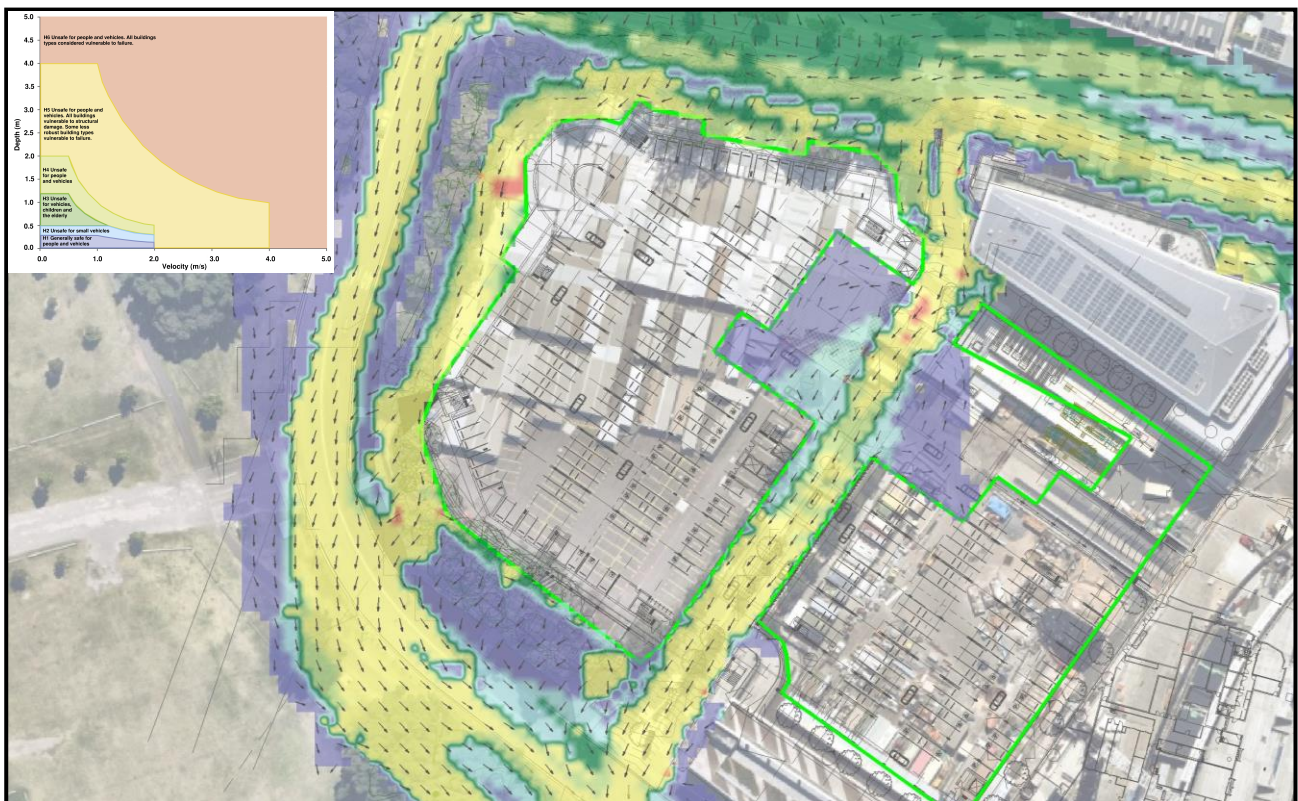


Figure 20. Proposed PMF Hazard



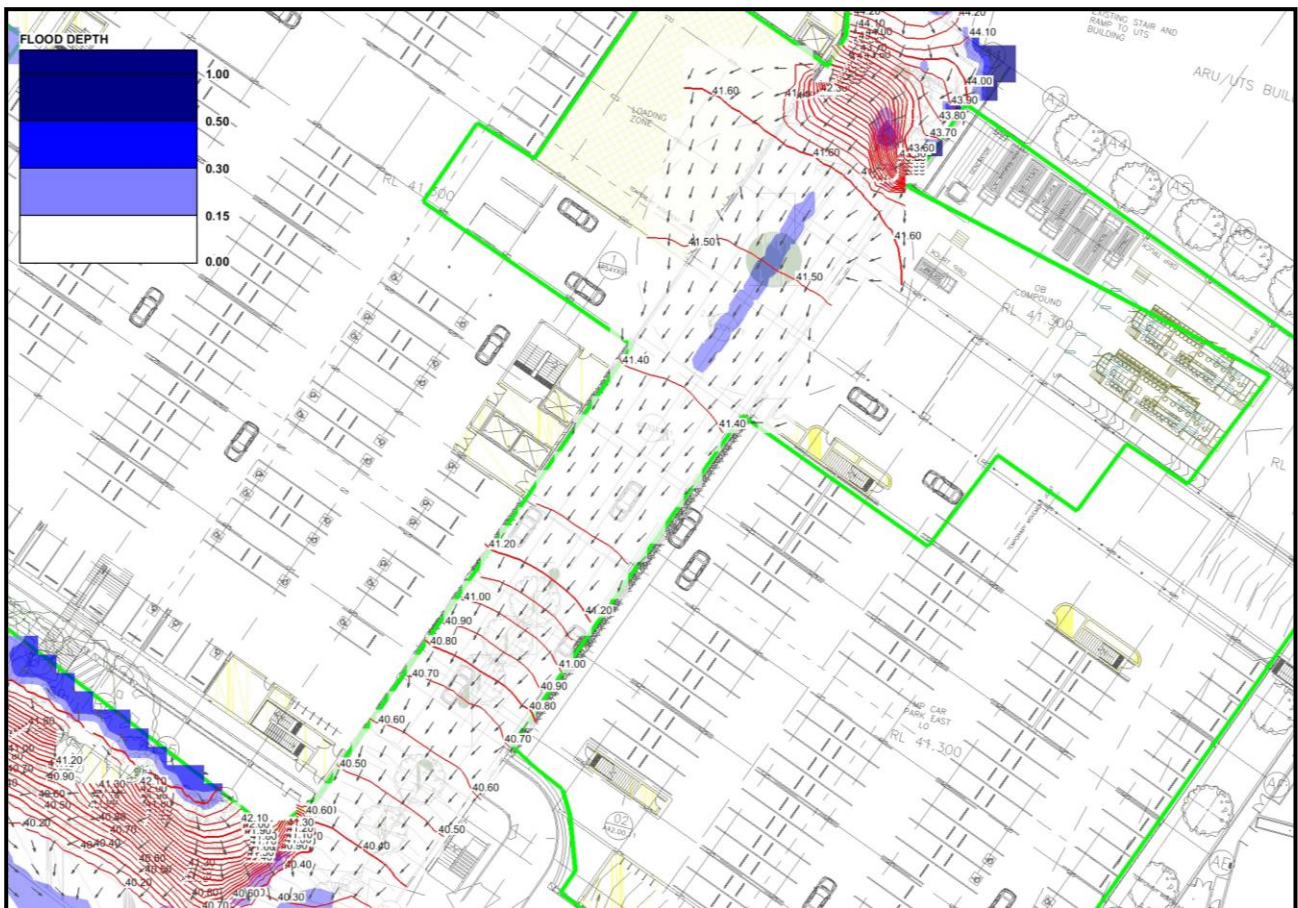


Figure 21. Proposed 1% AEP Depths and Levels Along Access Road



Figure 22. Proposed 5% AEP Flood Level Impact (Afflux)



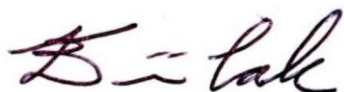


Figure 23. Proposed 1% AEP Flood Level Impact (Afflux)



Figure 24. Proposed PMF Flood Level Impact (Afflux)

**Yours faithfully,**  
TAYLOR THOMSON WHITTING (NSW) PTY LTD

A handwritten signature in dark ink, appearing to read 'E. Crabbe', written in a cursive style.

**EIRIAN CRABBE**  
Associate Director

A handwritten signature in dark ink, appearing to read 'S. Brain', written in a cursive style.

**STEPHEN BRAIN**  
Technical Director